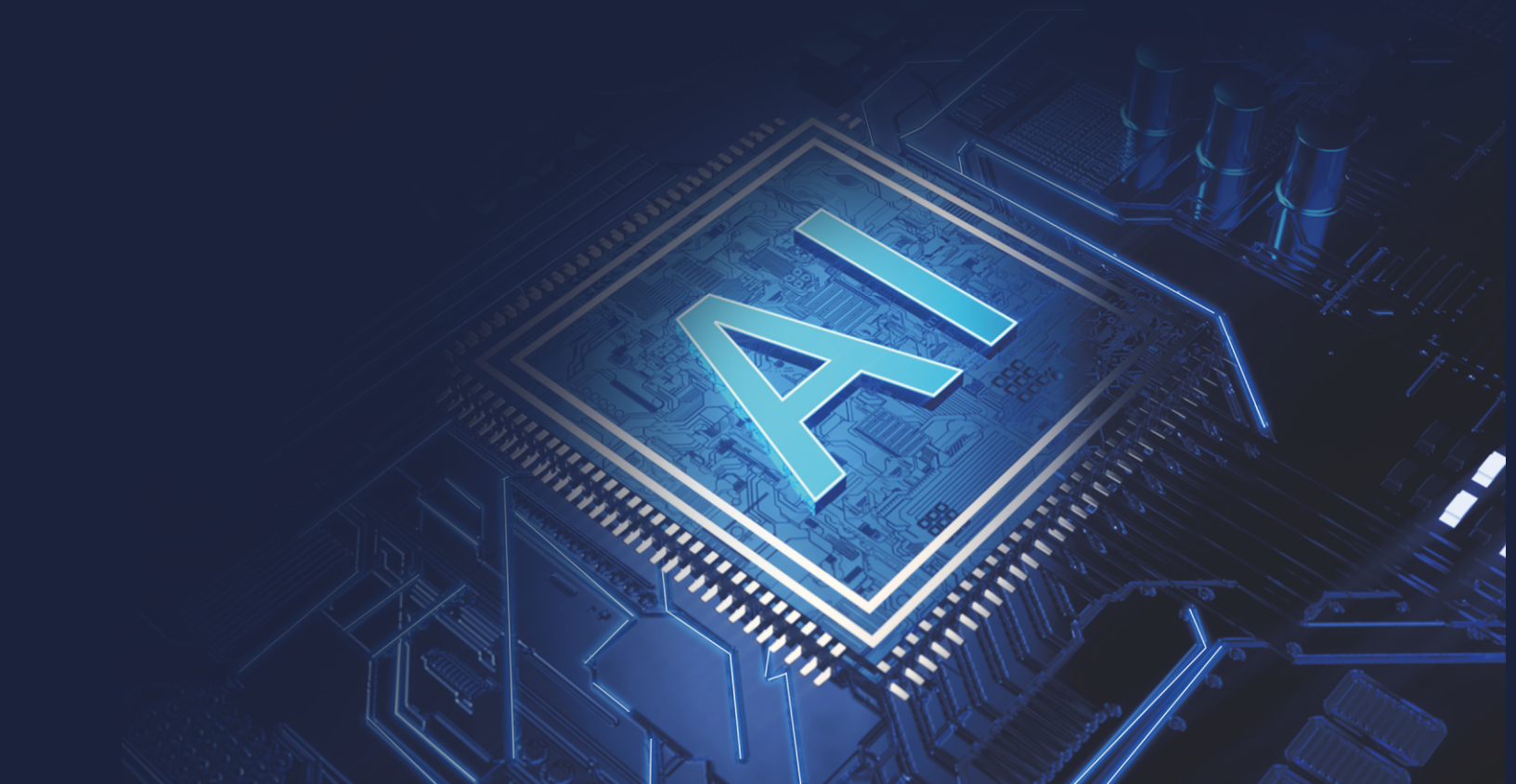
LIU SHEN
Intellectual Property
柳沈律师事务所

Intellectual Property Protection of Artificial Intelligence

（2021 年）



Editors & Authors

Main Editors: Xiaoming ZHANG and Yali SHAO

Counselors: Wankui DI, Xiaoning YU and Zhifei AN

Authors:

Chapter I: Lin LI
Chapter II: Yongjuan YUE, Xiaoming ZHANG and Zexin LIAO
Chapter III, Section 1: Jinlin CHEN, Xiaoming ZHANG and Lin LI
Chapter III, Section 2: Xiaoming ZHANG, Hao GAO and Yujie JIN
Chapter III, Section 3: Jing ZHANG, Zexin LIAO and Hongyu WU
Chapter III, Sections 4 & 5: Hongying ZHAO
Chapter IV: Peng ZHENG
Chapter V: Hongzhan ZHANG and Wenjie LI
Chapter VI: Yuan YUAN
Chapter VII: Wenjie LI and Hongzhan ZHANG

Postscript

About the editors

Yali SHAO

Partner | Patent Attorney | Attorney at Law

Ms. Yali Shao is a partner at Liu, Shen & Associates, and she is double qualified as patent attorney and attorney at law. She joined in the firm in 1997 and mainly specializes in patent prosecution, re-examination, patent invalidation, IP litigation, and client counseling with a focus on Electrical & Electronics, Telecommunication, Computer Science, AI, IoT, Internet & E-commerce.

Ms. Shao handles a number of cases relating to patent examination, reexamination, invalidation, administrative lawsuit, infringement lawsuit, licensing and other IP related matters. In recent years, she has been leading matters including studies of patent law related regulations and suggestions on revision to the regulations; all kinds of analysis including pre-litigation analysis, pre-invalidation analysis, and searching analysis; patent invalidation, patent infringement litigation relating to Standard Essential Patents (SEPs) and non-SEP; patent protection studies for specific technical fields such as Artificial Intelligence (AI), Internet of Things (IoT), 2G/3G/4G/5G telecommunications, etc.

Ms. Shao is a member of both Programme Committee and Patent Committee at AIPPI.

About the editors

Xiaoming ZHANG

Partner | Patent Attorney | Attorney at Law

Mr. Xiaoming Zhang joined Liu, Shen & Associates in 2007. Mr. Zhang specializes in patent prosecution, re-examination, patent invalidation, IP litigation, and client counseling with a focus on telecommunication, artificial intelligence, big data processing, semiconductor technology, image processing, network, optics and physics. Mr. Zhang processes extensive experience both before SIPO and USPTO and is skilled in drafting application documents in Chinese and English.

Mr. Zhang became a qualified patent attorney in 2008, and got his qualification as an attorney at law in 2018.

Mr. Zhang obtained a doctor's degree in Optics from Peking University in 2007.

About the counselors

Wankui DI

Partner | Patent Attorney | Attorney at Law

Mr. Di is a partner of Liu Shen & Associates. He became a qualified patent attorney in 2000, and got his qualification as an attorney at law in 2007. He specializes in the technical field of Mobile Communication, Electronic Tech., Computer Science, Internet and E-Commercial. He has successfully handled a great deal of representative cases and accumulated much experience in patent drafting, filing, prosecution, invalidation, litigation, and patent analysis. Up to now, he presented a lot of speeches and academic articles, as well as various patent forums. Mr. Di is currently the council member of Beijing Patent Agents Association and the vice president of Capital Intellectual Property Service Association.

Xiaoning YU

Partner | Patent Attorney | Attorney at Law

Mr. Xiaoning Yu, a partner with Liu, Shen & Associates, is specialized in patent prosecution, patent invalidation and patent litigation with a focus on fields including artificial intelligence, electronics and circuit, communication, computer and so on. In recent years, Mr. Yu has handled patent infringement litigation cases and invalidation cases for many famous foreign and domestic clients and achieved good outcomes. Mr. Yu has also provided various patent analysis and due diligence service including FTO analysis, patent validity analysis, SEP analysis, IP due diligence, etc. for high-tech companies. Mr. Yu also provides counseling service on establishment of IP protection strategy for clients.

About the counselors

Zhifei AN

Partner | Patent Attorney | Attorney at Law

Mr. Zhifei An is an attorney at law and patent attorney in China, and a partner at the law firm of Liu, Shen & Associates. Mr. An specializes in patent prosecution, patent reexamination, patent invalidation, litigation and dispute resolutions before administrative agencies and the courts, and counseling on IP licensing. He is specialized in telecommunication, computer hardware & software, AI, video codec and so on. Since 2012, Mr. An has handled dozens of patent related proceedings before the courts and handled a large amount of cases relating to infringement analysis, validity analysis, patent searching, patent evaluation.

Introduction

Liu Shen's Artificial Intelligence (AI) Team was established in June 2017 and comprised of attorneys who have strong technical background in computer science or related technical fields and have rich experiences in IP protection. Since its establishment, the Team has been focusing on the study of AI industry development, governmental policy for supporting and regulating of AI researches and applications, laws and regulations as well as practices in Intellectual Property (IP) protection of AI, etc., in China and some other countries and regions that are active in AI field. The research results of Liu Shen's AI Team include special reports of "Patent Protection of Intellectual Property (2018)" and "Protecting Artificial Intelligence Patents (2019)," collection of featured articles "Intellectual Property Protection of Artificial Intelligence in China," and some other articles & presentations about IP protection of AI in China and other countries/regions.

This report on "Intellectual Property Protection of Artificial Intellectual Property" (2021) is a research report contributed by LiuShen's AI Team, mainly about intellectual property protection of AI in China and some other countries/district including the United States, Europe, Japan and South Korea. The report aims to help relevant companies and IP practitioners to understand the overall development of AI industry and various aspects of AI-related IP protection.

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CHAPTER I

Overview of AI Technology

Lin LI

1.1 Birth and development of Artificial Intelligence

If the birth of the discipline of modern artificial intelligence is to be marked with the earliest appearance of the term "Artificial Intelligence (AI)", it should be in Dartmouth Artificial Intelligence Conference initiated in 1955 and held in 1956. It is generally accepted that AI was formally proposed by John McCarthy, convener of the conference[1].This conference aimed at calling like-minded people together to discuss "AI". In the proposal of this conference, McCarthy et al. said that "*We propose that a 2-month, 10-man study of artificial intelligence be carried out during the summer of 1956 at Dartmouth College in Hanover, New Hampshire. The study is to proceed on the basis of the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it. An attempt will be made to find how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves*[2]." This conference lasted for a month, basically focusing on a large-scale brainstorming. This gave birth to the AI revolution known to all.

In 2006, the parties to this conference reunited in Dartmouth
From left: Moore, McCarthy, Minsky, Selfridge, Solomonoff

After the birth of AI, it once went into a trough. During the period from 1970s to1980s, the development of AI fell into "a cold winter" in the 1970s due to the inability to complete large-scale data and complex tasks and the failure to break through the computing power. In 1980, the XCON developed by Carnegie Mellon University (CMU) was officially put into use, which became a milestone in a new era, since the expert system has began to exert its power in specific fields, leading the entire AI technology toward prosperity.

1. McCarthy recalled in his later years that he heard the word "Artificial Intelligence" from others, which means "AI" was not his original. AI is derived from Machine Intelligence, which was first proposed by Turing in the Intelligent Machinery, an internal report of the National Physical Laboratory (NPL). According to Wikipedia, these two words are synonymous.

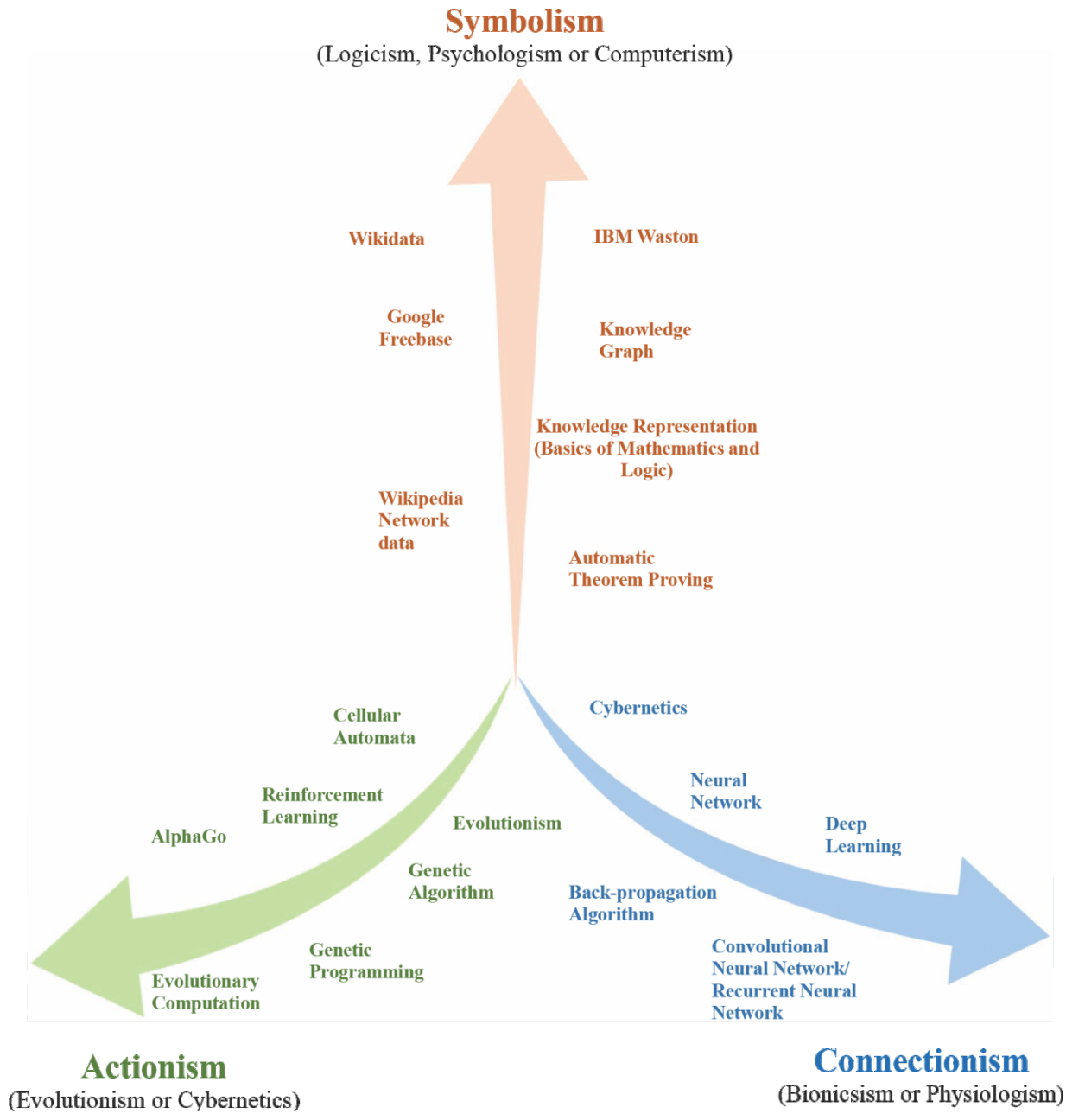
2. See Dartmouth AI Proposal , J. McCarthy et.al, August 31, 1955.

After more than half a century of development, numerous far-reaching technologies, scholars, companies and products have emerged in the filed of AI, deriving many different schools. Currently, there are three main AI schools:

(1) Symbolism, also known as Logicism, Psychologism or Computerism, with its main principle being the hypothesis of the physical symbol system (i.e., the symbolic operating system) and the principle of limited rationality.

(2) Connectionism, also known as Bionicsism or Physiologism, with its main principle being the neural network and the connection mechanism and learning algorithm among neural networks.

(3) Actionism, also known as Evolutionism or Cybernetics, with its principle being cybernetics and "perception-action" control system. Actionism held that action is a combination of various body responses of an organism to environmental changes, and its theoretical goal is to foresee and control actions.



Symbolism reduces all information to operational symbols. Like mathematicians, in order to solve equations, original expressions will be replaced with other expressions. Nowadays, most AIs are based on symbolism. In the industrial age, this school has gained a lot of limelight since it is the easiest for the standardized process to use the AI design of the symbolism school. One of the most representative examples of symbolism is IBM's Deep Blue, which defeated human chess champions and made humans realize the awful development of AI for the first time.

Symbolism has been thriving for a long time, and has made important contributions to the development of AI, especially to the successful development and application of expert systems. It is of great significance for AI to move toward engineering applications and realize the integration of theory with practice. Later, people discovered that symbolism also has shortcomings. Decision-making requires knowledge. A lot of intuition related knowledge cannot be expressed easily with symbolic reasoning, but require computers to learn from data.

In 1986, the American psychologist David Rumelhart et al. proposed back-propagation algorithm in a multi-layer network (also known as the reverse mode of automatic differentiation). Since then, connectionism witnessed a great momentum of development from model to algorithm, from theoretical analysis to engineering realization, laying a foundation for neural network computing to enter the market.

Now, Yoshua Bengio, a Canadian computer scientist, has led a team to revitalize the symbolic AI with deep learning, which is miraculous.

Actionists believe that learning is the link between stimulus and response, and basically assumed action is a learner's response to environmental stimuli. Learning is a gradual process of trial and error, while reinforcement is a key to successful learning. In terms of the actionism, we can see that in the model of deep learning, robot interaction is an approach of actionism in reality, which constantly receives feedback for evolving in learning. One of the most representative examples of actionism is Google's DeepMind intelligent system AlphaGo, which defeated Lee Sedol, the world Go champion and South Korean 9-dan professional Go player by taking a 4-1 lead in March 2016, making a sensation all over the world. From May 23 to 27, 2017, AlphaGo scored a 3:0 victory over Ke Jie, a Chinese Go player ranking 1st in the world, in three rounds of "Man-machine War 2.0".

Deep learning and deep neural networks, which witness the strongest development momentum and gain the most limelight at present, belong to connectionism, while the equally popular knowledge graph and the important expert system in the second industry wave of the last century belong to symbolism; the contribution of actionism is mainly in the robot control system.

In the second decade of the 21st century, with the explosion of mobile Internet, big data, cloud computing, and IoT technologies, AI technology has also entered a new era of convergence. From AlphaGo's victory over Lee Sedol to Microsoft's speech recognition technology surpassing humans, Google's autonomous driving, Boston Dynamics robots, smart speakers throughout the market, neural network chips and intelligent applications in everyone's mobile phones, AI has developed from an invisible thing into a tangible accompaniment to everyone's production and life, and the beautiful picture once described by previpus scientists more than half a century ago is being realized step by step by AI technology.

1.2 Definition of AI and Current Status of Technology

1.2.1 Definition of Artificial Intelligence

Generally speaking, Artificial Intelligence (AI) is the subject of knowledge, which is the science of how to express knowledge, acquire knowledge, and use knowledge. In terms of functionality, Artificial Intelligence (AI) enables machine to implement functions that are usually associated with human intelligence, including mental activities such as judgment, reasoning, proving, perception, recognition, understanding, designing, learning, thinking, planning and problem solving. These reflect the general objective of the AI discipline: to study and to apply the rules of intelligent activities of human. From the perspective of utility, AI is knowledge engineering focused on acquisition, representation, and use of knowledge. As shown in the following table.

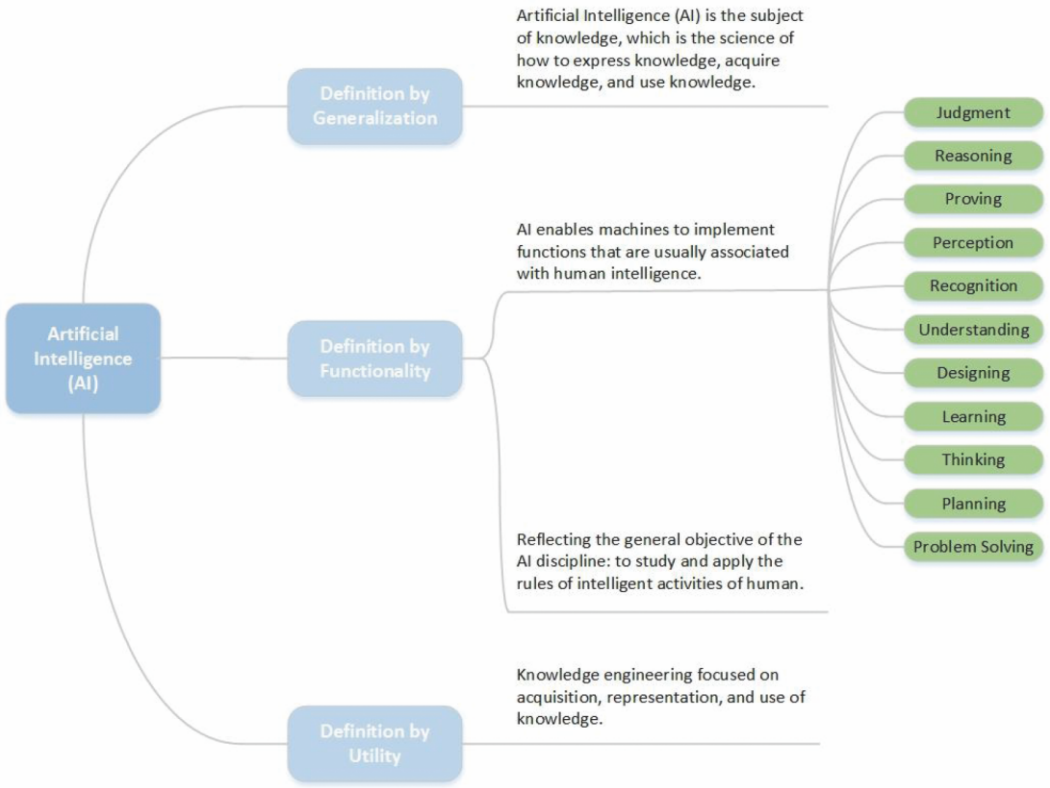


Fig. 1.2.1-1

In the AI field, three technology concepts are used most frequently: machine learning, deep learning and neural network. Generally speaking, machine learning is a method of realizing artificial intelligence; and deep learning is a method of realizing machine learning through a combination of deep neural network (DNN) and learning algorithm. The following figure gives a simple introduction to the three concepts and illustrates their relationship with AI.

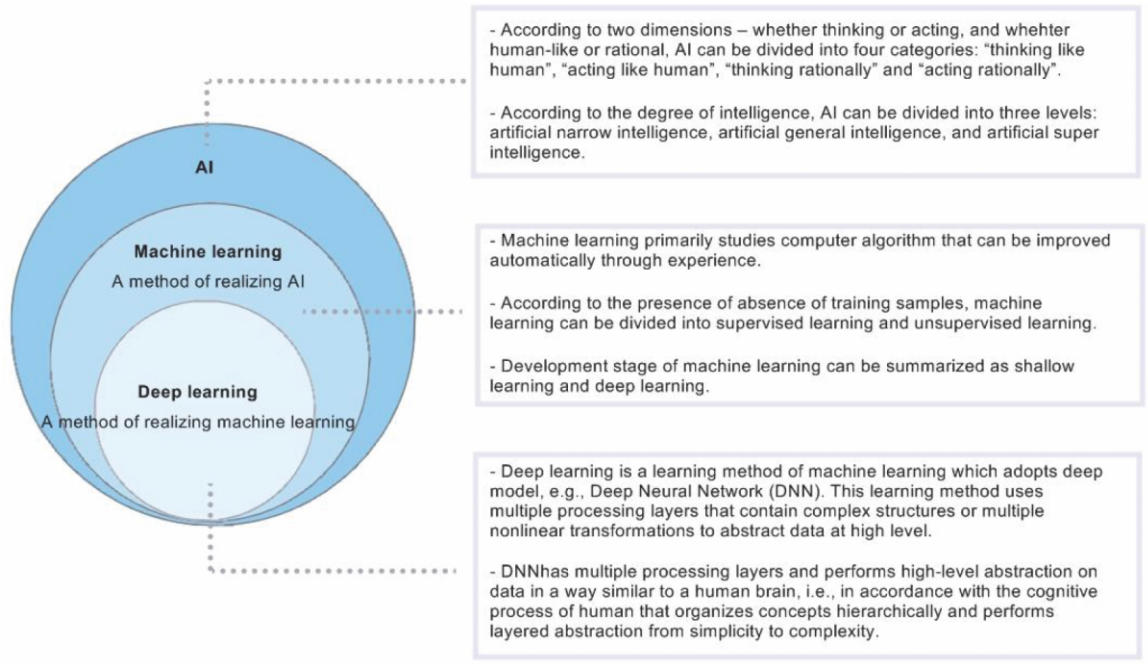


Fig. 1.2.1-2

1.2.2 Specialized Systems of AI

According to the degree of specialization, as shown in the below figure, AI can be divided to specialized AI and comprehensive AI.

1. Specialized AI: only capable of realizing elementary and role-based tasks;

2. Comprehensive AI: capable of human-level tasks and involving continuous machine learning.

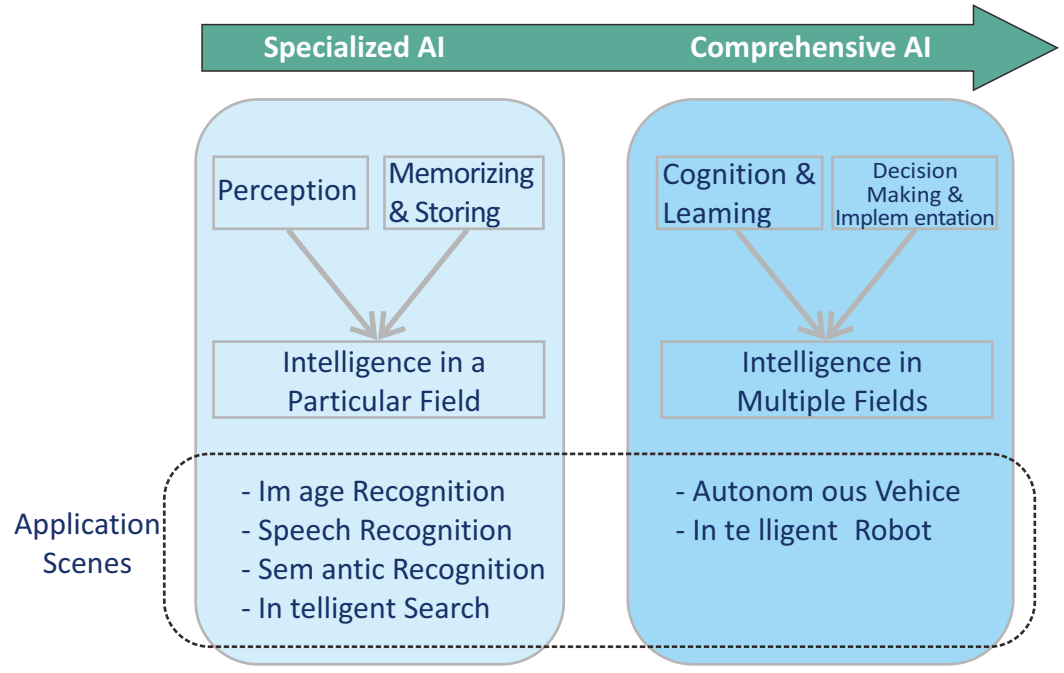


Fig. 1.2.2-1

In view of the current application scenes, AI is still “specialized” as being focused on particular field of application, however, it will eventually evolve into comprehensive AI in the future along with significant increase in computing capacity and data volume as well as improvement in algorithm in future.

1.2.2.1 Machine Learning

Machine learning is a branch of artificial intelligence focused on the study of how to design, analyze and improve automatic learning algorithm. Here, "automatic learning" means an algorithm with which a computer can, like human brain, find rules automatically through data analysis and predict unknown features according to the rules, without the need of traditional programming based on recognition of certain features beforehand.

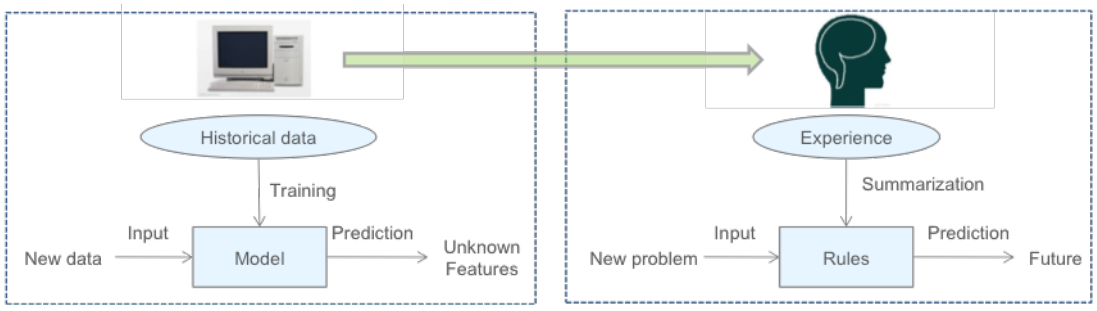


Fig. 1.2.2.1-1

In the field of machine learning, there are mainly four types of learning methods:

Supervised Learning:

Learning from labelled training examples so as to predict data beyond the training set. For supervised learning, all labels are known. Therefore, training examples have low ambiguity. A task is called regression in case of continuous output of supervised learning algorithm, and classification in case of discrete output.

Unsupervised Learning:

Learning from unlabeled training examples so as to discover structural knowledge from the training set. For unsupervised learning, all labels are unknown. Therefore, training examples are highly ambiguous. Clustering is a typical kind of unsupervised learning.

Semi-supervised Learning:

Conducting training and classification by using labelled examples and unlabeled examples. Semi-supervised learning makes use of unlabeled data to develop models with enhanced generalization on the entire data distribution. The entire learning process doesn’t need manual intervention, but solely based on the exploitation of unlabeled data by the learning system itself.

Reinforcement Learning:

Systematic learning by environment to action mapping, so as to maximize functional value of the reward signal (reinforcement signal). Namely, actions are taken after observation. Each action will exert influence on the environment, and the environment in turn will provide feedback in the form of reward to guide the learning of algorithm.

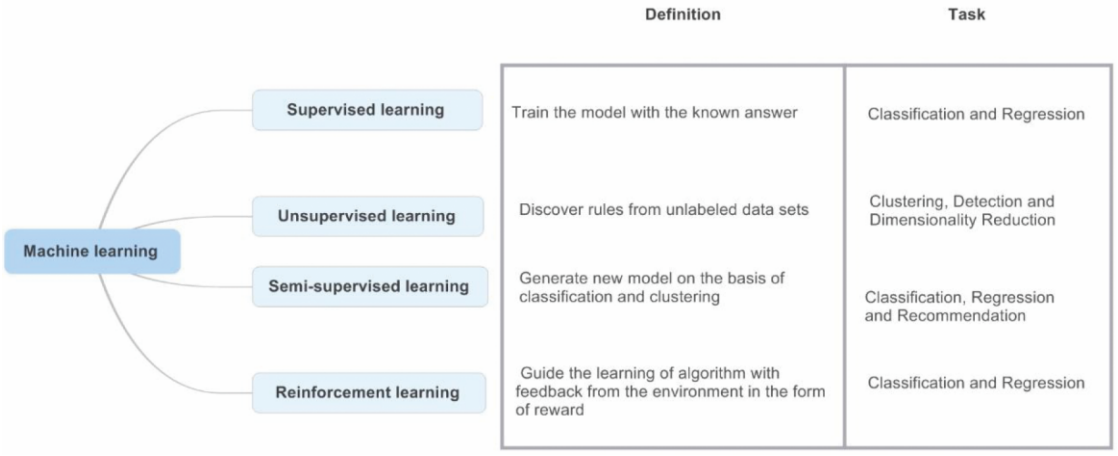


Fig. 1.2.2.1-2

1.2.2.2 Neural Network

Neural network is a mathematical model or a computing model that simulates architecture and functions of biological neural network to estimate or approximate unknown functions. Neural network performs computation through large amounts of artificial neuron connections. In most cases, an artificial neural network can change internal parameters on the basis of external information, therefore, it is a self-adaptive system.

Neural network is mainly devided into Single-layer neural network and Multi-layer neural network, which are separately introduced as follows:

Single-layer neural network:

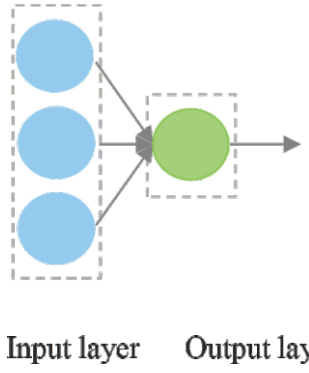


Fig. 1.2.2.2-1

The above Fig. 1.2.2.2-1 shows a single-layer neural network, the most basic form of neural network. It consists of an input layer of neurons and an output layer of neurons, and can solve simple linear problems such as "AND, OR, NOT."

Multi-layer neural network:

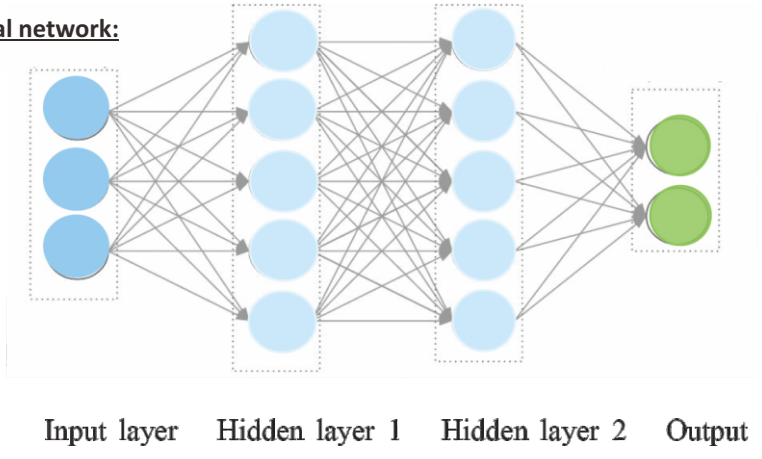


Fig. 1.2.2.2-2

The above Fig. 1.2.2.2-2 shows a multi-layer neural network, which can be understood as a neural network stacked with single-layer neural networks. The first layer of the neural network (the input layer) uses numeric vectors as input, weights the input vectors via a non-linear activation method, and generates another numeric vector as the input of the second layer of the neural network (the hidden layer 1), and so on. Multiple layers are connected together with appropriate vector dimensions. By using learning algorithms, the network learns statistical rules from a large number of training examples of features in order to predict unknown events, and forms a neural network "brain" to perform precise and complex process.

In multi-layer neural networks, there are many hidden layers between the input layer and the output layer. Each hidden layer can be understood as a feature layer, and similarly, each neuron can be regarded as a feature attribute.

1.2.2.3 Deep Learning

Shallow Learning

Before 2006, machine learning was still at the shallow learning stage. Although the neural network then was called multi-layer neural network, it usually had only one hidden layer, which limits the multi-level learning of features.

Deep Learning

Deep learning acquires associated weights by training a multi-layer neural network structure so that data can automatically obtain more specific meanings through the network, which can be further directly used for graphic classification, speech recognition, and natural language processing. Specifically, deep learning performs high-level abstraction on data using multiple processing layers that contain complex structures or multiple non-linear transformations, which is analogous to the current human brain model, and is in line with the cognitive process of human that organizes concepts hierarchically and performs layered abstraction from simplicity to complexity. Deep learning can simulate the process of human brain of learning, understanding, and even solving the ambiguity in the external environment.

The most impressive illustration of progress in deep learning is the **ImageNet** Large-Scale Visual Recognition Challenge (**ILSVRC**), which includes competition items such as classification with localization, image object detection, scene identification and segmentation.

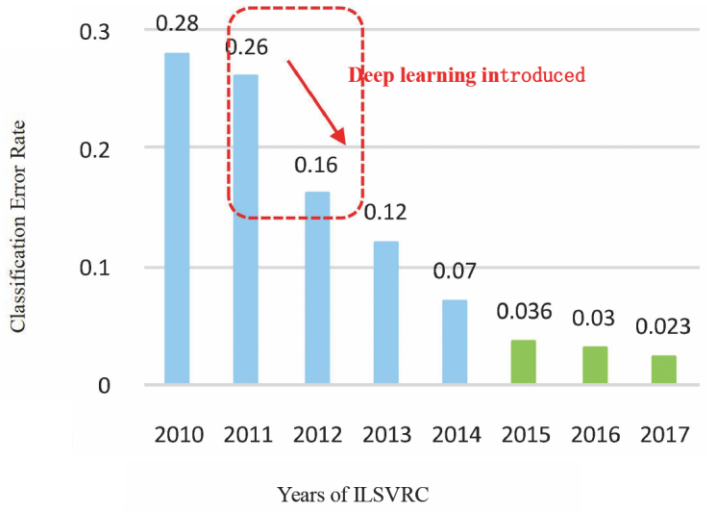


Fig. 1.2.2.3-1

The above Fig. 1.2.2.3-1 illustrates the changes of classification of error rate with the year goes on. From the above figure, it can be seen that before 2012, the classification error rate in the competition couldn't break through 25%; the classification error rate reduced to 16.4% after the introduction of deep learning in 2012, marking the beginning of the replacement of traditional visual methods by deep model; and the classification error rate of the champion was as low as 3.57% in 2015, which surpassed human (average error rate 5%) for the first time.

1.2.3 Hierarchy of AI technology

Speaking of the technical hierarchy of AI, it can be divided into three layers, an infrastructure layer, an enabling technology layer, and an application layer from bottom to top. The infrastructure layer is the nearest to the "cloud", and the application layer is the nearest to the "terminal," as shown in the below Fig. 1.2.3-1.

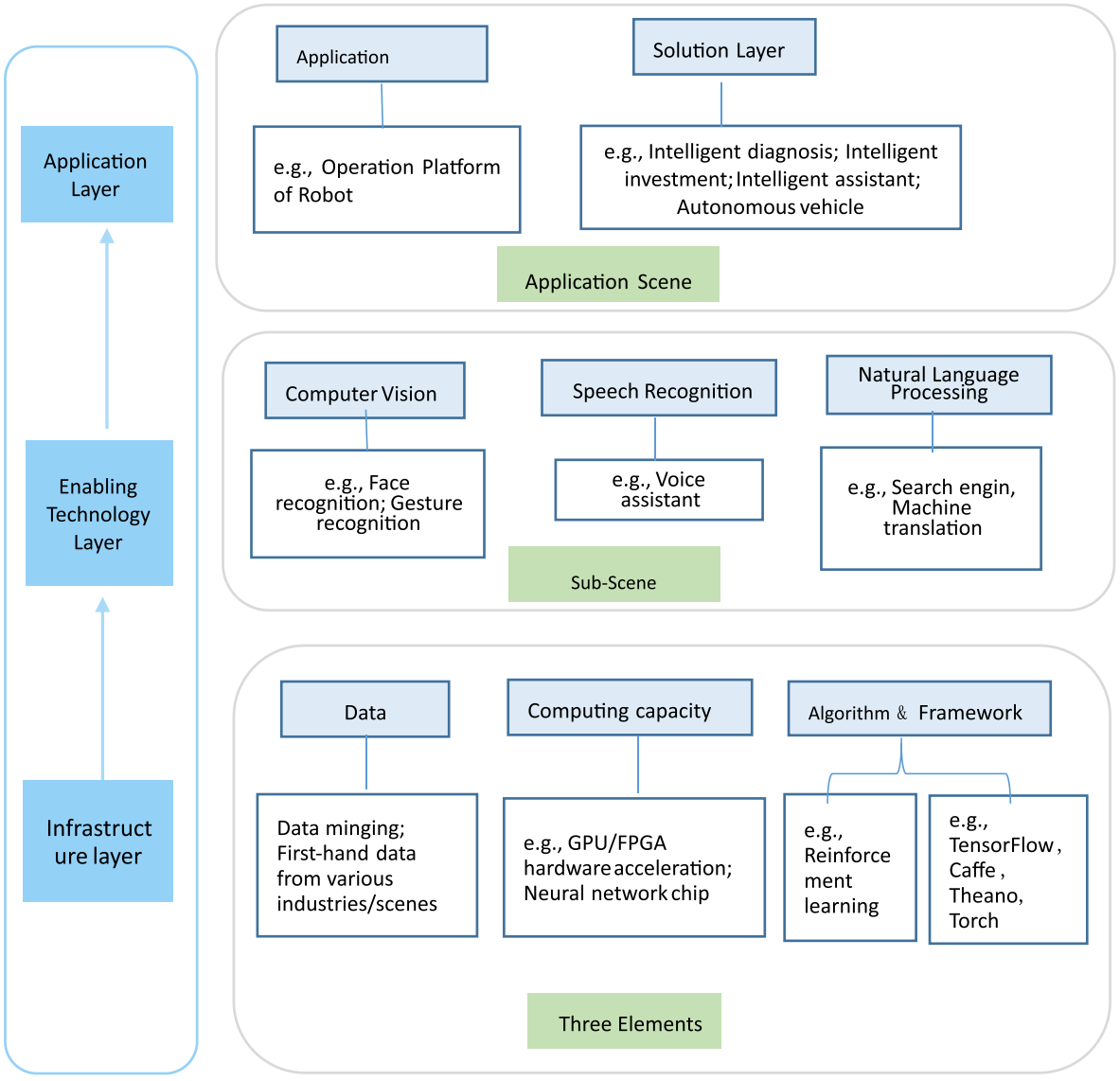


Fig. 1.2.3-1

Infrastructure Layer

The Infrastructure layer is the core carrier of AI, wherein the computing capacity, data and algoriths (& framework) is the three elements for supporting the AI industry development.

Computing capacity	Providers of computing capacity of hardware acceleration chips and neural network chips such as GPU/FPGA for Big data, cloud computing, and etc.
Data	First-hand data from various industries and scenes, such as identity, medical, shopping, and traffic information
Algorithm & Framework	Frameworks or operating systems such as TensorFlow, Caffe, Theano, Torch, DMTK, DTPAR, and ROS and the like
	Various algorithms for deep learning

Enabling Technology Layer:

The enabling technology layer is alsoc called as general technology layer, and is built upon the infrastructure layer, the most basic technologies of which include computer vision, speech recognition, and natural language processing.

Computer Vision	Computer vision means that the computer replaces the human eyes to identify, track and measure objects, and processes images to make them more suitable for observation by human eye or being sent to instruments for detection. Computer vision recognition can be further divided into three categories: object recognition, object attribute recognition, and object behavior recognition. Object recognition includes character recognition, human body recognition, and item recognition. Object attribute recognition includes shape recognition and orientation recognition. Object behavior recognition includes movement recognition, gesture recognition, and behavior recognition.
Speech Recognition	Speech recognition is a technology that converts voice signal into corresponding text or command after the machine automatically recognizes the language spoken by human through signal processing and recognition technology. Voice interaction technology, which combines speech recognition, speech synthesis, natural language processing and semantic network, is gradually becoming the main approach of multi-channel and multimedia intelligent human-machine interaction.
Natural Language Processing	Natural language processing means computer-based simulation of human language communication process, enabling the computer to understand and utilize the natural language of human society so as to achieve natural language communication between human and machine, thus replacing a part of mental work of human beings, including data looking-up, problem solving, document excerpting, material compilation, and all processing related to natural language information.

Computer vision, speech recognition, and natural language processing have a common architecture in technical process, particularly, their processes could all be divided into two parts, i.e., training and prediction.

For classification tasks, the training part is to select and extract features from training samples by the use of learning algorithms so as to train a classifier; and the prediction part is to detect, determine, and filter features from inputs by using the trained classifier.

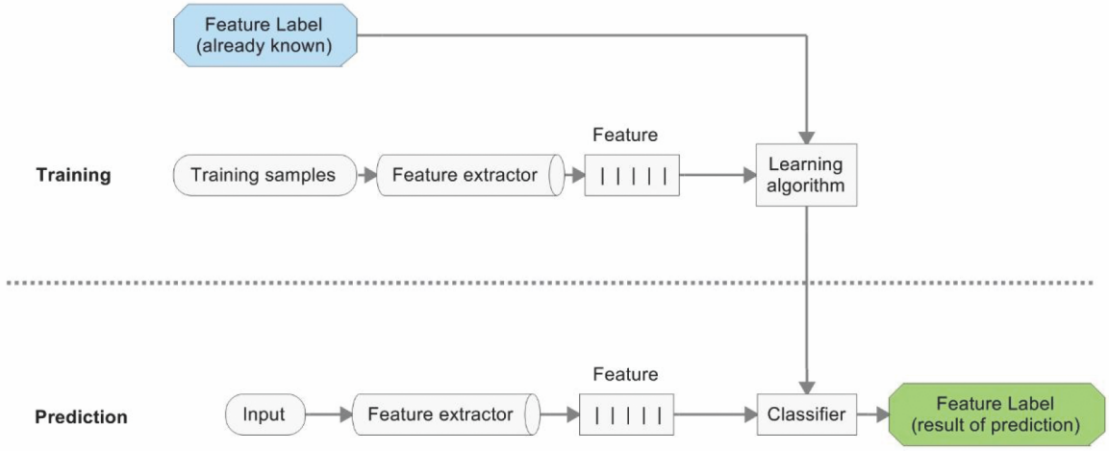


Fig. 1.2.3-2

Application Layer

The application layer is built upon the enabling technology layer. It includes application platform and solution, as shown in the below table.

Application platform	Develop various types of application platforms by differentiating combination of technologies. Examples include industry application distribution and operation platform, robot operation platform, and robot vision open platform.
Solution	Develop a large number of sub-scene applications based on scenes or industry data. Examples include applications in various scenes such as intelligent advertising, intelligent diagnosis, automatic writing, identity recognition, and intelligent investment advisor, smart assistant, and autonomous vehicle.

1.3 Development Trend of AI

1.3.1 Bottlenecks and Upsurge

According to McCarthy's classification, if the rise of machines in Cybernetics is excluded, the discipline of modern AI is at the second upsurge of development. No discipline like AI has experienced such violent ups and downs in a short period of decades. Every decline of AI is because the expected goals of science and technology hit a bottleneck, while every rise of AI is because new technical means emerged solve the problems that could not be solved before. For example, in this wave, deep learning has solved the problems related to voice and image that neural networks could not solve before. Later, just like "Deep Blue", which has defeated Kasparov in people's memory, as a landmark event, AlphaGo with reinforcement learning as its core algorithm has defeated Lee Sedol and Ke Jie. Another example is logicism. The progress of knowledge graph has also gone beyond the domain of expert system.

The developers of AI are constantly answering the hypothetical questions that previously answered by philosophers and science fiction writers, some of which are AI-related questions and ultimate questions concerned about by the general public. The means of science and engineering are making it possible to answer these questions, but people's high expectations do not necessarily lead to economic bubbles. If ranking based on the degree of contribution to the development of AI technology, the research should still focus on "computing power", "data" and "algorithms". Without sufficient computing power, there will be no means to process massive data. Besides, many algorithms relies on certain specific hardware. The improvement of the computing power to a certain critical point can make the corresponding learning algorithm possible.

1.3.2 Forecast and Trend

Entering the third decade of the 21st century, the development of AI technology and its solutions at the application level is increasingly matured, the AI model enterprises and the AI data enterprises across the world are integrating AI modules together, making the "industrialized" production and application of AI possible, helping the achievement of the ultimate goal of empowering upgrades and transformations in various industries. This is particularly reflected in the application of AI solutions in such aspects as finance, healthcare, and education.

AI Hardware

The increasing maturity of AI chip has enabled it to enter the preparatory stage for commercialization. Low cost, specialization and system integration make the neural network processing unit (NPU) one of the basic modules in the next-generation terminal-side CPU chipset. In the future, more and more terminal-side CPU chip designs will make new chip planning with compatible deep learning as the core support. In addition, the resulting computer architecture, new heterogeneous design ideas that support AI training and predictive computing will be redefined.

Deep Learning and AutoML

As one of the most effective algorithm technologies generally accepted in the industry in recent years, the open source platform based on the structure of deep learning has greatly reduced the threshold for the development of related AI technologies, and effectively improved the quality and efficiency in the specific application fields of AI. Automatic machine learning has built an automatic learning process for traditional machine learning. Meta-knowledge-based automatic selection of appropriate data, optimization of model structure, and configuration and construction of autonomous training models have greatly reduced the cost and lifecycle of machine learning, making AI applications quickly popularized in various business fields.

5G and IoT

With the development of 5G communication technology and IoT technology, the capability of edge computing will break through the boundaries of cloud computing centers and spread to everything. The AIoT system integrating AI technology and IoT technology will allow the IoT to carry out automatic learning and perform tasks without the involvement of humans, providing the best user experience in almost all vertical industries (finance, manufacturing, medical, retail, etc.). AI will appear as a service in all walks of life and everyone's life.

Quantum Computing

Neither "supercomputing" nor "super intelligence" can be achieved in this dimension (namely, knowledge and computing power) in any near future, and the "singularity" of AI still seems to be out of reach. However, "quantum computing" may contribute to a new round of development of AI. Programmable intermediate-scale noisy quantum computing equipment is basically ready for error correction, and will eventually be able to run quantum algorithms with certain use value. This will greatly help the practical application of quantum AI.

Standards and Ethics

As we can see, the fifth generation (5G) communication technology has been successfully developed, and the sixth generation (6G) is expected. However, no standards for AI technology have ever been drafted. In fact, with the outbreak and spread of the COVID-19 epidemic, all walks of life are faced with many challenges and pressures. A great number of employees work remotely from home, and people seek for improving the user experience of stakeholders with AI. Therefore, international partnerships such as the global AI partnership have been unveiled, showing a focus on questions such as "how to ensure that AI will be used for solving major global issues, and how to ensure inclusiveness and diversity" and "fairness of consistent algorithm and transparency of data". In the meantime, AI-related ethical issues have also become the focus of discussion.

About the author

Lin LI

Partner | Patent Attorney

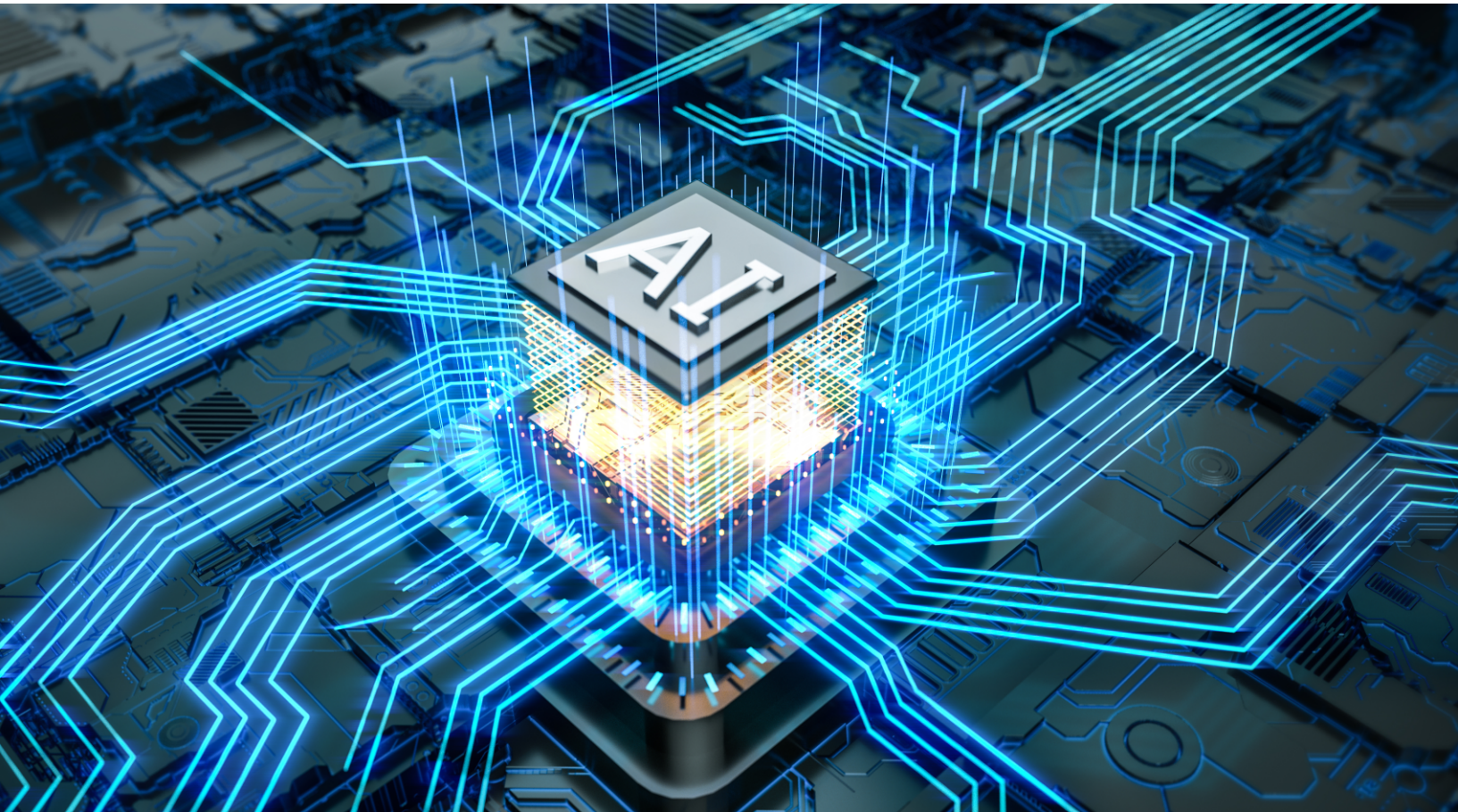
Mr. Lin Li, as a patent attorney, joining Liu, Shen & Associates since 2003, has accumulated rich experiences in various patent-related affairs, including invention patent prosecution, reexamination, invalidation, litigation, patent analysis and client counseling with focus points on electrical engineering, automatic control, telecommunication, computer science, networking & e-commerce, and artificial intelligence. Mr. Li has deep researches on invention patent relating to computer program, including AI-related inventions and business rules & methods related inventions, as well as laws and regulations, and has been providing valuable advices to the clients in the area. Mr. Li participated as a core member in a series of client-customized research reports on IP protection for AI, and produced a number of articles and presentations in the field. Mr. Li obtained his master's degree in Telematics from University of Twente, the Netherlands, and LL.M. from John Marshall Law School in Chicago, U.S.A., with Honors.

CHAPTER II

AI Industry Policies, All-Round Protection of Intellectual Property Rights and Patent Application Trends in Major Countries & Regions

Yongjuan YUE, Xiaoming ZHANG and Zexin LIAO

With the constant changes and improvements of artificial intelligence (AI) technology, all countries around the world are paying close attention to and actively introducing relevant policies to provide environmental and policy support for the rapid development of AI technology, and are taking the initiative to explore feasible plans and corresponding protection and response mechanisms in terms of those ignorable ethical and moral issues brought by AI technology. Unarguably, the irreplaceable status of AI technology in the fourth global industrial revolution and the leadership of AI technology in future strategy will quickly promote the application of AI in various fields, thus laying a foundation for epoch-making scientific progress in the world. Accordingly, AI-related patent applications are growing rapidly in number, covering various technical fields related to AI.



2.1 AI Industry related Policies in Major Countries and Regions

In recent years, all governments and related organizations around the world persistently strengthen the strategic layout of AI, constantly expand the cooperation between AI industries, and actively promote the development of AI. The following takes China, the United States, Europe, Japan, and South Korea, where AI technology is developing rapidly, as examples, and collects part of the policy guidance for the development of AI industry at the national level of various countries to give a glimpse of their attention and attitudes to the development of AI technology. As can be seen from the table below,all countries have provided strong policy guarantees and financial support for AI from such aspects as education, technology, research and innovation, ethics, supervision, and ecosystem at the national level.

2.1.1 China

The Chinese government attaches great importance to the development of AI, actively promoting the construction of standards for AI industry, inter-industry integrated, co-created and shared intelligent economic pattern, and advocating the establishment of a new order for the development of the intelligent industry in a standardized, orderly, safe and sound manner at the government level.

National Policies of China		
Date	**Event**	**Remarks**
May 2015	The State Council released "Made in China 2025"	It clearly states that China should "speed up the development of intelligent manufacturing equipment and products"
July 2015	The State Council released Guiding Opinions of the State Council on Promoting the “Internet Plus” Action Plan	It clearly states that artificial intelligence is one of the 11 key fields.
March 2016	The State Council released the draft of Outline of the13th Five-Year Plan for National Economic and Social Development	The term "artificial intelligence" was recited in the plan.

Date	Event	Remarks
May 2016	The National Development and Reform Commission (NDRC) issued the Three-year Implementation Plan for "Internet Plus" Artificial Intelligence	By 2018, it is expected to build up the basic resource and innovation platform for artificial intelligence, basically establish the industrial system, innovation service system and standardization system for artificial intelligence, make breakthroughs in the basic core technology, synchronize the overall technologies and industrial development with those in the world and lead in application and system level technologies in certain areas.
July 2016	The State Council released the National Scientific and Technological Innovation Planning for the 13th Five-Year Period	"Artificial intelligence" is included as a key aspect.
December 2016	The State Council released the Planning for Development of Emerging Sectors of Strategic Importance During the 13th Five-Year Plan Period	
March 2017	Keqiang Li, premier of the State Council, delivered the government work report on the 5th Session of the 12th National People's Congress	"We will fully implement our plan for developing strategic emerging industries. We will accelerate R&D on and commercialization of new materials, artificial intelligence, integrated circuits, bio-pharmacy, 5G mobile communications, and other technologies." This is the first appearance of "artificial intelligence" in government work report.
March 2017	The Ministry of Science and Technology added "Artificial Intelligence 2.0" to major projects for the Sci-Tech Innovation 2030 Agenda	Artificial intelligence is further lifted to the national strategy.
July 2017	The State Council's Notice of issuing the Development Plan on New-Generation Artificial Intelligence	The notice said that the goal shall be attained in three-steps: The first is to keep up the overall technology and application of artificial intelligence with the advanced level of the world by 2020; the second is to make major breakthroughs in basic theory of artificial intelligence and to lead in the world in some technologies and applications by 2025; and the third is to develop China into a major AI innovation center in the world with overall theory of artificial intelligence, AI technology and AI application reaching the world's top level by 2030.
November 2017	The National Development and Reform Commission established the alliance of China AI industry development	The leading group of this alliance includes Baidu, China Unicom, ZTE, Iflytek, AISpeech, Sysware, Haier, and Huawei.
March 2018	Keqiang Li, premier of the State Council, delivered the government work report on the 1th Session of the 13th National People's Congress	AI was mentioned again in the government work report since it was mentioned for the first time in 2017. Specifically, the government is planning to further reinforce the research of the new generation of AI, and its application in the area of medical service, elder care, education, cultural industry, and sports, developing Internet+ in multiple industries, and expand the coverage of smart living.

Date	Event	Remarks
October 2018	The Ministry of Science and Technology initiated the application of the new generation of AI in 2030 research program	The ultimate goal of this research program is to facilitate AI industry in China to achieve the world's leading level in 2030.
February 2019	The Ministry of Science and Technology initiated a working group meeting with the National Development and Reform Commission, the Ministry of Finance, the Ministry of Education and so on, to discuss the issue of the change of legal, ethnical, and social system and standards required by the development of AI technologies.	The main task of this meeting is to promote the deep integration of artificial intelligence and the real economy. The discussion mainly includes industrial landing policies for fiscal and tax incentives for artificial intelligence SMEs and start-ups; promoting various types of artificial intelligence innovation development, such as promoting the construction of artificial intelligence innovation bases; and formulating laws, regulations and ethics that promote the development of artificial intelligence.
March 2020	The Ministry of Science and Technology released the *Several Measures for Supporting the Resumption of Work and Production and the Stable Operation of the Economy with Technological Innovation*	Vigorously promote the breakthrough of key core technologies, including AI
April 2020	The National Development and Reform Commission defined the scope of new infrastructure for the first time	AI is one of the main areas of new infrastructure
June 2020	The Standing Committee of the National People's Congress mentioned the legal and regulatory issues related to AI	Actively study the legal issues related to AI
August 2020	Five ministries (the Standardization Administration, the Cyberspace Administration of China, the National Development and Reform Commission, the Ministry of Science and Technology, and the Ministry of Industry and Information Technology) issued the Guidelines for the Construction of the National New Generation Artificial Intelligence Standard System	Strengthen the top-level design of standardization in the field of AI, promote the R&D of AI industry technology and the formulation of relevant standards, and advance the healthy and sustainable development of the industry
January 2021	The Ministry of Industry and Information Technology issued the Action Plan for Innovative Development of the Industrial Internet (2021-2023)	Promote the digitization of industries, including opening up a broader space for the implementation of new generation information and communication technologies such as AI
September 2021	The National Governance Committee for the New Generation Artificial Intelligence released the Code of Ethics for the New Generation Artificial Intelligence	It aims at integrating ethics into the safety life cycle of AI, and providing ethical guidelines for natural persons, legal persons, and other related organizations engaged in AI-related activities

2.1.2 The United States

Although the U.S. government has invested a lot of funds and taken a lot of safeguard measures for the development of AI early on in terms of funds and policies, a report adopted by vote by the National Security Commission on Artificial Intelligence (NSCAI) in March this year pointed out that the U.S. government is "unprepared" in responding to the new threats of AI and thus must implement major changes. Therefore, it is foreseeable that the United States will invest more funds and provide more support for the development of AI in the future.

National Policies of the U.S.		
Date	**Event**	**Remarks**
April 2013	"Brain Research through Advancing Innovative Neurotechnologies" (BRAIN)	Government funding in 110 million US dollars
2014	The National Institute of Health (NIH) developed a detailed plan for the upcoming 10-year period	Total investment will be amounted to 45 billion US dollars over 10 years.
October 2015	The Defense Advanced Research Projects Agency (DARPA) held the "Future Technology Forum"	Prediction for technology development over the next 30 years.
November 2015	The Center for Strategic and International Studies (CSIS) issued "Defense 2045 - Assessing the Future Security Environment and Implications for Defense Policymakers"	The report states that AI is an important factor influencing future security environment.
February 2016	DARPA said that it is developing AI technology to lay its theoretical foundation	Support the "Third Offset Strategy" of the United States
May 2016	The White House established Artificial Intelligence and Machine Learning Committee	Discussion on the development of artificial intelligence related policies and laws
October 2016	Executive Office of the President released "Preparing for the Future of Artificial Intelligence" and "National Artificial Intelligence Research and Development Strategic Plan"	The artificial intelligence program is upgraded to national strategy in US, seven long-term strategies related to the development of artificial intelligence are determined.
December 2016	The White House released the report of "Artificial Intelligence, Automation, and the Economy"	Discussion about expected influence of AI-driven automation on the economy, and description of a wide range of strategies for improving benefits of AI and reducing its costs.
March 2017	President Trump established the White House Office of American Innovation (OAI) to develop policies and plans that improve government services and launch initiatives focused on innovation.	As part of Technology Week, OSTP hosted the American Leadership in Emerging Technology Summit to work with industry leaders to identify barriers to developing technologies in the United States.

Date	Event	Remarks
May 2018	White House Hosted a Summit on Artificial Intelligence for American Industry	The summit is for discussing the promise of AI and the policies we will need to realize that promise for the American people and maintain U.S. leadership in the age of artificial intelligence, from the following aspects: 1. Supporting the national AI R&D ecosystem, 2. Developing the American workforce to take full advantage of the benefits of AI, 3. Enabling high-impact, sector-specific applications of AI
February 2019	President Donald J. Trump signed an Executive Order launching the American AI Initiative for keeping American leadership in Artificial Intelligence is of paramount importance to maintaining the economic and national security of the United States	This initiative takes a multipronged approach to accelerating our national leadership in AI, and includes five key areas of emphasis: 1. Investing in AI Research and Development (R&D); 2. Unleashing AI Resources; 3. Setting AI Governance Standards; 4. Building the AI Workforce; 5. International Engagement and Protecting our AI Advantage
February 2020	The White House Office of Science, Technology and Technology Policy released the American Artificial Intelligence Initiative: Year One Annual Report	This Report summarizes the progress, and describes the sustaining long-term vision of the American Artificial Intelligence Initiative. The national strategy on enhancing U.S. leadership in AI emphasizes the following key policies and practices: 1. To invest in AI research and development (R&D); 2. Open AI resources; 3. To remove barriers to AI innovation; 4. To provide training for AI-ready labor force; 5. To promote an international environment that supports the AI innovation of the United States; 6. To embrace trustworthy AI for government services and tasks
September 2020	The U.S. government and the UK government jointly released a declaration on cooperation in AI R&D: a common vision to promote breakthroughs in AI technology	Established a bilateral dialogue between their governments on the fields identified in this vision and explore the AI R&D ecosystem to promote the common well-being, prosperity and security of present and future generations
January 2021	In order to monitor and implement the national AI strategy of the U.S., the White House established the National Artificial Intelligence Initiative Office in accordance with the 2020 American AI Initiative	This Office is the center of federal coordination and cooperation in the entire intergovernmental AI research and policy making, also the center of private sectors, academia, and other stakeholders
May 2021	The Biden administration launched AI.gov with a view to increase the efforts to federal AI innovation and encouraging future innovators	This Website is dedicated to gathering the information about such activities as design, development, and responsible use of trusted artificial intelligence (AI) advanced by American people and the federal government
June 2021	The Biden administration formed the National Artificial Intelligence Research Resource Task Force	Expand the application scope of key resources and educational tools, and draw a roadmap to stimulate AI innovation and economic prosperity throughout the country

2.1.3 Europe

In order to promote research, the European Union increases the investment in AI continuousely, supports investors from different industries in jointly making collaboration plans, and stimulates the application of AI in fields such as public service and academic research, in the hope of accelerating the derivation of successful products, services and collaboration networks through these practices.

Policies of EU		
Date	**Event**	**Remarks**
April 2018	European AI Strategy, *Coordinated Plan On Artificial Intelligence 2018*	Centered on four key areas: increasing investment, providing more data, cultivating talents, and ensuring trust. Enhanced coordination is essential for Europe to become a leading region in the development and deployment of cutting-edge, ethical and safe AI in the world
2014	*Building a Credible Human-centered Artificial Intelligence (also known as the Code of Ethics for Artificial Intelligence)*	Initiate a comprehensive pilot for the largest-scale stakeholders to participate in, so as to test the practical implementation of the ethical guidance on the development and use of AI
February 2020	*White Paper on Artificial Intelligence in Europe*	This White Paper has proposed policy options on how to achieve the dual goals of promoting the adoption of AI and addressing the risks of using new technologies
April 2021	Proposals of the European Parliament and the Council on the formulation of uniform rules for artificial intelligence (the Artificial Intelligence Act) and the amendments to certain EU legislations	This Proposal aims at putting forward a legal framework through trustworthy artificial intelligence to achieve the second goal of developing a trusted ecosystem (*White Paper on Artificial Intelligence in Europe*)
April 2021	*Coordinated Plan On Artificial Intelligence 2021*	Accelerate relevant actions, adjust priorities and implement strategies in accordance with the current AI landscape in Europe and the world
May 2021	BDVA, CLAIRE, ELLIS, EurAI and euRobotics established Adra (AI, Data and Robot Association)	Adra is one of the European partners in digital, industrial and space fields in “Horizon Europe”
June 2021	The European Commission released a new report entitled National Strategies for Artificial Intelligence: A European Perspective, which assessed the national AI strategies of various countries and offered advices on future development	Focus on four major areas of cooperation: 1. Strengthening AI education and skills; 2. Supporting research and innovation, so as to promote the development of AI into successful products and services, and improve collaboration and communication; 3. Creating a regulatory framework to solve the ethics and trust issues of the AI system; 4. Establishing a cutting-edge data ecosystem and ICT infrastructure
June 2021	The European Commission intends to invest EUR 1.3 billion in Adra, and the industrial sector is expected to invest EUR 2.6 billion by 2030	The Memorandum of Understanding as the basis of the partnership has been formally signed in June 2021 as part of the European Research and Innovation Day 2021

2.1.4 Japan

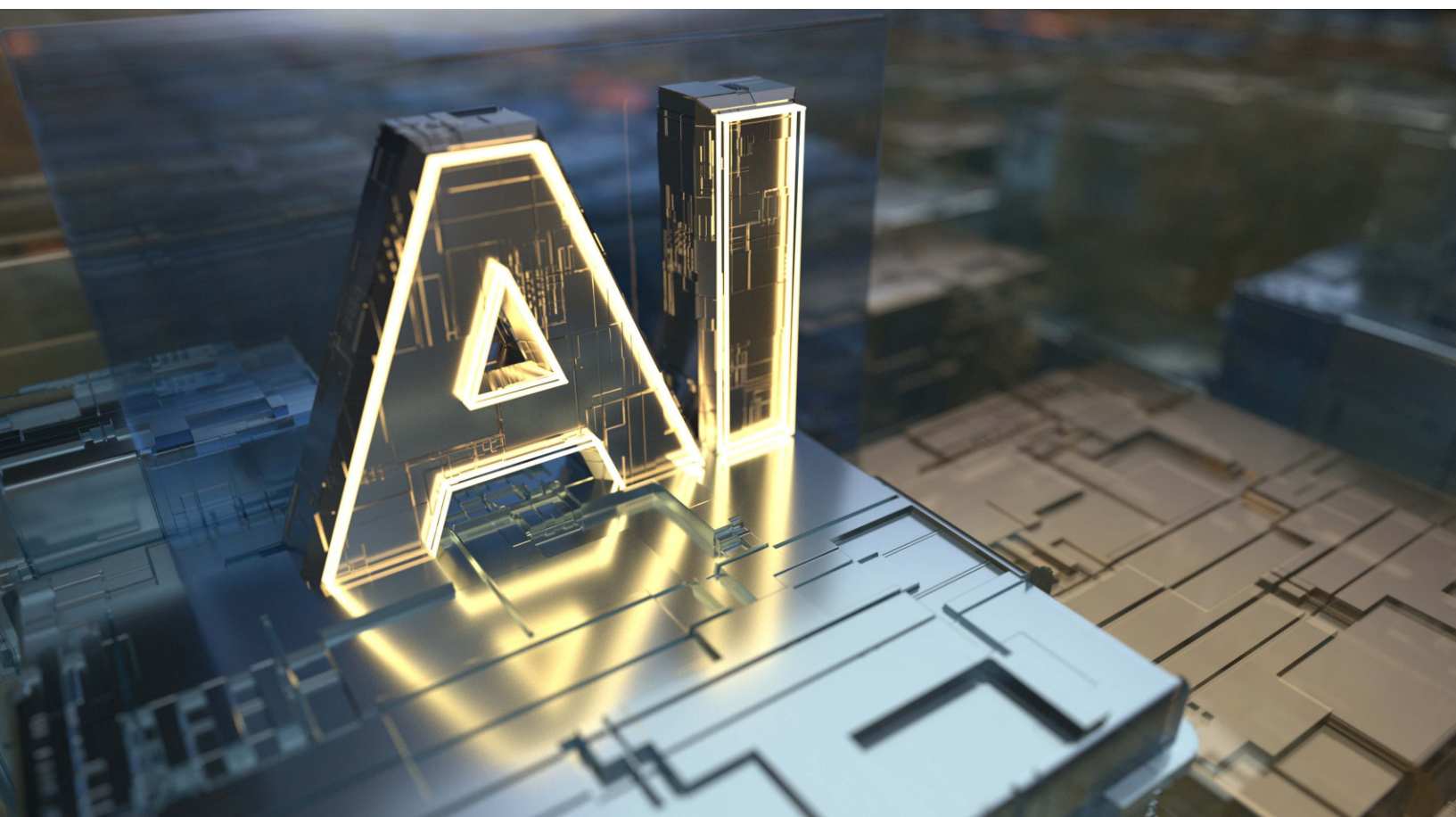
From the layout of AI in Japan, it can be seen that the Japanese government attaches great importance to the top-level design and strategy in terms of research and development, and hopes to maintain and expand its technical advantages, gradually solve social problems such as aging, labor shortage, medical care and elder-care, and build a "Super Intelligent Society" by striving to develop AI.

Policies of EU		
Date	**Event**	**Remarks**
January 2016	The Japanese government released the fifth *Science and Technology Basic Plan (2016-2020)*	Proposed to create a "Super Intelligent Society"
July 2016	The Japanese government released the *Next Generation Artificial Intelligence Promotion Strategy of Japan*	Defined the mechanism of cooperation among the Ministry of Internal Affairs and Communications, the Ministry of Education, Culture, Sports, Science and Technology and the Ministry of Economy, Trade and Industry
March 2017	Japan's Strategy Committee of Artificial Intelligence Technology released the *Artificial Intelligence Technology Strategy*	Developed a strategic framework for the technological development in the future around AI
April 2018	Released the fifth edition of the *Next Generation Artificial Intelligence/Robot Core Technology Development* Plan	Reflect the strategic deployment of Japan in fields such as AI and robot
June 2018	*Comprehensive Innovation Strategy 2018, Integrated Innovation Strategy*	Improve the foundation for cross-field data cooperation, designate AI as one of the key development areas, and emphasize the continuous cultivation of technical talents
July 2018	*The Second Strategic Innovation Promotion Program (SIP)*	Designated big data and AI based cyberspace technology, autonomous driving technology, advanced medical technology and logistics services as key areas
December 2018	*Principles for Human-centered Artificial Intelligence Society*	Indicated the attitude of the Japanese government towards AI in term of ethics
June 2019	*Comprehensive Innovation Strategy 2019, Artificial Intelligence Strategy 2019*	To form the Japanese-style AI R&D mode, and deploy strategies that lead to the integration of AI technology R&D and industry and ethics code
July 2020	*Comprehensive Innovation Strategy 2020*	Continue researching AI technology and promote social transformation with new technologies

2.1.5 South Korea

In order to accelerate innovation and development, and inject new vitality into the industry, the Korean government attaches great importance to the development of AI technology, and announced the National Artificial Intelligence Strategy in 2019, with a view to gathering national strength to realize the transformation from an "IT power" to an "AI power". On October 12, 2020, South Korea released the Development Strategy for Artificial Intelligence Semiconductor Industry (System Chip Outlook and Strategy 2.0) jointly formulated by relevant departments including the Ministry of Science and ICT at the 13th Science and Technology Ministers' Conference. This Strategy defined the vision of "marching toward a leading country in AI semiconductors and realizing the goal of becoming an AI and comprehensive semiconductor power", and the goal of possessing a global market share of 20%, 20 innovative enterprises, and cultivating 3000 high-level talents by 2030.

National Policies of South Korea		
Date	**Event**	**Remarks**
May 2018	*Artificial Intelligence R&D Strategy*	Promote AI and actively build an AI society
December 2019	*National Artificial Intelligence Strategy*	Demonstrated a national vision of leading the world in global AI field, and the strategy for the deployment in technical field
October 2020	*Development Strategy for Artificial Intelligence Semiconductor Industry 2.0*	Proposed an innovation strategy around the AI semiconductor industry



2.2 All-Round Protection of AI Intellectual Property Rights

The above part hereof has outlined AI technology and the AI industry policies in major countries. The following chapters will provide all-round protection schemes for intellectual property rights in AI field, introductions to and suggestions on the main types of intellectual property protection from the macro to the micro based on the technical characteristics of AI field.

2.2.1 All-Round Protection Schemes for AI Intellectual Property Rights

Concept of the layout of intellectual property rights: Layout of intellectual property rights is a top-level planning and guiding ideology for constructing intellectual property portfolios, and is an overall strategic consideration, which includes both large layout for overall consideration, as well as small layout for a certain product or a certain project.

The core objective of the intellectual property layout is to facilitate competition and cooperation in the business to the maximum extent.

Currently, there are not many lawsuits in the field of artificial intelligence, which is mainly due to the following reasons. On one hand, there is an endless stream of technological innovations related to artificial intelligence while all market players are still in the stage of obtaining their rights at present and they all are rushing to claim their share in new markets; on the other hand, related applications and markets are still in a very early stages and competition now is not so fierce. However, it is foreseeable that, with popularization of artificial intelligence applications and the increasingly fierce market competition, patent war in AI field will be inevitable in the future and may overshadow the litigations in the mobile Internet era.

According to the characteristics of AI field, it is advisable to select a combination of various suitable types of intellectual property, and establish an all-round intellectual property protection system involving patent, trademark, copyright, domain name, trade secret and defensive disclosure so as to prepare for the intellectual property competition in the future.

According to the characteristics of AI field, in the rich land of AI, it is advisable to select a combination of various suitable types of intellectual property, and establish an all-round intellectual property protection system involving patent, trademark, copyright, domain name, trade secret and defensive disclosure so as to prepare for the intellectual property competition in the future.

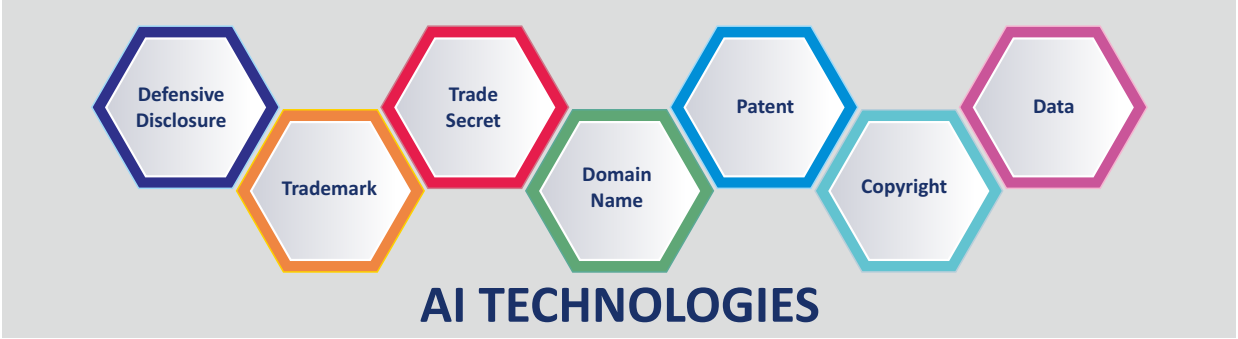


Fig. 2.2.1-1

Patent (Invention, Utility Model, and Design): It is the most common form of intellectual property protection, and represents core competitiveness of enterprises since it allows for exclusive ownership of core innovations, and also brings about intangible assets for the enterprises; and in the artificial intelligence field, patent protection can be sought for almost at all the layers from the infrastructure layer, to the enabling technology layer, and then to the application layer. The subsequent sections will detail characteristics and difficulties of patent protection for respective layers in the field of artificial intelligence.

Copyright (Ordinary Works, Software Copyright): It includes technical manual, product design drawing, and computer software code; algorithms and platform code suitable for the field of artificial intelligence. In addition, the copyright of ordinary works cannot be ignored. For example, Haier, after its "Call Firewall" were registered as written works, initiated copyright litigation against written works of other companies.

Trademark: A large number of artificial intelligence systems, platforms, applications and products are entering the market. Trademarking is to obtain market monopoly through trademark registration before or after entering the market so that the trademark becomes a distinctive identifier of a product, thus helping to obtain market-identified monopoly, and such monopoly is a permanent one, which means that the monopoly exists as long as the enterprises require and that the monopoly will become a legal right against a third party.

Domain Name: Given that artificial intelligence is currently so popular, domain names of ".ai" may become a new starting point for industry competition. Industry players will deploy domain names in line with their products, for example "drive.ai".

Trade Secret: Details of key and core algorithms in the field of artificial intelligence can be protected as trade secrets.

Data Protection and Compliance: Artificial intelligence needs to use a lot of training data in the process of machine learning. Training data can be gathered by oneself, be purchased from third-party data suppliers, or be captured from existing data through web crawlers. Training data must be acquired in accordance with the Civil Code, Cybersecurity Law, Data Security Law, Personal Information Protection Law, Anti-Unfair Competition Law and other applicable laws with legal methods so as to fully protect the legitimate rights and interests of the data and related data owners.

Defensive Disclosure: Considering costs or the patentability of technical innovation, some of the technical contents that are not intended to be patented or that are not trade secrets could be disclosed in open source. "Time Stamp Authority (TSA)" provides public time stamp for defensive disclosure, and makes powerful prior art defense in litigation.

2.2.2 Exemplary Case of All-Round Protection Scheme for AI

Face++ is an open artificial intelligence platform developed by Megvii Technology, providing the world's leading computer vision services in the form of API or SDK. Products involve face detection, face analysis, face recognition, image recognition, OCR document recognition, and text recognition.

The face recognition technique of Face ++ is taken as an example here, and its all-round protection scheme includes patent, technical secret, copyright, and domain name.

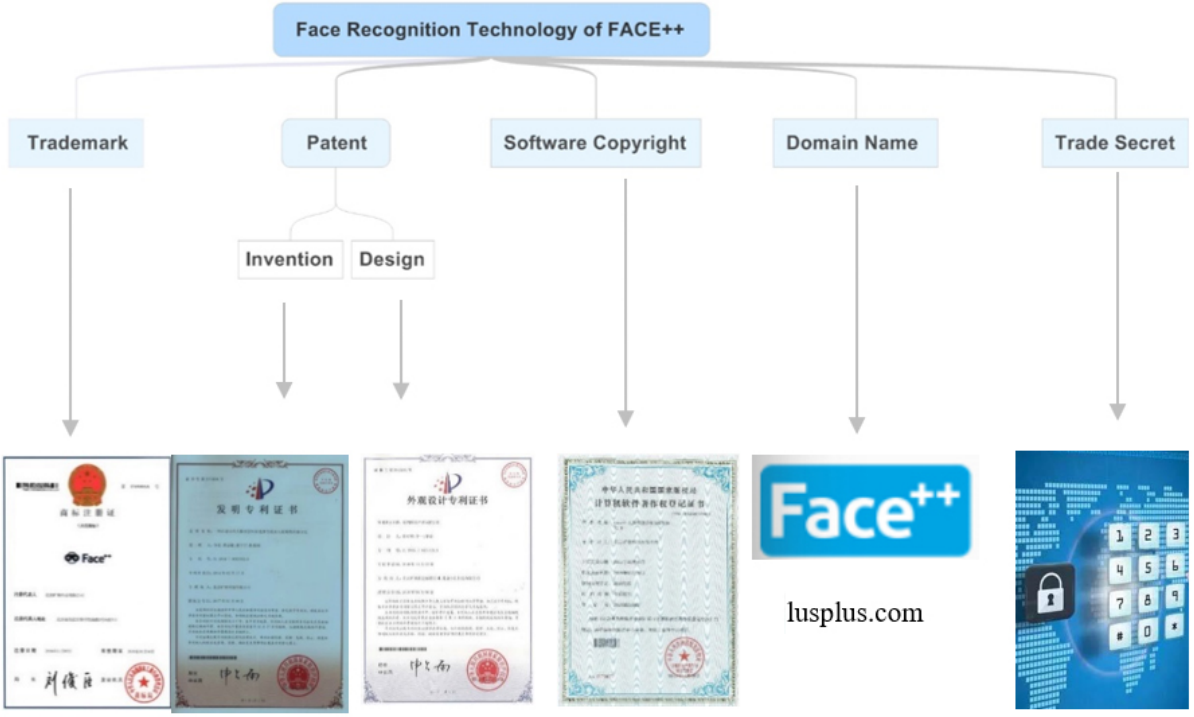


Fig. 2.2.2-1

2.3 Analysis on AI Patent Landscape

In terms of patent protection, the ownership of inventions and innovations can be determined through legal procedures, so as to effectively protect the results of inventions and innovations and monopolize the market to get in turn the greatest benefit. Therefore, patent protection is often the core in the above various intellectual property rights protection schemes.

In this part, by using the professional database IncoPat as the search database and through the fields in the title and abstract, the patent applications in the field of AI field in the world and in the major countries from January 1, 2010 to July 1, 2021 are searched and statistics.

Upon analysis of the search results, it can be found that AI, as one of the globally recognized scientific and technological development directions, has flourished globally.

2.3.1 Global AI Patent Application Trend and Layout

2.3.1.1 Global AI Patent Application Trend

From the number of artificial intelligence (AI) patent applications and the application-announcement trend in the world, it can be seen that the global AI patent applications are on the rise year by year[3], as shown in the following figures 2.3.1.1-1 and 2.2.1.1-2.

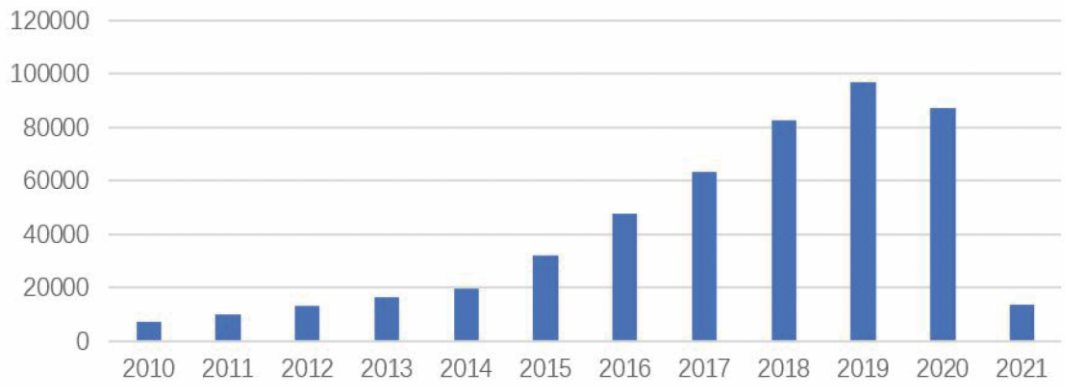


Fig. 2.3.1.1-1

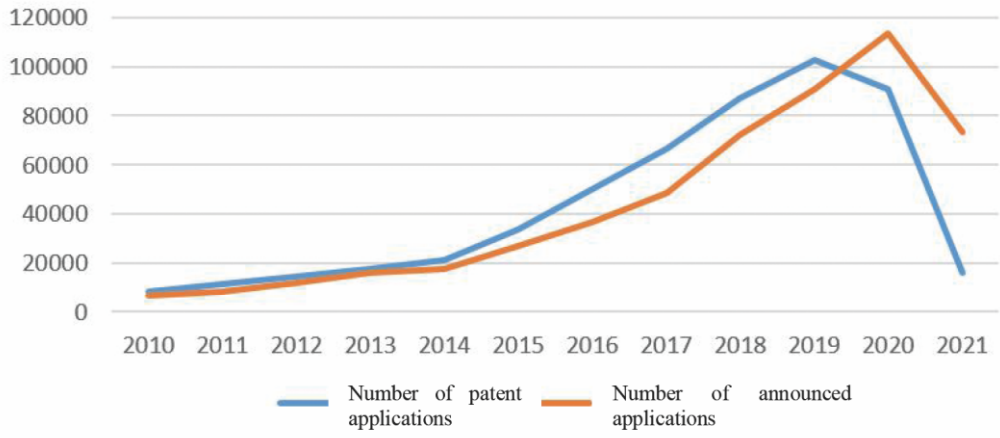


Fig. 2.3.1.1-2

3. Due to the limitation on disclosure after 18 months, the data of 2020 and 2021 in this figure only includes a small part of the actual and announced applications in 2020 and 2021. The remaining data are not added up as they are not disclosed. The same as below.

2.3.1.2 Global AI Patent Application Layout

The analysis results of the number of global AI patent applications in various technical subject directions showed that the calculation system based on calculation model (G60N), electrical digital data processing (G06F), data recognition, data representation (G060K), and control and regulation system (G05B) are hot innovation fields, as shown in Figure 2.3.1.2 below.

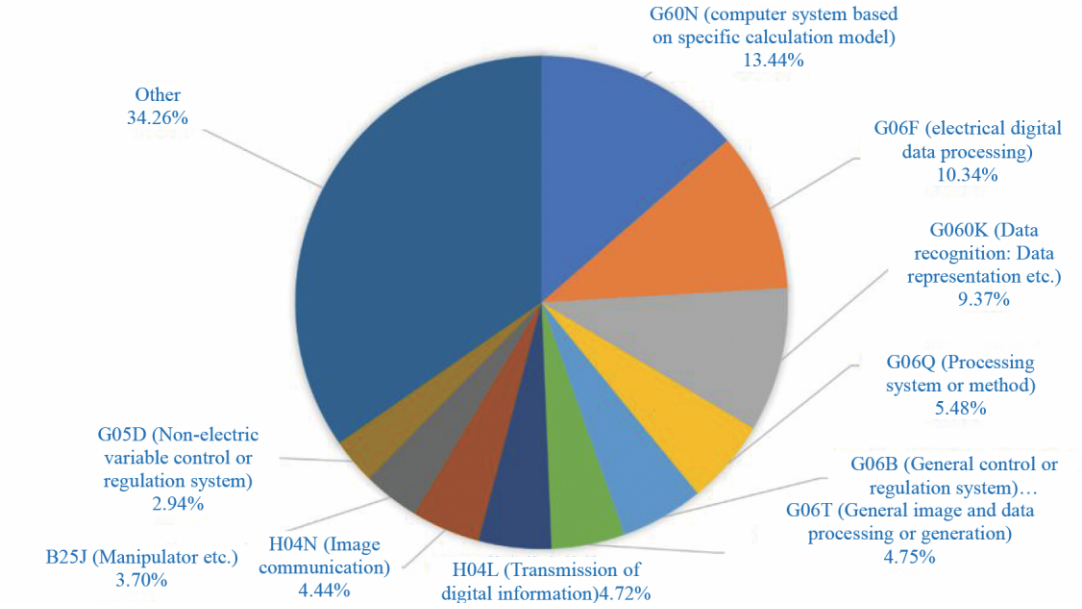


Fig. 2.3.1.2-1

2.3.2 AI Application Trend and Layout in Major Countries/Region

2.3.2.1 AI application Trend in Major Countries/Region

The following shows statistics on the number of patent applications of each major country/region in AI field. It can be seen from Figure 2.3.2.1 that currently, the global AI applications are mainly concentrated in China, the United States, Japan, South Korea and Europe. Among them, the number of patent applications in China was 384,116, ranking first in the world and clearly ahead of other countries/region.

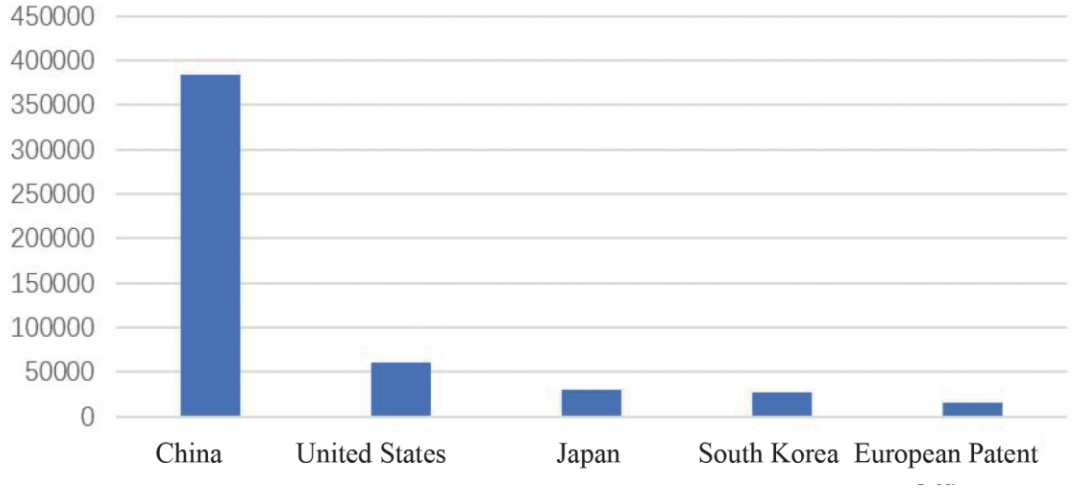


Fig. 2.3.2.1-1

2.3.2.2 Major Applicants

Statistics are made on the number of AI patent applications from 2010 to 2021. The following Figure 2.3.2.2-1 shows the ranking of the top ten applicants in the world. According to the following figures, the top ten organizations in the number of global AI patent applications are mainly concentrated in South Korea, the United States and China.

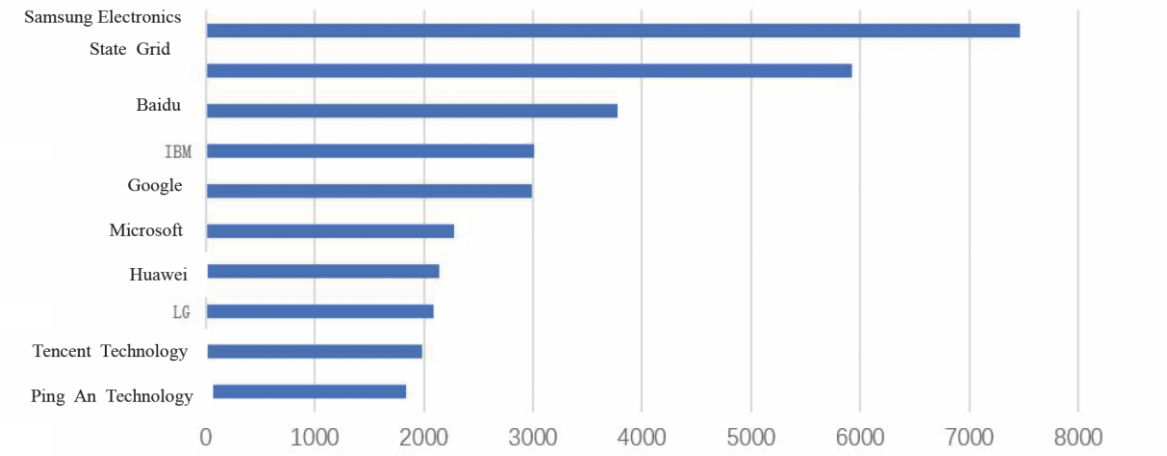


Fig. 2.3.2.2-1

The following Figure 2.3.2.2-2 shows the year-on-year application trend of the top ten major applicants. According to the following figures, the top ten organizations in the number of global AI patent applications are mainly concentrated in South Korea, the United States and China. Upon comparison of the number of global AI patent applications in each year, the application trend of the top ten applicants is generally the same as the global application trend. With the rapid increase in the number of applications filed by Chinese enterprises, China is becoming an important innovative force in the field of AI patent applications.

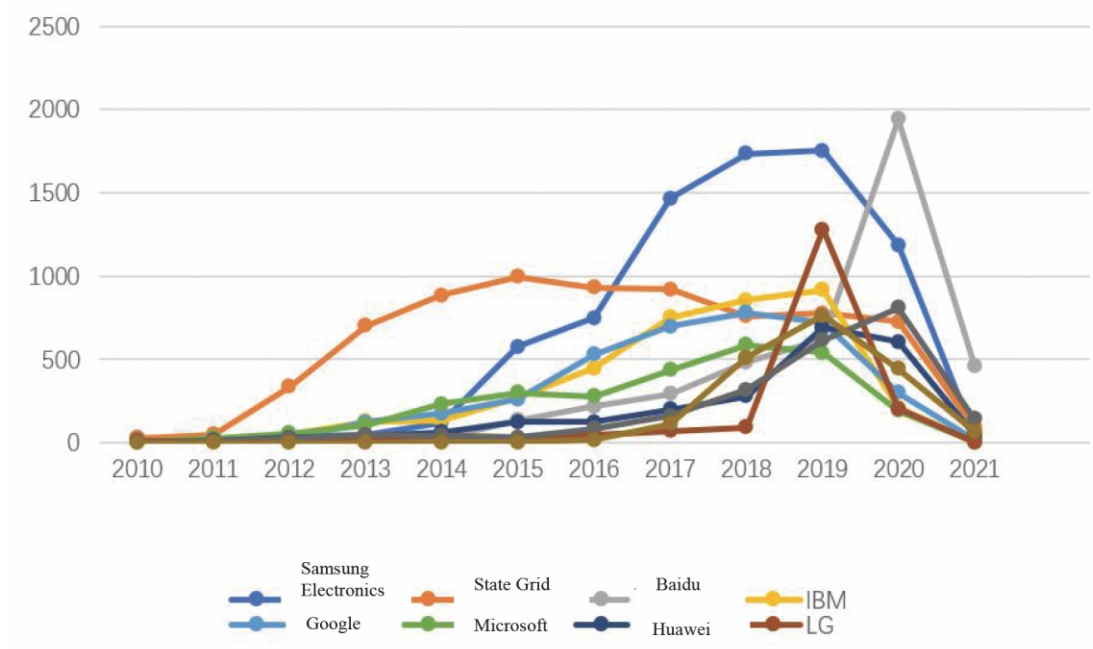


Fig. 2.3.2.2-2

2.3.2.3 AI Layout of Major Applicants

Figure 2.3.2.3 shows the distribution of patents in various technical fields of the world top ten applicants. It can be seen from the figure that Samsung Electronics has strong advantages in the field of transmission of digital information and computer systems based on specific calculation models. State Grid has obvious advantages in the field of control and regulation systems. Baidu is strong in data recognition, which is consistent with its search engine business. It can be seen from the technical themes applied for by enterprises that the enterprises mainly focus on the research related to their major business.

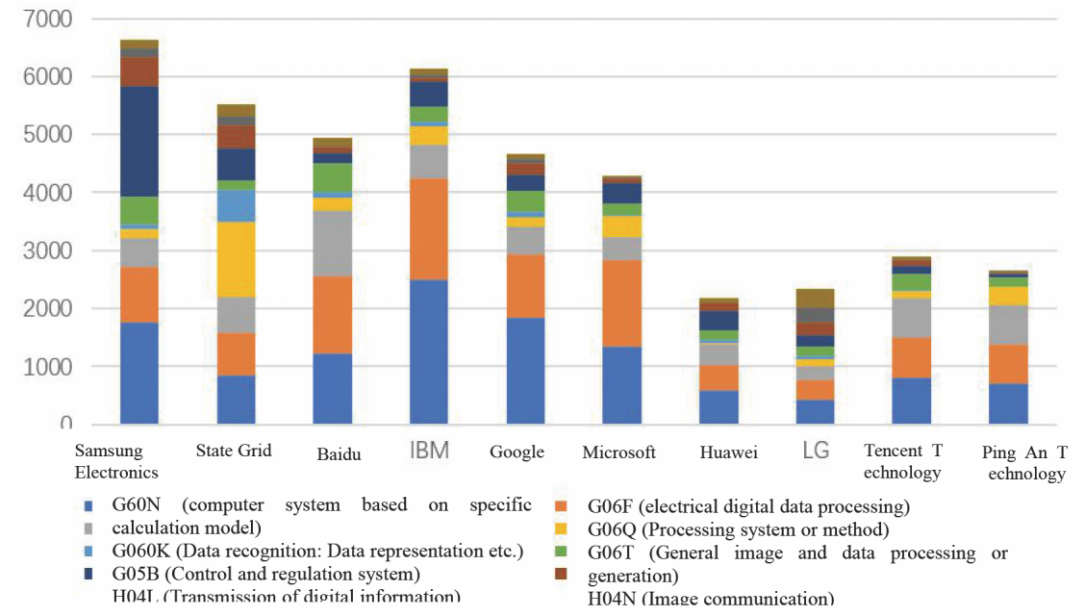


Fig. 2.3.2.3-1

2.3.3 AI Application and Layout in China

2.3.3.1 Analysis of Major Applicants in China

The top ten AI patent applicants in China are shown in Figure 2.3.3.1-1, including 5 enterprises and 5 colleges/universities. Currently, Internet enterprises and colleges/universities are the main force in the development of AI technology. State Grid ranks first in the number of applications, followed by Baidu, which shows that these two enterprises have strong advantages in AI field. In addition, colleges and universities also perform well in AI patent applications, with outstanding innovation capabilities.

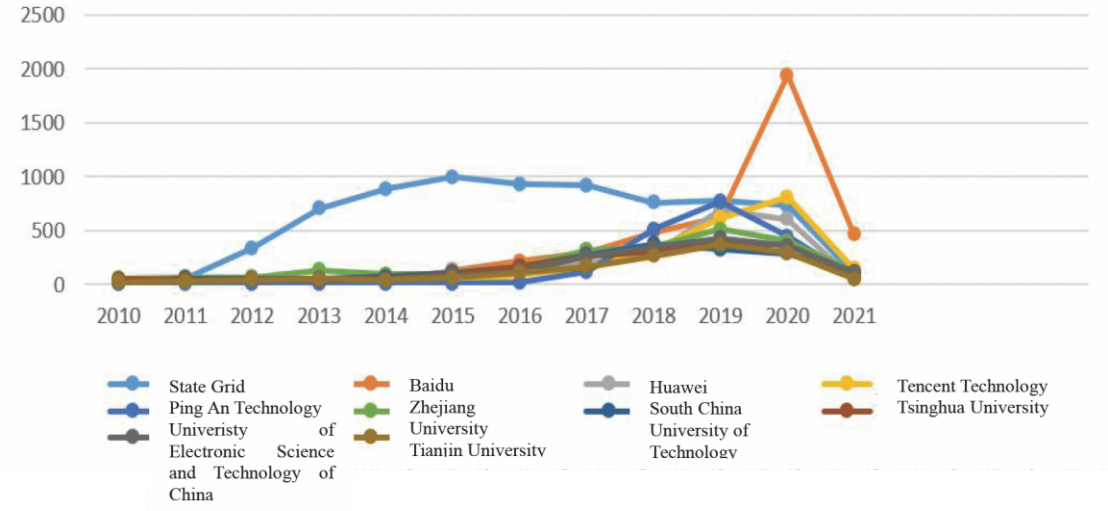


Fig. 2.3.3.1-1

Figure 2.3.3.1-2 shows the development trend of the number of patent applications filed by the top ten applicants in China. By comparing the patent application trends of each applicant, we can see that Internet enterprises show a rapid growth in the number of AI patent applications.

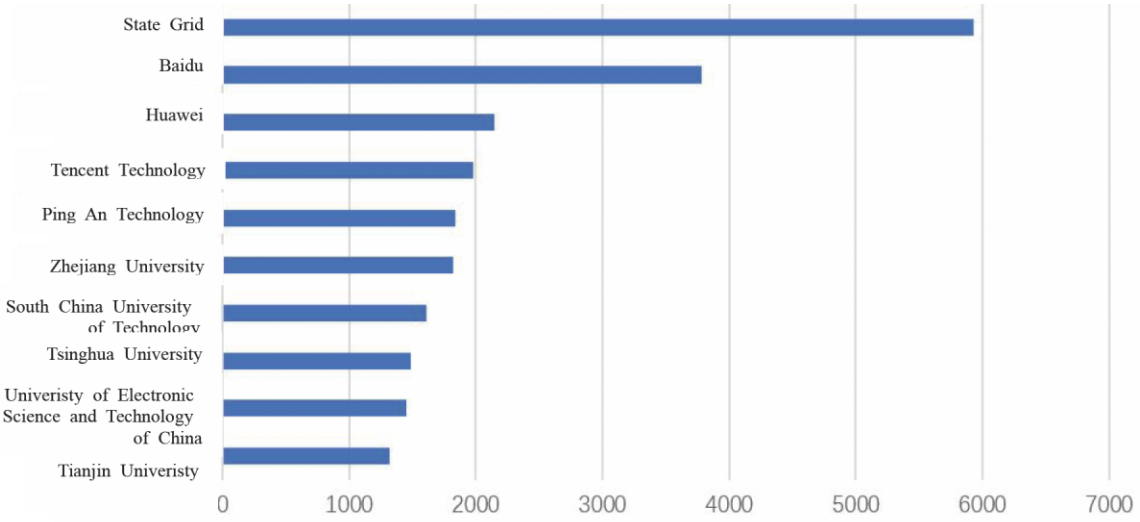


Fig. 2.3.3.1-2

2.3.3.2 AI Layout of Major Applicants in China

Chinese enterprises have great capabilities in fields of such as computer systems based on specific calculations, electrical digital data processing, data recognition, data representation, control and regulation system, and general image and data processing or generation. The AI research carried out by Chinese colleges and universities is relatively comprehensive, and their dominant technical fields are similar to those of Chinese enterprises. This makes the cooperation between Chinese enterprises and Chinese colleges/universities in promoting the innovation in AI field feasible, as shown in Figure 2.3.3.2 below.

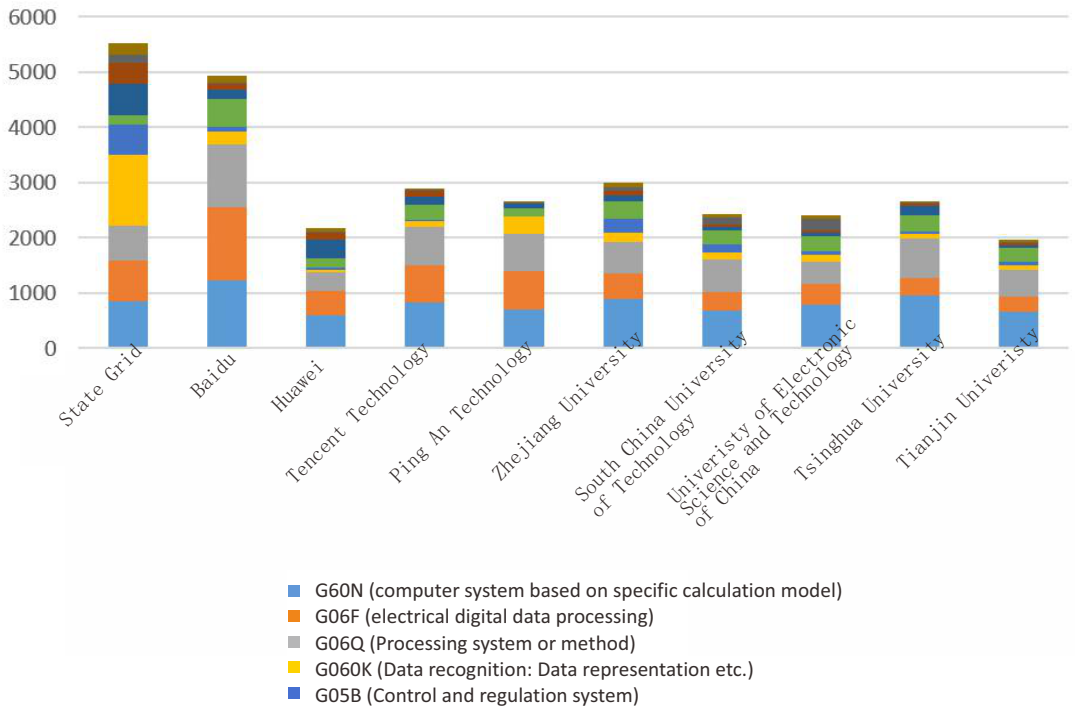
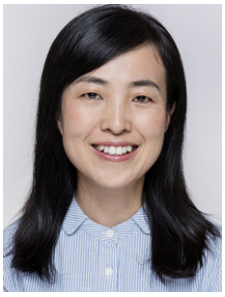


Figure 2.3.3.2

About the author

Yongjuan YUE



Patent Attorney

Ms. Yongjuan Yue joined Liu, Shen & Associates in 2016 and became a qualified patent attorney in 2017. Ms. Yue has rich experience in patent prosecution, patent analysis, patent search, reexamination, infringement, invalidation and client counseling with a focus on Telecommunication, Image Communication, TV Technology, Image Data Processing, Computer Science, Internet Technology and Intelligent system. Before joining Liu Shen, Ms. Yue worked as an examiner in CNIPA for 10 years, was a tutor-level examiner, and served as a Chairman of a panel for 6 years.

Zexin LIAO

Patent Engineer

Ms. Zexin LIAO is mainly engaged in patent related matters including patent prosecution, re-examination, patent invalidation, and client counseling with a focus on technical fields of electronics, telecommunication, computer science and internet, etc.

Zexin Liao graduated from Sichuan University with a bachelor's degree in computer science and completed her master's degree in the same major with a data science concentration at Emory University.

About the author

Xiaoming ZHANG

Partner | Patent Attorney | Attorney at Law

Mr. Xiaoming Zhang joined Liu, Shen & Associates in 2007. Mr. Zhang specializes in patent prosecution, re-examination, patent invalidation, IP litigation, and client counseling with a focus on telecommunication, artificial intelligence, big data processing, semiconductor technology, image processing, network, optics and physics. Mr. Zhang processes extensive experience both before SIPO and USPTO and is skilled in drafting application documents in Chinese and English.

Mr. Zhang became a qualified patent attorney in 2008, and got his qualification as an attorney at law in 2018.

Mr. Zhang obtained a doctor's degree in Optics from Peking University in 2007.

CHAPTER III

Patent Protection of AI in China and Other Major Jurisdictions

With the rapid development of Artificial Intelligence (AI) technology, a number of countries are constantly exploring the new challenges that the patent protection system brings to the patent protection system and the perfect demand for the protection system. In this chapter, the patent systems and practices of coutries/regions where the five IP offices (CNIPA, USPTO, EPO, JPO, and KIPO) locate are takan as examples introduce AI patent protection in China and other major jurisdictions.

3.1 AI-related Patent Practice in China

Jinlin CHEN, Xiaoming ZHANG and Lin LI

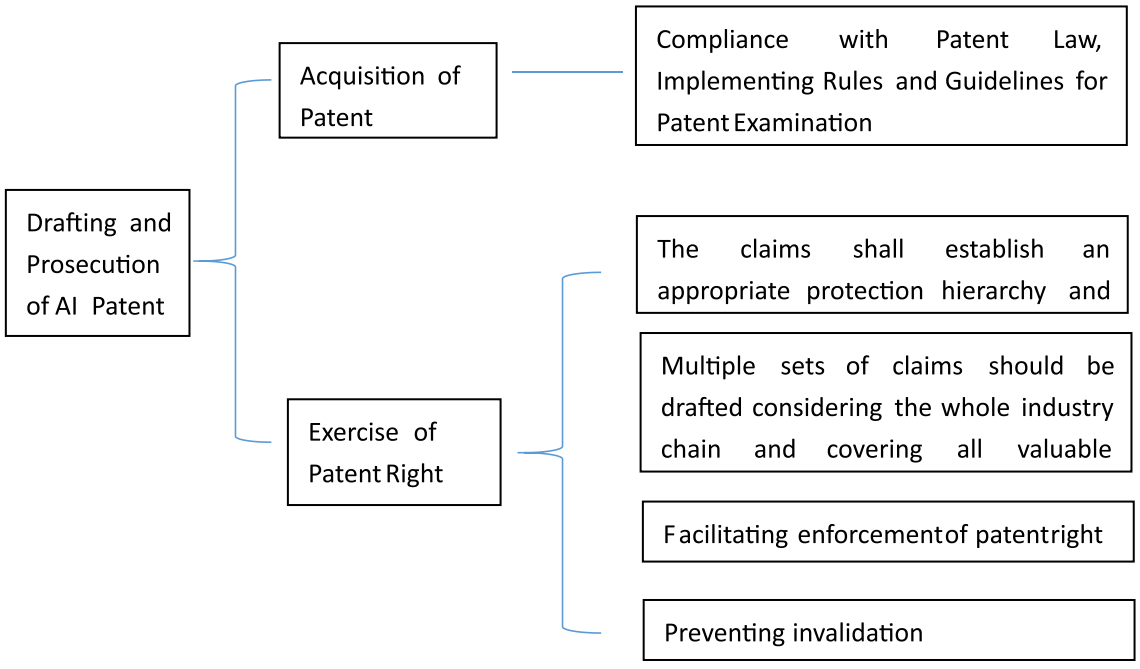
3.1.1 Factors Considered in AI Patent Prosecution

Similar to normal patents, the drafting and prosecution of patents in the field of artificial intelligence need to take into account both the acquisition of patents and the exercise of patent rights after acquisition.

The main consideration for the acquisition of patent rights is to comply with the Patent Law, the Implementing Regulations of the Patent Law and the Guidelines for Patent Examination.

The main considerations for the exercise of patent rights include:

- Define broad scopes in the independent claims, and put additional technical features in the dependent claims to secure sub-scopes in an appropriate gradation;
- In order to avoid limiting application scenes of a technical solution, consider the whole industry chain, and draft multiple sets of claims to cover all valuable topics;
- Facilitate the identification of infringement;
- Improve the stability of patents to prevent invalidation.



3.1.2 Main Legal Norms Related to Acquisition of Patent Rights

Main provisions involved in the acquisition of patent rights related to AI are the Patent Law, the Implementation Rules of the Patent Law and the Guidelines for Patent Examination, as shown in the table below.

Patentable subject matter	**Article 2.2**	Invention means any new technical solution relating to a product, a process or an improvement thereof.
	Article 25.2	For any of the following, no patent right shall be granted: … (2) rules and methods for mental activities; ...
	Guidelines Part II Chapter 9, 6.1.1, 6.1.2	Section 6.1.1 and Section 6.1.2 of Chapter 9 of Part II specifically stipulate the examination rules for patentable subject-matters of patent applications involving algorithms or business methods such as AI. In principle, **technical features and algorithm features or business rule and method features should not be simply separated, but all the content recorded in the claims should be taken as a whole, to analyze the technical means involved, the technical problems solved and the technical effects obtained.** If the claim contains technical features in addition to algorithmic features or business rule and method features, the claim as a whole is not a rule and method of mental activities, it should not be excluded the possibility of acquiring a patent right in accordance with Article 25, clause1(2) of the Patent Law. When examining whether a claim containing algorithmic features or business rules and method features is a technical solution, it is necessary to consider all the features recorded in the claim as a whole. If the claim recites a technical means that uses natural laws to solve a technical problem, and a technical effect conforming to natural laws is obtained thereby, the solution defined by the claim falls within the technical solution mentioned in Article 2, clause 2.
Novelty and inventiveness of claim	**Article 22.2 Article 22.3**	Novelty means that the invention or utility model concerned is not an existing technology, and prior to the date of application, no entity or individual has filed an application heretofore with the patent administrative department of the State Council for the identical invention or utility model and recorded it in the patent application documents or patent documents released after the said date of application. Inventiveness means that, as compared with the existing technology, the invention has prominent substantive features and represents a notable progress and that the utility model has substantive features and represents progress.
	Guidelines Part II Chapter 9, 6.1.3	Section 6.1.3 of Chapter 9 of Part II specifically stipulate the examination rules for novelty and inventiveness of patent applications involving algorithms or business methods such as AI. In principle, **when examining the novelty of an invention patent application that contains algorithmic features or business rule and method features, all the features recorded in the claims should be considered. The all features include both technical features, and algorithmic features or business rule and methods features. When performing inventiveness examination of an invention patent application that contains both technical features and algorithmic features or business rule and method features, the algorithm features or business rule and method features, which functionally support and interact with each other with technical features, and said technical features should be considered as a whole.** "Functionally support and interact with each other " means that the algorithm features or business rule and method features are closely combined with technical features, which together constitute a technical means to solve a technical problem, and can obtain corresponding technical effects.

Claims shall be clear, concise and supported by description	**Article 26.4**	The claims shall be supported by the description and shal1 clearly and concisely define the extent of the requested patent protection.
	Guidelines Part II Chapter 9, 6.3.1	Section 6.3.1 of Chapter 9 of Part II specifically stipulate the requirements for drafting claims for patent applications involving algorithms or business methods such as AI. In principle, the claims of an invention patent application containing algorithmic features or business rule and method features should be based on the description, and clearly and concisely define the scope of patent protection claimed. The claims shall record the technical features and the algorithm features or business rule and method features that functionally support and interact with each other.
Description shall be clear, complete and fully disclosed	**Rule 20.2**	An independent claim shall outline the technical solution of an invention or utility model and record the technical features necessary for solving technical problems.
	Article 26.3	The description shall set forth the invention or utility model in a manner sufficiently clear and complete so as to enable a person skilled in the re1evant field of techno1ogy to carry it out.
	Guidelines Part II Chapter 9, 6.3.1	Section 6.3.1 of Chapter 9 of Part II specifically stipulate the requirements for drafting description for patent applications involving algorithms or business methods such as AI. In principle, the description of an invention patent application containing algorithmic features or business rules and method features should clearly and completely describe the solution adopted by the invention to solve its technical problems. On the basis of including technical features, the solution may further include algorithm features or business rules and method features that functionally support and interact with each other with technical features. The description should state how the technical features and the algorithm features or business rules and method features that functionally support and interact with each other work together and produce beneficial effects.

3.1.3 Eligibility Issue

3.1.3.1 The Provisions of the Guidelines for Patent Examination for the Eligibility Issue of AI-Related Inventions

In China, eligibility issue mainly involves two articles of the Patent Law, namely Article 2 and Article 25.

An "invention" is defined as a new **technical solution** relating to a product, a process or improvement thereof according to Article 2, clause 2 of the Patent Law. That is, any patentable application for invention in China must constitute a technical solution. To determine a technical solution, China adopts a "**three-element criterion** (i.e., technical problem, technical means and technical effect)." Under this criterion, a technical solution should aim for solving a **technical problem**, by using **technical means** in conformity with the laws of nature, and can produce **technical effect** in conformity with the laws of nature.

According to Article 25, clause 1(2) of the Patent Law of China, rules and methods for mental activities are not patentable since they generally do not solve any technical problems and therefore are not technical solutions. Therefore, pure algorithms or mathematical rules are excluded from patentability as being rules and methods for mental activities.

Section 6 of Chapter 9 of Part II of the Guidelines for Patent Examination provides specific provisions on the examination particularity of "invention patent applications containing algorithm features or business rules and method features". Such patent applications cover "AI", "Internet plus", "big data" and "blockchain". This section involves examination rules related to eligibility issue, novelty/inventiveness, and drafting requirements regarding claims and specifications. Specially, ten examples are incorporated to illustrate examination rules regarding the examination of eligibility issue and novelty/inventiveness. Brief introduction to the eligibility issue will be provided in the following.

According to the provisions of this part of the Guidelines for Patent Examination, applications related to new fields are first examined in accordance with Article 25 of the Patent Law. If the application passes the examination of Article 25, that is, the application is not a rule or method of mental activities, the examination is carried out in accordance with Article 2 of the Patent Law to check whether the application is a technical solution.

(1) Examination Rules for Article 25 of the Patent Law

For examination under Article 25, if a claim includes technical features in addition to features of rules or methods for mental activities, the claim as whole is not considered as a rule or method for mental activities, and thus cannot be ruled out from being patentable according to Article 25. On the contrary, if a claim does not include any technical features and includes only features of rules or methods for mental activities, then the claim is considered as a rule or method for mental activities and shall be ruled out according to Article 25.

[Example 1]

Example 1 illustrates a method for mental activities without any technical features. Example 1 is a method of establishing a mathematical model. The claim of this example is as follows.

A method for establishing a mathematical model, characterized by comprising the following steps of:

according to feature values of training samples of a first classification task and feature values of at least one of training samples of a second classification task, training an initial feature extraction model to obtain a target feature extraction model, wherein the second classification task is another classification task related to the first classification task;

according to the target feature extraction model, processing the feature values in respective training samples of the first classification task to obtain extracted feature values corresponding to respective training samples;

combining the extracted feature values and label values corresponding to respective training samples into extracted training samples, and training the initial classification model to obtain a target classification model; and

combining the target classification model and the target feature extraction model into a mathematical model of the first classification task.

The method comprises steps of processing feature values and training models. However, the method does not involve any specific application area. Accordingly, the feature values in the method are abstract mathematical data, the processing steps are abstract mathematical method steps, and the resulting model is an abstract general classification model. Therefore, **the solution of example 1 does not involve any technical feature, and is thus a method for mental activities stipulated in Article 25.**

(2) Examination Rules for Article 2 of the Patent Law

For Article 2, whether a claim is a technical solution is examined based on whether the claim as a whole uses a technical means conforming to natural laws to solve a technical problem and achieve a technical effect. In particular, if algorithm steps defined in a claim are related to a technical problem and achieves a technical effect, the claim is a technical solution in principle. For example, an algorithm step can be considered as being related to a technical problem if the algorithm step processes data with definite technical meaning in a specific technical field and the execution of the algorithm involves using natural laws to solve a technical problem.

Examples 2 to 6 are related to examination based on Article 2, where examples 2 to 4 are considered as technical solutions, and examples 5 and 6 are not considered as technical solutions.

[Example 2]

Example 2 is related to a training method for a convolutional neural network (CNN) model. The claim of this example is as follows.

A method for training a CNN model, characterized by comprising:

obtaining initial model parameters of the CNN model to be trained, wherein the initial model parameters include an initial convolution kernel of each level of convolutional layer, an initial bias matrix of each level of convolutional layer, an initial weight matrix of fully connected layer, and an initial bias vector of the fully connected layer;

obtaining multiple training images;

at each level of convolutional layer, , performing a convolution operation and a maximum pooling operation on each training image by using the initial convolution kernel and the initial bias matrix at each level of convolutional layer to obtain a first feature image of each training image at each level of convolutional layer;

performing a horizontal pooling operation on the first feature image of each training image at at least one level of convolutional layer to obtain a second feature image of each training image at each level of convolutional layer;

determining a feature vector of each training image according to the second feature image of each training image at each level of convolutional layer;

processing each feature vector according to the initial weight matrix and the initial bias vector to obtain a category probability vector of each training image;

calculating a category error according to the category probability vector of each training image and an initial category of each training image;

adjusting the model parameters of the CNN model to be trained based on the category error;

continuing the process of model parameter adjustment based on the adjusted model parameters and the multiple training images until the number of iterations reaches a preset number; and

taking the model parameters obtained when the number of iterations reaches the preset number as the model parameters of the trained CNN model.

In this method, convolution operation and maximum pooling operation are performed on training images at each convolution layer, and then the feature images obtained after the maximum pooling operation are further horizontally pooled, so that the trained CNN model can recognize images of any size when identifying an image category. In this example, the data processed in the steps of the training method are image data, reflecting that the training algorithm is related to a specific technical field of image information processing. The training method in this example solves a technical problem that a CNN model can only recognize images of a fixed size and achieves a technical effect of recognizing images of any size by a technical means of performing different processing and training on images in different convolutional layers. Therefore, **example 2 is a technical solution stipulated in Article 2.**

[Example 3]

Example 3 is related to a method of using rental bikes. The claim of this example is as follows.

A method for using rental bicycles, characterized by comprising the following steps of:

Step 1: A user sends a request to use a rental bicycle to a server through a terminal device;

Step 2: The server acquires the user's first location information and retrieves a second location information of rental bicycles within a certain distance corresponding to the first location information and status information of these rental bicycles. The second location information and the status information of the rental bicycles are sent to the terminal device, wherein the first location information and the second location information are acquired through GPS signals;

Step 3: The user finds a target rental bicycle that can be ridden according to the location information of the rental bicycles displayed on the terminal device;

Step 4: The user scans a QR code on the body of the target rental bicycle through the terminal device, and obtains permission to use the target rental bicycle after being authenticated by the server;

Step 5: The server pushes a parking instruction to the user according to the riding situation. If the user parks the bicycle in a designated area, a discounted tariff will be used for billing, otherwise a standard tariff will be used for billing; and

Step 6: The user makes selection according to the instructions. After the riding is completed, the user performs a lock operation to the rental bicycle, and the rental bicycle sends a riding completion signal to the server after detecting a locked state.

In this method, a user initiates a use request of a rental bike through a user terminal device to a server, the server provides location information and state information of rental bikes around the user to the user terminal device based on the location of the user terminal device, and the user can find an available rental bike based on the information displayed on the user terminal device. The method uses computer programs in the user terminal device and the server to control or lead the way a user uses rental bikes. Collecting, calculating and using location information and state information involved in the claim are technical means to solve a technical problem of easily and precisely finding a rental bike. Therefore, **example 3 is a technical solution stipulated in Article 2.**

[Example 4]

Example 4 is related to a communication method between blockchain nodes. The claim of this example is as follows.

A method for block chain node communication, wherein block chain nodes in a block chain network include business nodes, the business node stores a certificate sent by a certificate authority (CA) and is pre-configured with a CA trust list, and the method comprises:

a first blockchain node receiving a communication request sent by a second blockchain node, wherein the communication request carries a second certificate of the second blockchain node;

determining a CA identifier corresponding to the second certificate;

judging whether the determined CA identifier corresponding to the second certificate exists in the CA trust list;

if yes, establishing a communication connection with the second blockchain node; and

if not, not establishing a communication connection with the second blockchain node.

The communication method uses a CA certificate and a pre-configured CA trust list to improve the security of data stored in the blockchain. Using a certificate to enhance communication security is a technical means conforming to natural laws to solve a technical problem. Therefore, **example 4 is a technical solution stipulated in Article 2.**

[Example 5]

Example 5 is related to a consumption rebating method. The claim of this example is as follows.

A method for consumption rebate, characterized by comprising the following steps of:

when a user makes a purchase at a merchant, the merchant returning a certain cash coupon according to an amount of consumption, Specifically, the merchant uses a computer to calculate the user's consumption amount, and divides the user's consumption amount R into M intervals, where M is an integer, and the value from interval 1 to interval M is from small to large, and an amount F of the returned cash coupon is also divided into M values, and the M values are also arranged from small to large;

according to the calculated value of the computer, determining that when the user's current consumption amount is in interval 1, the rebate amount is the first value, when the user's current consumption amount is in interval 2, the rebate amount is the second value, and so on, and returning the rebate amount of the corresponding interval to the user.

The method uses a computer to execute a set of rebate rules based on consumption amount to provide consumers with coupons so as to increase the consumers' consumption willingness. In this method, the rebate rule is an artificial rule, which is not conforming to natural laws. Therefore, although the method is executed by a computer, the computer does not run a program conforming to natural laws. Therefore, **example 5 is not a technical solution stipulated in Article 2.**

[Example 6]

Example 6 is related to an analysis method for economic prosperity indexes based on characteristics of electricity consumption. The claim of this example is as follows.

A method for economic prosperity index analysis based on electricity consumption characteristics of a district, characterized by comprising the following steps of:

according to economic data and electricity consumption data of the district to be inspected, selecting preliminary indicators of the economic prosperity index of the district to be inspected, wherein the preliminary indicators include economic indicators and electricity consumption indicators;

determining an economic prosperity indicator system including leading indicators, consistent indicators and lagging indicators of the district to be inspected by executing a cluster analysis method and a time difference correlation analysis method with a computer; and

according to the economic prosperity index system of the district to be inspected, obtaining the economic prosperity index of the district to be inspected with a synthetic index calculation method.

The method evaluates economic prosperity indexes of districts based on electricity consumption characteristics of the districts by executing analysis algorithm on a computer. This example uses tools conforming to economical laws rather than natural laws; therefore **it is not a technical solution stipulated in Article 2.**

The above are the current provisions of the Guidelines for Patent Examination on AI-related object issues. In August 2021, in order to adapt to the implementation of the new Patent Law, CNIPA issued an amendment draft of the Guidelines for Patent Examination for the public to provide comments. In the draft, there is no change in principle of the content of part II, Chapter 9, Section 6, but a few specific operational rules and a few examples are added for the examination of eligibility and novelty/inventiveness. Specifically, for examination of the eligibility issue, it was added that "If the solution of a claim involves improvements of AI and big data algorithm, such as deep learning, classification, etc., and there is a specific technical association between the algorithm and the internal structure of the computer, which can solve technical problems of how to improve operating efficiencies or execution effects of the hardware, including reducing data storage amount, reducing data transmission amount, increasing hardware processing speed, etc., so as to obtain technical effects of internal performance improvements of computer systems conforming to the natural laws, then the solution defined by the claim belongs to the technical solution described in the Article 2, clause 2 of the Patent Law." and "If a claimed solution deals with big data in a specific application field, uses classification and clustering, regression analysis, neural network, etc. to mine the internal relationships conforming to the natural laws in the data, so as to solve technical problems of how to improve the reliability or accuracy of big data analysis in the specific application field, and obtain corresponding technical effects, then the solution defined by the claim belongs to the technical solution described in the Article 2, clause 2 of the Patent Law." The draft provides clearer and more practical guidance on the eligibility issue of AI-related inventions.

3.1.3.2 Eligibility Issues Involved at Each Layer of AI Technology

As mentioned in the above, technical fields of AI can be roughly divided into three layers: application layer, enabling technology layer and infrastructure layer. This section will mainly discuss the eligibility issues that may occur at each technical level. According to the introduction of examination principles and rules of the eligibility issues mentioned above, the technologies that may have eligibility issues in AI technology mainly involve "data" and "algorithms" in the infrastructure layer and "business methods" in the solution layer of the application layer.

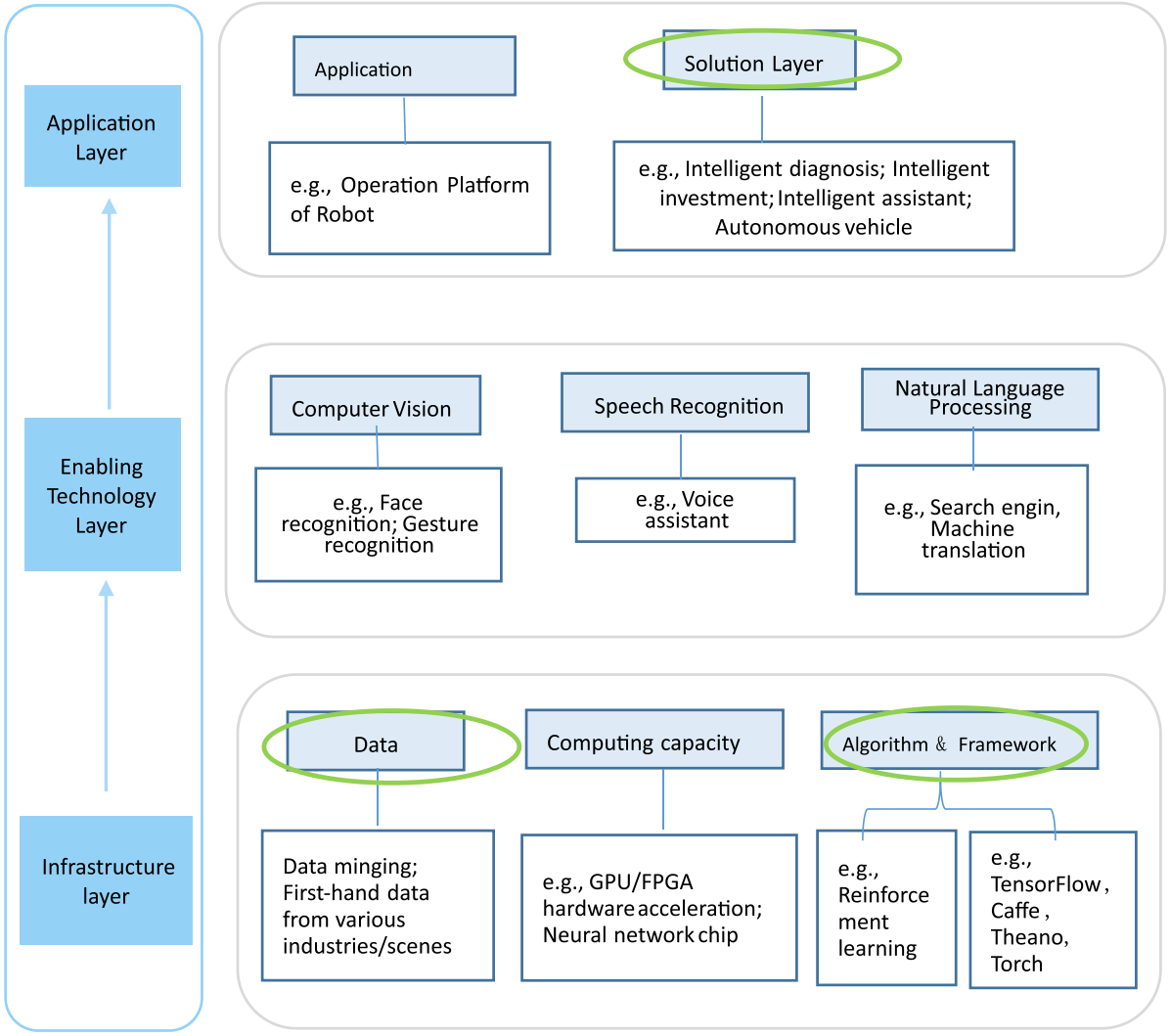


Fig. 3.1.3-1

3.1.3.2.1 Eligibility Issue of Patent Application Involving “Data” in AI Field

Subject:

To determine if a claim involving big data and database relates to a method of information representation only.

Criteria:

1. Without any technical features

If there isn’t any technical feature and the defined content is merely a human-defined data entry expression form, human-defined arrangement or definition of data fields, then it is actually a method of information representation, and the essence of claim protection is a set of specific data, which belongs to rules and method of mental activities and is not eligible;

2. Contains any technical features

If technical features are included in a subject matter, even if the title of subject matter is related to data or database, since the defined content is not merely a human-defined data entry expression form or a human-defined arrangement or definition of data fields, the subject matter is not a method of information representation, and thus does not belong to rules and methods of mental activities.

Recommendations regarding drafting:

If, although a data architecture is involved, certain data processing is realized through such data architecture, and the overall solution adopts technical means such as storage and indexing to solve the technical problems of reducing redundancy and reducing the storage space requirement, and brings about corresponding technical effects, then it constitutes a technical solution and belongs to a patentable subject matter. Patent documents should be drafted in a manner that not only the features of the data itself are described, but technical features of specific processing of the data are reflected.

Exemplary claims with eligibility issue for patent application involving "data" in AI field:

Eligible subject matter	Ineligible subject matter
1. A training database acquisition method for neural network training, comprising: acquiring raw data through sensor (such as image sensor and sound sensor); identifying and extracting features in the raw data; and classifying and storing raw data from which features are extracted for training the training database/text corpus of the neural network.	1. A knowledge database for natural language question and answer, wherein each knowledge entry includes: Identification number of knowledge entry; Title of knowledge entry; Initial question of knowledge entry; Solution of knowledge entry.

3.1.3.2. 2 Eligibility Issue for Patent Application Involving "Algorithm" in AI Field

Subject:

To determine if the claim involving algorithm is only algorithm or data computing rule or program itself.

Criteria:

1. Pure algorithm or computing rule

Since pure algorithm or computing rule only relates to the use of computer programs for numerical operations, it belongs to rules and methods of mental activities, thus cannot be granted a patent right.

2. Combination of algorithm and general computer

If the combination can reflect improvement on internal performance of the computer system, the combination shall be a patentable subject matter.

Operations of performing an algorithm on a general computer are usually not deemed as a pure rule and method of mental activities since the claims include a general computer that performs mathematical operations. However, such a solution may still be deemed not to be a technical solution because it does not use technical means to solve the technical problems, and does not comply with Article 2, clause 2 of the Patent Law. Therefore, in the scheme of combining algorithms with general-purpose computers, it is necessary to further consider whether it solves technical problems and bring technical effects. If the improvement of the algorithm brings about the improvement of the computer performance, it shows that the technical problems are solved and the technical effects are brought, so the combination is a patentable subject.

3. Combination of algorithm and specific technical field

In the case of combination of algorithm and an applied technical field, parameters involved in the algorithm reflect the physical meaning of such a technical field, and the solution as a whole is no longer pure numerical operation but to solve technical problem in the specific application field. Therefore, the solution does not belong to the rules and methods of mental activities, but a technical solution.

Suggestions on Drafting:

1. Establish clear technical correlation between each specific step of AI algorithm and the problem to be solved;

2. Relate factors in computation and data of AI algorithm to corresponding physical technical concepts;

3. Try to describe the relevant data processing in combination with computer process technology so as to distinguish the data processing from the abstract mathematic operation more clearly;

4. Emphasize that the technical solution as a whole has the three technical elements, and that technical problems in a specific technical field can be solved by applying the AI algorithm to address data processing in such field.

Exemplary claims with eligible issue for patent application involving "algorithm" in AI field:

Eligible subject matter	Ineligible subject matter
1. An image semantic segmentation method based on a neural network, wherein the said neural network comprises an input layer, an intermediate layer and an output layer, and the said image semantic segmentation method comprising: acquiring image to be segmented; inputting the said image through the said input layer; acquiring intermediate representation through the said intermediate layer; and outputting thermodynamic diagram for the said image through the said output layer, wherein the said thermodynamic diagram indicates semantic type of each pixel contained in the said image.	1. A computation method in a neural network, wherein the neural network comprises an input layer, an intermediate layer and an output layer, and the said computation method comprises: acquiring the data under computation; convolutional computing data through the neural network; and outputting result of computation.

3.1.3.2.3 Eligibility Issue for Patent Application Involving "Business Method" in AI Field

Subject:

Whether a claim relating to business methods involves a technical feature and solves a technical problem.

Criteria:

Claims involving business methods are patentable if they contain both technical features and the content of business rules and methods, and solve technical problems by adopting natural laws.

Suggestions on Drafting:

1. For a business method involving AI assistance, the combination of rule and technology should be reflected in the claim.

2. For a business method involving AI assistance, the solution shall reflect laws of nature.

Exemplary claims with eligible issue for patent application involving " business method " in AI field:

Eligible subject matter	Ineligible subject matter
1. An analysis method for electronic coupon usage tendency, which comprises: categorizing the electronic coupons according to the information of the electronic coupons to obtain the types of electronic coupons; acquiring user sample data according to the application scenario of the electronic coupons; extracting user behavior characteristics from the user sample data according to user behavior, and the user behavior includes: browsing the web, searching for keywords, adding attention, adding to the shopping cart, purchasing, and using electronic coupons; using user sample data as training samples and user behavior characteristics as attribute labels to train electronic coupon usage tendency recognition models for different types of electronic coupons; predicting the usage probability of electronic coupons by the trained electronic coupon usage tendency recognition model, and obtains the user's usage tendency of different types of electronic coupons.	1. A method for consumption rebate, characterized by comprising the following steps of: when a user makes a purchase at a merchant, the merchant returning a certain cash coupon according to an amount of consumption, Specifically, the merchant uses a computer to calculate the user's consumption amount, and divides the user's consumption amount R into M intervals, where M is an integer, and the value from interval 1 to interval M is from small to large, and an amount F of the returned cash coupon is also divided into M values, and the M values are also arranged from small to large; according to the calculated value of the computer, determining that when the user's current consumption amount is in interval 1, the rebate amount is the first value, when the user's current consumption amount is in interval 2, the rebate amount is the second value, and so on, and returning the rebate amount of the corresponding interval to the user.

3.1.4 Novelty/Inventiveness

As mentioned above, Section 6 of Chapter 9 of Part II of the Guidelines for Patent Examination provides specific provisions on the examination particularity of "invention patent applications containing algorithm features or business rules and method features". This section introduces the related content of novelty and inventiveness.

As a basic principle, all the features (including technical features, algorithm features or business rules and method features) recorded in the claims should be considered as a whole during the examination and should not be simply separated. This principle prohibits the examiner from simply ignoring algorithm features or business rules and method features (such as algorithms and business rules), which are likely to be invention points in related new fields.

When examining novelty, all the features defined in the claims should be considered, including technical features and algorithm features or business rules and method features.

For inventiveness examination, algorithm features or business rules or methods and technical features that support each other functionally and have an interactive relationship with each other shall be considered as a whole. In other words, examiners cannot disregard features of algorithm or business rules or methods directly for inventive examination, but need to consider whether the features of algorithm or business rules or methods support technical features functionally and have an interactive relationship with technical features to determine whether the features of algorithm or business rules or methods have technical contributions to the prior art. If the features of algorithm or business rules or methods have technical contributions to the prior art, the features of algorithm or business rules or methods shall be considered to have contributions regarding the inventiveness examination; otherwise, they shall not be considered to have contributions to inventive examination. "The features of algorithm or business rules or methods and the technical features support each other functionally and have an interactive relationship with each other" means that the features of algorithm or business rules or methods are closely combined with the technical features to form a technical means to solve a technical problem and obtain a corresponding technical effect.

Here are four examples of the Guidelines for Patent Examination for inventiveness examination. In Example 1 and Example 2, the distinguishing feature relative to the closest prior art is the algorithm feature, but these algorithm features and related technical features are functionally mutually supportive and have an interactive relationship. Therefore, these algorithm features and technology features are considered together to evaluate inventiveness. In Example 3, the distinguishing feature relative to the closest prior art includes technical features and business rule features, which are functionally support each other and have an interactive relationship with each other. Therefore, these technical features and business rule features are considered together to evaluate inventiveness. In Example 4, the distinguishing feature relative to the closest prior art is the rule feature of mental activities, which does not support the technical features in function, nor does it have an interactive relationship with the technical features. Therefore, the characteristics of the mental activities rules are not considered to have a technical contribution to the prior art.

[Example 1]

Example 1 is related to a method for detecting a fall state of a humanoid robot based on multi-sensor information. The claim of this example is as follows.

A method for detecting a fall state of a humanoid robot based on multi-sensor information, characterized by comprising the following steps of:

(1) establishing a sensor information fusion model with a hierarchical structure by fusion of attitude sensor information, zero-moment point (ZMP) sensor information and robot walking stage information;

(2) determining the stability of the robot in the front and rear directions and the left and right directions by using a front-rear fuzzy decision-making system and a left-right fuzzy decision-making system, the specific steps are as follows:

① determining the walking stage of the robot according to the contact between the supporting feet of the robot and the ground and the offline gait planning;

② using fuzzy inference algorithm to fuzzify the position information of ZMP points;

③ using fuzzy inference algorithm to fuzzify the pitch angle or roll angle of the robot;

④ determining the output membership function;

⑤ determining fuzzy inference rules according to step ① to step ④;

⑥ defuzzifying.

The distinctive features with respect to the closest prior art are a specific fuzzy algorithm. The specific fuzzy algorithm takes the posture information, ZMP point position information and walking stage information as input parameters to calculate the information for determining the stable states of the humanoid robot, which provides a basis for further issuing accurate posture adjustment instructions. Therefore, the above algorithm features and other technical features such as determining the stable states of the humanoid robot defined in the claim are closely combined together to form a technical means, that is, they support each other functionally and interact with each other, and shall be considered together to evaluate inventiveness. Since no prior art discloses or teaches using the above fuzzy algorithm to determine the stable states of a humanoid robot, **the solution of example 1 is considered to have inventiveness.**

[Example 2]

Example 2 is related to a multi-robot path planning system based on a cooperative coevolution and multiple population genetic algorithm. The claim of this example is as follows.

A multi-robot path planning system based on a cooperative coevolution and multiple population genetic algorithm, which is characterized in that:

(1) A path of a robot is represented by a chromosome, and the chromosome is represented as a linked list of nodes, namely [(x, y), time], (x, y, timeR), (x, y) represents the robot's position coordinates, time represents the time consumption of moving from this node to the previous node. The time of the start node is equal to 0. For the chromosome of each individual robot, the intermediate nodes and the number of nodes are variable except that the initial position of the initial node and the target position of the end node are fixed;

(2) The fitness function of path path(j) of each robot Robot(i) is expressed as ϕ (pi, j):

$||pi, j||=Distance(pi, j) + ws \times smooth(pi, j)+ wt \times Time(pi, j)$

Where ||pi, j|| is a linear combination of distance, smoothness and time consumption, ws is a smoothing weighting factor, wt is a time weighting factor; Distance (pi, j) represents the path length, and smooth (pi, j) represents the smoothness of the path, Time(pi,j) is the time consumption of path pi,j; each robot uses the fitness function to obtain the optimal path through Messy genetic algorithm optimization.

The distinctive features with respect to the closest prior art are a Messy genetic algorithm for multi-robot path planning. The forward paths of the robots are obtained with optimization of the Messy genetic algorithm. Therefore, the above algorithm features and other technical features such as paths and locations of the robots defined in the claim support each other functionally and interact with each other, and shall be considered together to evaluate inventiveness. However, in example 2, another prior document discloses using various genetic algorithms to optimize paths, and Messy genetic algorithm can obtain better optimization results. Therefore, **the solution of example 2 is considered to lack inventiveness** in view of the combination of the two prior art documents.

[Example 3]

Example 3 is related to a logistics distribution method. The claim of this example is as follows.

A logistics distribution method, which improves the efficiency of logistics distribution by notifying users in batches for pickup, wherein the method comprises:

when a deliverer needs to notify users to pick up goods, the deliverer sends a notification that the goods have arrived to the server through a handheld logistics terminal;

the server notifies in batches all order users within the delivery range of the deliverer;

order users who have received the notification perform the pickup according to the notification information;

wherein, the specific implementation method of the server to notice in batches is that the server determines all target order information within the delivery distance corresponding to the deliverer ID and centered on the current location of the logistics terminal, according to the deliverer ID carried in the arrival notification sent by the logistics terminal, the current location of the logistics terminal, and the corresponding delivery range, and then pushes the notification information to order user terminals corresponding to all the order user accounts in the target order information.

within a delivery range in batch rather than notifying them one by one and accordingly different specific notification implementations such as different data architectures and communication methods. The feature of notification rule and the features of specific notification implementations support each other functionally and interact with each other, and shall be considered together. Since no prior art discloses or teaches using the above features to improve delivery efficiency, **the solution of example 3 is considered to have inventiveness.**

[Example 4]

Example 4 is related to a visualization method for dynamic viewpoint evolution. The claim of this example is as follows.

A visualization method for dynamic viewpoint evolution, which comprises:

Step 1: A computing device determines emotional membership degree and emotional classification of information in a collected information set, wherein the emotional membership degree of the information indicates how likely the information belongs to a certain emotional classification;

Step 2: The emotion is classified as positive, neutral or negative. The specific classification method is: if the value r of the number of likes p divided by the number of unlikes q is greater than a threshold a, then the emotion classification is considered to be positive, if the value r is less than a threshold b, then the emotion classification is considered as negative, if the value $b \leq r \leq a$, then the emotion classification is neutral, where $a > b$;

Step 3: Based on the emotion classification of the information, a geometric layout of an emotion visualization graph of the information set is automatically established, and the horizontal axis represents the time when the information is generated, and the vertical axis represents the amount of information belonging to each emotion classification;

Step 4: The computing device colors the established geometric layout based on the emotional membership degree of the information, and colors the information on each emotion classification layer according to the gradual order of the color of the information.

The method automatically collects information on an event published by people on social platforms, analyzes the emotions in the information, and visualizes changes of the emotions over time by coloring diagrams to be displayed in a computer. The closest prior art discloses a similar method, and the difference is only that the solution of example 4 uses a different emotion classification rule to determine the emotions and their changes. The emotion classification rule is an artificial rule, and the rule does not influence the coloring process. In other words, the feature of emotion classification rule and the technical feature of coloring process do not support each other functionally and do not interact with each other. Therefore, the distinctive feature is considered as an isolated feature of rules for mental activities, and even if no prior art document discloses such a feature, **the solution of example 4 is considered to lack inventiveness since it has no technical contributions to the prior art.**

3.1.5 Drafting of Claims

3.1.5.1 Considerations of Compliance with Requirements for Granting

■ Requirement for Subject Matter Title

According to the current Examination Guidelines, the claims of an invention application relating to computer programs may be drafted as process (method) claim or product claim, i.e., the apparatus for executing the process. An ambiguous subject matter of a claim such as “a technique for...” or “an algorithm for...” should be not allowable since it is not clear whether it is claimed for the protection of a product or a method.

Even though there is no definition to what a product is, it is generally understood that a patentable “product” in China should be a physically tangible product, rather than an intangible object such as a program model. Therefore, a claim which directly claims for the protection of algorithms or mathematical models is not patentable in China. According to the current Guidelines for Patent Examination, software-related patent claims can generally be written as “methods", "devices" and "computer-readable storage media". However, according to the draft of the Guidelines for Patent Examination published in August 2021, "computer program product" will also become an acceptable form of claim, for example, "a computer program product including a computer program/instruction, when executed by a processor, performs the following steps:..."

Further, for an AI related invention, it is highly recommended to specify the technical field or application scenario utilizing the AI in the subject matter portion of and independent claim so that the claim may constitute a technical solution to be allowed in China.

For example, assuming a prediction model or learning model is applied to the technical field of autonomous vehicle for the purpose of predicting the behavior or action to be taken by the vehicle, an independent claim of the invention may be drafted as a product claim, e.g., “a driverless vehicle comprising a processor and a memory storing computer executable instructions which, when executed by the processor, cause the processor to perform operations including… (specific operations of the prediction model)”, and/or a method claim, e.g., “a method of predicting behavior of a driverless vehicle, the method comprising… (specific operations of the prediction model)”.

■ Technical Solution Requirement

First of all, according to the above description of the eligibility issue, the solution protected by the claims should be a technical solution, which must meet the requirements of the Patent Law and the Guidelines for Patent Examination for the protected object.

In addition, the following issues should be paid attention to in practice when drafting the technical solutions of AI-related claims.

(1) No matter what kind of claim format is drafted, the claim shall reflect the technical solution of the invention in its entirety and record the essential technical features for resolving the technical problems, but cannot only generalize the functions of the computer program and the effects the functions can achieve. If a method claim is drafted, the various functions performed by the computer program and the way to perform the functions shall be described in detail according to the steps of the process. If a product (e.g., an apparatus, a device) claim is drafted, a detailed account shall be given on the performing steps of the various functional component parts of the computer program.

(2) For an AI related invention, it is commonly seen that a claim comprises both technical features and non-technical features, e.g., algorithms or mathematical models. Under the current Examination Guidelines, the claim comprising both technical features and non-technical features shall not be excluded from patentability merely because of the non-technical features. However, if the non-technical features do not have contribution to the solving of a technical problem, it may be left out of consideration when determining the novelty/inventiveness of the technical solution claimed to be protected by the claim. Therefore, it is very important the non-technical features are drafted as being closely inter-connected with the technical features so as to function commonly with the technical features to resolve a technical problem.

Inventiveness Requirements

China adopts a three-step method to determine the inventiveness of the solution defined by the claims, including: step 1, determining the closest prior art; step 2, determining the distinguishing features of the invention and the technical problem actually solved by the invention; step 3, determining whether the claimed invention is obvious to those skilled in the art.

According to the current Examination Guidelines, for AI-related inventions, when an invention patent application that contains both technical features and algorithmic features or business rule and method features is to be examined for inventiveness, the algorithm features or business rules or methods and technical features that support each other functionally and have an interactive relationship with each other shall be considered as a whole. "Functionally support each other and have an interactive relationship" means that the algorithm features or business rules and method features are closely combined with technical features, which together constitute a technical means to solve a technical problem, and can obtain corresponding technical effects. For example, if the algorithm in the claims is applied to a specific technical field and can solve a specific technical problem, then it can be considered that the algorithm feature and the technical feature support each other in function and interact with each other, and the algorithm feature becomes a part of the technical means adopted. In the inventiveness examination, the contribution of the described algorithm features to the technical solution shall be taken into consideration. For another example, if the implementation of the business rules and method features in the claims requires adjustment or improvement of technical means, then it can be considered that the business rules and method features and the technical features are functionally mutually supportive and interact with each other, and when inventiveness examination is being carried out, the contribution of the stated business rules and method features to the technical solution should be considered. Therefore, it is very important to describe in the claims how non-technical features interact with technical features in specific application scenarios, so as to jointly contribute to solving technical problems.

Requirement for Support by the Description

According to Article 26, clause 4 of the Patent Law of China, "The claims shall be supported by the description and shall define the extent of the patent protection sought for in a clear and concise manner."

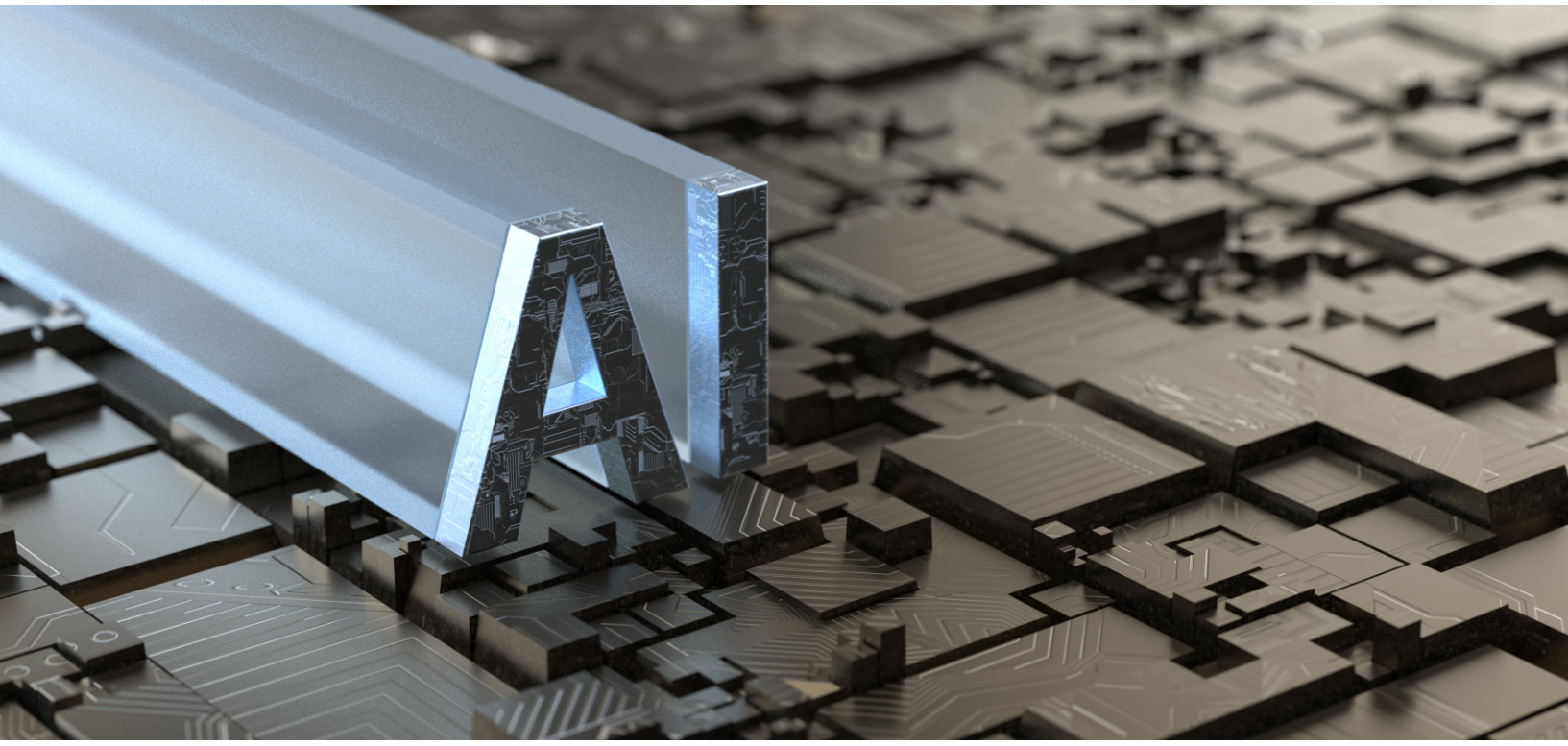
In order to obtain relatively broader protection scope, it is common that a technical solution defined by a claim, especially an independent claim, is the summarization of the embodiments disclosed in the specification. Such summarization, however, is often objected by the examiner in an office action on the grounds that the protection scope of the claim is not supported by the specification. In such circumstances, the applicant's arguments are difficult to be accepted by the examiner if no sufficient number of embodiments are recorded in the specification. As a result, the claim often needs to be specifically limited to be consistent with the disclosure of the specification.

For an AI related invention, e.g., if only an algorithm is disclosed in the specification for solving a technical problem, it is generally not allowable to summarize a generic term, such as "an algorithm" in an independent claim. Rather, the specific parameters of the algorithm in the application scenario may need to be recorded into the independent claim.

Requirement for Clearness of Protection Scope

According to Article 26, clause 4 of the Patent Law of China, "The claims shall be supported by the description and shall define the extent of the patent protection sought for in a clear and concise manner."

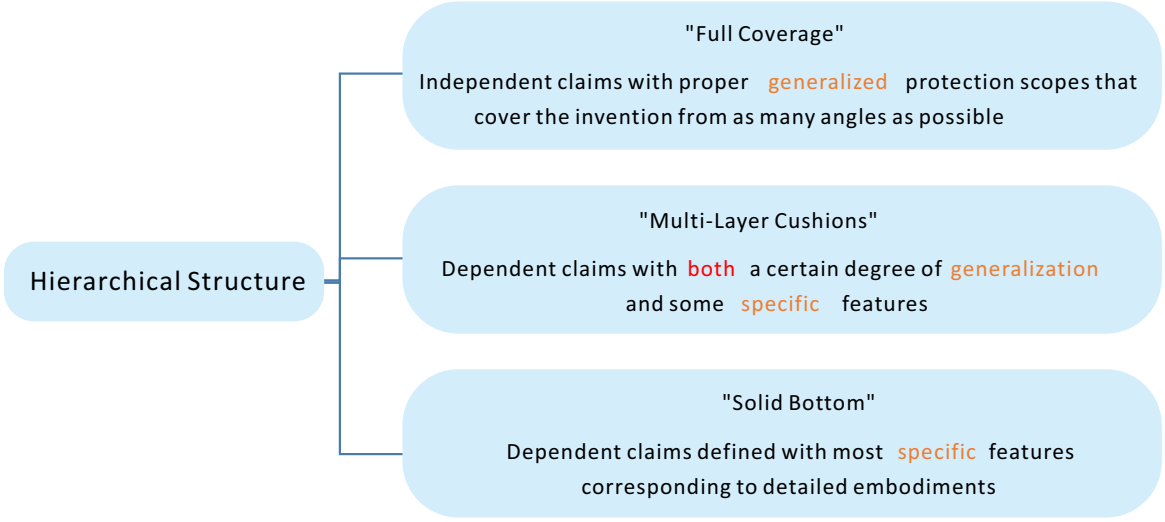
A claim should be defined with features that are defined clearly and concisely so that the claim may be construed as having definite protection scope. Therefore, long and ambiguous sentences in a claim should be avoided as far as possible.



3.1.5.2 Considerations of Sufficient Protection

■ Proper Hierarchy of Claims Drafting

It is preferable to draft a larger scope of protection in independent claims, and further restrict additional technical features to form a smaller scope of protection in dependent claims, so as to establish a reasonable hierarchy and level of protection. The purpose of establishing a reasonable hierarchy and level of protection is to make the scope of patent protection expandable, for example, drafting dependent claims to include additional non-technical problems that are solved on the basis of the solution of the technical problems, additional non-technical means on the basis of the technical means, and additional non-technical effects that are achieved on the basis of the achievement of the technical effects, could be helpful, so as to provide a multi-level flexible defense system in both prosecution and invalidation procedure, as shown below.



■ **Subjects Covered by the Claims**

In order to facilitate the enforcement of patent rights, **the entire industry chain should be considered, multiple sets of claims should be drafted to cover all valuable subjects,** claiming at the same time methods, devices, storage media and systems.

The following are some examples of drafting:

1. **An image semantic segmentation method based on a neural network,** wherein the neural network comprises an input layer, an intermediate layer and an output layer, and the said image semantic segmentation method comprises: . . .

2. **A training method for neural network for image semantic segmentation,** wherein the said neural network comprises an input layer, an intermediate layer and an output layer, and the said training method comprises: . . .

3. **An image semantic segmentation device** the said image semantic segmentation device comprises:

a memory for storing non-transitory computer-readable command; and

a processor for running the said computer-readable command to enable the said image semantic segmentation device to perform . . .

4. **A training apparatus,** the said training apparatus comprises:

a memory for storing non-transitory computer-readable command; and

a processor for running the said computer-readable command to enable the said training apparatus to perform a training method of a neural network for image semantic segmentation . . .

5. **A computer-readable storage medium** for storing non-transitory computer-readable command which, when it is executed by a computer, enables the said computer to perform an image semantic segmentation method based on neural network . . .

6. **An image semantic segmentation method based on neural network,** comprising:

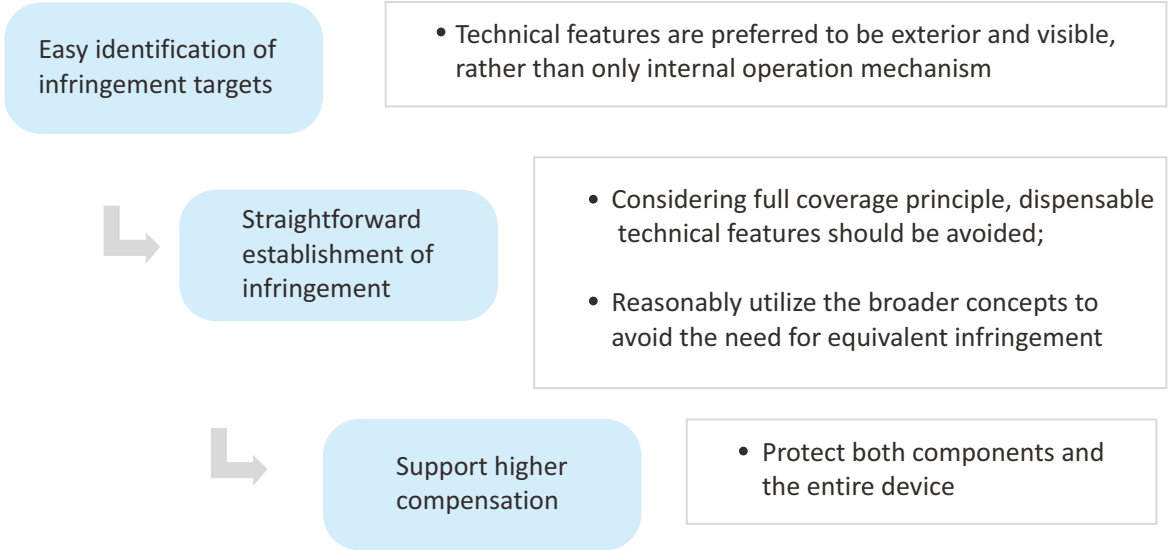
image acquisition equipment;

communication equipment;

processing equipment . . .

■ **Considerition of Facilitating Patent Enforcement at Stage of Exercising the Right**

In order to facilitate the identification of infringement, description of the patent shall take into account the following three aspects: easy identification of infringement targets, straightforward establishment of infringement, and support of higher amount of compensation, which are shown in the figure below.



3.1.6 Drafting of Specification

■ **Patent Eligibility Requirements**

In order to present that AI-related inventions are eligible, the specification of an AI related invention should be drafted as being able to constitute a technical solution, that is, the three elements of technical problem, technical means and technical effect should be substantially reflected in the specification.

It is quite common that an AI related invention aims to perform a specific task by using computational models and/or algorithms, which, however, are regarded as rules and methods for mental activities under the Chinese Patent Law. Therefore, in order to get a patent right in China, **it is necessary for an AI related invention to serve a technical purpose to solve a technical problem.** That is, the technical field or technical application scenario for using the AI should be recorded in the specification.

According to the current Examination Guidelines, statement of technical problem is required to be included in the specification, but in practice, lacking of statement is not a defect that needs to be corrected. That is to say, a technical problem solved by an invention does not necessarily need to be explicitly recorded in the specification. So basically an applicant may decide by him or herself whether or not to include a clear statement of technical problem in the specification.

Generally speaking, we do not recommend to specifically state a technical problem in the specification because it will limit the invention to resolve the stated specific technical problem. In practice, it is usually not allowable for the patentee to argue for another technical problem which is not recorded in the specification when enforcing the patent right in an infringement lawsuit or defending the patent right in an invalidation procedure initiated by others. However, if an AI related invention does not clearly have a "technical" purpose, it is highly recommended to record in the specification a technical problem or specify technical inefficiency of the prior art in the background part of the specification, and/or record in the specification a technical effect in the embodiment part of the specification, so as to convince the examiner that the invention is for solving **problems comprising a technical problem.**

A significant change made to the Examination Guidelines in April 1, 2017 is that a claim relating to a business model is no longer excluded from patentability. Before the change, business method related invention was very likely to be rejected as being rules and methods for mental activities for which no patent right shall be granted. So, before the revision of the Examination Guidelines, in order to give the examiner a "good" first impression that the invention is not purely business method, it was very important to state clearly a technical problem in the specification for a business method related invention. Currently thanks to the revision, such statement of technical problem is not so important than before, but still, a clear statement of technical problem is helpful for a business method related invention or an AI related invention which could be regarded as "non-technical" purpose.

■ **Sufficient Disclosure Requiremen**

According to Article 26, clause 3 of the Patent Law of China, "*The specification shall set forth the invention or utility model in a manner* ***sufficiently clear and complete*** *so as to* ***enable a person skilled in the relevant field of technology to carry it out;*** *where necessary, drawings are required.*"

According to the current Examination Guidelines, for an invention application relating computer programs, the principle flow chart of the computer program should be presented in the drawings, and explanation of every step of the computer program should be made in the specification in natural language based on the flow chart in chronological order. The main technical features of the computer program shall be described in the specification to such an extent that a person skilled in the art can, on the basis of the flow chart presented in the specification and explanation thereof, produce the computer program capable of producing the technical effect as described in the specification. Source code is not required to be provided in the specification, which,

however, may be partly presented by using marked program language that is customarily used to help understanding of the invention, when necessary.

An invention utilizing AI usually comprises non-technical features, such as algorithm which is regarded as rules and methods for mental activities. If both technical features and non-technical features are involved in an invention utilizing AI, the non-technical features must be those features that are associated with the technical features and function in common with the technical features. In this case, the current Guidelines for Patent Examination, Part II, Chapter 9, Section 6.3.1 clearly stipulates that "the specification should state how the technical features and the algorithm features or business rules and methods that functionally support each other and interact with each other work together and produce beneficial effects. For example, when algorithm features are included, abstract algorithms should be combined with specific technical fields, and the definitions of at least one input parameter and its related output results should be associated with specific data in the technical field.; when business rule and method features are included, the entire process of solving technical problems should be described and explained in detail, so that those skilled in the art can implement the solution of the invention according to the content recorded in the specification." In other words, it should be described clearly and completely how the abstract rules and methods for mental activities, e.g., algorithm, are combined with the specific application scenario and how the parameters are defined and associated with all kinds of data in such application scenario, so that a person skilled in the art is able to follow the contents in the specification and drawings to carry out the invention utilizing the AI, and therefore to solve the technical problem declared to be resolved by the invention and to produce the expected results.

For example, if an AI algorithm (or a prediction model, or a learning model) is built based on training data to output a particular result in accordance with inputted data, the algorithm itself should be described clearly, what data set is used as the inputting data and how the data are processed to obtain predicted output data should be disclosed in the specification to enable a person skilled in the art to carry out the invention by using the same or similar data set. If different data sets are used for training the learning algorithm, the differences between the data sets and how the differences are used in training the learning algorithm should be described clearly in the specification. It is dangerous to just describe a “black box algorithm,” or to just mention “a neural network” unless using of such algorithm or neural network is commonly known as prior art.

Case Example of Insufficient Disclosure:

The patent holder, Shanghai Zhizhen, holds a Chinese patent ZL200410053749.9 regarding a chatting robot system (called “Little i Robot”). Shanghai Zhizhen believed Apple’s Siri function has the same function with its patent technology and then initiated a patent infringement lawsuit by taking Apple as the defendant before Shanghai Intermediate Court in June 2012. As a countermeasure, Apple initiated the patent invalidation procedure against Zhizhen’s patent at the Patent Reexamination Board (PRB) with insufficient disclosure as one of the reasons for invalidating the patent. This case is regarded as the first AI invention infringement and invalidation case in China. The patent right was decided as valid by the PRB. Apple then initiated patent administrative lawsuit by taking the PRB as the defendant before the Beijing Intellectual Property Court, but the PRB’s decision was sustained by the Beijing Intellectual Property Court. Apple then appealed the case to the Beijing High People’s court.

In April 2015, the Beijing High People’s Court ruled that the patent does not sufficiently disclose the mechanism of chatting robot so that persons in the art cannot obtain the technical effect of how user interacts with the chatting robot to play games (which is regarded as the distinguishing feature of the invention over the prior art). In particular, the description does not clearly describe how to analyze the input format sentence and/or natural language and then send the content related to game to the game server.

In June 2020, the Supreme People's Court revoked the judgment of the Beijing Higher People's Court and upheld the judgment of the Beijing Intellectual Property Court and the decision of the Patent Reexamination Board, that is, the patent right was

finally maintained in effect. The Supreme People's Court determined that the technical features of the game server belonged to the technical features shared with the existing technology, rather than distinguishing technical features, and therefore had lower requirements for full disclosure. Those skilled in the art can know all the existing technologies in this field and have the ability to apply conventional experimental methods, and can search the existing technologies by themselves to realize the functions of shared technical features. There is no need for the specification to give specific guidelines. Therefore, in this case, those skilled in the art can know how to implement the technical features of the game server based on their knowledge level, so that the technical features are fully disclosed.

From the above case between Apple and Shanghai Zhizhen, although the Supreme People's Court finally determined that the patent was sufficiently disclosed, it can be learned that sufficient disclosure of invention is crucial for an invention, especially for the technical part relating to the inventive idea of the invention. Once the "insufficient disclosure" issue is raised by the examiner during the substantive examination stage for an invention application, or by a patent right challenger during a corresponding invalidation procedure, it will be very difficult for the applicant/patentee to argue for this issue. One dilemma is, if you argue that the undisclosed technical part to be a part of the prior art, it may result in non-obviousness issue of the invention, but if you argue that the undisclosed technical part to be uniquely proposed in in the invention, it does not cure the defect of insufficient disclosure at all.

■ Support for the Claims Requirement

According to Article 26, clause 4 of the Patent Law of China, "The claims shall be supported by the description and shall define the extent of the patent protection sought for in a clear and concise manner."

In order to obtain relatively broader protection scope, it is commonly seen that a technical solution defined by a claim, especially an independent claim, is the summarization of the embodiments disclosed in the specification. Such summarization, however, is often objected to by the examiner in an office action on the grounds that the protection scope of the claim is not supported by the specification. In such circumstances, the applicant's arguments are difficult to be accepted by the examiner if no sufficient number of embodiments are recorded in the specification. Therefore, it is important for the specification to have multiple embodiments to support a generic protection scope of a claim.

For an AI related invention utilizing algorithms or mathematical models, sometimes it is hard to limit the invention to a certain technical field because it will significantly narrow the invention to this specific technical field. In such case, it is recommended to describe multiple application scenarios for using the AI. It is possible that the multiple application scenarios may lead to the unity problem, but the unity problem may be easily resolved by filing divisional applications.

3.1.7 Conclusion

Any patentable invention must be a technical solution in China, and an AI related invention does not have any exemption in this regard. Since an AI related invention often involves the using of algorithms and/or computational models, it is highly recommended to describe the technical field or application scenario of using the AI in the specification and in the claims. Under the current Examination Guidelines, an AI related invention will not be excluded for patentability only if non-technical features are involved. However, it is highly recommended to describe the close inter-connection between the technical features and non-technical features in the specification and in the claims so as to make both the technical features and non-technical features function in common to resolve a technical problem.

Considering the fact that Chinese enterprises are very active in developing, researching and utilizing AI technologies and AI technologies are highly encouraged by Chinese governments in all levels, it is expectable that inventions utilizing AI will be relatively easy to get protected in China.

About the author

Jinlin CHEN

Partner | Patent Attorney | Attorney at Law

Mr. Jinlin Chen is an Attorney-at-Law and Patent Attorney with Liu, Shen & Associates, with a Ph.D degree in Optical Engineering and a LL.M degree in civil and commercial law. Mr. Chen joined Liu, Shen & Associates in 2010. He specializes in patent prosecution, invalidation and infringement dispute resolutions before CNIPA and the courts, and counseling on patent issues in the fields of Computer Science, Artificial Intelligence, Telecommunication, Optics, Electrics& Electronics, Semiconductor technology among others. Mr. Chen is very familiar with Chinese patent law and practice, and regularly provides lectures on Chinese patent law and practice to clients, associates and other organizations.

Xiaoming ZHANG

Partner | Patent Attorney | Attorney at Law

Mr. Xiaoming Zhang joined Liu, Shen & Associates in 2007. Mr. Zhang specializes in patent prosecution, re-examination, patent invalidation, IP litigation, and client counseling with a focus on telecommunication, artificial intelligence, big data processing, semiconductor technology, image processing, network, optics and physics. Mr. Zhang processes extensive experience both before SIPO and USPTO and is skilled in drafting application documents in Chinese and English.

Mr. Zhang became a qualified patent attorney in 2008, and got his qualification as an attorney at law in 2018.

Mr. Zhang obtained a doctor's degree in Optics from Peking University in 2007.

About the author

Lin LI

Partner | Patent Attorney

Mr. Lin Li, as a patent attorney, joining Liu, Shen & Associates since 2003, has accumulated rich experiences in various patent-related affairs, including invention patent prosecution, reexamination, invalidation, litigation, patent analysis and client counseling with focus points on electrical engineering, automatic control, telecommunication, computer science, networking & e-commerce, and artificial intelligence. Mr. Li has deep researches on invention patent relating to computer program, including AI-related inventions and business rules & methods related inventions, as well as laws and regulations, and has been providing valuable advices to the clients in the area. Mr. Li participated as a core member in a series of client-customized research reports on IP protection for AI, and produced a number of articles and presentations in the field. Mr. Li obtained his master's degree in Telematics from University of Twente, the Netherlands, and LL.M. from John Marshall Law School in Chicago, U.S.A., with Honors.

3.2 AI-related Patent Practice in the United of States

Xiaoming ZHANG, Hao GAO and Yujie JIN

This section presents recommendations regarding AI-related patent application drafting under the patent laws of the United States. In U.S., for patent applications and grants, AI is defined as comprising one or more of the following eight component technologies: knowledge processing, speech, AI hardware, evolutionary computation, natural language processing, machine learning, vision, and planning control.

3.2.1 Main Provisions Related to Obtaining of Patent Rignt

Main provisions of the U.S. Patent Law and Manual of Patent Examining Procedure (MPEP) to be considered at the stage of AI-related patent prosecution are shown as in the below table.

Patent Subject Matter Eligibility	**35 U.S.C. §101**	The four statutory categories of the invention that is eligible for patenting: Process, Machine, Manufacture, or Composition of matter.
	MPEP 2106	Any eligible patent subject matter must satisfy the following two criteria: (1)the claimed invention must be to one of the above four statutory categories; and (2)the claim of the claimed invention must not be directed to a judicial exception unless the claim as a whole includes additional limitations amounting to significantly more than the judicial exception. Wherein, the "judicial exceptions" are limited to abstract ideas, laws of nature and natural phenomena (including products of nature); and "significantly more than the judicial exception" means that additional elements of the claim provide an inventive concept.
	2019 Revised Patent Subject Matter Eligibility Guidance	Evaluating whether a claim is directed to a judicial exception using a Two-Prong Analysis. Under the Two-Pronged Analysis, a claim is directed to a judicial exception when the claim recites a judicial exception and the recited judicial exception is not integrated into a practical application of that exception.
Novelty and Inventiveness of the Claims	**35 U.S.C. §102**	Novelty means that the invention is not anticipated by the prior art, and more specifically, no one single reference in the prior art teaches each and every element of the invention. Further, under certain condition, inventor may have a ONE-YEAR grace period to file the application within one year after the disclosure.
	35 U.S.C. §103	Inventiveness (also called non-obviousness) means that the claimed invention is not identical to any prior arts, and the differences between them are non-obvious to a skilled person at the time the invention was made.
The Requirements of Specification Including the Written Description Requirement, the Best Mode Requirement, and the Enablement Requirement.	**35 U.S.C. §112(a)**	The specification should provide adequate teaching and support for the manner and process of making and using the claimed invention in full, clear, concise, and exact terms. The specification should provide adequate support for the claims. The specification should disclose the best mode such that those skilled in the art could enable the claim invention.
Claims Defining the Scope of the Claimed Invention	**35 U.S.C. §112(b)**	The claims must set forth the subject matter of the claimed invention, and particularly point out and distinctly define the metes and bounds of the subject matter.
Functional Limitation of the Claims	**35 U.S.C. §112(f)**	The functional language in the claims shall be construed to cover the corresponding structures, materials or acts recited in the specification and equivalents thereof.

3.2.2 Eligibility of Patent Subject Matter

In this part, 2019 Revised Subject Matter Eligibility Guidance and Examples published by USPTO are introduced.

In the field of AI, strategies for developing patent portfolio in the United States share great similarities with those in China. Essentially, when filing an AI-related patent application, the U.S. and China both require subject matter eligibility, novelty, and inventiveness of the invention. Further, a full, clear, concise, and exact disclosure of the invention is necessary, including claims that clearly define the protection scope sought for. Enablement of the invention is also a common requirement, which ensures that the technical solution involved in the invention can be realizable by those skilled in the art.

However, in practice, the determination of whether the subject matter of an AI-related invention is eligibility in the United States is more complicated. On the basis of the Alice Two-Part Test, formulated from the U.S. Supreme Court (see *Alice Corp. v. CLS Bank International, 573 U.S. 208* (2014)), in 2019, the 2019 Revised Patent Subject Matter Eligibility Guidance (2019 PEG) was published in order to increase clarity, predictability and consistency in how 35 U.S.C. §101 is applied during the examination, as well as enable examiners to more readily determine if a claim does recite an abstract idea of the judicial exception.

In the 2019 PEG, the examination procedure to evaluate subject matter eligibility has been revised with respect to Step 2A by introducing a new Two-Prong Analysis. Under this new two-prong analysis, a claim directing to a process, a machine, a manufacture, or a composition of matter can be eligible unless it recites a judicial exception but the exception is not integrated into a practical application. For a claim reciting a judicial exception but the exception is not integrated into a practical application, the claim will be re-evaluated to determine whether additional elements that significantly more than the judicial exception are recited (i.e., determine whether the claim elements are more than well-understood, routine, conventional activity in the relevant field. The 2019 PEG, further limits the “abstract idea” in Prong One to the following three groupings: mathematical concepts, certain methods of organizing human activity, and mental processes. Figure 3.2.2-1 demonstrates the flowchart to evaluate subject matter eligibility under 2019 PEG.

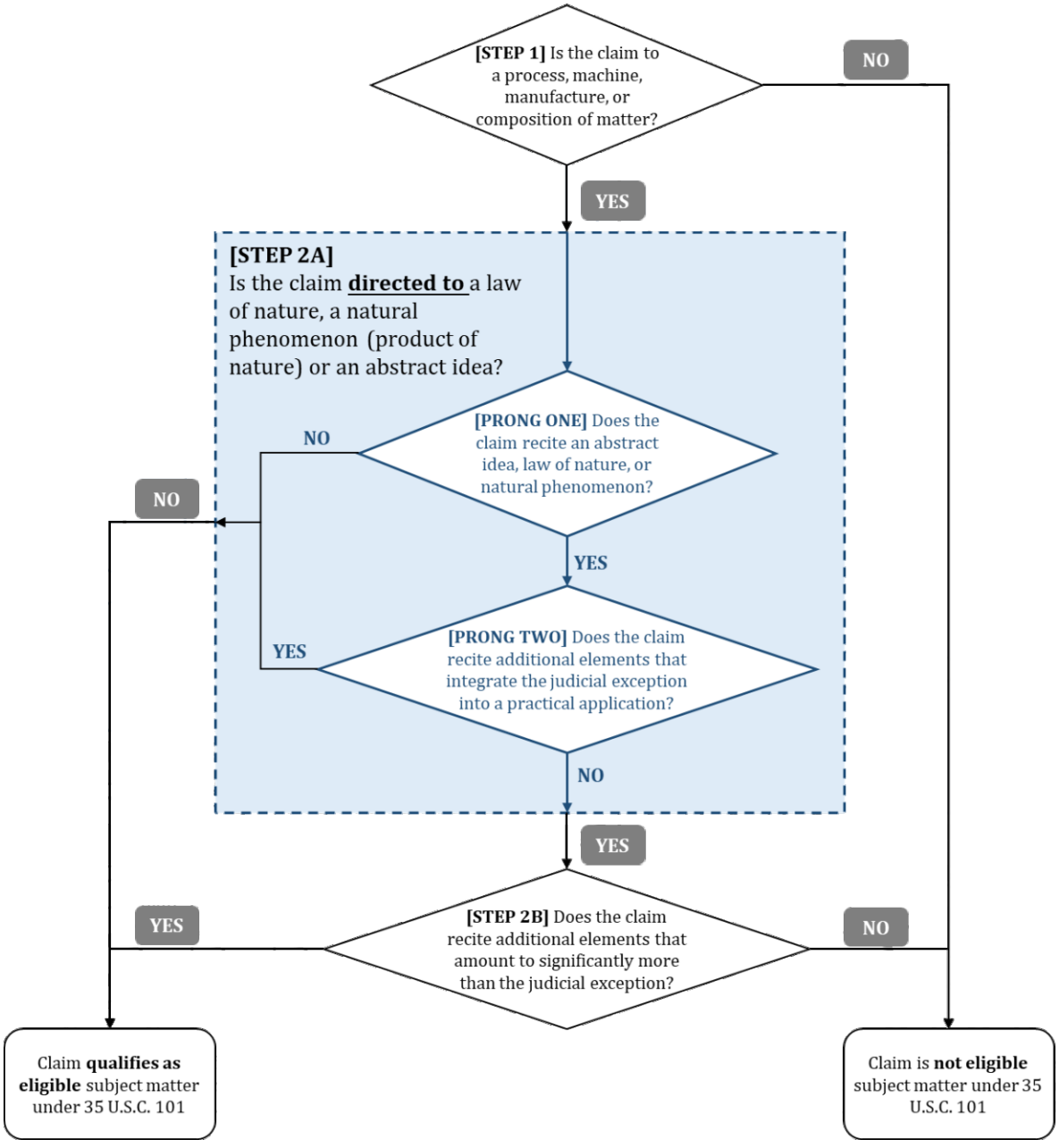

[STEP 1] Is the claim to a process, machine, manufacture, or composition of matter?
NO
YES
[STEP 2A]
Is the claim directed to a law of nature, a natural phenomenon (product of nature) or an abstract idea?
[PRONG ONE] Does the claim recite an abstract idea, law of nature, or natural phenomenon?
NO
NO
YES
[PRONG TWO] Does the claim recite additional elements that integrate the judicial exception into a practical application?
YES
NO
YES
[STEP 2B] Does the claim recite additional elements that amount to significantly more than the judicial exception?
YES
NO
Claim qualifies as eligible subject matter under 35 U.S.C. 101
Claim is not eligible subject matter under 35 U.S.C. 101

Fig. 3.2.2-1

Further, along with the 2019 EPG, the USPTO has issued numerous examples (*see Subject Matter Eligibility Examples: Abstract Ideas*) to illustrate how to apply the 2019 EPG to practice, for example, to computer-related inventions, and software.

One of these examples ("Example 39") demonstrates a situation in which the claim does not recite any of the judicial exceptions enumerated in the 2019 PEG. In particular, Example 39 relates to an AI-related hypothetic invention and claims a computer-implemented method of training a neural network for facial detection as follows:

"A computer-implemented method of training a neural network for facial detection, comprising:

collecting a set of digital facial images from a database;

applying one or more transformations to each digital facial image including mirroring, rotating, smoothing, or contrast reduction to create a modified set of digital facial images;

creating a first training set comprising the collected set of digital facial images, the modified set of digital facial images, and a set of digital non-facial images;

training the neural network in a first stage using the first training set;

creating a second training set for a second stage of training comprising the first training set and digital non-facial images that are incorrectly detected as facial images after the first stage of training; and

training the neural network in a second stage using the second training set."

According to the USPTO's analysis, though some of the claim elements may be based on mathematical concepts (e.g., the one or more transformations are mathematical transformation functions), the mathematical concepts are not recited in the claims. Further, the claimed steps are not practically performed in the human mind, then the claim does not direct to a mental process. The claim also does not recite any method of organizing human activity such as a fundamental economic concept or managing interactions between people. Therefore, the USPTO states that the above claim is patent-eligible because the claim does not fall into any of the three groupings of the abstract idea.

Another AI-related hypothetic invention directs to a method for adaptive monitoring of network traffic data ("Example 40"). In this example, the USPTO provides two sets of claims as follows:

Claim 1	**Claim 2**
A method for adaptive monitoring of traffic data through a network appliance connected between computing devices in a network, the method comprising: collecting, by the network appliance, traffic data relating to the network traffic passing through the network appliance, the traffic data comprising at least one of network delay, packet loss, or jitter; comparing, by the network appliance, at least one of the collected traffic data to a predefined threshold; and collecting additional traffic data relating to the network traffic when the collected traffic data is greater than the predefined threshold, the additional traffic data comprising Netflow protocol data.	A method for monitoring of traffic data through a network appliance connected between computing devices in a network, the method comprising: collecting, by the network appliance, traffic data relating to the network traffic passing through the network appliance, the traffic data comprising at least one of network delay, packet loss, or jitter; and comparing, by the network appliance, at least one of the collected traffic data to a predefined threshold.

From the above, it can be noticed that the main difference between Claim 1 and Claim 2 is that Claim 1 further includes one more feature that "collecting additional traffic data relating to the network traffic when the collected traffic data is greater than the predefined threshold, the additional traffic data comprising Netflow protocol data." However, such a difference renders Claim 1 eligible while Claim 2 ineligible.

Referring to the USPTO's analysis, Claim 1 and Claim 2 both belongs to a mental process. This is because both of the two claims recite the feature of "comparing, by the network appliance, at least one of the collected traffic data to a predefined threshold", however, the mere language of "*by the network appliance*" cannot precludes the step from practically being performed in the mind. In other words, a nominal recitation of a generic network appliance does not remove the claim from the mental processes grouping.

Though Claim 1 and Claim 2 are determined having recited judicial exception after applying Prong One of Step 2A, only Claim 1 as a whole integrates the judicial exception into a practical application. Specifically, the above-mentioned one more feature recited in Claim 1 avoids excess traffic volume on the network and hindrance of network performance, and provides a specific improvement over prior systems, and results in an improved network monitoring. Therefore, Claim 1 is eligible. In comparison, additional elements (features other than the one directed to the mental process) in Claim 2, are no more than mere instructions to apply the mental process using a generic computer component (i.e., the network appliance), which means no meaningful limits have been imposed on practicing the abstract idea. In this case, the abstract idea is not integrated into a practical application in view of Prong Two of Step 2A, and the claim as a whole is an abstract idea.

Furthermore, according to Figure 3.5.2-1, Claim 2 should be further evaluated in Step 2B. USPTO has included the following statements in its analysis, that "[u]nder the 2019 PEG, a conclusion that an additional element is insignificant extra-solution activity in Step 2A should be re-evaluated in Step 2B … to determine if it is more than what is well-understood, routine, conventional activity in the field." In this example, mere collection of data in a merely generic manner (i.e., *by the network appliance*) is a well-understood, routine, conventional activity and does not provide any inventive concept. Thus, Claim 2 is not eligible.

In another example ("Example 41"), the USPTO provides a hypothetic invention relates to a method for establishing cryptographic communications between two computer terminals.

The example claim recites a mathematical concept by claiming that "encoding each of the message block word signals M_A to produce a ciphertext word signal C_A, whereby $C_A=M_A^e \pmod n$". The mathematical concept is integrated into a process that secures private network communications in view of the combination of additional elements in the claim (i.e., ("receiving the plaintext word signal at the first computer terminal", "transforming the plaintext word signal to one or more message block word signals M_A", and "transmitting the encoded ciphertext word signal C_A to the second computer terminal over a communication channel"). So, the example claim is eligible.

In this example, USPTO has also states that the abstract idea can be integrated into a practical application by a well-understood, routine, conventional activity, and this should not be evaluated in Prong Two of Step 2A.

In yet another example ("Example 42"), the claimed invention is a method of managing interactions between people which allows for users to access patients' medical records and receive updated patient information in real time from other users. In this example, two claims are provided and both of the two claims recite the method of organizing human activity. However, one of the two claims, Claim 1, recites an improvement over prior arts by allowing remote users to share information in real time in a standardized format regardless of the format in which the information was input by the user, showing an integration of the abstract idea into a practical application. Therefore, Claim 1 is eligible. On the other hand, Claim 2 just simply implement the abstract idea on a generic computer, which cannot be considered as a practical application of the abstract idea. Claim 2 does not provide any inventive concept that can be added to the abstract idea as well, rendering Claim 2 ineligible.

3.2.3 Regarding *Additional Elements*

In this part, USPTO Guidance to adress wether *aditional eements* represent well-understood, routine, conventional activity are introduced.

As mentioned above, determining whether additional elements that significantly more than the judicial exception are recited is to determine whether the claim elements are more than well-understood, routine, conventional activity in the relevant field. USPTO release a memorandum on April 19, 2018 to clarify the determination of whether an additional element represents well-understood, routine, conventional activity. The memorandum was released in view of the Federal Circuit decision in *Berkheimer* case (see *Berkheimer* v. HP Inc., 881F.3d 1360 (Fed. Cir. 2018)).

In *Berkheimer*, the invention of the disputed U.S. Patent No. 7,447,713 (‘713 patent) relates to digitally processing and archiving files in a digital asset management system. The independent claim 1 of the ‘713 patent recites:

1. A method of archiving an item in a computer processing system comprising:

presenting the item to a parser;

parsing the item into a plurality of multi-part object structures wherein portions of the structures have searchable information tags associated therewith;

evaluating the object structures in accordance with object structures previously stored in an archive;

presenting an evaluated object structure for manual reconciliation at least where there is a predetermined variance between the object and at least one of a predetermined standard and a user defined rule.

In addition, the specification of the ‘713 patent describes an inventive feature that stores parsed data in a purportedly unconventional manner. In detail, the specification mentions that the conventional digital asset management systems include numerous documents containing multiple redundant document elements, which lead to inefficiencies and increased costs. However, the claimed invention can increase efficiency and computer functionality over the prior art systems, as recited in the specification (see the ‘713 patent at 16:52-60):

“By eliminating redundancy in the archive 14, system operating efficiency will be improved, storage costs will be reduced and a one-to-many editing process can be implemented wherein a singular linked object, common to many documents or files, can be edited once and have the consequence of the editing process propagate through all of the linked documents and files. The one-to-many editing capability substantially reduces effort needed to up-date files which represent packages or packaging manuals or the like as would be understood by those of skill in the art.”

In the decision, the Federal Circuit concludes that the above claim 1 is directed to the abstract idea of parsing and comparing data, however, it does not recite any of the purportedly unconventional activities disclosed in the specification. In particular, the Federal Circuit opined that “Claim 1 recites a method of archiving including parsing data, analyzing and comparing the data to previously stored data, and presenting the data for reconciliation when there is a variance. It does not include limitations which incorporate eliminating redundancy of stored object structures or effecting a one-to-many change of linked documents within an archive.” Thus, the elements of claim 1 amount to no more than performing the abstract idea of parsing and comparing data with conventional computer components, without including the purportedly unconventional manner. In this case, the Federal Circuit holds that claim 1 is ineligible under step 2B of the eligibility determination.

3.2.4 Regarding Computer-Implemented Functional Claim

In this part, examination of computer-implemented functional claim limitations for compliance with 35 U.S.C. §112 is introduced.

During the practice, USPTO found that functional language is likely to be used to claim computer-implemented inventions, such as most of the AI-related inventions. To a better understanding on how to draft a computer-implemented functional claims having functional limitations, and on how to meet requirements of written description and enablement, a guidance has been released by USPTO in 2019.

In general, a patent application should have proper written description and enablement support in the disclosure of the application. Further, for the computer-implemented functional claims, functional limitations (i.e., claim limitations that define an element in terms of the function it performs without reciting the structure, materials, or acts that perform the function) are required to be properly treated as means (or step) plus function limitation and to be sufficiently definite.

In particular, for a computer-implemented functional claim performs a specific computer function, the specification must disclose an algorithm for performing the claimed specific computer function. Further the specification must be consulted to determine the corresponding structure, material, or act for performing the claimed function, wherein the corresponding structure should be a computer specially programmed to perform the disclosed algorithm. A failure of disclosing any algorithm or the disclosed algorithm is not sufficient to perform the entire claimed function(s) will result in the indefiniteness of the computer-implemented claim.

The following is an example where the written description is insufficient to support computer-implemented claim limitations. On the basis of Media Rights Techs., Inc. v. Capital One Financial Corp., 800 F.3d 1366, 1374 (Fed. Cir. 2015), USPTO provides a hypothetical claim derived from the disputed patent, US 7,316,033, as follows:

"A method of preventing unauthorized recording of electronic media comprising:

activating a **compliance mechanism** in response to receiving media content by a client system, the compliance mechanism coupled to the client system, the client system having a media content presentation application operable thereon and coupled to the compliance mechanism;

controlling a data output pathway of the client system by diverting a commonly used data pathway of the media content presentation application to a controlled data pathway;

monitoring the controlled data pathway with the compliance mechanism to ensure there is no unauthorized recording of the media content; and

directing the media content to a custom media device coupled to the compliance mechanism via the data output pathway, for selectively restricting output of the media content."

In the above claim, the Federal Circuit first determined that the term "compliance mechanism" is a means-plus-function limitation that performs computer-implemented functions including "monitoring the controlled data pathway with the compliance mechanism to ensure there is no unauthorized recording of the media content." The Federal Circuit then found that the specification does not disclose sufficient structure for the monitoring function. In view of the following portion of the specification,

"… While the newly retrieved portion is presented, CCM 300 then again checks that the rules are enforced, and retrieves an additional portion of the media file or suspends presentation of the media file if the rules are not being enforced, and these steps are performed repeatedly throughout the playback of the media file, in a loop environment, until the media file's contents have been presented in their entirety. Advantageously, by constant monitoring during playing of media files, CCM 300 can detect undesired activities and enforces those rules as defined by CCM 300."

the Federal Circuit holds that though the specification states that there are set of rules which the compliance mechanism applies to monitor the data pathway, the specification does not provide details about the rules themselves or how the compliance mechanism determine whether the rules are being enforced. Therefore, the "compliance mechanism" limitation of claim 1 is indefinite.

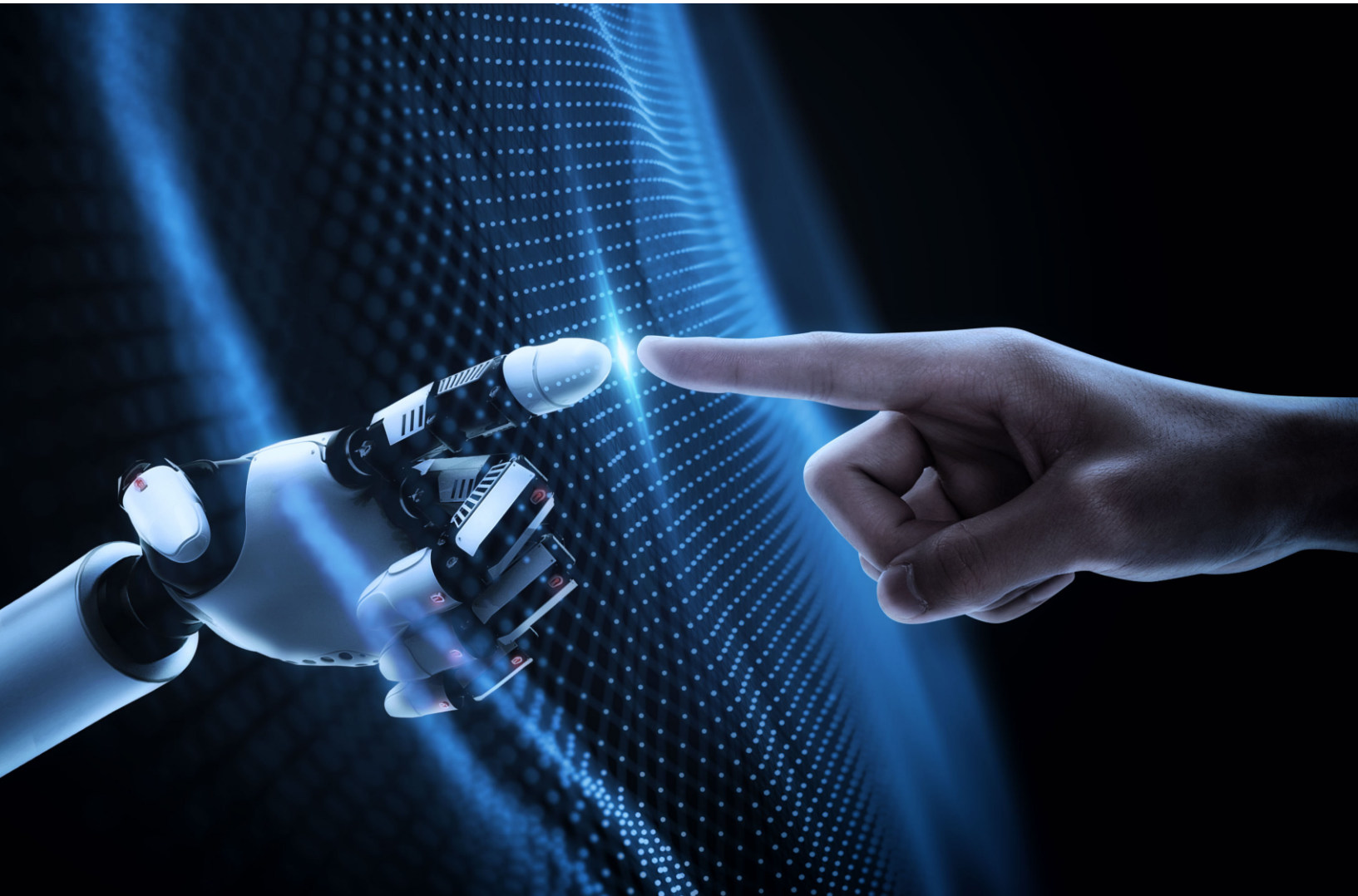
Furthermore, when a claim containing a computer-implemented claim limitation is found to be indefinite as above mentioned, the specification would also lack written description. In this case, the enablement requirement may not be met as well.

3.2.5 Inventorship of AI

Since more inventions are developed in advantage of AI, what if AI starts inventing the invention by itself? Will USPTO accept a patent application wherein the inventor is an AI? The answer is NO.

USPTO has expressed its attitude on the inventor-ship of AI in a recently released decision (see Decision on Petition, Appl. No. 16/524,350 (April 27, 2020)). In this decision, USPTO holds that "AI cannot be an inventor" by interpreting the language used in the U.S. Patent law and MPEP, as well as illustrating with some Federal Circuit decisions. For example, the Federal Circuit stated that "only natural persons can be 'inventors.'" in an earlier decision (see Beech Aircraft Corp. v. EDO Corp. 755 F. Supp. 985, 987).

Similarly, the CNIPA does not recognize AI as an inventor as well. Referring to Chinese Guidelines for patent examination, in Chapter 1 Section 4.1.2, it has clearly stated that "the inventor shall be the person."



3.2.6 Case Study

[Case Example 1]

The present case relates to the technology for facial detection in the filed of image processing. On the basis of the application involved in this case, the assume claim is as follows:

"A method for facial spatial positioning, the method comprising:
obtaining a facial image acquired by a single image acquisition device;
performing facial area detection on the facial image to determine position information of a facial area in the facial image; and
determining spatial position information of a face according to the position of the facial area."

During the examination, the above claim was rejected by the examiner under 35 U.S.C. §101. In particular, the examiner stated that, first, the above claim is directed to a process and falls within the "mental process" grouping of abstract ideas. In other words, the claim recites a judicial exception. The examiner then stated that the claim does not have any additional element that integrates the judicial exception into a practical application. The examiner also stated that the claim does not include additional elements that are sufficient to amount to significantly more than the judicial exception.

To overcome the above examiner's opinion raised during the examination, amending the claim as follows:

"A method for facial spatial positioning, the method comprising:
obtaining a facial image acquired by a single image acquisition device;
performing facial area detection on the facial image to determine position information of a facial area in the facial image; and
determining spatial position information of a face according to the position of the facial area and predetermined position information of a facial rectangle box within which the single image acquisition device performs facial recognition."

In view of the 2019 PEG, the following argument has been made along with the amended claim. In the argument, it has first focus on rebutting examiner's opinion that "the claim recites a judicial exception". In the above claim, the recited features "*a facial image acquired by a single image acquisition device*" and "the single image acquisition device performs facial recognition" can not be performed in the human mind and thus the claim does not relate to a mental process. Even though the claim is regarded as reciting a mental process, a further argument is made that the technical solution sought protection in the amended claim has practical value and can solve specific technical problems, e.g., improving the field of image processing. Moreover, it is also argued that elements in the amended claim are significantly more than a judicial exception, rather than merely describing a well-understood or routine or conventional activity in the field.

Base on the above amended claim and the argument, the application overcome the rejection under 35 U.S.C. §101.

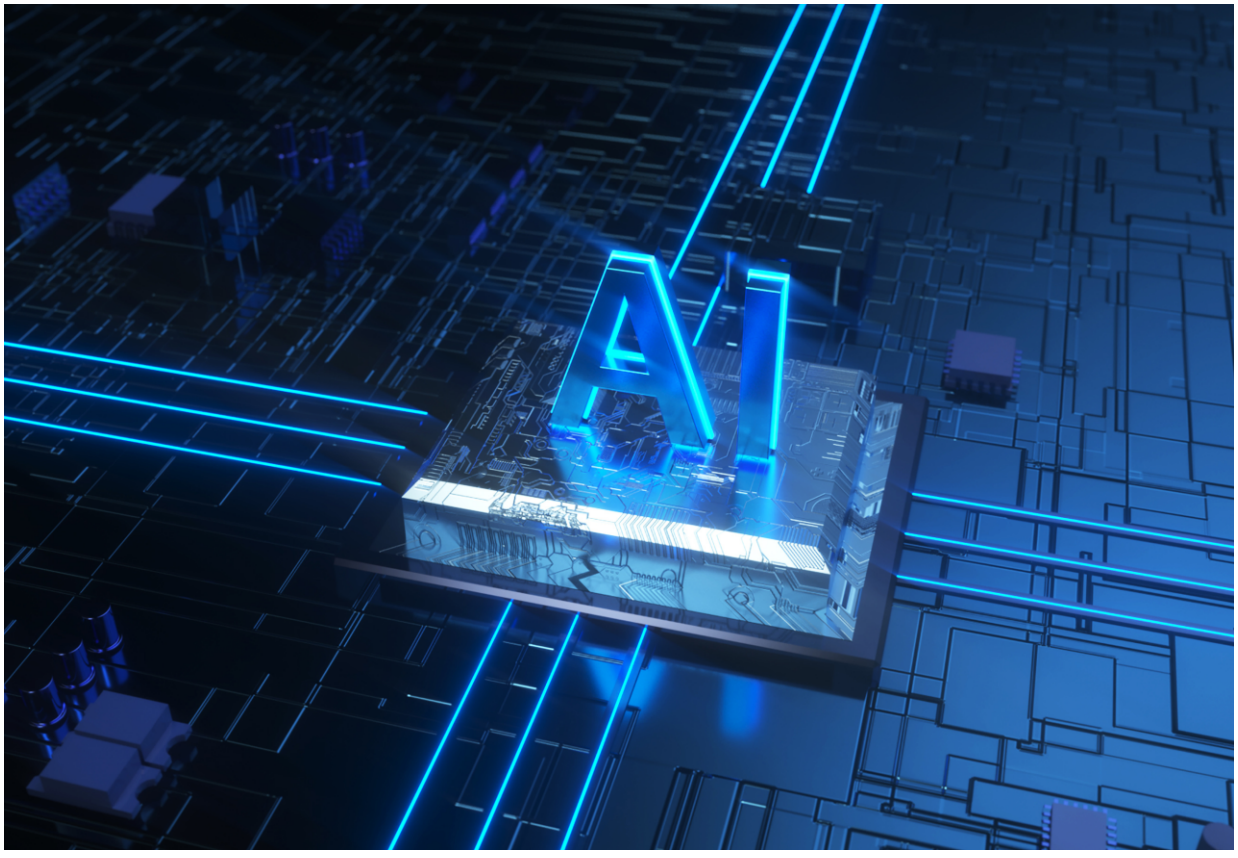
[Case Example 2]

This case mainly focuses on how to argue that "the claim recites additional elements that amount to significantly more than the judicial exception" in responding the Office Action. The invention in this case relates to a video monitoring method. During the examination, the examiner raised the opinion that the claim directs to a judicial exception without including additional elements that are sufficient to amount to significantly more than the judicial exception, and thus the claim is rejected under 35 U.S.C. §101.

To overcome the rejection, the claim has been amended and an argument has been made in the response to the Office Action. The followings are a comparison chart of the original filed claim and the amended claim, both derived from the actual case, and the argument made in the response.

The original claim:	**The amended claim:**
A video monitoring method, the method comprising: pre-setting scene information, the scene information comprising a monitored region; obtaining video data collected by a video data collecting apparatus; and based on the scene information and the video data, performing determination and statistics of monitored objects in the monitored region.	A video monitoring method, comprising: pre-setting scene information, the scene information comprising a monitored region; obtaining video data collected by a video data collecting apparatus; and based on the pre-set scene information and the video data, performing determination and statistics of monitored objects in the monitored region, wherein pre-setting the scene information comprises marking positions of each of the monitored objects in the monitored region, and determining weight of the monitored object in each position with respect to area of the monitored region, and the weight is an area occupied by the monitored object in each position in a video image.

The amended claim recites the features “marking positions of each of the monitored objects in the monitored region,” “determining weight of the monitored object in each position with respect to area of the monitored region” and “the weight is an area occupied by the monitored object in each position in a video image.” These features are obvious significantly more than an abstract idea that can be implemented by an operator. Therefore, the amended claim complies with 35 U.S.C. §101.



About the author

Xiaoming ZHANG

Partner | Patent Attorney | Attorney at Law

Mr. Xiaoming Zhang joined Liu, Shen & Associates in 2007. Mr. Zhang specializes in patent prosecution, re-examination, patent invalidation, IP litigation, and client counseling with a focus on telecommunication, artificial intelligence, big data processing, semiconductor technology, image processing, network, optics and physics. Mr. Zhang processes extensive experience both before SIPO and USPTO and is skilled in drafting application documents in Chinese and English.

Mr. Zhang became a qualified patent attorney in 2008, and got his qualification as an attorney at law in 2018.

Mr. Zhang obtained a doctor's degree in Optics from Peking University in 2007.

Hao GAO

Patent Engineer

Ms. Hao Gao is mainly engaged patent related matters including patent prosecution, patent reexamination, patent invalidation, and client counseling with a focus on the technical fields of electronics, telecommunication, computer science, semiconductor, Artificial Intelligence, autonomous vehicles, etc.

Ms. Hao Gao graduated from Johns Hopkins University with a Master degree in Materials Science and Technology, as well as obtained a Master of Science in Law from Northwestern University in U.S. She has worked in an IP law firm in Chicago as a technical specialist, working on patent infringement search and analysis, FTO search, patent invalidity search, etc.

About the author

Yujie JIN

Partner | Patent Attorney

Yujie JIN is a senior patent attorney of the Electronic and Electrical Department of Liu, Shen & Associates, and now has more than 10 years' experience in the field of IP law in China.

Ms. Jin joined Liu, Shen & Associates in 2005 and became a qualified patent attorney in 2006. Her practice focuses on patent preparation and prosecution, patent reexamination, patent invalidation, patent analysis and client counseling, with a particular focus in the areas of electronic engineering, communication technology, telecommunication, computer science, semiconductor technology and automatic control. Ms. Jin also has experience in pre-litigation analysis and patent infringement litigation relating to SEP.

Ms. Jin obtained a master of law degree (LL.M) in IP from the John Marshall Law School, Chicago, Illinois, USA in 2012. Before that, Ms. Jin graduated as a master in Communication and Information System from Tsinghua University in 2005, and received her bachelor's degree from the same university in 2002.

3.3 AI-related Patent Practice in Europe

Jing ZHANG, Zexin LIAO and Hongyu WU

This section will introduce the patent practice related to artificial intelligence (AI) under the European Patent Law.

3.3.1 AI-related Revision to the EPO Guidelines for Examination

With the fast development of AI technology, the number of patent applications in various countries has increased rapidly. In this context, major intellectual property powers have adjusted their patent examination standards in succession and formulated provisions on patentability of AI technology. In order to meet this demand, the European Patent Office (EPO) has revised the Guidelines for Examination in the EPO respectively in 2018, 2019 and 2021, as shown in the following table.

November 2018	The EPO issued the Guidelines for Examination in the EPO (2018), in which revision has mainly been made to Section 3.3 "Mathematical methods", Section 3.5 "Schemes, rules and methods for performing mental acts, playing games or doing business" and Section 3.6 "Programs for computers" under the Section 3 "List of exclusions", Chapter II, Part G, and Section 3.3.1 "Artificial intelligence and machine learning" has been added under Section 3.3 "Mathematical methods".
November 2019	The EPO issued the Guidelines for Examination in the EPO (2019). In the revision to Section 3.3 "Mathematical methods", Chapter II, Part G, emphasis has been put on that the computational efficiency of the steps affecting that established technical effect is to be taken into account when assessing inventive step, while in the revision to Section 3.3.1 "Artificial intelligence and machine learning", emphasis has been put on that the use of a technical means has to be taken into account, depending on the context, when examining whether the claimed subject-matter has a technical character as a whole.
March 2021	The EPO issued the Guidelines for Examination in the EPO (2021), in which the provision that special attention needs to be paid to the clarity of terms used in claims related to mathematical methods has been mainly deleted under Section 3.3 "Mathematical methods", Chapter II, Part G and Section 3.3.1 "Artificial intelligence and machine learning" thereunder.

3.3.2 Main provisions of the EPC regarding the grant of patent rights

The main provisions regarding the grant of patent rights (including the grant of patent rights related to AI technology) in the European Patent Convention (EPC) are shown in the following table.

Patentability of Subject-Matter	**EPC Art. 52**	(1) European patents shall be granted for any inventions, in all fields of technology, provided that they are new, involve an inventive step and are susceptible of industrial application. (2) The following in particular shall not be regarded as inventions within the meaning of paragraph 1: (a) discoveries, scientific theories and mathematical methods; (b) aesthetic creations; © schemes, rules and methods for performing mental acts, playing games or doing business, and programs for computers; (d) presentations of information. (3) Paragraph 2 shall exclude the patentability of the subject-matter or activities referred to therein only to the extent to which a European patent application or European patent relates to such subject-matter or activities as such.

Novelty and Inventive step of a claim	**EPC Art. 54**	**Novelty** (1) An invention shall be considered to be new if it does not form part of the state of the art. (2) The state of the art shall be held to comprise everything made available to the public by means of a written or oral description, by use, or in any other way, before the date of filing of the European patent application. (3) Additionally, the content of European patent applications as filed, the dates of filing of which are prior to the date referred to in paragraph 2 and which were published on or after that date, shall be considered as comprised in the state of the art. (4) Paragraphs 2 and 3 shall not exclude the patentability of any substance or composition, comprised in the state of the art, for use in a method referred to in Article 53©, provided that its use for any such method is not comprised in the state of the art. (5) Paragraphs 2 and 3 shall also not exclude the patentability of any substance or composition referred to in paragraph 4 for any specific use in a method referred to in Article 53©, provided that such use is not comprised in the state of the art.
	EPC Art. 56 **Guidelines for Examination in the EPO, Part G, Chapter VII, Section 5**	**<u>Inventive step</u>** An invention shall be considered as involving an inventive step if, having regard to the state of the art, it is not obvious to a person skilled in the art. If the state of the art also includes documents within the meaning of Article 54, paragraph 3, these documents shall not be considered in deciding whether there has been an inventive step. <u>Problem-solution approach</u> (i) determination of the closest prior art, (ii) formulation of the objective technical problem (iii) considering whether or not the claimed invention, starting from the closest prior art and the objective technical problem, would have been obvious to the skilled person.

3.3.3 Regarding Patentability

3.3.3.1 "Invention" must have a technical character in accordance with EPC Art. 52 (1)

It is regulated in Section 1, Chapter II, Part G of the *Guidelines for Examination in the EPO that, "an "invention" within the meaning of Art. 52 (1) must be of both a concrete and a technical character*." Furthermore, it is regulated in Section 2, Chapter I, Part G of the Guidelines for Examination in the EPO, that, the invention must be of "technical character" to the extent that it must relate to a technical field, must be concerned with a technical problem and must have technical features in terms of which the matter for which protection is sought can be defined in the claim.

3.3.3.2 Principle of determining whether the subject-matter of a claim has a technical character

Section 3, Chapter II, Part G of the Guidelines for Examination in the EPO has specified several general aspects that need to be paid attention to when considering whether the subject-matter of an application is an invention within the meaning of EPC Art. 52(1). Firstly, any exclusion from patentability under EPC Art. 52(2) applies only to the extent to which the application relates to the excluded subject-matter as such [EPC Art. 52(3)]. Secondly, the subject-matter of the claim is to be considered as a whole, in order to decide whether the claimed subject-matter has a technical character. If it does not, there is no invention within the meaning of EPC Art. 52(1). It must also be borne in mind that the basic test of whether there is an invention within the meaning of EPC Art. 52(1) is separate and distinct from the questions whether the subject-matter is susceptible of industrial application, is new and involves an inventive step. Technical character is assessed without regard to the prior art.

3.3.3.3 Specific explanation on determining whether the subject-matter of an AI-related claim has a technical character

According to the provisions of the above-mentioned EPC Art. 52(2) and (3), a purely abstract mathematical method is not patentable. However, Section 3.3 “Mathematical methods” under Chapter II, Part G provides that based on the principle of determining whether the claimed subject-matter has a technical character as a whole, if a claim is directed either to a method involving the use of technical means or to a device, its subject-matter is not excluded from patentability under EPC Art. 52(2) and (3) and is thus an invention within the meaning of EPC Art. 52(1). According to Section 3.3.1, Chapter II, Part G, artificial intelligence and machine learning are based on computational models and algorithms, which are per se of an abstract mathematical nature. Hence, the guidance provided in Section 3.3 “Mathematical methods”, Chapter II, Part G of the Guidelines generally applies also to such computational models and algorithms.

A mathematical method may contribute to the technical character of an invention, i.e. contribute to producing a technical effect that serves a technical purpose, by its application to a field of technology and/or by being adapted to a specific technical implementation.

Mathematical Methods:

Section 3.3, Chapter II, Part G provides examples of mathematical methods being considered to be applied to a field of technology and/or be adapted to a specific technical implementation.

Examples of technical purposes which may be served by a mathematical method are :

- controlling a specific technical system or process, e.g. an X-ray apparatus or a steel cooling process;
- determining from measurements a required number of passes of a compaction machine to achieve a desired material density;
- digital audio, image or video enhancement or analysis, e.g. de-noising, detecting persons in a digital image, estimating the quality of a transmitted digital audio signal;
- separation of sources in speech signals; speech recognition, e.g. mapping a speech input to a text output;
- encoding data for reliable and/or efficient transmission or storage (and corresponding decoding), e.g. error-correction coding of data for transmission over a noisy channel, compression of audio, image, video or sensor data;
- encrypting/decrypting or signing electronic communications; generating keys in an RSA cryptographic system;
- optimising load distribution in a computer network;
- determining the energy expenditure of a subject by processing data obtained from physiological sensors; deriving the body temperature of a subject from data obtained from an ear temperature detector;
- providing a genotype estimate based on an analysis of DNA samples, as well as providing a confidence interval for this estimate so as to quantify its reliability;
- providing a medical diagnosis by an automated system processing physiological measurements;
- simulating the behaviour of an adequately defined class of technical items, or specific technical processes, under technically relevant conditions (see G-II, 3.3.2).

Examples of being adapted to a specific technical implementation is:

- adaptation of a polynomial reduction algorithm to exploit word-size shifts matched to the word size of the computer hardware.

Artificial Intelligence and Machine Learning:

Section 3.3.1, Chapter II, Part G provides examples of technical application of artificial intelligence and machine learning.

Examples of technical application of artificial intelligence and machine learning are:

- use of a neural network in a heart-monitoring apparatus for the purpose of identifying irregular heartbeats makes a technical contribution;

- classification of digital images, videos, audio or speech signals based on low-level features (e.g. edges or pixel attributes for images) are further typical technical applications of classification algorithms.

(2) Case Examples

Example 1 (EP1770612B1):

A computer-implemented method for parallel training a support vector machine using a plurality of processing nodes and a centralized processing node connected to a network of processing nodes based on a set of training data, each of the processing nodes stores a subset of a kernel matrix only, comprising the steps of:

a) at each of the plurality of processing nodes, selecting a local working set of training data based on said set of training data;

b) at each of the plurality of processing nodes, transmitting selected data related to said local working set of training data to said centralized processing node, said selected data comprising gradients of said local working set of training data;

c) at each of the plurality of processing nodes, receiving an identification of a global working set of training data selected, at said centralized processing node, based on the data transmitted from the plurality of processing nodes, said identification being sent by said centralized processing node;

d) at each of the plurality of processing nodes, optimizing said global working set of training data by executing a quadratic function;

e) at each of the plurality of processing nodes, updating a subset of gradients of said global working set of training data, the step of updating comprising computing the subset of the kernel matrix, wherein said subset of gradients corresponds to said subset of the kernel matrix; and

f) repeating said steps a) through e) until a convergence condition is met, the convergence condition being the Karush-Kuhn-Tucker condition.

Analysis:

This application involves an algorithm for support vector machine filed in 2006, which is an improvement to the algorithm and does not provide “technical features” in the traditional meaning, and the application has been granted in Europe in 2016. The following is a brief description of the examination process:

During the examination of the original application documents (Ep1770612), the EESR alleged that, “No technical effect of the features of the method can be determined by the examiner. In particular, the output of the method is not used in any technical application, no technical considerations are required to carry out the claimed method, and no details of implementation are claimed either. Therefore, claim 1 does not have a technical character and is merely a mathematical method.” Specifically, original claim 1 is as follows:

A method for training a support vector machine based on a set of training data at one of a plurality of processing nodes, comprising the steps of:

a) selecting a local working set of training data based on local data;

b) transmitting selected data related to said local working set;

c) receiving an identification of a global working set of training data;

d) optimizing said global working set of training data;

e) updating a portion of gradients of said global working set of training data; and

f) repeating said steps a) through e) until a convergence condition is met.

The applicant has made the following amendments to claim 1 and requested for substantive examination, and argued in the reply to the EESR filed that, "The support vector machine running on a network of processing nodes can be trained in shorter time, and the output of the method is a trained support vector machine which can be used in further technical application."

A method for parallel training a support vector machine using a plurality of processing nodes connected to a network of processing nodes based on a set of training data at one of ~~a~~ said plurality of processing nodes, comprising the steps of:

a) selecting a local working set of training data on said one processing node based on ~~local data~~ said set of training data;

b) transmitting selected data related to said local working set of training data from said one processing node to said network;

c) receiving an identification of a global working set of training data sent by said network on said one processing node;

d) optimizing said global working set of training data on said one processing node by executing a quadratic function;

e) updating a ~~portion~~ number of gradients of said global working set of training data on said one processing node; and

f) repeating said steps a) through e) until a convergence condition is met.

The examiner disagreed with the applicant's above reply, and alleged that the technical problem referred to in the applicant's reply could not be solved by the technical solution described in the currently amended claim 1.

In response, the applicant submitted the following two different amendments to claim 1. As for Solution (1), the examiner held that such amendments as "via a processor" and "via a network" are not supported by the original application documents. As for Solution (2), judging from the subsequent examination history, the examiner accepted Solution 2 and continued to examine the inventive step of the application documents.

Solution (1):

A method for training a support vector machine ~~based on a set of training data at one of a plurality of processing nodes~~, comprising the steps of:

a) selecting, via a processor of a first processing node, a local working set of training data based on local training data stored in a memory of the first processing node;

b) transmitting, via a network interface of the first processing node, certain gradients to a second processing node, the certain gradients selected ~~data related to said local working set~~ from gradients of the working set of training data;

c) receiving at the network interface of the first processing node an identification of a global working set of training data;

d) executing, via the processor of the first processing node, a quadratic function stored in a storage device of the first processing node to optimize ~~optimizing~~ said global working set of training data;

e) updating ~~a portion of~~ gradients of ~~said global working set of~~ the training data stored in the memory of the first processing node; and

f) repeating said steps a) through e) until a convergence condition is met.

Solution (2):

A computer-implemented method for parallel training a support vector machine using a plurality of processing nodes connected to a network of processing nodes based on a set of training data ~~at one of a plurality of processing nodes~~, each of the processing nodes stores a subset of a kernel matrix only, comprising the steps of:

a) at each of the plurality of processing nodes, selecting a local working set of training data based on ~~local data~~ said set of training data;

b) at each of the plurality of processing nodes, transmitting selected data related to said local working set of training data to said network, said selected data comprising gradients of said local working set of training data;

c) at each of the plurality of processing nodes, receiving an identification of a global working set of training data selected, at said network, based on the data transmitted from the plurality of processing nodes, said identification being sent by said network;

d) at each of the plurality of processing nodes, optimizing said global working set of training data by executing a quadratic function;

e) at each of the plurality of processing nodes, updating a portion number of gradients of said global working set of training data, the step of updating comprising computing the subset of the kernel matrix; and

f) repeating said steps a) through e) until a convergence condition is met, the convergence condition being the Karush-Kuhn-Tucker condition.

Example 2 (EP3291146A):

A method for use with a convolutional neural network-CNN-used to classify input data, the method comprising:

after input data has been classified by the CNN, carrying out a labelling process in respect of a convolutional filter of the CNN which contributed to classification of the input data, the labelling process comprising inputting an output of the convolutional filter, and/or an output of a max-pooling filter associated with the convolutional filter, into a filter classifier which employs an input data classification process to assign a label to a feature of the input data represented by the convolutional filter;

repeating the labelling process in respect of each individual convolutional filter of the CNN which contributed to classification of the input data;

translating the CNN into a neural-symbolic network in association with the assigned labels;

using a knowledge extraction method to extract from the neural-symbolic network knowledge relating to the classification of the input data by the CNN; and

generating and outputting at least one of: a summary comprising the input data, the classification of the input data assigned by the CNN, and the extracted knowledge; and an alert indicating that performance of an action or task, using the extracted knowledge and classified input data, is required.

Analysis:

This application involves an algorithm for neural network to classify data filed in 2003, which is an improvement to the algorithm. During the examination of the original application documents, the EESR alleged that, “Claim 1 is directed to an abstract method based on the use of certain mathematical or abstract models (a convolutional neural network, filter classifier, neural-symbolic network). The claim does not specify any technical means whatsoever to perform the steps. The few terms that might be interpreted as technical features (such as alert) are also not further specified and technically characterised.” The applicant did not make a reply to the EESR, which means, the application did not enter the subsequent substantive examination stage.

Example 3 (EP1546948A2):

A method of simulating movement of an autonomous entity through an environment, the method comprising:

providing a provisional path through a model of the environment from a current location to an intended destination;

providing a profile for said autonomous entity;

determining a preferred step towards said intended destination based upon said profile and said provisional path;

determining a personal space around said autonomous entity;

determining whether said preferred step is feasible by considering whether obstructions infringe said personal space.

Analysis:

This application involves a method for computer simulation filed in 2003. During the examination, the examiner alleged that the simulation model has no technical character, and its implementation on the computer was obvious. In the subsequent appeal phase, the appellant raised the following questions:

(1) In the assessment of inventive step, can the computer-implemented simulation of a technical system or process solve a technical problem by producing a technical effect which goes beyond the simulation's implementation on a computer?

(2) If the answer to the first question is yes, what are the relevant criteria for assessing whether a computer-implemented simulation claimed as such solves a technical problem?

(3) What are the answers to the first and second questions if the computer-implemented simulation is claimed as part of a design process, in particular for verifying a design?

The appellant's arguments can be summarized as follows: the application concerned modelling pedestrian movement, which could be used to help design or modify a venue, and it sought a more accurate and realistic simulation of pedestrian crowds in real-world situations, which could not be adequately modelled by conventional simulators.

The Board of Appeal handed over the above questions, namely how to assess the inventive step of an invention of computer simulation, to the EU Enlarged Board of Appeal (EBA). EBA made a decision on February 22, 2019, and answered the above questions as follows:

1. In order to assess the inventive step, the computer-implemented simulation in a technical system or process can solve technical problems by producing technical effects that exceed those produced by such simulation on computers;

2. For this assessment, the technical principle of simulation to be based entirely or partly on the simulation system or process is not a sufficient condition;

3. If computer-implemented simulation is claimed to be part of the design process, especially to be used for verifying the design, the answers to the first question and the second question will be no different.

(See: https://www.epo.org/law-practice/case-law-appeals/recent/t140489ep1.html)

Example 4 (EP1257904B1):

A computer-aided method for numerical simulation of a circuit with a step width δ, and which is subject to 1/f noise influences,

in which the circuit is described by a model (1) which has input channels (2), noise input channels (4) and output channels (3),

in which the behavior of the input channels (2) and of the output channels (3) is described by a system of differential equations or algebraic-differential equations,

in which an output vector (OUTPUT) is calculated by 1/f-distributed random numbers for an input vector (INPUT) present on the input channels (2), and for a noise vector (NOISE) y present on the noise input channels (4), and

in which the noise vector y is generated by the following steps:

determining a desired spectral value P of the 1/f noise,

determining a value n for the number of the random numbers, to be generated, of a 1/f noise,

determining an intensity constant const,

forming a covariance matrix C of dimension (n × n), one element e(i, j) each of the covariance matrix C being determined using the following equation:

e(I, j) = const · δ β + 1 · i - j + 1 β + 1 - 2 i - j β + 1 + i - j - 1 β + 1, where i, j = 1, ..., n

forming the Cholesky decomposition L of the covariance matrix C,

the following steps being carried out for each sequence, to be generated, of random numbers of a 1/f noise:

forming a vector x of length n from random numbers normally distributed in (0,1), and

generating a vector y of length n of the desired 1/f-distributed random numbers by multiplying the Cholesky decomposition L by the vector x.

Analysis:

This application involves a computer-aided method filed in 2001. During the examination, the original examination department held that claim 1 is excluded from patentability under EPC Art. 52(2) on the ground that the simulation method described in claim 1 constitutes a psychological behavior or mathematical method. However, in the subsequent appeal process, the Board held that, “Simulation of a circuit subject to 1/f noise constitutes an adequately defined technical purpose for a computer-implemented method functionally limited to that purpose. Specific technical applications of computer-implemented simulation methods are themselves to be regarded as modern technical methods which form an essential part of the fabrication process and precede actual production, mostly as an intermediate step. In that light, such simulation methods cannot be denied a technical effect merely on the ground that they do not yet incorporate the physical end product.”

(See: https://www.epo.org/law-practice/case-law-appeals/recent/t051227ep1.html)

Example 5 (EP2833303A1):

A method for solving multidimensional optimization problems on a set of feasible solutions {S1, ..., Sn} of a discrete combinatorial problem comprising steps of:

calculating optimization values for the set of feasible solutions {S1, ..., Sn} by using a set of optimization functions {f1, ..., fk};

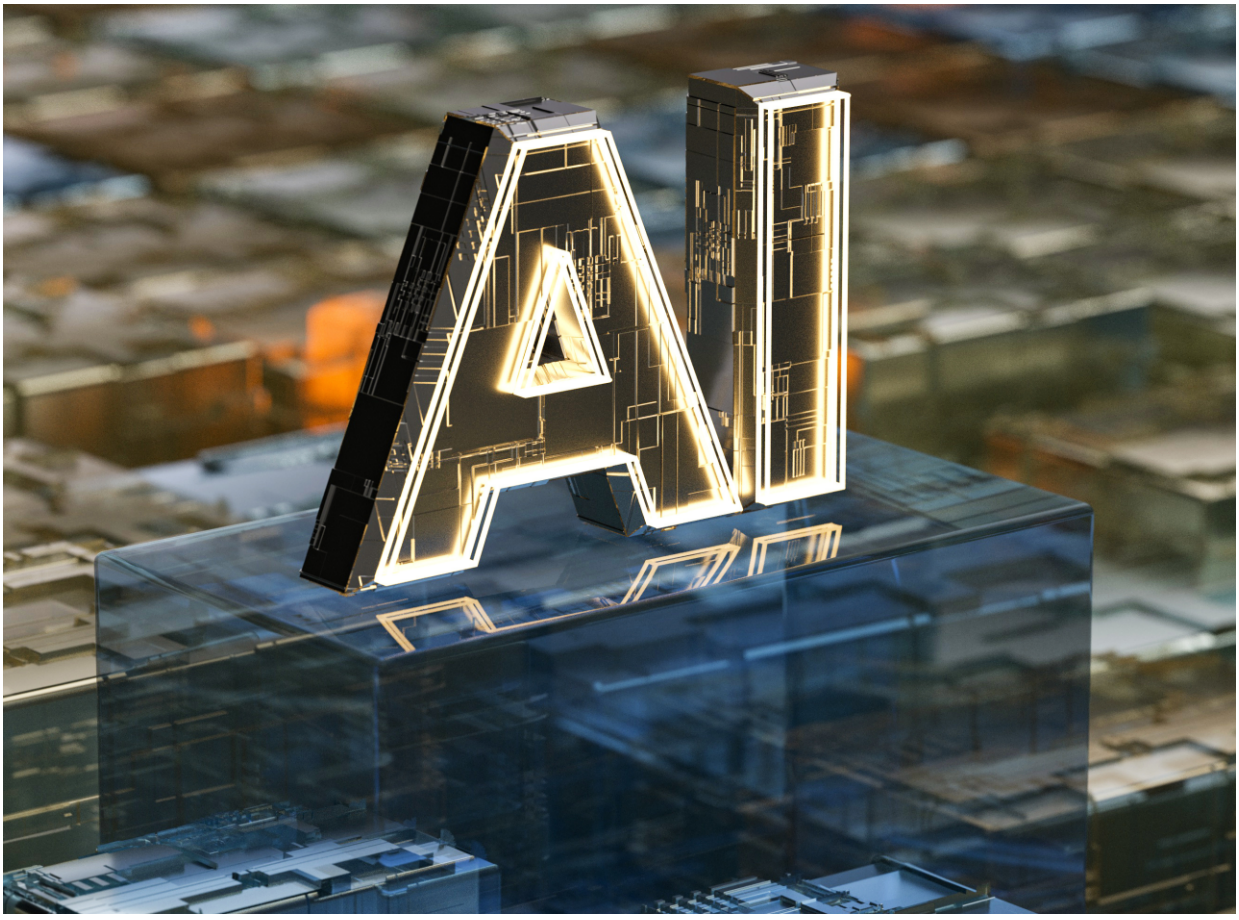
calculating mean values μ(fi) to the set of optimization functions {f1, ..., fk} according to $\mu(f_i) = \frac{1}{n} * \sum_{j=1}^{n} f_i(S_j)$;

calculating standard deviation values s(f) to the set of optimization functions {f1, ..., fk} according to $s(f_i) = \sqrt{\frac{1}{n-1} \sum_{j=1}^{n} (f_i(S_j) - \mu(f_i))^2}$;

normalize the optimization values for the set of feasible solutions {S1, ..., Sn} according to $norm(f_i(Sol)) = \frac{f_i(Sol) - \mu(f_i)}{s(f_i)}$;

accumulate the normalized optimization values norm (fi(Sol)) according to $f(Sol) = \sum_{i=1}^{k} norm(f_i(Sol))$;

find a minimum for the accumulated normalized optimization values $\min_{i=1}^{n} f(S_i)$.



Analysis:

This application involves an optimization algorithm filed in 2013. During the examination, the examiner alleged that a computer implementation is neither explicitly specified in claim 1, nor could it be acknowledged as being implicit from the present wording of claim 1; throughout the whole application, the claimed method is presented as an abstract method without any condition of being “computer-implemented”, and no computer implementation is defined; in addition, a complex formulation of the optimization problem is not sufficient to imply that the method must be computer-implemented. The Board held that if the use of computer means were indeed indispensable, it would have been necessary to include the computer implementation as an essential feature in the claimed method. In addition, a complex formulation of the optimization problem is not sufficient to imply that the method must be computer-implemented.

(See: https://www.epo.org/law-practice/case-law-appeals/recent/t161820eu1.html)

Suggestions on Drafting

It can be seen from the foregoing examples that EPO is relatively strict in the patentability of patents involving AI algorithms. In the practice of examination, based on the principle of determining whether the claimed subject-matter has a technical character as a whole, the drafting of a claim needs to be able to reflect that the mathematical method may contribute to producing a technical effect that serves a technical purpose, by its application to a field of technology and/or by being adapted to a specific technical implementation. For example, the technical features defined in the claim should reflect that the method must be implemented by a computer or serve a sufficiently-defined technical purpose.

About the author

Jing ZHANG

Partner | Patent Attorney | Attorney at Law

Ms ZHANG joined Liu-Shen in 2010.

She obtained her PhD degree from Shanghai Jiao Tong University on 2007. Before joining this firm, Ms ZHANG worked as a software engineer at Telecommunication Research Institution of Samsung Electronics Co., Ltd in Korean for 2 years.

She got her qualification as a patent attorney in 2009 and an attorney at law in 2015. She received training from D Young & CO, LLP, UK. in 2018.

She specializes in patent protection, and has extensive experience in a variety of areas, including computer science, digital image processing, digital video processing and telecommunication.

Ms ZHANG provides legal services in patent application/inquiry, patent re-examination and invalidation, patent administrative and legal proceedings, and other matters related to intellectual property rights.

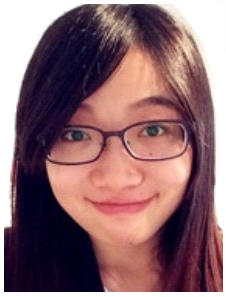
Zexin LIAO

Patent Engineer

Ms. Zexin LIAO is mainly engaged in patent related matters including patent prosecution, re-examination, patent invalidation, and client counseling with a focus on technical fields of electronics, telecommunication, computer science and internet, etc.

Zexin Liao graduated from Sichuan University with a bachelor's degree in computer science and completed her master's degree in the same major with a data science concentration at Emory University.

About the author



Hongyu WU

Patent Attorney

Hongyu Wu joined Liu, Shen & Associates in August, 2018 and began her legal career. Her current practice mainly focuses on patent drafting, examination and re-examination, searching and analysis, etc.

She got a bachelor degree in mechanical engineering and automation from Beijing University of Posts and Telecommunications in 2013, and got a master degree in mechanical engineering from University of Pittsburgh in 2015. During her graduate study, she obtained the Fundamentals of Engineering (FE) certification in the United States.

3.4 AI-related Patent Practice in Japan

Hongying ZHAO

This section will introduce the patent practice related to AI under the Japanese Patent Law.

3.4.1 Revision schedule for important normative documents related to AI invention examination

The Japan Patent Office (JPO) attaches great importance to AI-related patent examination, and issued relevant examination standard changes and case guidelines in 2018, 2019 and 2021, as shown in the following table.

March 2018	JPO issued guidelines for the examination of inventions related to computer software, and attributed AI inventions to inventions related to computer software so that the revision is also applicable.
March 2019	In response to the examination standards for AI-related patent applications, JPO issued case guidelines for AI-related patent applications. These cases were compiled into a document and provided in English version, called *Case Examples pertinent to AI-related technology.*
April 2021	JPO released *Comic Version of Examination Guidelines: AI/IoT-related Technology*.

3.4.2 Major Provisions of the Japanese Patent Law Considered at the Right Acquisition Stage

Protectable subject matter	**A2**	Invention refers to the creation with high-level technological ideas using the law of nature.
Novelty/inventive step of a claim	**A29**	Any inventor who completes an industrially usable invention can obtain a patent for such invention, unless such invention: 1. is a well-known invention in Japan prior to the patent application; 2. has been publicly implemented in Japan prior to the patent application; 3. has been documented in publications published in Japan or abroad prior to the patent application; 4. if, before applying for a patent, a person with ordinary knowledge in the technical field of such invention can easily realize the invention based on the invention described in each clause of the preceding paragraph, the invention cannot be patented, regardless of the provisions of the same paragraph.
Description Requirements, comprising Enablement Requirement and Support Requirement	**A36 (4) (i)** **A36 (6)**	The specification should be clear and sufficient to enable a person of ordinary skill in the art to which the invention belongs to realize the invention. The record of the claims shall meet any one of the following requirements: (I) the claimed invention is recorded in the detailed description of invention in the specification; (ii) the claimed invention is clear; (iii) the record of each claim is brief; (iv) the record of the claims complies with the relevant laws and regulations of the Ministry of Economy, Trade and Industry (METI).

3.4.3 Subject Matter Eligibility

(1)Two-Step Approach

JPO stipulates a two-step approach to judge the subject matter eligibility:

The first step is the common criteria, that is, invention is the creation with high-level technological ideas using the law of nature;

the second step is the special criteria for inventions related to computer software, which proceeds according to the concepts based on software viewpoint.

In the first step, if the invention is considered to be mathematical formulas, human mental activities, subjective arrangements (such as the rules of playing games), simple information expression, etc., it will be ineligible. Inventions related to computer software will be considered to be eligible if device control or processing related to control is concretely performed, or information processing is concretely performed based on technical characteristics such as physical, chemical, biological, or electrical properties of an object, without necessity to proceed according to the concepts based on software viewpoint in the second step; if it is not possible to determine whether they are eligible, then it is necessary to make judgment in the second step. In the second step, if the information processing through software is realized through hardware resources, or the processor or its operating method is operated in cooperation with software and hardware resources, such inventions are considered to be eligible.

It can be seen from the above that JPO has a relatively high tolerance for subject matter eligibility, and AI-related programs, data structures, models, etc. meet the eligibility requirements under certain conditions. Specifically, in addition to the protectable subject matter of storage media currently recognized in China's patent examination practice, Japan has further recognized the protectable subject matter of inventions related to computer software such as programs, data, data structures, and machine learning models that meet certain conditions. In more detail, the use of hardware resources to concretely realize software-based information processing, the information processing device that works in association with the software, its working method, and the storage media for recording the software can all be considered to be a creation with high-level technological ideas using the law of nature. Among them, software-related protectable subject matters such as programs, data structures, and machine learning models related to AI technology can be considered to meet the requirement for subject matter eligibility, provided that the record of their claims can clearly specify computer-based information processing. However, if the data to be protected is only a simple expression of information, and there is no stipulation regarding computer-based information processing, it still doesn't meet the requirement for subject matter eligibility.

Protectable subject matter	Requirement for the technical solution of a claim
Device/system/method; Computer program (need to be written as "a computer program that enables a computer to perform xx functions"); Storage medium; Trained model	It should be an embodiment for concrete realization using hardware resources, that is, it can embody computer-based information processing. In addition, it is a creation with high-level technological ideas using the law of nature.

(2) Case Example

[Example 1]:

A trained model for causing a computer to function to output quantified values of reputations of accommodations based on text data on reputations of accommodations, wherein;

the model is comprised of a first neural network and a second neural network connected in a way that the said second neural network receives output from the said first neural network;

the said first neural network is comprised of an input layer to intermediate layers of a feature extraction neural network in which the number of neurons of at least one intermediate layer is smaller than the number of neurons of the input layer, the number of neurons of the input layer and the number of the output layer are the same, and weights were trained in a way each value input to the input layer and each corresponding value output from output layer become equal;

weights of the said second neural network were trained without changing the weights of the said first neural network; and

the model causes the computer function to perform a calculation based on the said trained weights in the said first and second neural networks in response to appearance frequency of specific words obtained from the text data on reputations of accommodations input to the input layer of the said first neural network and to output the quantified values of reputations of accommodations from the output layer of the said second neural network.

Analysis:

JPO holds that the main content of this application is to use neural networks to process text information and make analysis based on the appearance frequency of specific words obtained from the text data on reputations of accommodations. The core of the claims is a computer program. The JPO considers such a technical solution as a patentable subject matter in the JPO Examination Guidelines for Patentability on the grounds that the information processing of the software is concretely realized through the use of hardware resources. Therefore, the trained model of claim 1 is a creation with technological ideas using the law of nature, and is thus an "invention".

(3) Suggestion on Drafting

It is recommended to record the examples used to protect different subject matters in multiple dimensions. Specifically, in addition to the subject matters of the claims that are also recognized by China's domestic examination practice, it is recommended that the software-related protectable subject matters such as programs, data structures, and machine learning models be further added in the specification based on the key points of protection and implementation forms of AI technology so as to enable applicants to obtain a more comprehensive scope of protection in Japan in multiple dimensions.

3.4.4 Inventive step

(1) Examination on inventive step

According to the provisions of the JPO Examination Guidelines for Patentability, the specific steps to determine whether a patent application involves an inventive step include:

1) Understanding the claimed invention;

2) Finding a comparison document that is most similar to the present invention;

3) Comparing the present invention with the comparison documents to find the same technical features and distinct technical features;

4) **Reasoning** for distinct technical features.

The **reasoning** part includes:

1) First consider whether the distinct technical feature is a technical innovation easily thought of by those

skilled in the art, such as: selection of the most suitable material from the known materials, optimization of the numerical range, replacement of equivalents, technical changes in specific applications, content recognized by the applicant, etc.; if the distinct technical feature is not a technical innovation easily thought of by those skilled in the art, the present invention involves an inventive step;

2) If the distinct technical feature is a technical innovation easily thought of by those skilled in the art, continue to discuss whether there is a motivation, for example, whether the comparison document and the present application have: A. relevance in the technical field, B. commonality in the subject, C. commonality in the function and role, D. whether the cited invention has enlightenment, or belongs to common knowledge (any single item in the above A-D can be considered as a motivation); if there is no motivation, the present invention involves an inventive step;

3) If there is motivation, continue to discuss whether there are elements that deny the above logical reasoning, for example: A. obstacle factors (different cited documents cannot be combined due to technical obstacles therein), B. advantageous invention effect, C. commercial success, long-term pending subjects, etc., among which the obstacle factors are the key to answering questions about inventive step.

According to the Examination Guidelines, general principles are applied to the judgment of the inventive step of AI inventions, and technical features and non-technical features are not distinguished, but all the features recorded in the claims should be considered. In particular, according to the examples provided in the Examination Guidelines, the main dimensions for judging whether an AI-related patent application meets the requirement for inventive step include:

1) Is “human behavior” systematized only using AI technology;

2) Is it simply an improved method of predicting the output result based on the input data;

3) Is the change to training data used for machine learning just a combination of known data without significant effects;

4) Is it preprocessing of training data for machine learning?

Specifically,

a) AI inventions will be considered not to involve an inventive step if AI is simply used to transform manually-operated tasks into computerized processing or to systematize known methods, in other words, if it is an invention that simply uses AI technology to systematize the processing performed by humans (e.g., formulas and operating methods manually calculated by humans) and make it processed by computers, or the prediction method used to generate prediction results based on original input data is simply changed from existing technology to AI technology, it is often considered that the above improvement is predictable by those skilled in the art, and the inventive step will not be recognized;

b) If beneficial effects can be obtained through the selection/change of input data, the invention is considered to involve an inventive step; on the contrary, if the selection/change of input data is only a combination of known data that does not achieve beneficial effects, the invention doesn’t involve an inventive step. In other words, due to the possibility of generating data noise when using data with unclear correlation to change training data (such as adding data into input data), if the present invention can produce unpredictable and significant technical effects by changing the training data, its inventive step will be recognized; on the contrary, if the change to the training data is only a combination of related data that can be predicted by those skilled in the art and does not produce significant technical effects, the inventive step will not be recognized;

c) If the preprocessing of the input data is not disclosed and can produce beneficial effects, the invention is considered to involve an inventive step, otherwise it is not. In other words, changing the form of the training data to improve the accuracy of the target output data by performing certain preprocessing on the training data used as input will be considered as a simple design change, and inventive step will not be recognized. However, if the

preprocessing of training data is not disclosed in the prior art and has produced significant technical effects, the inventive step can be recognized.

(2) Case Examples

[Example 1]

A cancer level calculation apparatus that calculates a possibility that a subject person has cancer, using a blood sample of the subject person comprising:

a cancer level calculation unit that calculates a possibility that a subject person has cancer, in response to an input of measured values of A marker and B marker that have been obtained through blood analysis of the subject person,

the cancer level calculation unit including a neural network that has been trained through machine learning using training data to calculate an estimated cancer level in

response to the input of the measured values of A marker and B marker.

Analysis:

JPO holds that such claim lacks an inventive step on the grounds that there are such solutions in the prior art: a cancer level calculation apparatus that calculates a possibility that a subject has cancer, using a blood sample of the subject, comprising a step that calculates a possibility that a subject has cancer, in response to an input of measured values of A marker and B marker that have been obtained through blood analysis of the subject. In the field of machine learning, a trained neural network is used to calculate the possible that a subject has a certain disease based on the subject's data input. The input data may be human biological data, and the output data is on the possibility of having a disease, both of which are well-known, so the patent lacks an inventive step.

It shows that, in accordance with the JPO Examination Guidelines for Patentability, for the invention combining technical features with AI algorithms, i.e. the invention using AI algorithms to solve technical problems, if the relevant technical means are known, the AI algorithms used are also known, only known algorithms are applied to new scenes, and neither algorithms nor technical means have been improved, such patent lacks an inventive step.

[Example 2]

A dementia stage estimation apparatus comprising:

a speech information obtainment means for obtaining a speech information on a conversation between a questioner and a respondent;

a speech information analysis means for analyzing the speech information, and then specifying a speech section by the questioner and a speech section by the respondent;

a speech recognition means for converting, through speech recognition, the speech information on the speech section by the questioner and the speech section by the respondent into text and then outputting a character string;

a question topic specification means for specifying a question topic by the questioner based on the result of the speech recognition; and

a dementia stage determination means for inputting, to a trained neural network, the question topic by the questioner and the character string of the speech section by the respondent to the question topic in an associated manner with each other, and then determining a dementia stage of the respondent,

wherein the neural network is trained through machine learning using training data so as to output an estimated dementia stage, in response

to an input of the character string of the speech section by the respondent in an associated manner with the question topic by the questioner.

Analysis:

The prior art document involves a dementia stage estimation apparatus, comprising: a speech information obtainment means for obtaining a speech information on a conversation between a questioner and a respondent; a speech recognition means for converting, through speech recognition, the speech information into text and then outputting a character string; and a dementia stage determination means for inputting, to a trained neural network, the character string that has been converted into text by a speech recognition means, and then determining a dementia stage of the respondent, wherein the neural network is trained through machine learning using training data so as to output an estimated dementia stage, in response to an input of the character string.

JPO holds that the patent involves an inventive step compared to the prior art because those skilled in the art modify the training data through certain preprocessing. This training data is the input of the neural network used for machine learning in order to improve the estimation accuracy of the neural network. Such technical feature is not disclosed in the prior art, and the technology of inputting, to a trained neural network, the question topic by the questioner and the character string of the speech section by the respondent to the question topic in an associated manner with each other, and then determining a dementia stage of the respondent is not a technical common sense either. The invention of claim 1 brings about a remarkable effect, that is, by associating the question topic by the questioner and the answer (corresponding character string) by the respondent, a highly accurate estimation of the dementia stage can be carried out.

The key reason why this application involves an inventive step lies in the preprocessing of the training data, associating the question topic by the questioner with the character string of the answer by the respondent. This association is not disclosed in the prior art, even though the prior art has disclosed the technical solution of estimating dementia stage using neural networks, the invention still involves an inventive step.

Based on the analysis of the above two examples, it can be concluded that if a technical solution in the AI field needs to involve an inventive step, it must be improved in the following two aspects: (1) there are technical or algorithmic features that are not easy to predict by those skilled in the art, which can be expressed as preprocessing of training data; (2) there are new improvements in the algorithm. However, the invention that only applies the known algorithm to the new scene, with the known technical means used in the related scene, and predictable technical effect obtained, lacks an inventive step.

(3) Suggestion on Drafting

When describing the training data of the present invention in the specification, try to determine the beneficial technical effects of each correlation. Furthermore, in terms of the change in the correlation caused by the change of the training data, further define the significant technical effect produced by the changed correlation compared to the original correlation. In addition, in terms of optimizing the preprocessing of training data, further describe the changes in the correlation and significant technical effects caused by the optimization of the preprocessing. In addition, in terms of the change of correlation and that caused by the optimization of preprocessing, supplementally describe the breakthrough point of the change compared to the conventional means, and thus provide a sufficient basis for argumentation for inventive-step examination during substantive examination.

3.4.5 Insufficiency of Disclosure and Specification Support

(1) Description Requirements

The so-called Description Requirements comprise “Enablement Requirement” and “Support Requirement”. The “Enablement Requirement” is similar to the provisions of Article 26.3 of the Patent Law of the People’s Republic of China regarding the full disclosure of the specification, which requires a clear and full description of the present invention in the specification to the extent that those skilled in the art can implement it. The “Support Requirement” is similar to the provisions of Article 26.4 of the Patent Law of the People’s Republic of China regarding the basis of the specification, which requires the invention claimed by the claims shall not exceed the scope of the detailed description of the invention in the specification.

JPO holds that in AI-related technical fields, training data containing multiple types of data for machine learning is usually used, which generally must meet the following two conditions, that is, based on the disclosure in the specification, it can be recognized that there is a certain relationship, such as the correlation between multiple types of data, or based on general technical knowledge, it can be inferred that there are relationships between multiple types of data. That is to say, the specification generally discloses the relevance between input data and output data, unless the relevance of such data can be inferred by those skilled in the art.

Therefore, the key to judging whether an AI-related application meets the “Enablement Requirement” and “Support Requirement” lies in: whether the correlation between multiple types of data used for AI machine learning, that is, relevance, is clear, wherein “whether is clear” includes whether the applicant has described it with enough information in the application document, or whether it can be easily clarified by those skilled in the art. According to the examples disclosed by JPO, the above-mentioned correlation can be clarified in the following ways, that is, the existence of correlation between multiple types of data can be proved in the following ways:

1) Directly and concretely record the correlation between multiple types of data in the specification;

2) Directly prove the correlation between multiple types of data through description or statistical analysis in the specification;

3) In the specification, perform performance evaluation on the formed AI algorithm model, and indirectly prove the correlation between multiple types of data according to the results of the performance evaluation;

4) Although the specification does not record or prove the correlation between multiple types of data, those skilled in the art can reasonably infer the existence of the correlation based on the technical common sense at the time of application.

In addition, special attention needs to be paid to:

a) For an invention of products that are predicted to have a certain function through AI, for example, under the circumstance that the prediction result is obtained through the prediction of the AI algorithm model, if the prediction accuracy of the AI algorithm model is not tested, in the patent examination practice in Japan, it is usually considered that the prediction result of the AI algorithm model is not an evaluation of the actually manufactured product and cannot replace the same. Therefore, it will be deemed that the description of the specification does not meet the “Enablement Requirement”;

b) When individual types of data in the training data are summarized by a broader concept in the claim for the purpose of obtaining greater scope of protection, if the correlation between individual types of data in training data is only recorded in the specification, but the correlation related to the data that is summarized by a broader concept is not recorded, the correlation between the broadly summarized data may not be supported by the specification.

(2) Analysis of Examples in Practice

[Example 1]

A sugar content estimation system comprising:

a storage means for storing face images of people and sugar contents of vegetables produced by the people;

a model generation means for generating a determination model through machine learning, to which a face image of a person is input and from which a sugar content of a vegetable produced by the person is output, using training data containing the face images of the people stored in the storage means and the sugar contents of the vegetables,

a reception means for receiving an input of an face image; and

a processing means for outputting, using the generated determination model that has been generated by the model generation means, a sugar content of a vegetable produced by a person that is estimated based on the face image of the person inputted to the reception means.

Analysis:

JPO holds that this patent application only indicates there is a specific correlation between “a face image of a person” and “a sugar content of a vegetable produced by the person”, but it does not clearly specify or elaborate on this correlation, and those skilled in the art cannot clarify the connection between the two at the time of application. That is, the correlation between the two types of data (input data and output data) used for AI machine learning is not clear. Therefore, claim 1 of this patent application does not meet the “Enablement Requirement” in the “Description Requirements”.

[Example 2]:

A body weight estimation system comprising:

a model generation means for generating an estimation model that estimates a body weight of a person based on a feature value representing a face shape and a body height of the person, through machine learning using training data containing feature values representing face images as well as actual measured values of body heights and body weights of people;

a reception means for receiving an input of a face image and body height of a person;

a feature value obtainment means for obtaining a feature value representing a face shape of the person through analysis of the face image of the person that has been received by the reception means; and

a processing means for outputting an estimated value of a body weight of the person based on the feature value representing the face shape of the person that has been received by the feature value obtainment means and the body height of the person that has been received by the reception means, using the generated estimation model by the model generation means.

The body weight estimation system as in Claim 1, wherein the feature value representing a face shape is a face-outline angle.

Analysis:

JPO holds that this patent application only describes the correspondence between the face-outline angle of the human face and the body weight, and it is impossible to determine the relationship between other types of facial feature data and the body weight through the application documents. Therefore, claim 1 of this patent application does not meet the “Support Requirement”, while claim 2 does.

(3) Suggestion on Drafting

In order to meet the “Enablement Requirement” as much as possible, it is recommended to clarify the correspondence between the various types of data in the training data in a hierarchical manner. Specifically, for each of the various types of data that constitute the training data, while clearly distinguishing the data summarized by broader and narrower concepts, further specifically clarify the correspondence between the data summarized by broader and narrower concepts and other data summarized by broader and narrower concepts, and thus to make a sufficient description in the specification to realize the hierarchical layout of the claims from broad to narrow.

In order to meet the “Enablement Requirement” as much as possible, it is recommended to clearly describe the correlation reflected by the correspondence between data. Specifically, for each correspondence, a certain correlation reflected by such correspondence, that is, the correlation between multiple types of data, should be clearly recorded in the specification as far as possible. For the correspondence that is not easy to directly reflect the correlation through text description, it is recommended to use the chart data obtained by statistical analysis of the training data, the performance evaluation result for the AI algorithm model, and the data obtained through other experimental methods to prove directly or indirectly the existence and rationality of correlation. In addition, although it is not necessary to clearly record the correlation that can be reasonably inferred by those skilled in the art based on the technical common sense at the time of application in the specification, it is still recommended to define the same in the specification in the manner described above in response to the difference in the determination of technical common sense by the examiners caused by the difference in the technical environment of various countries, and thus to further provide specification support for the correlation between the various data in the claims.

3.5 AI-related Patent Practice in South Korea

Hongying ZHAO

3.5.1 Revision Schedule for Important Normative Documents related to AI Invention Examination

March 2019	KIPO revised the *Computer-related Invention Examination Standards*
April 2020	KIPO released the *AI-related Invention Examination Cases*
January 2021	KIPO officially released the *Guidelines for Examination Practice of AI-related Invention*

3.5.2 Major Provisions regarding the Acquisition of Patent Rights

The major provisions of the Invention Patent Law of South Korea (Patent Law of South Korea) and Examination Guidelines considered at the right acquisition stage are shown in the following table.

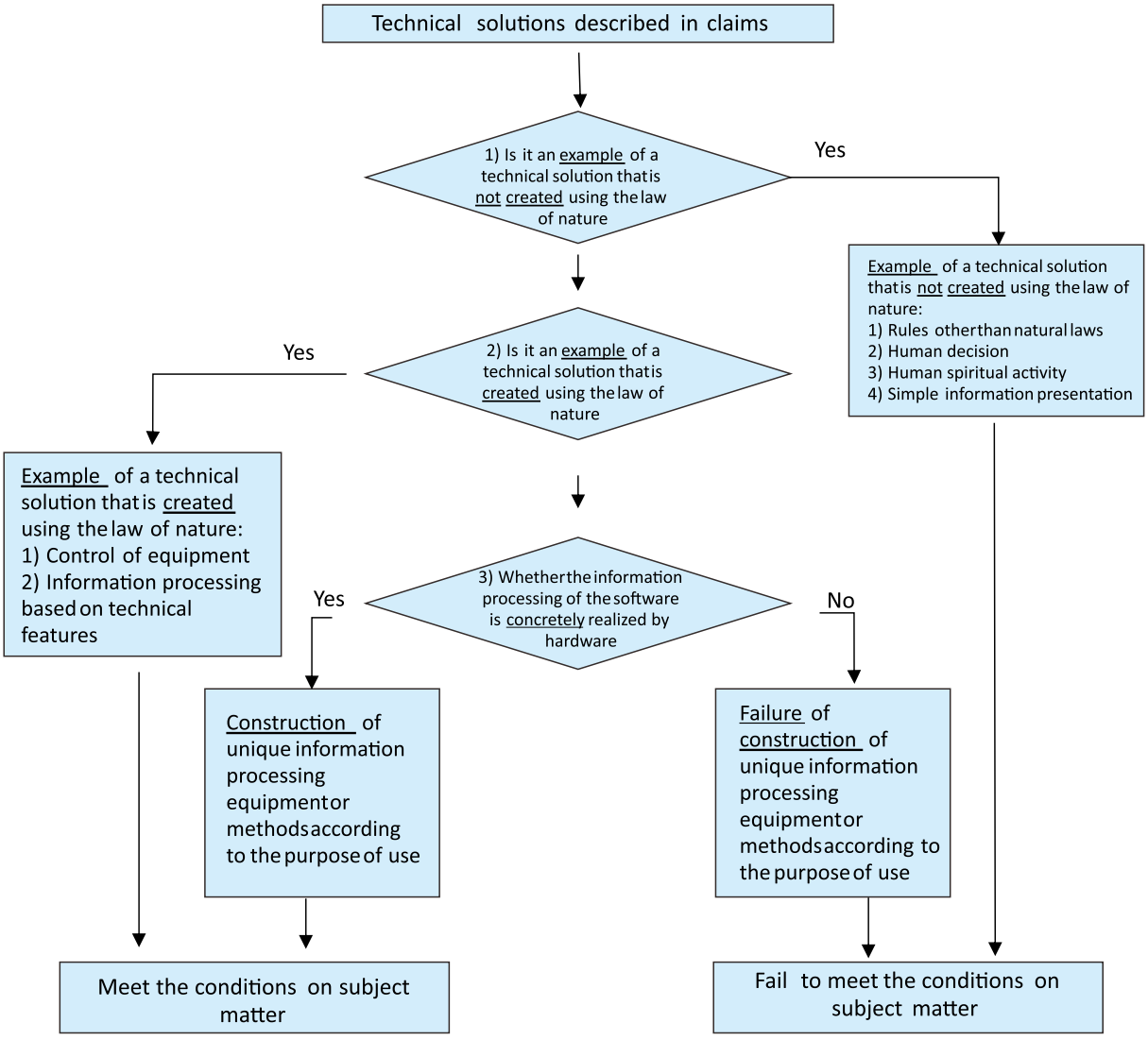
Protectable subject matter	**A2**	Invention refers to the creation with high-level technological ideas using the law of nature. Patented invention refers to the invention that has been patented.
Novelty/inventive step of a claim	**A29 (2)**	If a person of ordinary skill in the art to which the invention belongs can easily implement an invention, the invention is not patentable.
Implementability requirement	**A42 (3) (i)**	The description of an invention should be clearly and completely drafted so that those of ordinary skill in the art to which the invention belongs can easily implement the claimed invention.

3.6.3 Subject Matter Eligibility

(1) Conditions on Subject Matter

In examining the patented subject matter, South Korea is relatively flexible and lenient. For AI-related inventions, the KIPO Patent Examination Guidelines require that the information processing process of AI can be implemented by hardware. However, in South Korea's examination practice, the subject matter eligibility of AI-related inventions is not strictly assessed. Technological ideas are more likely to be assessed on the basis of novelty/inventive step rather than eligibility.

The conditions on subject matter of AI-related inventions are equivalent to those of computer-related inventions. Specifically, the subject matter eligibility of AI-related inventions can be judged through the steps shown in the following figure (Source: Examination Standards for Invention and Utility Model Patents (KIPO, 2020.8)).



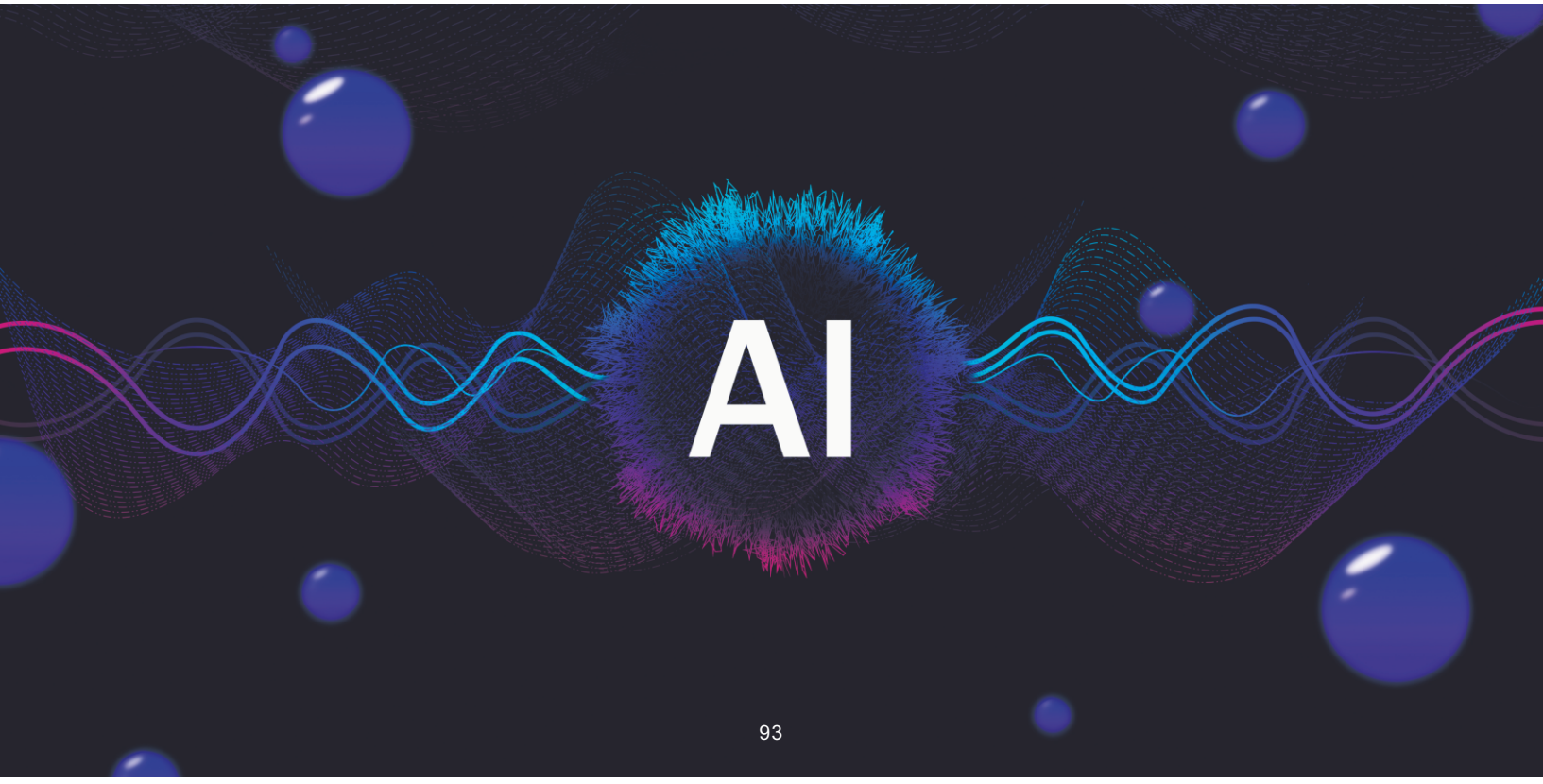
Protectable subject matter	Requirement for the technical solution of a claim
Device/system/method; Computer program recorded on storage medium; Storage medium	The information processing process of AI can be implemented by hardware. In addition, for patent applications that apply AI technology to disease diagnosis, the examination standards have been appropriately relaxed.

More specifically, in accordance with the Classification of Information and Communication R&D Technology issued by the Ministry of Science, ICT and Future Planning (MSIP) in 2016, AI technology can be classified as shown below [Table 1-1]. According to this Technology Classification Table, AI technology may involve the invention of computer software programs. According to the KIPO Patent Examination Guidelines, software program inventions need to meet the following requirements: "When the software's information processing process is concretely implemented by hardware, the information processor operating with the software, its operating method, and the computer-readable carrier that records the software can be regarded as a creation with technological ideas using the law of nature. In addition, the specific realization of software information processing by hardware refers to that software is read by computer to operate or process the information that meets the purpose of use through the specific means of software and hardware synergy, so as to realize the specific information processing device or such operation method that meets the purpose of use."

Therefore, if the information processing of software cannot be realized by hardware, the invention will not belong to a creation with technological ideas using the law of nature. When an AI-related software invention can be realized by hardware, the invention can be recognized as an invention under the Patent Law of South Korea. The scope of software invention includes products, methods, computer-readable carriers recording software programs, and software programs recorded on computer-readable carriers.

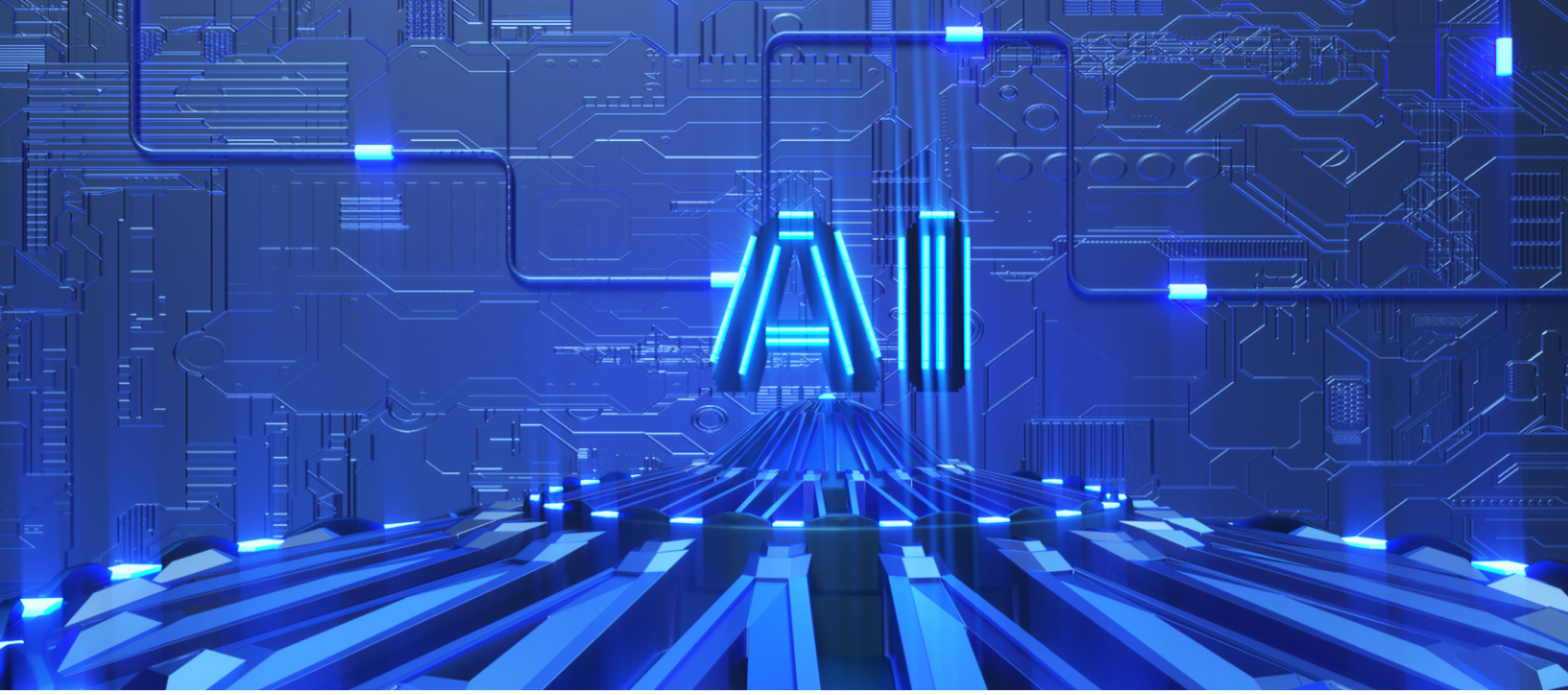
In addition, AI-related inventions may involve business method inventions, in which case the invention needs to meet the patentability requirements for general inventions and the said software program requirements.

If an AI-related invention meets the patent standards required for software program invention or business method invention, the invention should also be able to obtain patent rights to protect the interests of the right holders who develop new technologies and reward their contributions, thereby promoting industrial development. According to a similar logic, if the industrial design made by AI meets the patentability requirements set forth in the Industrial Design Protection Law of South Korea, the interests of the right holder of the new design should also be protected and industrial development should be promoted by granting patent rights.



[Table 1-1]

Core technology	Technology	Technology summary
Learning and reasoning technologies	Knowledge expression	Technology that expresses analytical knowledge in a computer-understandable language
	Knowledge foundation	Technology that constructs and manages accumulated expertise, facts and rules needed to solve problems using a stored database
Situation understanding technology	Emotion understanding	Technology that can recognize and distinguish human feelings and emotions
	Space understanding	Technology that correctly recognizes the time and space world and can change the 3D world
	Collaborative intelligence	Technology that communicates with other agents, understands them, explains their actions and effectively responds to them
	Self-understanding	Cognitive technology that can understand and feel oneself (personality, mental and psychological characteristics)
Language understanding technology	Processing natural speech (morphological analysis, named entity recognition, sentence analysis, meaning analysis)	Morphological analysis, named entity recognition, sentence analysis and meaning analysis of human natural language
	Question answer	Technology that answers questions
	Audio processing	Technology that converts digital audio signals into computer-processable language
	Automatic translation	Technology that automatically translates one language into another
Visual understanding technology	Retrieving images based on content	Technology that extracts the characteristic information of image data, such as color, appearance, texture, etc., which can represent the content of image data, and performs indexing and retrieval based on it
	Action recognition	Technology that recognizes things acting in video
	Visual knowledge	Technology that extracts and generates knowledge information from image data using action recognition, image understanding, background recognition, etc.
Recognition and cognitive technology	Understand human life	Technology that understands human life in order to provide intelligent assistance in daily life such as personal resume management, health, interpersonal relation, financial management, etc.
	Cognitive architecture	Technology that performs computer modeling of the human mental structure from the perspective of cognitive psychology



(2) Case Example

2007Hu265 Judgment of the Supreme Court of Korea: “To constitute a business method invention, software-based information processing on a computer is required to be concretely realized by hardware. In addition, while judging whether the claimed invention is an invention using the law of nature, an overall judgment is required in accordance with the claims. Therefore, the invention does not belong to that under the Patent Law if the entire claim is not recognized to use the law of nature, even if a part of the invention described in the claims uses the law of nature.”

2007heo2957 Judgment of the Patent Court of Korea: “The claims of a business method invention should not be the technology using human mental activities, etc. or simply using the general-purpose functions of the computer or the Internet, but the constructed information processing device or such operating method used to concretely implement information processing to achieve a specific purpose after software is read by computer and synergized with hardware. The scope of rights of the business method invention needs to be determined to the extent where the said information processing device or such operating method is constructed. Therefore, in order to claim that the alleged infringing invention belongs to the scope of the rights of the registered business method invention, the alleged infringing invention should include the constituent elements of the patented invention that reflect the characteristics of the said business method invention and the organic combination of the constituent elements.”

Analysis:

If AI-related inventions involve business method inventions, the invention can further meet the requirements for subject matter eligibility of AI invention only when it meets the patentability requirements for a general invention and the conditions required for the relevant software program.

(3) Suggestion on Drafting

It is recommended that when drafting the claims, it is necessary to ensure that the technical solutions recorded in the claims meet the special requirements that the information processing process of AI can be concretely implemented by hardware while ensuring that such solutions meet the general requirements for the patented subject matter (that is, those created using the law of nature). In addition, it is recommended to record the examples for protecting different subjects in multiple dimensions so that the applicant can obtain a more comprehensive scope of protection in South Korea in multiple dimensions.

3.6.4 Inventive step

(1) Examination on Inventive step

According to the relevant provisions of the KIPO Patent Examination Guidelines, the general examination standard for inventive step is: judging whether those skilled in the art can easily obtain the invention involved in the present application based on the comparison documents and common knowledge before the application. For the inventive-step examination of AI-related inventions, the judgment method of computer-related patent applications can be referred to: consider the technical difficulty in the application of related technologies in different fields, whether the common technical problems in the computer field are solved, and whether the common technical effects are obtained in the computer field.

At the same time, KIPO holds that a claim that only describes the use of AI technology is unlikely to be patented unless there are distinctive technical configurations used to solve technical problems (for example, training data, data preprocessing, trained models, loss functions, etc.). Otherwise, the claimed invention will only be regarded as a known AI technology, and this technology can be easily completed by a person of ordinary skill in the art to which the invention belongs to. The said point of view is also applicable to those designs that only use AI technology to systematize or computerize processes that may have been implemented or were previously implemented manually, and simply modify the conventional AI technology (for example, simple change to the trained model) as well as inventions that only add or replace known technologies on the basis of conventional AI technology.

(2) Case Example

Claim:

A method of providing stock information using AI charts that display different colors based on an AI algorithm for judging the rise/fall of stock prices, ...including the steps of displaying different colors based on the algorithm used to identify stock price trends, ...

Analysis:

The standard for judging the rise/fall of stock prices and the method of displaying different colors accordingly are conventional technical means widely used in the field of stock investment or chart analysis, and it is not a creative invention to simply implement such conventional technical means in this field as AI algorithms without defining specific information processing (refer to the 2013HEO1788 Judgment of the Patent Court of Korea).

(3) Suggestion on Drafting

In terms of the requirements for inventive step, KIPO recommends specifying differentiated technical configurations (for example, training data, data preprocessing, trained models, loss functions, etc.), and detailing technical effects that are directly generated by technical configurations and exceed the effects of conventional AI technology, that is, it is necessary to avoid only making conclusive statements about technical effects (such as increasing processing speed, effectively processing massive amounts of data, reducing errors, or providing accurate predictions, etc.). Some drafting skills for the inventive-step requirements are as follows:

1. Invention of AI training data

Provide detailed information on how to process the raw data to obtain training data, for example, describe how to extract features from the input data, and how to generate training data (for example, through standardization, normalization, or vectorization).

Explain the specific effects or improvements that can be derived from data preprocessing (for example, by implementing data preprocessing on closed-circuit television video images related to the “motion tracking” function, the object in the video image can be recognized more accurately because the motion of the object is considered. However, the existing technology only uses the video image to recognize the object).

2. Invention of AI modeling

Describe the specific configuration of modeling, such as the configuration of the training environment, model evaluation, multi-model linkage, parallel or decentralized processing, and optimization of hyperparameters.

Provide the prediction accuracy of training speed and training model, and other effects caused by a specific configuration, with such effects unachievable by conventional AI technology.

3. Invention of AI application

Describe the specific purpose of the output data of the trained model and the effect of using the output data in a specific way, for example, by using the output data of the trained model (such as a label on a car part destroyed in a car accident) to calculate the estimated cost for each repair type, users can easily predict the increase in their insurance premiums based on the repair type they choose.

In addition, it is recommended to draft claims from multiple perspectives (training data, trained models, application services, etc.) to facilitate the determination of infringement. Specifically, for training data, when preprocessing the raw data, the generation method, device, and program storage medium of training data can be used as the defined features in claims,if “the data structure is used to define the processing content executed by the computer”, the data storage medium can also be used as a defined feature in claims; for the trained model itself, where the internal structure of the trained model contains technical features, the method, device, and program storage medium that define the structure of the trained model can be used as the defined features in claims; for the application service, use the method, device, and program storage medium as the defined features in claims.

3.6.5 Sufficiency of Disclosure

(1) Enablement Requirement

In accordance with the Article 42.3.i of the Patent Law of South Korea, the description of an invention should be clearly and completely drafted so that those of ordinary skill in the art to which the invention belongs can easily implement the claimed invention. In terms of AI inventions, KIPO recommends explaining technical problems, solutions, and specific technical configurations (for example, training data, data preprocessing, trained models and loss functions, etc.) so that those of ordinary skill in the art to which the invention belongs can implement the claimed inventions, unless the technical configuration is well known in the art.

In this regard, the specification should specifically record the means for those of ordinary skill in the art to implement AI-related inventions: a) for example, training data, data preprocessing methods, trained models, etc.; b) for example, the correlation between the input data and output data of the trained model; c) a simple description of the well-known trained model (model name, basic structure, source, etc.).

(2) Case Example

Claim 1:

A house temperature automatic control system, comprising:

a storage unit for storing past daily weather data and historical house temperature data;

a trained model generation unit for generating the trained machine model; the said trained machine model uses the temperature from the daily weather data, ..., at least one of the haze concentration data and the said historical house temperature control data as training data;

a collection unit for collecting meteorological information from the server of the China Meteorological Administration; and

an output unit for outputting the house temperature automatic control information predicted by the said current weather information using the said trained machine model.

Specification:

The correlation between the haze concentration data and the house temperature automatic control information is not concretely recorded, and no example that can prove the said correlation is given.

Determination:

The invention described in the claim does not meet the conditions for sufficiency of disclosure/support since it cannot be implemented by those of ordinary skill.

(3) Suggestion on Drafting

The KIPO Patent Examination Guidelines provide some drafting skills for different types of AI inventions, with the details as follows (in order to simplify the description, the AI model training inventions are divided into two categories as follows, that is, “invention of AI training data” used for data preprocessing, and “invention of AI modeling” aiming at constructing machine learning models):

1. Invention of AI Training Data

Describe how to process the raw data to generate, change, add, or delete training data, and the correlation between the raw data and the training data (that is, explain why the raw data is used and why the training data should be preprocessed in some way).

2. Invention of AI Modeling

Specify any technical configuration or method to implement or train the model (for example, if a neural network collection is used to train the model, the neural network used and the process or means of training the model using such neural network should be confirmed).

3. Invention of AI Application

Provide detailed information about the correlation between the input data and output data of the trained model, namely: (1) specify training data; (2) describe the correlation between the characteristics of the training data used to solve the technical problem; (3) use training data or training methods to indicate the machine learning model to be trained; (4) describe how to generate trained models that solve technical problems by using training data and methods.

About the author

Hongying ZHAO

Patent Attorney | Attorney at Law

Ms. Zhao joined Liu, Shen & Associates in 2017 and became a qualified patent attorney in 2014, and obtained the qualification as an attorney at law in 2018. Ms. Zhao specializes in patent prosecution, re-examination, patent invalidation, IP litigation, and client counseling with a focus on telecommunication, electronics, machine vision, image processing, intelligent control, semiconductor circuit, semiconductor apparatus, computer science as well as Internet. Ms. Zhao is proficient in both English and Korean, and her working languages include Chinese, English and Korean.

Chapter IV

Copyright Protection of AI

Peng ZHENG

4.1 Subject Matter Protected by AI Copyright

4.1.1 Overview

The subject matter protected by AI-related copyright, namely works, may include the following types:

Graphic works and model works such as product design drawings

AI-related product design drawings and model works can be used as the bottom protection for graphic works and model works such as product design drawings. However, the copyright protection of product design drawings can only protect the reproduction from plane to plane, that is, prevent others from reproducing the drawings themselves, instead of preventing others from designing the same products according to the drawings.

Computer software

While applying for patent protection for the "creative ideas" of AI software, it is also possible to apply for copyright registration for the "form of expression" of the software. There are many kinds and large quantities of software with different functions involving AI technology, almost covering the various technical layers of AI (basic support layer, general technology layer and application layer).

Fine art works

AI may also involve a variety of fine art works, including logo graphics of software, AI virtual robot image design, and others.

An AI virtual image costs a designer's great efforts, so a unique design is more likely to be counterfeited, making the protection of AI virtual image tricky. If image protection is involved, the relevant provisions of the Copyright Law are first considered. The AI virtual image can be classified as a fine art work. As a designer (or commissioned designer) of a fine art work, an AI company enjoys copyright to its image, and unauthorized use of others' AI image constitutes an infringement upon copyright.

If the human-computer interaction interface of AI has strong originality and artistic design, it can also be protected by copyright as a fine art work.

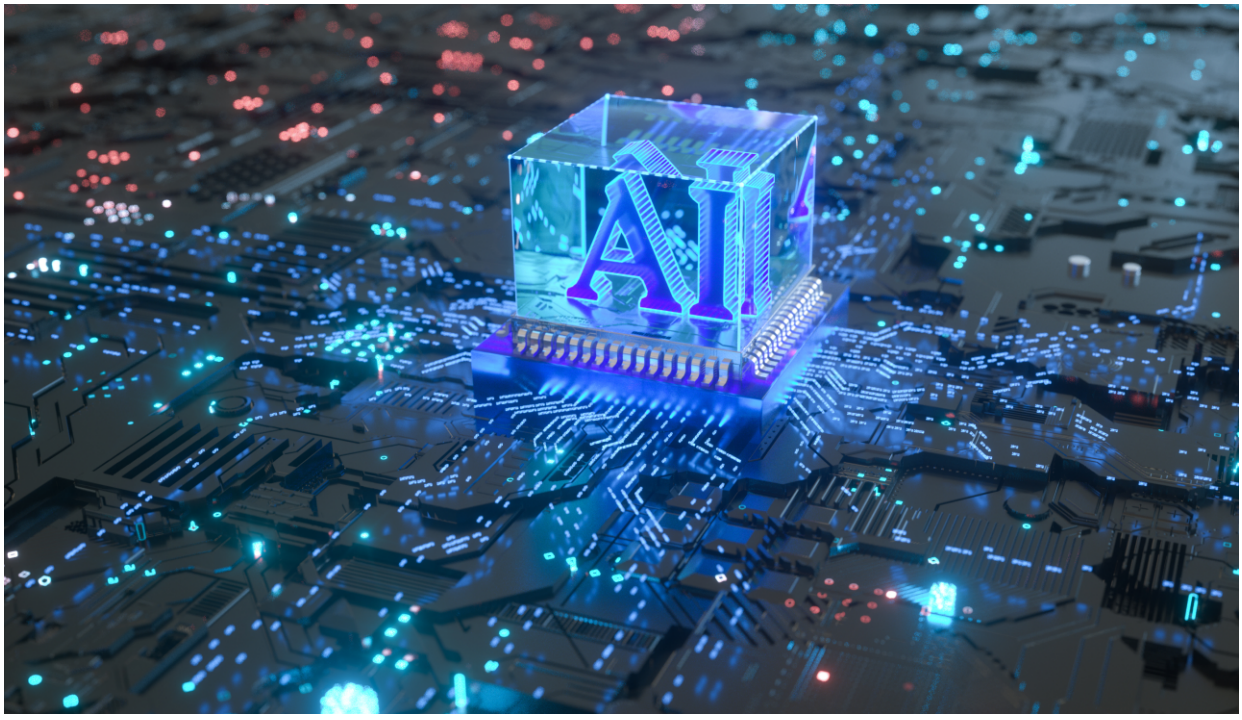
The following mainly introduces the computer software protection of AI.

4.1.2 Copyright protection term of AI software

According to Article 14 of the Regulation on Computers Software Protection of the People's Republic of China, software copyrights shall arise from the date of completion of software development.

The software copyright of a natural person shall be protected for the whole life of the natural person and 50 years after his/her death, and expire on December 31 of the 50th year after the death of the natural person; Where the software is co-developed, its copyright will expire on December 31 of the 50th year after the death of the natural person who dies last.

The software copyright of a legal person or other organizations shall be protected for 50 years, and expire on December 31 of the 50th year after the software is first published, but the software will no longer be protected by this Regulation if it has not been published within 50 years as of the completion of the development.



4.1.3 Copyright ownership of AI software

In accordance with the *Copyright Law* of the People's Republic of China, the copyright ownership of AI software may be divided into the following categories.

Works of natural person	In accordance with Article 11 of the Copyright Law, the author of works is the natural person who has created the works. Except otherwise provided in this Law, the copyright in the works shall belong to the author thereof. Therefore, the most basic form of copyright ownership is that a natural person creates works and enjoys the copyright thereof. If AI software is created by a natural person, its copyright belongs to such natural person. However, in practice, since the creation of software, especially AI software, is a huge project, it is difficult to be developed by a natural person independently. Therefore, it is rare for a natural person to enjoy copyright.

Works for hire	In accordance with Article 18 of the Copyright Law, works created by a natural person when fulfilling the tasks assigned to him/her by a legal person or another unincorporated organization shall be deemed to be works for hire. Service works are divided into two categories, one is general service works, the copyright of which is enjoyed by the author; the other is special service works, of which only the right of authorship is enjoyed by the author, and other rights in copyright are enjoyed by legal persons or unincorporated organizations. Computer software that is mainly created using the material and technical conditions of legal persons or unincorporated organizations, for which the legal persons or unincorporated organizations are responsible, belongs to special service works, and its copyright except for the right of authorship belongs to legal persons or unincorporated organizations. Therefore, under normal circumstances, AI software works should be regarded as service works, of which the right of authorship is enjoyed by author, and other rights in copyright are enjoyed by legal persons or unincorporated organizations.
Works of legal person	In accordance with Paragraph 2, Article 11 of the Copyright Law, where works are created according to the intention and under the supervision and responsibility of a legal person or another unincorporated organization, such legal person or unincorporated organization shall be the author of the works. In accordance with Article 13 of the Regulations on the Protection of Computer Software, if the software developed by a natural person during his/her tenure in a legal person or other organization falls under any of the following circumstances, the software copyright is enjoyed by the legal person or other organization, and the legal person or other organization may reward the natural person who develops the software: (I) Software is developed for the development objectives clearly defined for his/her own work; (II) Software developed is the foreseen result or the natural result of engaging in his/her own work; (III) Software developed using the funds, special equipment, undisclosed special information and other material and technical conditions of and under the responsibility of legal persons or other organizations. In accordance with Article 13 of the Regulations on the Protection of Computer Software, the computer software created by employees based on their own work belongs to works of legal person rather than special service works, which conflicts with the provisions of Article 18 of the Copyright Law. In practice, it is difficult to distinguish the nature of special service works and works of legal person. In order to avoid disputes, it is recommended that the employees' labor contracts indicate that the software they create belong to works of legal person, of which the ownership shall be vested in employer.
Commissioned works	In accordance with Article 19 of the Copyright Law, the ownership of copyright in commissioned works shall be agreed upon in a contract between the commissioning and the commissioned parties. In the absence of a contract or of an explicit agreement in the contract, the copyright in such works shall belong to the commissioned party. Therefore, in practice, if an AI company commissions other companies or individuals to develop AI software, it should be clearly stipulated in the commission contract that the copyright belongs to the commissioning party to avoid future disputes.
Joint works	In accordance with Article 14 of the Copyright Law, where works are created jointly by two or more co-authors, the copyright in the work shall be enjoyed jointly by those co-authors. In practice, if multiple companies cooperate to complete the AI software, the copyright of the software will belong to the cooperating parties. However, a clear agreement should be made in the contract on how the parties will use and dispose of the software works to avoid future disputes.

4.1.4 Protection Features of AI Software

Advantages	Simple and easy, timely protection	Compared with the protection under the Patent Law, namely it takes a long patent examination period to obtain the patent right, the software can automatically obtain legal protection as of the date of its successful development, and can be registered after simple procedures are performed. This feature of copyright protection is just in line with the fast update and short life cycle of AI software.
	Widely protected	The protection of works under the Copyright Law only requires the works to be "original", that is, the works are independently created by the author without the three requirements of "novelty, inventive step, and practicality" under the Patent Law. Therefore, the use of Copyright Law to protect AI software can enable software at different levels and in different creation stages to obtain legal protection.
Disadvantages	The Copyright Law only protects the form of expression rather than creative ideas	In terms of the protection of software, the Copyright Law only protects the form of expression of the software, that is, specific codes and documents. If the other party creates similar software according to the identical or similar algorithms and ideas, with different forms of expression such as specific code and document, no copyright infringement is constituted.
	Software copyright protection is inferior to software user interface protection	According to relevant previous court cases (such as (2005) Hu Gao Min San (Zhi) Zhong Zi No. 38), the software copyright protects its code and document rather than the user interface. Generally speaking, the software user interface is often functional and low in originality, and thus difficult to constitute the protection features under the Copyright Law.

4.1.5 Protection object of AI software

Computer software refers to "computer programs and related documents".

Computer programs comprise "coded instruction sequences", or "symbolized instruction sequences or symbolized sentence sequences that can be automatically converted into coded instruction sequences". The source code and target code of the same computer program are the same works.

Documents refer to "text data and diagrams used to describe the content, composition, design, functional specifications, development status, test results, and usage methods of the program, etc.", such as program design specifications, flowcharts, user manuals, etc. (Article 2, Paragraphs 1 and 2 of Article 3 of the *Regulations on the Protection of Computer Software*)

Generally speaking, the functional modules, functions, source programs, target programs, program specifications, flowcharts, user manuals, etc. of the software can all serve as the protection objects under the Copyright Law.

Specifically, in terms of the various technical layers of AI, the documents in the software copyright protection are similar, and the protection objects of its computer programs are briefly analyzed as follows:

Technical layers	Meaning	Example
Infrastructure layer	Register the copyright of the program code of each algorithm as a whole, or independently register the program code of each module and/or function within the algorithm.	The neural network architecture itself in deep learning is difficult to meet the requirements for the protectable subject matter under the Patent Law if it does not involve general (or specific) technical applications, so it is difficult for us to use the simple neural network architecture as a protection object under the Patent Law to obtain patent rights; However, in the Copyright Law, we can independently protect the program code of the neural network in deep learning.
General technology layer	Register the copyrights of the program codes involved in general technologies such as computer vision, speech recognition, natural language recognition, etc.	Object recognition in computer vision recognition technology includes character recognition, human body recognition, and other object recognition, of which the copyright of the program codes can be independently registered, or of which the program codes can be assembled into the overall code of "object recognition" for copyright registration.
Application layer	Program codes involved in different application scenarios can be registered	We can carry out copyright protection for the development of software involved in the solution layers such as intelligent diagnosis, intelligent investment advisors, intelligent assistants, autonomous vehicles at the application layer.

4.1.6 Copyright registration of AI software

According to the *Copyright Law* of the People's Republic of China, copyright is automatically enjoyed when the creation of works is completed, without taking copyright registration as a prerequisite. However, copyright registration is conducive to proving ownership, avoiding future ownership disputes, and facilitating future rights protection by litigation. Therefore, it is recommended to register the copyright of AI software.

Information required for software copyright registration	Copyright owner information	Including company name, company ID number, nationality, contact name, address, telephone number, fax number and email, and others.
	Software information	Including the full name of the software, the software version number, the completion date, the first publication or release date (if released), the first publication or release city, the original or upgraded software, the main functions and technical features of the software, the software acquisition method (original or by transfer), source program quantity or length, hardware environment, software environment, programming language, and others.
Software copyright registration authority	Copyright Protection Center of China, a public institution affiliated to the National Copyright Administration.	
Time required for registration	About 30 working days.	

4.2 Copyright protection of AI product

The AI at the basic support layer and general technology layer may not involve the copyright protection of product. While the AI at the application layer, such as automatic writing robot, automatic composing robot, and automatic drawing robot involves the issue of whether the products (written works, music, fine art works, etc.) created by such AI are protected by copyright.

4.2.1 Traditional point of view: the AI product does not belong to works protected by Copyright Law

According to the traditional theory and practice under the Copyright Law, the content created by AI is not regarded as works in the sense of Copyright Law and cannot be protected by copyright. The reasons are:

1. It is not created by a natural person. According to the Copyright Law, works must be created by natural persons. Although legal persons or unincorporated organizations can also be identified as authors, such identification is a legal fiction, and works of legal person are fundamentally created by natural persons.

2. It is not original. It is believed that works created by AI are only the processing and arrangement of data, which do not meet the definition of creation, and are not considered to be original.

When the monkey's "self-portrait" caused a copyright ownership dispute in the United States in 2015, the U.S. Copyright Office clearly indicated that only human works are protected by U.S. Copyright Law, and the Office will not accept copyright registration of works created by nature, animals, or plants. Therefore, the monkey's self-portrait is not copyrighted. The San Francisco Federal Court also finally ruled in support of the U.S. Copyright Office's decision: animals cannot own the copyright to their photos.

4.2.2 Practice development: limited recognition of obtaining copyright protection

Despite the above-mentioned legal obstacles, due to the existence of a large number of works created by AI in practice and the fact that they have important economic value and legal protection significance, the academic and practical circles are increasingly inclined to protect the copyright of works created by AI.

Reasons for advocating copyright protection of AI products:

1. AI is just a tool, not a creator. The actual creator of AI products is essentially human rather than AI.

2. AI products have the originality required by the Copyright Law. AI products are not simple and mechanical data processing, but also embody human wisdom and creation. With the development of AI technology, AI products have reached the level of human creations. Without prior explanation, it is difficult for ordinary people to distinguish from their appearance which are AI products and which are works created by natural persons.

Typical Cases:

	Case 1 (Baidu case)	Case 2 (Tencent case)
Title of case	Beijing Film Law Firm v. Baidu copyright infringement case	Tencent v. Shanghai Yingxun Technology Co., Ltd. copyright infringement case
Case No.	(2019) Jing 73 Min Zhong No. 2030	(2019) Yue 0305 Min Chu No. 14010
Court of first instance	Beijing Internet Court	People's Court of Nanshan District of Shenzhen
Time of first-instance judgment	April 25, 2019	December 24, 2019
Court of second instance	Beijing Intellectual Property Court	N/A
Time of second-instance judgment	May 18, 2020	N/A
Judgment Summary	Works should be created by a natural person. In the process of generating related content, the behavior of the software developer (owner) and user is not an act of creation, and the related content does not convey the original expression of the two. Therefore, **neither of them should be the author of the intelligently generated content of computer software, nor can the content constitute works.** Although the court did not determine that AI products constitute works, the court further held that this does not mean that AI products fall into the public domain and can be freely used by the public. In order to encourage their use and dissemination, and promote cultural communication and scientific development, software users shall be granted corresponding rights and interests if they have paid for retrieval.	The specific form of expression and the creation process derived from the creator's personalized selection and arrangement and technically "generated" by the Dreamwriter software of the article in question meet the protection conditions for written works under the Copyright Law and meet the requirements for originality. **Therefore, it belongs to the written works protected by the Copyright Law of the People's Republic of China.** At the same time, the court held that the article in question was an overall intellectual creation by a multi-team and multi-person division of labor under the supervision of the plaintiff, and embodied the plaintiff's needs and intentions for publishing articles related to stock comment, and thus **it belonged to works of legal person created under the supervision of the plaintiff.**

Difference in the judgments on the two cases:

- In Case 1 (Baidu case), the court held a conservative position and held that the product of AI software was not works under the Copyright Law, but determined that the software users should be granted corresponding rights and interests;

- In Case 2 (Tencent case), the court further held that AI software was only a tool, and that the product created by using AI software was still the result created by human beings, and thus determined that the product of AI software should be protected in accordance with the Copyright Law.

AI can be divided into three layers: weak AI, strong AI, and super AI. Weak AI is only equivalent to an enhanced version of tools. Works created using it can be certainly regarded as works created by natural persons and should be protected by Copyright Law. Super AI has not yet been fully realized. From the current practice, strong AI is still inclined to be protected under the Copyright Law (such as the Tencent case), or granted a certain degree of protection (such as in the Baidu case) on the premise that it is not recognized to constitutes works.

However, in the Baidu case and the Tencent case, judgments are only made on individual circumstances, and it is hard to say that they have given clear and universal guidance on the copyright of AI products. Especially for some complicated situations, more judgments may be required in the future. We will continue to pay attention to relevant judicial and legislative developments to provide more in-depth analysis and guidance for AI companies.

4.2.3 Copyright ownership of AI product

Based on the judicial decision on the Tencent case, Chinese courts are currently inclined to protect AI products, provided that they determine that the products are still the results created by human beings, and the author is human rather than AI itself. After solving the problem of whether the AI product can be protected by the Copyright Law, it is necessary to analyze to which subject the copyright of the AI product should belong.

- AI Developer

There is a view that the AI product should fundamentally belong to the developers of AI software. In the process of AI generation, software developers have contributed the most and gained the most technical achievements; while users of AI software get the products only by inputting data or instructions, with the creation process all made by the AI software. Therefore, the copyright of AI product should be vested in AI developers so as to better protect the interests of developers, and encourage and stimulate the development of AI industry.

- AI User

There is another view that the AI software is essentially just a tool. Works created by humans using AI software is just like those created using other created tools, of which the copyright should belong to the users of AI software. For example, humans use cameras to take photos. Although camera manufacturers have made great contributions to the design and development of cameras, and the process of taking photos is simply a click of the shutter, the copyright of the photos should still belong to the persons who took the photos. In addition, another reason is that developers have already obtained sufficient commercial profits by selling AI software, and its protection should not be extended to its products. Otherwise, users of AI software will lose the control over the works created using such software, and it is also not conducive to the growth of the AI software industry.

- Court's Point of View – AI User

In the Baidu case, although the court did not held that AI products are works in the sense of Copyright Law, it further pointed out that AI users should be granted relevant rights and interests: "Software developers (owners) can obtain benefits by charging software royalties, etc., and their development investment has been rewarded accordingly; moreover, the analysis report is generated by software users according to different usage requirements and retrieval settings, for which the software developers (owners) lack dissemination motivation.

Therefore, the relevant rights and interests in and to the analysis report will not be applied actively by the software developers (owners) if they are granted to them, which is not conducive to the development of cultural communication and scientific undertakings. Software users make an investment through paid use, set keywords based on their own needs and generate analysis reports, having the motivation and expectations for further use and dissemination of the analysis reports. Therefore, software users should be granted the relevant rights and interests in and to the analysis reports to encourage their use and dissemination. Otherwise, the software users will gradually decrease, and be unwilling to further disseminate the analysis reports, which is ultimately not conducive to cultural dissemination and value development."

In the Tencent case, the court held that: the article in question was an overall intellectual creation by a multi-team and multi-person division of labor under the supervision of the plaintiff, and embodied the plaintiff's needs and intentions for publishing articles related to stock comment. The article in question was published on the Securities Channel of Tencent Net operated by the plaintiff, at the end of which it is indicated that "this article is automatically written by Tencent Robot Dreamwriter", and in which the authorship of "Tencent" should be understood as the plaintiff in combination with its publishing platform, indicating that the plaintiff bears responsibility for the article in question. Therefore, in the absence of evidence to the contrary, the court determined that the article in question was works of legal person created under the supervision of the plaintiff.

Based on the judgments on the two cases, it was determined in the Tencent case that the plaintiff Tencent, user of the AI software Dreamwriter, was the author of the article in question and only used AI software as a tool for creation. The court held that the article in question embodied the special selection and arrangement of the chief creators of the plaintiff, expressed the unique personality of the software user, and reflected the will of the software user. In the Baidu case, although the court didn't recognize that AI products should be protected by copyright, it emphasized the grant and protection of certain rights and interests, which should belong to users of AI software, rather than developers.

Conclusion:

In accordance with the provision of the Copyright Law of the People's Republic of China that "works must be created by a natural person", it may be a more reasonable inference to determine that the user of AI software is the author of the AI product, otherwise it is difficult to reasonably explain where the process of "creation" is embodied, and how it is made by "human beings".

- Obligation to indicate AI software product

Although affirming that AI users enjoy rights and interests in and to their products, in the Baidu case, the judge emphasized that users should indicate that AI products were generated by some AI software, for the purpose of explaining to the public the creation of their works and satisfy the public's right to know; and protecting the interests of AI developers, making the relevant public aware of the AI software, expanding the popularity and influence of AI software, thereby achieving a balance between the interests of AI users and developers.

- Agreement on product copyright ownership

In the Tencent case, Tencent Technology (Beijing) Co., Ltd., the developer of the AI software Dreamwriter, and the plaintiff Shenzhen Tencent Computer System Co., Ltd., the software user, agreed that the copyright of the software product belongs to the plaintiff, on which the court did not make any comment.

Considering that the current legislation does not clearly stipulate the copyright of AI products, it is recommended that AI companies specify the copyright ownership of AI products in the software licensing agreement to avoid possible future disputes.

4.3 Copyright Issues in Machine Learning

Machine learning is the key technology of AI, which has not only brought many social issues, but also challenged the existing legal system with the rapid development and widespread application of AI technology. Machine learning uses a large amount of "data" as training data, which can be divided into two categories: data, information or works not protected by Copyright Law, and works protected by Copyright Law. The former category is protected by data regulations such as the Personal Information Protection Law, while the latter category may involve various copyright infringement risks.

Machine learning is divided into three stages, namely input stage, learning stage and output stage. At the input stage, the collected data is input into the preliminary model so that the preliminary model can analyze the data through algorithms; At the learning phase, the training data is analyzed, model is optimized, and task is completed by relying on the powerful processing and computing power of the computer; The output stage is the last stage of machine learning, at which the task is processed through the model to obtain the corresponding answer. At each stage, the potential copyright issues are different from time to time.

4.3.1 Input Stage

The sources of input training data in machine learning can be roughly divided into the followings:

Crawling website data through "crawler protocol"	AI companies may use crawlers to crawl data from many websites and use the same as training data for machine learning. In this process, the crawler protocol (Robots protocol) should be followed. The crawler protocol is a recognized industry norm and business ethics in the industry. Crawling data from others' websites in violation of the crawler protocol will constitute unfair competition and may constitute an infringement upon the copyright of the crawled websites.
Crawling data from database	AI companies will not constitute an infringement upon the intellectual property rights of others if they crawl data from database with legal authorization. AI company crawling data by undermining or bypassing the technical protection measures of the database may constitute an act of "destroying technological measures" as stipulated in Article 4 of the Regulation on the Protection of the *Right to Communicate Works to the Public over Information Networks,* thereby constituting copyright infringement.
Digitizing non-digital works	Inputting publicly published paper books and documents into the computer by scanning and other digital methods; such "digital" method belongs to the "reproduction" set forth in Paragraph 5, Item 1, Article 10 of the Copyright Law, which will constitute an infringement upon the copyright of the copyright owner if not authorized by the copyright owner.
AI developers forcibly request user license through service agreements	AI developers are often Internet companies, having their products covering a large user base and occupying a considerable market share. Users of these network products will create a large number of works and other information and data, which is undoubtedly extremely important machine learning training data for AI developers. The AI development company may agree on copyright licensing matters in the intellectual property clauses of the user service agreement, whereby the user will license the use of such data worldwide for free. In this way, AI developers can legally obtain de-copyrighted works of users for machine learning, otherwise, they cannot use them without authorization.

Conclusion:

Crawling and reproducing others' works for input without authorization involves a higher risk of copyright infringement. However, the input stage is often an act that occurs within the company, and it is generally difficult to be discovered, so the possibility of being sued for copyright infringement is low in practice.

4.3.2 Leaning Stage

The process at the learning stage involves reproduction, translation, adaption, and compilation of training data. Do these acts of use constitute copyright infringement of works? There are several points of view as follows.

- Constitute Copyright Infringement

There is a view that the use of copyrighted works as training data by machine learning at the learning stage is the use of works by reproduction, translation, adaptation, and compilation. Therefore, the use of these works by machine learning must be authorized by the copyright owner, otherwise it will constitute copyright infringement.

However, this view does not take into account the current status and particularity of machine learning. Since machine learning requires improvement using the massive amounts of data, if strict protection requires AI companies to obtain authorization from the author of each piece of works in advance, it is almost impossible to complete the task, will greatly damage the normal development of the AI industry, and will not be conducive to the balance of interests between the AI industry and copyright owners.

- Belong to Fair Use

Existing foreign legislation and judicial practice seem to be inclined to apply the fair use system to machine learning in order to exempt its infringement liability. For example, the exceptions to text data mining (Articles 3, 4 and 7) in the EU's 2019 Directive on Copyright in the Digital Singles Market (Articles 3, 4, 7), and the US court found that text data mining constitutes fair use and rejected the Authors Guild's a series of infringement lawsuits against Google Books project.

Correspondingly, most scholars at home and abroad also advocate adopting a fair use system to solve the copyright issues in machine learning works.

Article 24 of the Copyright Law of the People's Republic of China stipulates the fair use system. To satisfy fair use, four requirements must be met: (1) Thirteen specific items; (2) Specify the name or title of the author and the title of works; (3) Not affect the normal use of works; (4) Not unreasonably damage the legal rights and interests of the copyright owner.

Others' works used in machine learning are only input as training data into the computer system for practicing by machine, of which the process occurs at the machine level, so under normal circumstances it will not affect the normal use of works, nor unreasonably damage the legal rights and interests of copyright owners.

However, the difficulty in applying the fair use clause is that the thirteen specific items set forth in this article must be conformed to, which, however, do not explicitly include machine learning. Among the 13 items, the most related item may be "(6) for the purpose of school classroom teaching or scientific research, the published works are translated, adapted, compiled, broadcast or reproduced in small quantities for use by teaching or scientific research personnel, instead of being published or distributed", which, however, emphasizes "scientific research, and for use by teaching or scientific research personnel"; although the process of machine learning is related to scientific and technological research, it is a commercial activity after all. Therefore, it is difficult to

apply this item since it requires non-commercial and simple research field. In addition, although the last one "(13) other circumstances provided for by laws and administrative regulations" in the 13 items seems to be an open clause, it also cannot be applied since the "laws and administrative regulations" are defined, but machine learning is not determined as fair use by laws or administrative regulations at present.

Therefore, under the current Copyright Law of the People's Republic of China, it is difficult to identify the learning stage of machine learning as fair use.

- Belong to Use in the Sense of Non-copyright

There is another view that the "use" of copyrighted works in the learning process is different from the "use" in the sense of the traditional Copyright Law. The subject of the "use" set forth in the Copyright Law is human, namely "human reading"; while in machine learning, the subject of the use is "machine", namely "machine reading". In this sense, the works used in the machine learning process are just converted into a language understood by the machine in a machine way for learning. The text processing process is only a mechanical processing process rather than the use of works. Therefore, the learning process of machine learning should be regarded as use not in the sense of Copyright Law, and naturally does not constitute copyright infringement.

Conclusion:

Regarding the learning stage of machine learning, there are currently no clear regulations in legislation, and there are no relevant case references in judicial practice. The main point of view in academic circles is that it constitutes fair use or use not in the sense of Copyright Law, thereby exempting it from the risk of copyright infringement. The identification of its nature may be further defined in legislation or judicial practice in the future.

4.3.3 Output Stage

At the learning stage of machine learning, the risk of infringement may be exempted using fair use or use not in the sense of Copyright Law, but there is still a greater risk of copyright infringement at the output stage.

According to whether the output result of machine learning is original, machine learning can be divided into expressive machine learning and non-expressive machine learning. The output result of non-expressive machine learning is not original, while that of expressive machine learning has a certain originality.

- Non-expressive Machine Learning:

No expressive content is output, and the reproduction of works in the process of machine learning does not result in the public dissemination of expressive content of subsequent works. Therefore, works created by this type of machine learning will not be identical or substantially similar to the works it is learning, and **will be exempted from liability for copyright infringement.**

- Expressive Machine Learning:

Expressive machine learning can be divided into ordinary expressive and special expressive types. Ordinary expressive type does not take the style of a specific author as a model object; while special expressive type aims to imitate a certain style of an author.

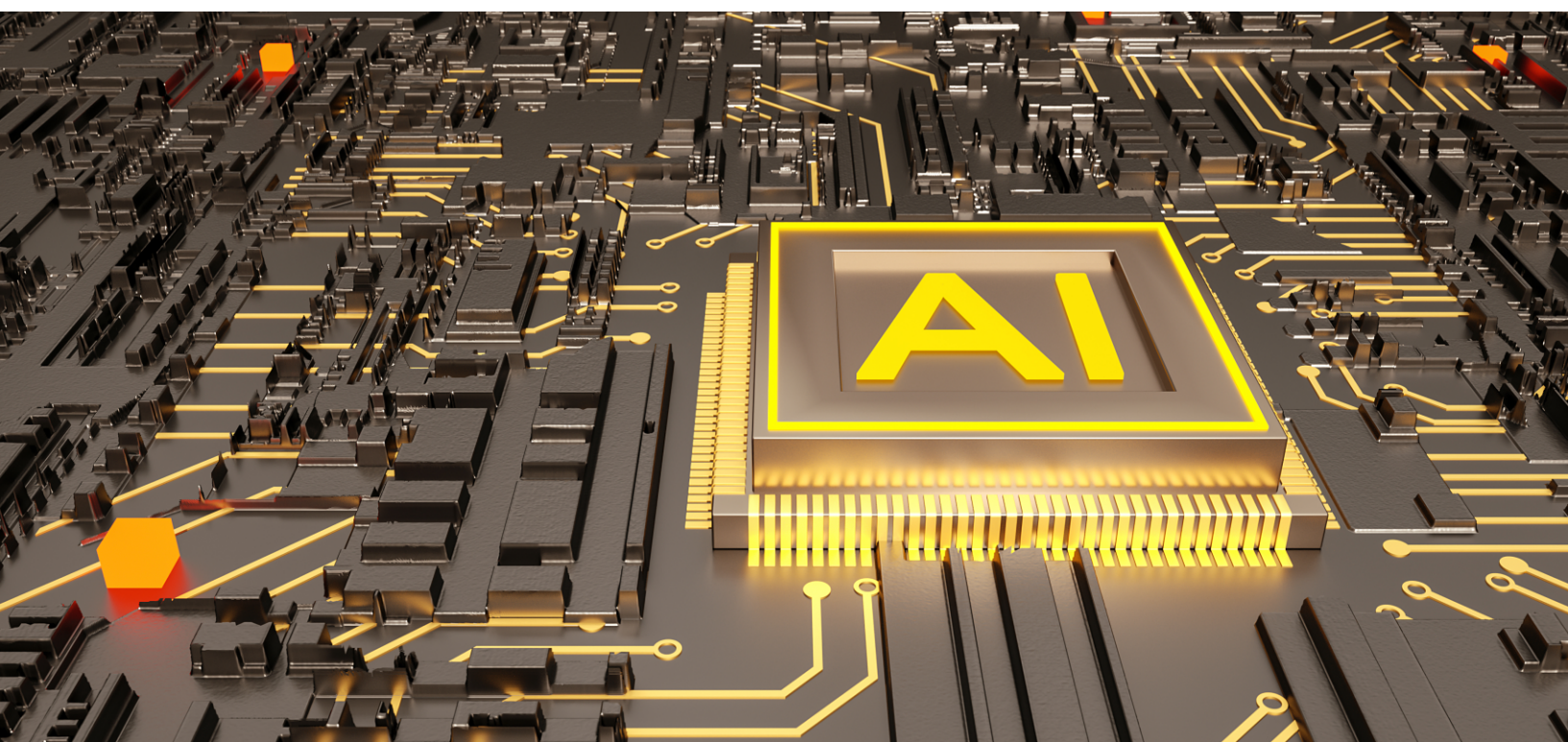
(1) In terms of **ordinary expressive type,** its training data is sourced from a large number of authors, and its output result integrate the styles and expressions of multiple authors, making it difficult to determine the similarity with works of a specific author. **Generally speaking, it will not constitute copyright infringement. However, if some of the expressions in the output result are obviously similar to works of some authors even though it comes from multiple authors, the similar part will constitute copyright infringement.**

(2) **In terms of special expressive type,** it aims to imitate and reproduce the expression of a specific author's works, with the technical goal of approximating such author's creation style indefinitely, so the information extracted by this kind of AI from works is essentially a consistent personalized expression of an author, and the personalized expression of works created by this kind of AI may also have the market effect of replacing learning authors. **Therefore, in this case, the possibility of copyright infringement is high.** For this type of machine learning, AI companies should obtain the author's license in advance.

Typical Case:

In the copyright infringement case of the hit drama *Princess Weiyoung*, the author Qin Jian was accused of plagiarizing 219 pieces of works using "writing software". After more than two years of defending rights, 12 authors won all the plagiarism cases against *Princess Weiyoung*. In May 2019, the People's Court of Chaoyang District, Beijing made a judgment that: Compared with the 16 pieces of works previously published by 12 well-known authors such as Wen Rui'an, the novel *Princess Weiyoung* also uses unique metaphors or descriptions in terms of sentences, or uses the same or similar details to describe people or things, or uses similar combinations of a large number of commonly used languages; in terms of the plot, the novel *Princess Weiyoung* adopts the original background settings, appearance arrangements, conflicts and specific plot designs of the said 16 pieces of copyrighted works, with identical or substantially similar contents in 763 sentences and 21 plots, involving a total of 114 thousand words. The writing software used by the author Qin Jian learns the works of others through machines, and outputs the results at the users' demands, but uses a large number of language expressions or similar combinations of the learning content, constituting a substantial similarity to the multiple works in question. Therefore, the novel *Princess Weiyoung* constitutes copyright infringement.

The determination of the infringing subject is also involved in the determination of infringement of output of machine learning. As mentioned in the previous section, current judicial practice tends to identify software users as the authors of AI products, and software users should bear the liability for infringement. However, software users may require the developers of AI software to bear the liability for compensation on the grounds of the "defect guarantee obligation" set forth in the *Product Quality Law*.



About the author

Peng ZHENG

partner | Attorney at Law

Since 2013, Mr. Zheng has been working in Liu, Shen & Associates, responsible mainly for trademark non-litigation and administrative litigation cases, trademark infringement administrative raid actions, and IP infringement litigations. Mr. Zheng has been served as authorized attorney for many trademark litigations against the government authority, as well as trademark infringement civil litigations, on behalf of many huge companies such as Lego, Dow Chemistry, Karcher, Schneider and several Chinese time-honored companies.

Before joining Liu, Shen & Associates, Mr. Zheng worked as an in-house lawyer successively in BYD Company, and China International Copyright Exchange Center for years, dealing with contract review, legal disputes resolution and IP management.

Mr. Zheng achieved a bachelor degree in law fromTsinghuaUniversityin 2008; in 2012, he achieved a master degree in law from theChineseAcademyof Social Sciences. Mr. Zheng got his qualification as an attorney at law in 2016.

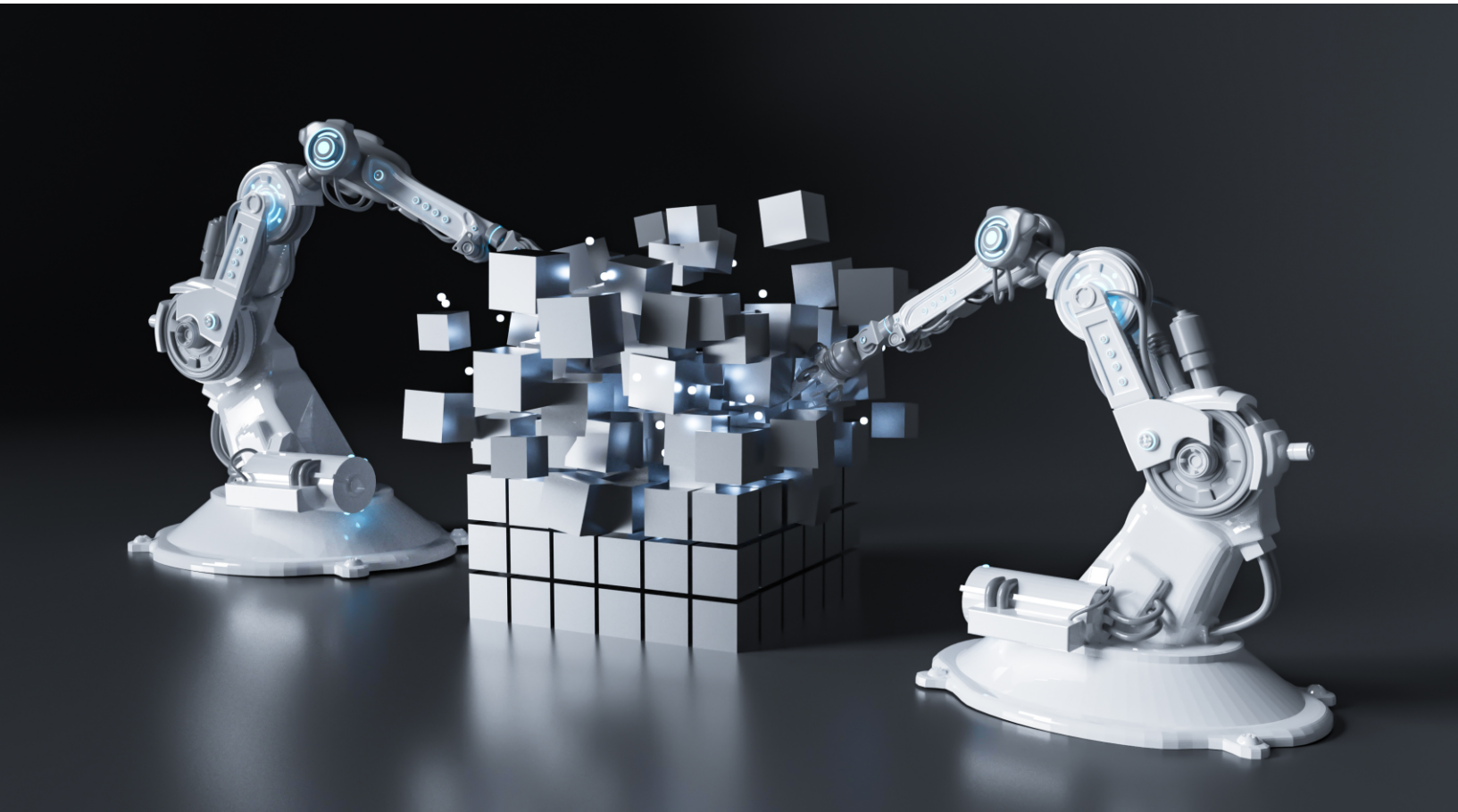
Chapter V
Trade Secret Protection of AI

Hongzhan ZHANG

5.1 Typical Cases of AI Trade Secret Protection

The protection of trade secrets mainly refers to the judicial protection of trade secrets. The cases of judicial protection of trade secrets reflect the conditions and characteristics of the judicial protection of trade secrets to a certain extent, and is of great significance to enterprises' management and protection of trade secrets.

Analysis of typical cases of AI trade secret protection is conductive to the quick grasp of its characteristics that are the same as and different from those of other technical fields.



5.1.1 Case Analysis

[Case 1]

Case [(2017) Jing 73 Min Chu No. 2000] of dispute over trade secret infringement between Beijing Baidu Netcom Science & Technology Co., Ltd., Baidu Online Network Technology (Beijing) Co., Ltd. and Baidu (China) Co., Ltd. as the plaintiffs and Wang Jin as the defendant before Beijing Intellectual Property Court

On December 20, 2017, the plaintiffs Beijing Baidu Netcom Science & Technology Co., Ltd., Baidu Online Network Technology (Beijing) Co., Ltd. and Baidu (China) Co., Ltd. (collectively "Baidu") sued Wang Jin to Beijing Intellectual Property Court for infringement of trade secrets.

Baidu's main causes of action is Wang Jin, former general manager of Baidu's autonomous driving business department, who had already resigned at the time of the litigation, has carried out the following actions during his employment and resignation, which constituted an infringement upon Baidu's trade secrets: 1. Violating the non-competition agreement and creating a company that directly competes with Baidu; 2. Failing to complete the procedures for handover at the resignation, to hand in computers, printers and other items storing Baidu's trade secrets on the grounds of "loss", and causing Baidu's trade secrets to be infringed upon; 3. Registering companies in China and the United States before resigning, and poaching the core employees of Baidu's autonomous driving business department.

The main claims of Baidu are as follows: Immediately stop the infringement upon Baidu's trade secrets, including but not limited to stopping using such trade secrets to engage in autonomous driving-related businesses that compete with Baidu; Order the defendant to compensate Baidu for its economic losses and reasonable expenses of RMB 50 million, to make a public announcement to eliminate the impact, and to fully bear the legal costs.

After accepting this case, the court held a private hearing on this case on May 7, 2019. However, before the judgment was made, Baidu applied to the court for withdraw the lawsuit in writing, and this case was finally closed by way of withdrawing the lawsuit.

[Case 2]

Criminal judgment made by a Shenzhen Court on the case of DJI's source code leakage.

At the beginning of 2019, a Shenzhen court made the first-instance judgment on the case of DJI's source code leakage. As the former employee of DJI volunteered to confess his guilty and showed repentance, the court sentenced him to six-month imprisonment for the crime of infringing upon trade secrets and a fine of RMB 200,000 after comprehensively considering the specific circumstances.

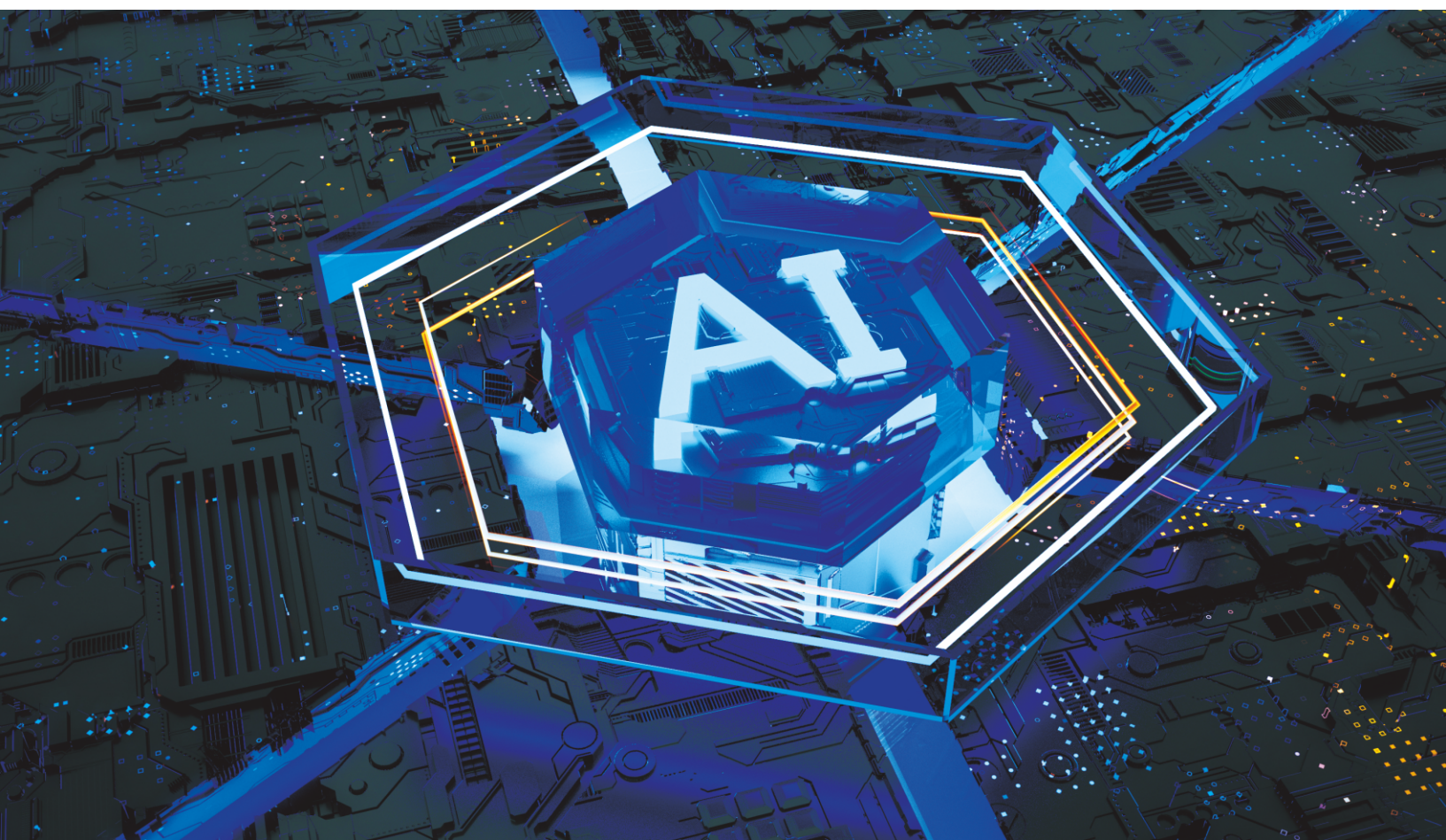
'The cause of the incident was that when the employee was responsible for developing the code for the two modules of the agricultural drone management platform and the agricultural machinery spraying system in DJI, he uploaded the template code to the "public warehouse" on GitHub, causing the leakage of the source code. These code have been used in DJI's agricultural drone products, and thus are trade secrets. Until 2017, security researcher Kevin Finisterr discovered this serious vulnerability in DJI. This vulnerability can enable attackers to obtain the private key of the SSL certificate and allow them to access sensitive customer information stored on the DJI server, thus making all the old keys of DJI useless, and such private data as user information and flight logs on the DJI server available for download. The leakage of the code caused an economic loss of RMB 1.164 million to DJI.

5.1.2 Characteristics of AI trade secret protection reflected in the case

Case I mentioned above is known as “the first driverless vehicle case in China”, on which the court did not make a formal judgment due to Baidu’s withdrawal of the lawsuit in the end, therefore, there is no authoritative information disclosed about the facts of this case. However, according to a statement later published by Allride AI Technology Co., Ltd., an affiliate of Wang Jin, this case was “withdrawn by Baidu in the end after twice trials and immediately before the pronouncement of the court” and “in this case, Baidu can neither prove the existence of trade secrets, nor prove Wang Jin’s infringement upon trade secrets”. This statement may imply that Baidu’s rights protection process is relatively difficult on the one hand; and the difficulty of this case, as an AI trade secret case, is exactly the same as that of a general trade secret case on the other hand, that is, the proof of ownership and infringement.

Case II mentioned above is a criminal case, in which the subject matter of trade secrets involved is the source code of software. Although AI field belongs to a new technical field, when seeking protection of trade secrets, the subject matter of existing trade secrets is protected first in practice. Therefore, the protection of AI, as a specific protection type, also has the common characteristics of the protection of the subject matter of trade secrets.

The subject matter of AI trade secret protection can be determined based on the laws currently in force and the specific characteristics of AI (see the foregoing content of this Report). Article 1 of the *Provisions of the Supreme People’s Court on Several Issues Concerning the Application of Law in the Trial of Civil Cases Involving Infringements upon Trade Secrets* stipulates that a people’s court may determine the information on structure, raw materials, components, formulas, materials, samples, styles, propagation materials of new plant varieties, processes, methods or their steps, algorithms, data, computer programs and their relevant documents, among others, relating to technology as technical information set forth in Paragraph 4, Article 9 of the Anti-Unfair Competition Law. The above-mentioned types of subject matter are common in know-how protection. Specifically, in AI field, technology-related algorithms, data, computer programs and related documents are the main subject matters of AI trade secret protection.

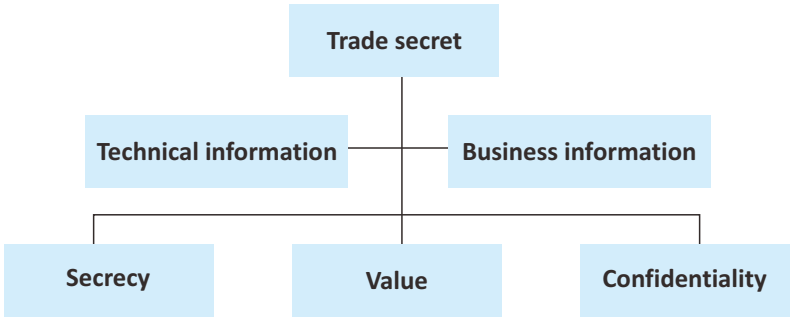


5.2 Conditions and characteristics of AI trade secret protection

5.2.1 Basic concepts of trade secret protection

Paragraph 4, Article 9 of the Anti-Unfair Competition Law of the People's Republic of China provides that: Trade secret herein refers to commercial information such as technical information and business information that is not known to the public, has commercial value, and has been subject to appropriate confidentiality measures taken by the right holder.

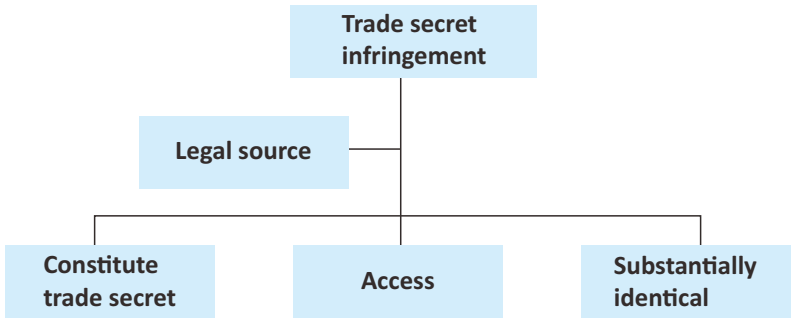
This article officially defines trade secret in Chinese laws, and is generally accepted in theory and practice. According to the provisions of this Article, trade secret is essentially commercial information, with secrecy, value and confidentiality, that is, the "three features" in the constitutive elements of trade secrets generally referred to.



5.2.2 Conditions for Trade Secret Protection

The conditions for trade secret protection refer to the elements required for the constitution of an infringement and the obtainment of legal protection in case of any infringement upon trade secret. Article 14 of the *Interpretation of the Supreme People's Court on Several Issues Concerning the Application of Law in the Trial of Civil Cases Involving Unfair* Competition stipulates that if a party alleges that others have infringed upon its trade secrets, such party shall be responsible for proving that the trade secrets it possess meet the statutory requirements, the information of the other party is identical or substantially identical to its trade secrets, and the other party has adopted improper means. Article 12 stipulates that any trade secret obtained through self-development or reverse engineering shall not be deemed to have infringed upon the trade secrets under Paragraphs (1) and (2), Article 10 of the Anti-Unfair Competition Law.

According to the above provisions, there are mainly four conditions for the protection of trade secrets, of which three are positive and one is negative. The three positive conditions are respectively constitute trade secret, access, and substantially identical, and one negative condition is not obtained through self-development or reverse engineering, which are commonly referred to as the constitutive elements of trade secret infringement: Constitute trade secret + access + substantially identical - legal source.



Among the above conditions for trade secret protection:

In terms of constituting trade secret, evidence that a trade secret meets statutory conditions includes the carrier, specific content, commercial value, and specific confidentiality measures taken for the trade secret, and others.

In terms of access, the court may consider the following factors related to the employees and former employees while determining whether such employees and former employees have channels or opportunities to obtain the right holder's trade secrets: (I) Positions, responsibilities, and authorities; (II) work undertaken or the tasks assigned by company; (III) the specific circumstances of participating in production and business activities related to trade secrets; (IV) whether to keep, use, store, copy, control or otherwise access and obtain trade secrets and their carriers; (V) other factors that need to be considered.

In terms of substantially identical, if there is no substantial difference between the alleged infringing information and the trade secret, it can be determined that the alleged infringing information and the trade secret are substantially identical as set forth in Paragraph 2, Article 32 of the Anti-Unfair Competition Law. The following factors may be considered when the court determines whether they are substantially identical as mentioned in the preceding paragraph: (I) The degree of similarities and differences between the alleged infringing information and the trade secret; (II) whether those related people in the same fieldcan easily think of the difference between the alleged infringement information and the trade secret when the alleged infringement occurs; (III) whether the alleged infringing information and the trade secret are substantially different in the usage, use method, purpose, effect, etc.; (IV) information related to trade secrets in the public field; (V) other factors that need to be considered.

In terms of legal source, reverse engineering refers to the disassembly, surveying & mapping, and analysis of products obtained from public channels through technical means to obtain relevant technical information of the products. After the parties have learned of the trade secrets of others by improper means, they claim that the acquisition is legal on the grounds of reverse engineering, which does not belong to reverse engineering.

5.2.3 Characteristics of trade secret protection

Since AI field mainly involves the protection of technical information, compared with technical information, the protection characteristics of trade secrets are mainly reflected in the comparison with patent protection, which can be specifically divided into the following aspects:

First, the starting point for trade secret protection is lower than patent protection. The legal requirements for the protection degree of trade secrets are mainly reflected in the secrecy in the constitutive elements. The so-called secrecy is usually not known to the public. Generally speaking, information that is claimed as a trade secret can be deemed to meet the requirements of secrecy as long as it reaches a level that is not generally known to the public, without any need to meet higher requirements for inventive step.

Second, the protection of trade secrets does not require complicated authorization procedures. Trade secrets will be protected by law as long as they meet the constitutive requirements, without any need to apply for authorization to the competent authorities, and without determination and authorization by authorities on whether the trade secrets are constituted, which can be determined in specific cases by judicial authorities only when the judicial protection is sought for infringement upon trade secrets. Generally speaking, the unawareness of the public will naturally bring conditions for the right holders to exercise their rights, that is, a certain degree of exclusive right.

Third, there is no time limit for the protection of trade secrets. Trade secrets can be authorized without application, and the law does not specifically limit the duration of their rights. Accordingly, trade secrets can obtain continuous protection provided that they still meet the constitutive requirements stipulated by law.

Finally, trade secrets are more complicated in terms of management and rights protection. The aforementioned non-disclosure characteristic of trade secrets has not only brought advantages to the protection of trade secrets, but also brought more uncertainty to the management and rights protection of trade secrets. Due to the non-disclosure characteristic, trade secrets lack sufficient right appearance, and it is difficult for right holders to effectively delimit the boundaries of rights. On the one hand, it makes the implementation of confidentiality measures in management more difficult, and on the other hand, it increases difficulty in providing proof of trade secrets in rights protection.

It can be seen that whether to use trade secrets to protect technical information has advantages and disadvantages, and it depends on the company's own situation and the characteristics of the information to be protected.

5.3 Suggestions for AI trade secret protection

5.3.1 General suggestions for AI trade secret protection

First, it is necessary to sort out trade secrets, mainly from the two aspects of secrecy and value.

Secrecy also refers to unknown to the public. Generally speaking, the information requested to be protected by the right holder shall be deemed to be unknown to the public as set forth in Paragraph 4, Article 9 of the Anti-Unfair Competition Law if it is not generally known and easily available to those skilled in the art when the alleged infringement occurs. Because it is negative information, secrecy also has negative conditions, that is, (1) the information belongs to common sense or industry practice in the field; (II) the information only involves the size, structure, material, simple combination of components, etc. of products, and can be obtained directly by those related people in the same filed by observing the marketed products; (III) the information has been publicly disclosed in public publications or other media; (IV) the information has been disclosed through seminars, exhibitions, etc.; (V) the information can be obtained by those related people in the same filed from other public channels. However, if the new information formed after sorting, improving, and processing the information known to the public conforms to the constitutive requirements for trade secrets, it shall be deemed as unknown to the public.

In terms of value. Generally speaking, the information requested to be protected by the right holder shall be deemed to have commercial value set forth in Paragraph 4, Article 9 of the Anti-Unfair Competition Law if it has actual or potential commercial value because it is not known to the public. If the phased results formed in the production and business activities meet the requirements, the results may be determined to have commercial value.

Second, it is necessary to manage trade secrets, mainly from the aspect of confidentiality measures.

In terms of confidentiality measures. In order to prevent the disclosure of trade secrets, the reasonable confidentiality measures taken by the right holder before the alleged infringement occurs shall be determined to be the corresponding confidentiality measures set forth in Paragraph 4, Article 9 of the Anti-Unfair Competition Law. When making determination, it shall be determined that whether the right holder has taken corresponding confidentiality measures according to such factors as the nature of the trade secret and its carrier, the commercial value of the trade secret, the degree of identification of the confidentiality measures, the degree of correspondence between the confidentiality measures and the trade secret, and the confidentiality intention of the right holder. If one of the following circumstances is sufficient to prevent the disclosure of trade secrets under normal circumstances, it shall be determined that the right holder has taken corresponding confidentiality measures: (I) signing a confidentiality agreement or stipulating confidentiality obligations in the contract; (II) requiring employees, former employees, suppliers, customers, visitors, etc. who can access and obtain trade secrets to keep confidential by means of articles of association, training, rules and regulations, written notification, etc.; (III) restricting visitors or conducting differentiated management on secret-related plants, workshops and other production and business places; (IV) differentiating and managing trade secrets and their carriers by means of marking, classifying, isolating, encrypting, sealing, and restricting the scope of persons who can have access to or obtain the trade secrets; (V) taking measures such as prohibiting or restricting the use, access, storage, copying, etc. of computer equipment, electronic equipment, network equipment, storage equipment, software, etc. that can have access to and obtain trade secrets; (VI) requiring the resigned employee to register, return, clear, destroy the trade secrets and their carriers that they have accessed or obtained, and continue to assume the obligation of confidentiality; (VII) taking other reasonable confidentiality measures.

5.3.2 Specific Suggestions for AI Trade Secret Protection

Article 1 of the Provisions of the *Supreme People's Court on Several Issues Concerning the Application of Law in the Trial of Civil Cases Involving Infringements upon Trade Secrets* stipulates that a people's court may determine the information on structure, raw materials, components, formulas, materials, samples, styles, propagation materials of new plant varieties, processes, methods or their steps, algorithms, data, computer programs and their relevant documents, among others, relating to technology as technical information set forth in Paragraph 4, Article 9 of the Anti-Unfair Competition Law. The people's court may determine that information related to business activities, such as creativity, management, sales, finance, plans, samples, bidding and tendering materials, customer information, and data, constitutes the business information set forth in Paragraph 4, Article 9 of the Anti-Unfair Competition Law. The customer information referred to in the preceding paragraph includes the customer's name, address, contact information as well as transaction habit, intention, content, and other information.

According to the said provisions and based on the characteristics of AI, the types of AI trade secret protection can be divided into know-how and business secrets. However, even for AI, the business secrets lack uniqueness, and have more commonality with other fields, so unnecessary details will not be given about the protection of business secrets. Protection suggestions will be discussed as follows mainly around several common technical scenarios of AI:

First of all, about the trade secret protection of AI data. Data is the foundation of AI development, and there are many types of AI data. According to whether the data is generated with the creative work of the right holder, the data can be divided into basic data and processed data. For basic data, more value is reflected after quantitative integration since it has not undergone any processing by the right holder, so such data can be protected as trade secrets as a whole. For processed data, both individual data and overall data can be protected as trade secrets since they may reflect certain protection values.

Second, about the trade secret protection of AI algorithms or programs. AI algorithms are valuable technical information. The algorithm or the program that implements the algorithm, that is, its related documents, can be protected as trade secrets, especially the source code that carries the algorithm, which can be protected as trade secrets without being made public.

Finally, about the trade secret protection of AI programs. There is little controversy about the protection of AI programs as trade secrets, and even in the AI field, the characteristics of the programs are basically the same as those in other fields from the perspective of trade secrets, so the AI programs protected as trade secrets are basically the same as other programs.

About the author

Hongzhan ZHANG

Mr. Hongzhan ZHANG has 13 years of working experiences in intellectual property. He worked in Beijing No.1 Intermediate People's Court and Beijing Intellectual Property Court for nearly 11 years, and tried nearly 1000 intellectual property cases and civil and commercial cases, including patents, trademarks, copyrights, monopolies, unfair competition, etc. Mr. HongZhan ZHANG is a veteran litigator in IP field with comprehensive experience in handling all kinds of IP-related disputes including but not limited to patent, trademark, copyright, trade secrets, unfair competition and anti-monopoly. With extensive experience in handling cases. Mr. HongZhan ZHANG has deep insights into the IP protection system in China and fully developed the ability to understand technical problems smoothly and properly. Being familiar with judicial requirements and standards, Mr. HongZhan ZHANG is particularly experienced in designing proper litigation strategy to achieve satisfactory results.

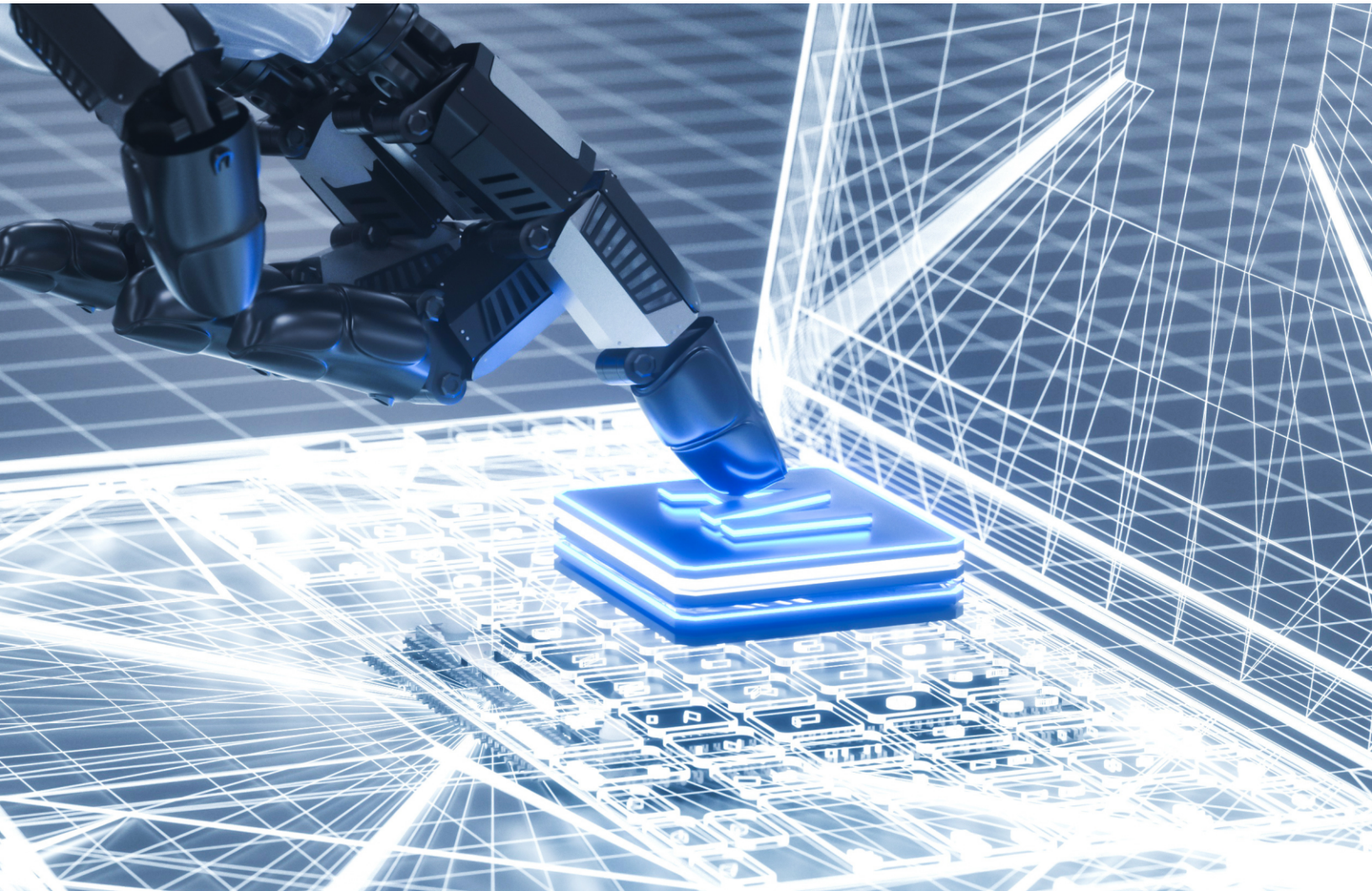
Chapter VI

Trademark Protection of AI

Yuan YUAN

Artificial intelligence (AI) is currently a hot field in China. Most of the major domestic manufacturers such as Alibaba, Tencent, and Baidu, foreign giants such as IBM and MICROSOFT, or start-up technology companies favored by capital involve the AI field, and some of the latter have developed into emerging unicorn companies.

At present, most articles on the protection of AI in the field of intellectual property rights focus on patents, copyrights, and trade secrets, while the protection and influence of AI on trademarks are very rarely discussed. We try to analyze the early layout and later protection of AI-related trademark in this chapter, hoping to help enterprises.



6.1 Early Layout of AI Trademark

No matter in most countries and jurisdictions represented by China that determine the ownership of trademark rights mainly relying on "first filing", or in other countries represented by the United States that determine the ownership of trademark rights mainly relying on "first use", it is necessary to file national trademark applications or designate the mark through the Madrid System for the International Registration of Marks as early as possible, so as to occupy an earlier filing date.

Before filing an AI trademark application, there are two aspects that need to be determined. One is to select an appropriate AI trademark, and the other is to specify the corresponding goods and services.

The problem with selecting an appropriate AI trademark is that it is becoming more and more difficult to select an appropriate AI trademark without prior conflicts, especially when most applicants hope to select the same AI trademark in all markets around the world, considering on the one hand, applicants preferring to select concise and catchy trademarks with harmonious meaning and hi-tech indication, and on the other hand, the existing stock and annual huge increase of trademarks in various countries and regions.

We have noticed that under such circumstances, major domestic manufacturers and foreign giants will choose to apply for new AI trademarks by combining existing main trademarks with new catchy names/nouns, such as IBM's IBM Watson, MICROSOFT's MICROSOFT AI SOLUTION, Huawei's HUAWEI ATLA, Alibaba's Alibaba Cloud, and Tencent's Tencent Cloud. The advantage of such choice is that on the one side, the previous main trademark registered for many years can greatly ensure the chances for the new combined trademark to pass the examination smoothly, and are not likely to collide with the other existing trademarks, and on the other side, consumers will have trust on the goods/services bearing such combined marks knowing from which manufacturers the goods and services are from, and meanwhile know the trademarks are for new series of production line due to the new name/noun behind the main trademark, and the newly added nouns like "Cloud" and "AI SOLUTION" can even function to show the specific contents of the goods and services.

However, due to various considerations, some major manufacturers choose to adopt brand-new AI trademarks that are completely unrelated to the previous main trademarks, such as Baidu's Apollo. The advantage of such choice is that the brand-new brand will give consumers a refreshing impression and a more concise appellation; plus, such brand-new brands grant more flexibility of trademark use in actual commerce, that is, after registration, it can be used alone as well as in combination with the main trademark based on the circumstances. The problem is, it greatly increases the risk of colliding with the prior trademark, even for many large companies with fairly complete IP strategies. For example, when Huawei tried to apply for the registration of its AI trademark "HiAI", it was found that its partner had already filed the same application dozens of days ago, and then two parties fought for this trademark for several years; another example is when AMAZON tried to apply for the registration of its AI trademark "ECHO" in China, it also encountered prior obstacles and failed to have it registered for the moment. Therefore, if choosing a brand-new AI trademark, the company must firstly do a good job in confidentiality work and sign a confidentiality agreement with the partners, secondly, do a lot of retrieval beforehand to evaluate the possibility of registration, and thirdly, file an application as soon as possible to get an early filing date. But even if it takes a huge amount of time and economic cost, sometimes the registration result of such a brand-new AI trademark is not satisfactory, especially if the company intends to register and use it globally.

Emerging AI technology companies do not have such long-standing main trademarks to rely on, and are often at the stage of choosing their own main trademarks for AI products and services. In order to avoid too many prior conflicting trademarks when choosing a brand-new main trademark, try to choose a coined word rather than dictionary vocabulary. If the coined word can have elements corresponding to its company name and can imply the attributes of a technology company, the trademark will have a better performance in terms of registration pass rate, marketing convenience and potential consumer acceptance. IFLYTEK, the English trademark of iFLYTEK, is one good example. Under the influence of trademarks such as IPHONE, IPAD, and IWATCH, consumers can easily understand 'I" as an element representing new high-tech technologies; the "TEK" is homophonic to "TECH", which also implies the element of technology; for one thing, the dictionary vocabulary "FLY" inserted in the middle corresponds to the meaning of "飞" in the company name, and for another, the addition of the preceding and following "i" and "TEK" elements will not cause conflicts with other trademarks containing the separate word "FLY".

In addition to the careful selection of AI trademarks, the goods and services designated by AI trademarks also need to be carefully considered. Different from other intellectual property rights, the registration and protection of trademarks must be combined with the corresponding goods and services. Before the AI trademark application is filed for registration, the designated goods and services must be selected. At present, most countries and jurisdictions in the world adopt the *Nice Classification*, which divides common goods and services into 45 major classes. The essence of AI technology is a software program that can implement various functions, so its core protection category is Class 9 in the Nice Classification; at the same time, the upgrade and maintenance of the software program belongs to Class 42 in the *Nice Classification.*

However, different from other technologies, AI technology can also be widely used in other fields in addition to its products and services. From vehicle & driving to lighting & cooking, from living & home furnishing to toy & education, you always can see the application of AI technology. Although in many cases, the AI technology owner just provides AI technology for another manufacturer for use in its vehicles, lamps, kitchenware, household supplies, toys, and online education services, instead of producing and selling such products or providing such services by itself; but if the owner of AI technology fails to apply for the registration and protection of its own trademarks in the corresponding Classes 12 (vehicles), 11 (lamps and kitchenware), 21 (household supplies), 28 (toys) and 41 (education services), other parties may register highly similar or even identical trademarks with AI trademarks on these goods and services, making consumers easily think that the technology of the AI technology owner is used in these goods and services, thereby resulting in confusion and misleading, and even a bad impact on the goodwill of the AI technology owner. So should the AI trademark cover the goods and services in all of these possible application areas when selecting goods and services in registration application? The answer is not absolutely so.

As mentioned above, in most countries and jurisdictions represented by China, the ownership of trademark rights is determined mainly relying on "first filing", while in some countries represented by the United States, the ownership of trademark rights is determined mainly relying on "first use". Under the former system, trademark applicants can apply for registration of and maintain a trademark without necessity to voluntarily provide evidence on trademark use; while under the latter system, trademark applicants can apply for registration of and maintain a trademark only after voluntarily providing evidence on trademark use. Due to the difference of trademark systems, AI technology owners can consider covering all the above related categories when designating goods and services in addition to the core categories in the former countries and jurisdictions so as to prevent others from registering the same and similar trademarks on vehicles, lamps, kitchenware, household supplies,

toys and online education services, causing consumers to believe that such goods and services have the AI technology of the AI technology owner; while under the latter system, especially in the United States where false statements and evidence on trademark use will result in trademark invalidation, fine and imprisonment, it is recommended that AI technology owners apply for registration only in the core categories that they actually use.

Comparing the applications for AI trademark registrations by the above-mentioned companies such as Alibaba, Tencent, Baidu, IBM, MICROSOFT, and iFLYTEK under the two systems, we have indeed found that they often cover all relevant categories in the Nice Classification as more as possible under the former system, for example, in China; and under the latter system, for example, in the United States, often only designate the actual used categories in the Nice Classification, less than those designated in China.

Therefore, the selection of designated goods and services for AI trademark requires comprehensive consideration of local trademark practices, and it is important to avoid "one-size-fits-all approach" in all countries and jurisdictions, resulting in insufficient protection under the former system, or designating goods and services that are not actually used under the latter system, which leads to the subsequent failure of the registration and maintenance of and invalidation of trademark, or fine and other severe penalties.

6.2 Later Protection of AI Trademark

The most fundamental purpose of trademark registration is to protect one's brand; on the one hand, to make consumers understand the AI trademark and which manufacturer its goods and services come from, and on the other hand, to prevent other parties from registering and using the same and similar trademarks on the same and similar goods; the purpose of the AI trademark registration is nothing more than this.

Similarity can be easily judged when the trademarks and goods are identical. However, when the trademarks and goods are different, the practices of different countries and jurisdictions are different in judging whether the trademarks and goods are similar. Such a situation inevitably produces confusion as much as trademark confusion. Generally speaking, China's practice tends to make judgment in strict accordance with the Similar Goods and Services Table, while the United States will take into more consideration of the influencing factors in actual business. Moreover, even in the same country and jurisdiction, the judgment standards and consideration factors are not the same at the stage of administrative right grant and in civil tort cases.

For example, at the early stage of administrative right grant on trademark, the United States use The Polaroid Factors determined in the Polaroid Corp. vs. Polaroid Elecs, Corp. to determine whether the trademarks of both parties constitute similar trademarks on similar goods and services. The Polaroid Factors include:

1. the strength of the senior user's mark;
2. the degree of similarity between the two marks;
3. the proximity of the products;
4. the likelihood that the prior owner will bridge the gap;
5. actual confusion;
6. the junior user's good faith in adopting its own mark;
7. the quality of junior user's product; and
8. the sophistication of buyers.

In the later judgment of civil infringement, the US court followed the John H. Harland Co. vs. Clarke Checks, Inc., in which the following seven elements need to be considered in determining whether the trademark infringement is constituted, namely:

A. Type of Trademark.
B. Similarity of Design.
C. Similarity of Products.
D. Identity of Retail Outlets and Purchasers.
E. Similarity of Advertising Media Used.
F. Defendant's Intent.
G. Actual Confusion.

It can be seen from the comparison that the two judgment standards are mostly overlapped, but the former considers the strength of trademarks and public interests more, while the latter is more inclined to the scenario of actual sale.

However, what is gratifying is that in current Chinese judicial practice, considering the specific application scenarios of AI, various influencing factors in actual commercial use have been taken into consideration more rather than determining the similarity of trademarks and goods, and then drawing a conclusion on whether the trademark infringement is constituted by strictly following the Similar Goods and Services Table. In the Baidu Online vs. Beijing Zile Technology Co., Ltd. (2021), the defendant prominently referred to its products as "Xiaodu" in the Duyaya learning machine produced and sold; however, products such as smart speakers and learning machines using AI technology in the market, consumers call products more often with voice rather than traditionally relying more on text to identify products, which will lead to the fact that "Xiaodu (小度)" and "Xiaodu (小杜)", which do not generally constitute similar trademarks based on Chinese text, are easily confused and misidentified in the application scenario of such AI technology. Considering the popularity of the plaintiff's "Xiaodu (小度)" and "xiaodu xiaodu(小度小度)" and the defendant's subjective bad faith, the People's Court of Haidian District, Beijing judged beyond the Similar Goods and Services Table that the plaintiff's Xiaodu smart speaker and the defendant's Duyaya learning machine are similar products in terms of functions, audiences, and sales channels.

In addition to voice call interaction, when consumers use keywords to find suitable products and services during shopping on e-commerce platforms, and search for information about corresponding products and services in search engines, AI technology is also increasingly being used. With the sales of e-commerce platforms beginning to surpass offline stores, and search engines providing consumers with more product and service information than traditional media, AI technology is playing an increasingly critical role in consumers' purchasing decisions. In this case, whether AI technology providers will become potential trademark infringers is a question that every AI technology provider needs to think about.

In the *Coty Germany GmbH vs. Amazon Services Europe Sàrl, Amazon Europe Core Sàrl, Amazon FC Graben GmbH, Amazon EU Sàrl (2020),* Amazon's AI technology did not automatically select keywords and was not actively involved in the keyword advertising system, so it is determined that Amazon shall be exempted from liability for trademark infringement. Therefore, if AI technology does not automatically and selectively "help" consumers choose keywords, nor is it actively involved in the keyword advertising system of the seller in question, and the AI technology provider will also implement corresponding removal procedures later and timely follow up the implementation, the AI technology provider shall be exempted from liability for trademark infringement.

However, if the AI technology provider is involved in more infringements, it may constitute trademark infringement. In the *Cosmetic Warriors Ltd an Lush Ltd vs. Amazon.co.uk Ltd and Amazon EU Sarl (2014),* the defendant Amazon was ruled to bear corresponding legal liabilities since the website links triggered by Amazon's AI technology after consumers use the trademark search do not contain the brand products corresponding to the trademark, and consumers may be confused and even misled as whether the products sold on the website are from the brand owner of the targeted trademark.

In summary, AI technology providers need to select appropriate trademarks according to their own circumstances in the early trademark layout, and consider different trademark practices in different countries and jurisdictions to designate different goods and services; in the later trademark protection, on the one hand, they need to decide whether to take rights protection actions with a comprehensive consideration of the special features of AI technology application scenarios while protecting their own rights and interests, and on the other hand, they need to pay attention to whether their own algorithm technology has been excessively and inappropriately involved in consumers' purchasing decisions.

About the author

Yuan YUAN

Partner | Trademark Attorney | Attorney at Law

Ms. Yuan joined Liu, Shen & Associates in 2008 as a trademark attorney and got her qualification as an attorney at law in 2009. Her practice encompasses trademark prosecution, invalidation, litigation, and corporate Trademark counseling. Her expertise is in trademark clearance and filing strategies, trademark strategies, filing trademarks through Madrid system.

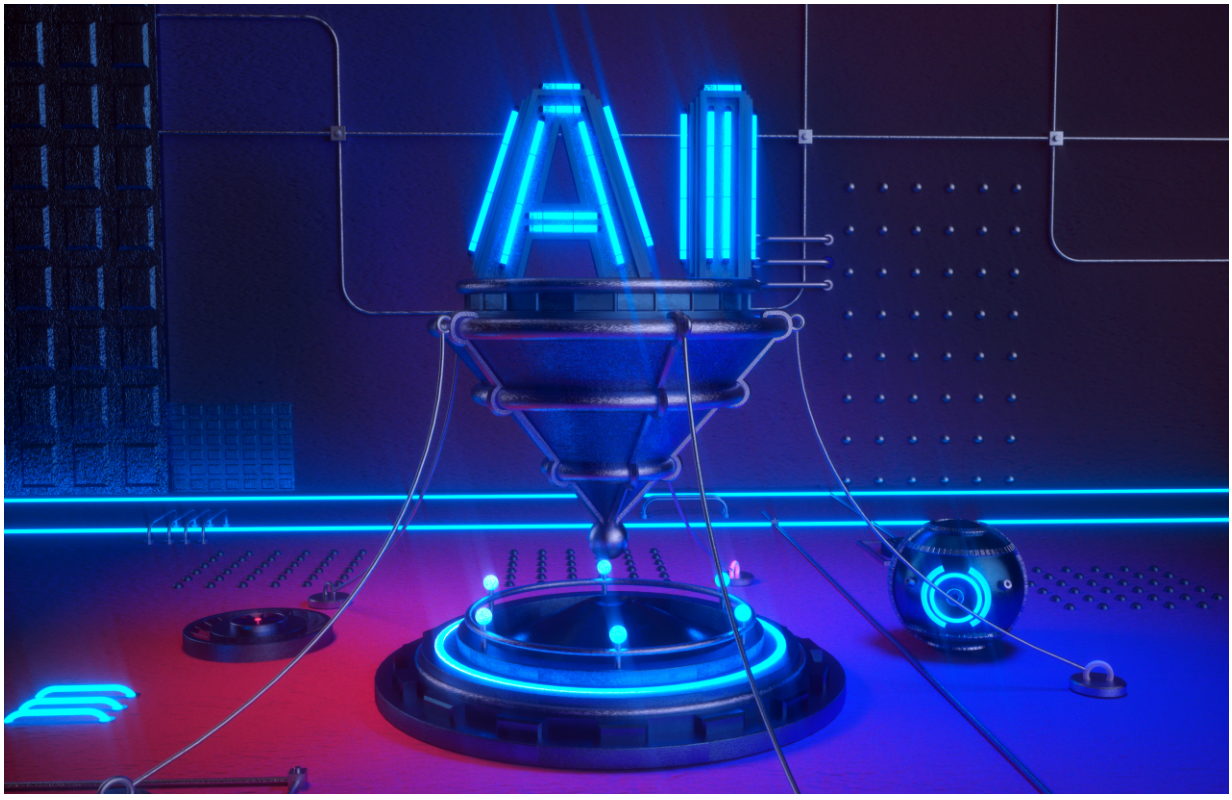
Ms. Yuan holds a Bachelor of English Literature from Wuhan University and a Master of Intellectual Property from Franklin Pierce Law Center (now Law School of the University of New Hampshire). She received training from Birch, Stewart, Kolasch & Birch, LLP in 2008.

Ms. Yuan's clients include Fortune 500 companies, SMEs, start-ups, and solo entrepreneurs. Ms. Yuan has a client-centric, business-minded, holistic and worldwide approach to not only register trademarks for clients, but also make sure clients' trademarks commercialized and enforced.

Chapter VII

Data Ccompliance of AI

Wenjie LI and *Hongzhan ZHANG*



7.1 Relationship between AI and Data

7.1.1 Significance of Data in the Realization of AI Technology

One of the major advantages of AI technology is that it can process a large amount of data at high speed since the application of AI technology at the present stage is mainly to induce patterns and rules from artificially provided data through computers independently, that is, AI technology itself constructs rules and models from the provided data. However, the data provided manually in the early stage may not be complete, and AI technology also needs to continuously adjust and improve the technology based on the ever-increasing data to optimize the performance of the entire technology. Therefore, the realization of AI technology requires humans to provide a large amount of data support, and in the process of AI technology induction, it is necessary to continuously provide data to correct and improve AI technology. Of course, these data can also be used to test the performance and evaluate the advantages and disadvantages of AI technology, because the development of high-performance AI technology depends on the amount of quality data related to the research subject.

The industry generally believes that data plays a vital role for AI at the present stage. The application of AI technology relies on huge high-quality data, so both the “quality” and the “quantity” of the data are of great significance to the realization of AI technology.

7.1.2 Characteristics of Data in the Realization of AI Technology

In the process of realizing AI technology, the use of data can be divided into three stages, namely data collection, data storage and data use. To facilitate discussion, we will classify the processing, transmission, provision, disclosure and deletion of data as the use of data.

In the data collection process, it is necessary to first collect a large number of basic information related to the subject, such as image, video or audio data of personal information such as name, gender, ID number, address, personal biometric information, phone number, etc., thus forming a comprehensive tracking of the subject object. These data may be collected by AI technology developers themselves, purchased from third-party databases, or obtained through web crawler technology to meet the requirements for the minimum amount of data. At this stage, data acquisition and recording are the main tasks.

After obtaining the support of the minimum amount of data, AI technology needs to analyze the data to form a "model", which is the use and processing of data. In this process, basic data will be analyzed to more vividly "sketch" the subject object, such as analyzing the subject object's shopping habits, daily whereabouts, etc., involving more private personal information.

Compared with the relatively independent characteristics of the above two stages, data storage has been throughout the entire process of AI technology realization, and is involved in the collection and use of data. In practice, it is mainly necessary to guard against the intrusion of hackers and other illegal means or the vulnerability of the system itself leading to the theft, disclosure or illegal use of data information.

7.2 Data Risk in the Implementation of AI Technology

7.2.1 Risk of Infringement upon Property Rights and Interests

In order to obtain high-quality data that meets the minimum requirements, AI technology needs to invest a lot of manpower, material resources and financial resources to collect, sort out and process a large amount of data, so as to finally develop high-performance AI technology. Therefore, data is important asset for AI technology. At present, there are no clear provisions on the property rights of data in China. It is authoritatively stipulated only in Article 127 of the *Civil Code* that where any laws provide for the protection of data and network virtual property, such laws shall apply, beyond which there are no more specific provisions. In judicial practice, due to the restriction of the "statutory principle of property rights", judges do not directly protect data as property rights, but protect data from the perspective of protecting property rights and interests in accordance with Article 2 of the *Anti-Unfair Competition Law* in cases where data itself is not explicitly defined as an independent civil right.

Article 2 of the *Anti-Unfair Competition Law* stipulates that businesses shall adhere to the principles of free will, equality, fairness, and good faith, as well as generally accepted business ethics, in their market transactions, which are often used as general terms for judging unfair actions. The owners of AI technology are mostly competitors in the same industry, and if they obtain the data from others unfairly through means such as "crawlers", they may violate the provisions of this article. In judicial practice, there have been many cases involving data protection, in which data is protected in accordance with Article 2 of the *Anti-Unfair Competition Law.*

Case Analysis:

[Case 1]

Dispute over unfair competition in which "Maimai" illegally grabs and uses user information of "Sina Weibo" (see: Judgment [(2015) Hai Min (Zhi) Chu Zi No. 12602] of the People's Court of Haidian District, Beijing and Judgment [(2016) Jing 73 Min Zhong No. 588] of the Beijing Intellectual Property Court

Fact of case	Weimeng Company is the operator of Sina Weibo, while Taoyou Technology Company and Taoyou Technology Development Company jointly operate Maimai software and Maimai website. Maimai is a mobile-based social networking application that help users find new friends and make connections with them by analyzing their Sina Weibo and address book data. From September 11, 2013 to August 15, 2014, the parties signed the *Developer Agreement* to carry out cooperation through the Weibo platform openAPI and agree that Maimai is only a normal user and can obtain the ID avatar, friend relationship (without friend information), tag, and gender of Sina Weibo users, and cannot obtain the occupation and education information of Sina Weibo users, but Maimai violated the *Developer Agreement*, so that the relevant information of a large number of Sina Weibo users who were not registered as Maimai users was also displayed in the Maimai software, and after the termination of the cooperation between the parties, Maimai still used the information of a large number of Weibo users who were not registered as Maimai users. Sina held that Maimai's actions constituted unfair competition and thus filed a lawsuit.
Claims	1. Taoyou Technology Company and Taoyou Technology Development Company should immediately stop the four actions of unfair competition; 2. Publish a statement in a prominent position on the homepage of www.maimai.cn and in the App for 30 consecutive days to eliminate the impact; 3. Compensate Weimeng for financial losses of RMB 10 million and reasonable expenses of RMB 300,000 (reasonable expenses include attorney fee of RMB 200,000, and notarization fee and other expenses of RMB 100,000).
Summary of first-instance judgment	1. The parties have competing interests in the use of relevant users' social networking information, etc., and have a competitive relationship; 2. The court analyzed the relationship between the data source of collaborative filtering algorithm used by Maimai and the accuracy of the calculation results shown by the evidence in this case, and accordingly judged that the non-Maimai user information in question was sourced from Sina Weibo; 3. During the cooperation period, Maimai illegally grabbed and used the occupation and education information of the Sina Weibo users in question; after the cooperation between the parties ended, Maimai failed to delete such information in time and continued to illegally use the user information of Sina Weibo in question; 4. User information can bring huge economic benefits to network platform operators. On the one hand, the scale and quality of user information reflect the activity of network platform users to a certain extent, affect the attractiveness of the network platform, so mastering more user information usually means having a larger user scale; on the other hand, user information is an important source for operators to analyze and sort out user needs, develop featured products and services, and improve user experience; 5. The subjective will of Internet application software operators to give full play to their wisdom, expand their business models, and try to attract and expand the user base as more as possible is legitimate, but they cannot illegally grab and use the user information and relationship of their competitors in a way that violates the user's right to know; 6. Internet operators must not only legally obtain user information, but also properly protect and use the same.

Summary of second-instance judgment	1. In the identification of unfair competition involving the acquisition and use of user information on the Internet, whether to obtain users' consent and whether to ensure users' free choice are universally recognized business ethics. In this case, Maimai, as a market operator, shall abide by recognized business ethics, perform the obligations stipulated in the agreement between the parties, and obtain users' consent when obtaining relevant information through the OpenAPI; 2. It is not an industry practice for Maimai to display the correspondence between the mobile phone address book and other APPs. The act of obtaining and displaying the correspondence damages the fair market competition order and the competing interests of Sina Weibo to a certain extent; 3. As data resources have become an important competitive advantage and commercial resource for Internet companies, in the Internet industry, corporate competitiveness is not only reflected in the technical equipment, but also in the scale of data it owns. Big data owners can get more data from the data they own and convert it into value. For social software, more users will attract more to register for use, and more active users will create more business opportunities and economic value. As a social media platform, Sina Weibo has 100 million monthly active users and tens of millions of average daily active users. As the operator of Sina Weibo, Weimeng owns the huge data of Sina Weibo users as its important commercial resources. User information serves as the foundation and core of social software to enhance corporate competitiveness; 4. Maimai's act of obtaining and using the correspondence between the contacts of non-Maimai users in the mobile phone address book of Maimai users and the Sina Weibo users without the consent of the Sina Weibo users and the authorization of Sina Weibo violates the principle of good faith and recognized business ethics, undermines the operating rules of OpenAPI, harms the reasonable, orderly and fair market competition order of the Internet industry, and damages the competitive advantages and commercial resources of Sina Weibo to a certain extent, and thus constitutes an unfair competition.
Judgment results	1. From the effective date of this judgment, the defendants Beijing Taoyou Tianxia Technology Co., Ltd. and Beijing Taoyou Tianxia Technology Development Co., Ltd. shall cease the acts of unfair competition in question; 2. Within thirty days from the effective date of this judgment, the defendants Beijing Taoyou Tianxia Technology Co., Ltd. and Beijing Taoyou Tianxia Technology Development Co., Ltd. shall jointly publish a statement on the unfair competition in this case on the homepages of Maimai website (www.maimai.cn) and Maimai APP for 48 consecutive hours to eliminate the impact for the plaintiff Beijing Weimeng Chuangke Network Technology Co., Ltd. (the content of the statement shall be reviewed by the court of first instance. In case of overdue non-performance, the court of first instance will publish the main content of the judgment in the relevant media according to the petition of the plaintiff, Beijing Weimeng Chuangke Network Technology Co., Ltd. at the expense of the defendants Beijing Taoyou Tianxia Technology Co., Ltd. and Beijing Taoyou Tianxia Technology Development Co., Ltd.); 3. Within ten days from the effective date of this judgment, the defendants Beijing Taoyou Tianxia Technology Co., Ltd. and Beijing Taoyou Tianxia Technology Development Co., Ltd. shall jointly compensate the plaintiff Beijing Weimeng Chuangke Network Technology Co., Ltd. for financial losses of RMB two million and reasonable expenses of RMB two hundred and eight thousand nine hundred and ninety eight; 4. Other claims of the plaintiff Beijing Weimeng Chuangke Network Technology Co., Ltd. are dismissed. The appeal is rejected and the original judgment is sustained in the second instance.a
Comment	In this case, it is determined that data constitutes an important commercial resource for and can bring huge economic value to a company, and it is emphasized that Internet operators must not only legally obtain user information, but also properly protect and use the same.

[Case 2]

Dispute over unfair competition in which "Baidu" collects user information of "dianping.com" through web crawlers (see: Judgment [(2015) Pu Min San (Zhi) Chu Zi No. 528] of the Shanghai Pudong New Area People's Court and Judgment [(2016) Hu 73 Min Zhong No. 242] of the Shanghai Intellectual Property Court

Fact of case	Baidu collects user reviews from dianping.com (operated by Hantao), and uses the collected data in Baidu Maps and other products. When users search for catering merchants through Baidu products, the collected information from dianping.com can be seen in the search results. Therefore, dianping.com believes that Baidu's use of crawler technology to collect and display a large number of user reviews from dianping.com in Baidu products constitutes unfair competition, and therefore files a lawsuit.
Claims	1. Baidu shall immediately cease unfair competition, that is, stop making and deleting the content involving unfair competition on the website (URL: www.baidu.com) and Baidu Maps APP operated by Baidu; 2. Jietu shall immediately cease unfair competition, that is, stop embedding and using related products and services of Baidu Maps containing infringing content on its website; 3. Baidu and Jietu shall jointly compensate Hantao for financial losses of RMB (the following currencies are the same) 90 million and Hantao's reasonable expenses for stopping infringements of RMB 453,470; 4. Baidu and Jietu shall publish an announcement in the China Intellectual Property News, and in prominent positions on the website homepages of Baidu and Jietu for thirty consecutive days to clarify the facts and eliminate adverse influence, with the content of announcement approved by Hantao in writing.
Summary of first-instance judgment	1. Baidu and dianping.com are almost the same in the service model of providing users with merchant information and review information, and thus have a direct competitive relationship; 2. As one of the company's core competitive resources, dianping.com's review information can bring the company a competitive advantage and thus has commercial value. dianping.com has paid a huge cost for its operation. In the case that it cannot obtain enough review information from its own users, Baidu uses technical means to obtain review information from websites such as dianping.com to enrich its Baidu Maps and Baidu Zhidao, which has caused damage to dianping.com; 3. The court holds that Baidu's extensive and full-text use of the review information in question violates the recognized business ethics and principle of good faith and is thus unfair.
Summary of second-instance judgment	1. Through long-term operation, a large amount of user review information has been accumulated on the website of dianping.com, which can bring traffic to the website, and has a certain influence on consumers' transaction decisions, making itself boast a high economic value; 2. When using information obtained by others, market entities must still follow generally accepted business ethics and use it within a relatively reasonable range; 3. Although Baidu's innovation in business model has improved the user experience of consumers to a certain extent, and thus has a positive effect. However, Baidu uses search technology to collect and display a large amount of full-text information from dianping.com, which this court holds has exceeded the necessary limit. This act not only harms the interests of dianping.com, but may also make other market entities reluctant to invest in information collection, thereby destroying the normal industrial ecology, and exerting a certain negative impact on the order of competition.

Judgment results	1. Baidu shall immediately stop using in an improper manner the review information from dianping.com operated by Hantao as of the effective date of the judgment; 2. Baidu shall compensate Hantao for financial losses of RMB 3 million and reasonable expenses of 230,000 for stopping unfair competition within ten days as of the effective date of the judgment; 3. Other claims of Hantao are dismissed. The appeal is rejected and the original judgment is sustained in the second instance.
Comment	In this case, the court determined that data such as user review information has high economic value, clarified that the information use should follow the principle of "minimum necessity", required market entities to follow generally accepted business ethics when using information obtained by others, and defined the judgment criteria for violation of business ethics.

In addition, data may also constitute a company's trade secrets, which is discussed in the trade secrets section.

7.2.2 Risk of Violation of Personal Privacy

Article 111 of the *Civil Code* provides that the personal information of natural persons shall be protected by law. The Data Security Law also stipulates that the state protects the rights and interests of individuals and organizations related to data. At the same time, the *Personal Information Protection Law* stipulates that the personal information of natural persons is protected by law, and no organization or individual may infringe upon the rights and interests relating to personal information of natural persons. Most of China's existing laws and regulations enumerate personal information. For example, Article 1034 of the *Civil Code* provides in the protection of personal information of natural persons that personal information refers to all kinds of information recorded electronically or in other ways that can identify a specific natural person alone or in combination with other information, including the natural person's name, date of birth, ID number, biometric information, address, telephone number, Email, health information, whereabouts information, and others. For private information in personal information, relevant privacy regulations apply; if there are no such regulations, the regulations on the protection of personal information shall apply. Meantime, as stipulated in Article 1032, privacy is the peace of private life of a natural person and his or her private space, private activities, and private information that he or she does not want to be known to others. The article also stipulates that natural persons have the right to privacy. No organization or individual may infringe the right to privacy of others by spying, intruding, leaking, or disclosing. The *Personal Information Protection Law* stipulates that personal information is a variety of information related to an identified or identifiable natural person recorded electronically or by other means, excluding anonymized information.

Therefore, it can be seen that personal information, whether private or not, can be protected by the Civil Code. In addition, the protection of portrait rights and other personality rights is separately defined. For example, Article 1019 defines the protection of portrait rights; no organization or individual shall infringe upon the portrait rights of others by defaming, defacing or forging by means of information technology. Supreme People's Court has also issued the *Regulations on Several Issues Concerning the Application of Law in the Trial of Civil Cases Related to the Use of Face Recognition Technology to Process Personal Information* to protect the "biometric information". We have already introduced that AI technology needs to collect a large number of personal information data such as names, certificate numbers, personal biometric information, etc. as basic support, so it is necessary to legally obtain personal information in strict accordance with the *Civil Code*, the *Personal Information Protection Law, the Data Security Law, Personal Information Security Specification* and other relevant

laws, instead of using, processing or transmitting, or illegally trading, providing or disclosing the personal information of others, so as to ensure that AI technology will not infringe upon the rights and interests relating to personal information of others. Article 253-1 of the Criminal Law stipulates that those selling or providing citizens' personal information for others in violation of relevant state regulations shall be sentenced to fixed-term imprisonment or criminal detention of less than three years, and/or a fine separately if the circumstance is serious; if the circumstance is particularly serious, they shall be sentenced to fixed-term imprisonment of more than three years but less than seven years, and a fine. Therefore, those violating the personal information of others will not only bear civil liability for infringement upon the civil rights of others, but may also bear criminal liability therefor.

Case Analysis:

[Case 1]

Guo Bing v. Hangzhou Safari Park Co., Ltd. service contract dispute (see Judgment [(2019) Zhe 0111 Min Chu No. 6971] of the Hangzhou Fuyang People's Court and Judgment [(2020) Zhe 01 Min Zhong No. 10940 of the Hangzhou Intermediate People's Court)

Fact of case	In April 2019, Guo Bing applied for the annual card of Hangzhou Safari Park, determined the way to enter the park by fingerprint recognition, Guo Bing and his wife left their names, ID numbers, phone numbers, etc., and recorded fingerprints and took photos. After that, Hangzhou Safari Park changed the way for annual card customers to enter the park from fingerprint recognition to face recognition, and replaced the store notice. In July and October 2019, Hangzhou Safari Park sent two text messages to Guo Bing to inform that the annual card system of the park has been upgraded to the entry mode of face recognition, the original fingerprint recognition has been cancelled, and from now on, users who have not registered for face recognition will not be able to enter the park normally. Guo Bing believed that personal biometric information is personal sensitive information, and once leaked, illegally provided or misused, it will easily endanger the personal and property safety of consumers, so he refused to activate face recognition, and filed a lawsuit upon failure of negotiation between the parties.
Claims	1. Confirm that the contents such as "activate the annual card after scanning the fingerprint" and "normally use with the annual card and fingerprint" in the notice on "Annual Card Application Procedures" of the defendant Hangzhou Safari Park are invalid; the content "cardholders must verify the annual card and fingerprints at the same time before entering the park" in the notice on "Instructions for Use of Annual Card" is invalid; 2. Confirm that the content "annual card users that haven't activated face recognition are advised to bring the physical card to the annual card center for activation" in the SMS notice sent by the defendant Hangzhou Safari Park to the plaintiff Guo Bing on July 12, 2019 is invalid; 3. Confirm that the content "the annual card system of the park has been upgraded to the entry mode of face recognition, the original fingerprint recognition has been cancelled, and from now on, users who have not registered for face recognition will not be able to enter the park normally" in the SMS notice sent by the defendant Hangzhou Safari Park to the plaintiff Guo Bing on October 17, 2019 is invalid; 4. Confirm that the contents such as "receive the annual card after face registration" and "enter the park with the annual card and by face scanning" in the notice on "Annual Card Application Procedures" of the defendant Hangzhou Safari Park are invalid; the content "cardholders must verify the annual card and face at the same time before entering the park" in the notice on "Instructions for Use of Annual Card" is invalid; 5. Order the defendant Hangzhou Safari Park to refund the annual card fee of RMB 1,360 to the plaintiff Guo Bing;

	6. Order the defendant Hangzhou Safari Park to compensate the plaintiff Guo Bing for the round-trip transportation fee of RMB 360 incurred from traveling to the defendant Hangzhou Safari Park on October 26, 2019, the round-trip transportation fee of RMB 400 incurred from traveling to the court for filing case on October 28, 2019, and other round-trip transportation expenses of RMB 400 incurred from traveling to the court for appearing in court and responding to lawsuit; 7. Order the defendant Hangzhou Safari Park to delete all personal information (including but not limited to name, ID card number, mobile phone number, photo, and fingerprint information) submitted by the plaintiff Guo Bing at the time of applying for the annual card on April 27, 2019 and using the same thereafter in the witness of a third-party technical organization, and bear the corresponding technical witness fee (subject to the actual expenditure on the date of witness); 8. The litigation costs in this case should be borne by the defendant Hangzhou Safari Park. Facts and grounds: The plaintiff Guo Bing purchased the annual card of Hangzhou Safari Park from the defendant on April 27, 2019, and paid the defendant an annual card fee of RMB 1,360. When the plaintiff applied for the annual card, the defendant made a clear undertaking on unlimited travel within the one-year validity period of the card (from April 27, 2019 to April 26, 2020).
Summary of first-instance judgment	1. The collection and use of personal information in the consumption field is not prohibited, but the supervision and management of the personal information processing process is emphasized in laws of China, that is, the “legal, legitimate, and necessary” principles and rules of obtaining the consent of the parties need to be followed at the stage of collection of personal information; in the controlling process of information, the principle of ensuring security must be followed, and personal information shall not be leaked, sold or illegally provided for others; when personal information is infringed, business operator shall take remedial measures and bear other corresponding infringement liabilities in accordance with the law; 2. In order to better perform the service contract in question, Hangzhou Safari Park collects the information in question with the consent of the party concerned when the contract is signed and concluded, so this court holds that the collection of information other than face recognition information complies with the aforementioned “legal, legitimate, and necessary” principles stipulated by laws; in the absence of evidence proving Hangzhou Safari Park has processed personal information in violation of laws or agreements, Guo Bing’s request to order Hangzhou Safari Park to delete relevant information lacks legal basis and is thus not supported by this court; 3. When applying for the annual card, the contracting party signed a service contract regarding an entry mode of fingerprint recognition, so Hangzhou Safari Park’s collection of the face recognition information of Guo Bing and his wife exceeded the requirements of the necessary principle and was not justified.
Judgment results	1. The defendant Hangzhou Safari Park Co., Ltd. shall compensate the plaintiff Guo Bing for the loss of contract interests and transportation expenses totaling RMB 1,038, which shall be paid off within ten days from the effective date of this judgment. 2. Within ten days from the effective date of this judgment, the defendant Hangzhou Safari Park Co., Ltd. shall delete the facial feature information including photos submitted by the plaintiff Guo Bing when he applied for the fingerprint-based annual card. 3. Other claims of the plaintiff Guo Bing are dismissed. Second-instance judgment: 1. Uphold items 1 and 2 of the first-instance judgment; 2. Revoke item 3 of the first-instance judgment; 3. Within ten days from the effective date of this judgment, Hangzhou Safari Park Co., Ltd. shall delete the fingerprint recognition information submitted by the plaintiff Guo Bing when he applied for the fingerprint-based annual card. 4. Other claims of Guo Bing are dismissed.

Comment	Although this case is a service contract dispute, it is called China's "first face recognition case" since it involves face recognition information, which defines the obligations and standards for collecting, using and keeping personal biometric information, emphasizes the importance of personal biometric information, and promotes the awareness of citizens to protect personal information.

7.2.3 Risk of Endangering National Security

The *Data Security Law* clearly stipulates that China implements a big data strategy, promotes the construction of data infrastructure, and encourages and supports the innovative application of data in various industries and fields; and China supports the development and utilization of data to improve the intelligence level of public services. Meantime, it also defines that data related to national security, the lifeline of the national economy, important people's livelihood, and major public interests belongs to national core data.

The data collected in AI technology not only contains personal information, but may also involve data in areas such as finance, energy, transportation, telecommunications, public security, genetic resources, etc. Meantime, the "model" of AI technology may also generate data in areas such as finance, transportation and telecommunications through personal information; for example, the application of AI technology in cancer diagnosis requires the transmission of patients' living habits, images, occupation and other background information in the early stage, which may involve important data in the field of genetics or biology, so an improper use or disclosure may also endanger national security.

Where the relevant act is serious, it may even constitute a crime. Article 111 of the Criminal Law provides that whoever steals, secretly gathers, purchases, or illegally provides state secrets or intelligence for an organization, institution, or personnel outside the country is to be sentenced from not less than five years to not more than 10 years of fixed-term imprisonment; when circumstances are particularly serious, he is to be sentenced to not less than 10 years of fixed- term imprisonment, or life sentence; and when circumstances are relatively minor, he is to be sentenced to not more than five years of fixed-term imprisonment, criminal detention, control, or deprivation of political rights. This is especially a reminder that in the implementation of AI technology, more attention should be paid to the risk of endangering national security when cross-border use of data is involved.

7.3 Data Compliance Suggestions in the Implementation of AI Technology

7.3.1 Legal Collection of Evidences based on the Principle of "Minimum, Necessity"

Do not collect personal information excessively, obtain the full authorization of the right holder when collecting data, ensure that personal information is collected by lawful means, do not illegally steal others' information, otherwise, the criminal liability may be borne due to violation of the provisions on the "crime of illegally obtaining citizens' personal information" set forth in the *Criminal Law.* At the same time, try to remove personal information or personal privacy from legally obtained data, so that the data used is not identifiable or related to individuals, so as to avoid infringing upon the rights and interests relating to personal information. The *Personal Information Protection Law* has revised and improved the personal information processing rules, requiring that the collection of personal information should be limited to the minimum scope for the purpose of processing, and personal information should not be collected excessively. Meantime, the *Personal Information Protection Law* recognizes the personal information of minors under the age of 14 as sensitive personal information. The collection of data of minors under the age of 14 requires the consent of their guardians, the establishment of special information protection rules, and the compliance with the *Law of the People's Republic of China on the Protection of Minors, Provisions on the Cyber Protection of Children's Personal Information* and other regulations.

7.3.2 Taking Necessary Measures to Prevent Improper Leakage

In accordance with Article 1038 of the Civil Code, the Personal Information Protection Law and the *Cyber Security Law*, take technical measures and other necessary measures during use and storage to ensure the security of personal information and prevent information leakage, tampering or loss, and do not illegally sell or illegally provide others with personal information, otherwise, the criminal liability may be borne due to violation of the provisions of the Criminal Law.

7.3.3 Complying with the Principle of Open Processing

Article 1034 of the Civil Code stipulates the restrictions on the processing of personal information, and Article 1037 stipulates the right of decision on personal information of natural persons. Chapter IV of the *Personal Information Protection Law* stipulates the rights of individuals in the processing of personal information, defines that individuals have the right to know, the right to decide on the processing of and the right to request deletion of their personal information, and improves the provisions on the protection of the personal information of the deceased. In the entire process of data collection, processing, and use, it is also necessary to comply with the principle of open processing, strictly follow such principle to ensure that the data subject is informed, and ensure that individuals have the right to control data by granting the rights to delete, modify, restrict processing, and portability of personal information.

7.3.4 Complying with Special Restrictions on Data Cross-border Transfer

In accordance with the Cyber Security Law and other provisions, strictly abide by the restrictions on the cross-border transfer of important data generated and produced in domestic operations. The Personal Information Protection Law stipulates that the competent authorities of the People's Republic of China shall handle requests from foreign judicial or law enforcement agencies for the provision of personal information stored in China in accordance with the relevant laws and international treaties jointly concluded or acceded to by the People's Republic of China, or based on the principles of equal footing and mutual benefit. Without the approval of the competent authorities of the People's Republic of China, personal information processors shall not provide personal information stored in the territory of the People's Republic of China for foreign judicial or law enforcement agencies. Personal information processors shall take necessary measures to ensure that the processing of personal information by overseas recipients meets the personal information protection standards under this Law. The *Interim Measures for the Management of Ride-hailing Business* Services also explicitly stipulates that the personal information collected and business data generated by ride-hailing platform can only be stored and used in mainland China, and in principle shall be provided overseas. Therefore, prior to cross-border transfer of data, it is necessary to define the restrictions on the cross-border transfer of data in this field; if personal information is involved, it is necessary to obtain the explicit consent of the personal information subject, conduct a security assessment on the personal information and impose restriction on the data recipient, and keep the cross-border transfer records of data such as personal information in accordance with relevant regulations. In addition, the *Several Provisions on Automobile Data Security Management (for Trial Implementation)* implemented on October 1, 2021 also emphasizes that while carrying out important data processing activities, automobile data processors should abide by the regulations on storage within the territory of China in accordance with the law, and strengthen the security protection of important data; if it is really necessary to provide important data abroad due to business needs, automobile data processors shall implement the requirements of the rules for security assessment of data cross-border transfer, shall not provide important data abroad in violation of regulations beyond the conclusion of safety assessment of cross-border transfer, and shall supplement relevant information in the annual report.

About the author

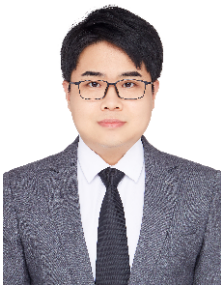
Wenjie LI

Attorney at law

Attorney Wenjie Li is currently mainly engaged in trademark, copyright and unfair competition business, including trademark administrative cases, e-commerce platform intellectual property protection and litigation cases.

Attorney Wenjie Li obtained a bachelor's degree in law from Macau University of Science and Technology and a master's degree in intellectual property law from Queen Mary, University of London. She has worked in a large domestic law firm, followed the team as perennial legal counsel to provide daily legal services, and participated in a number of civil and commercial litigation cases.

Hongzhan ZHANG



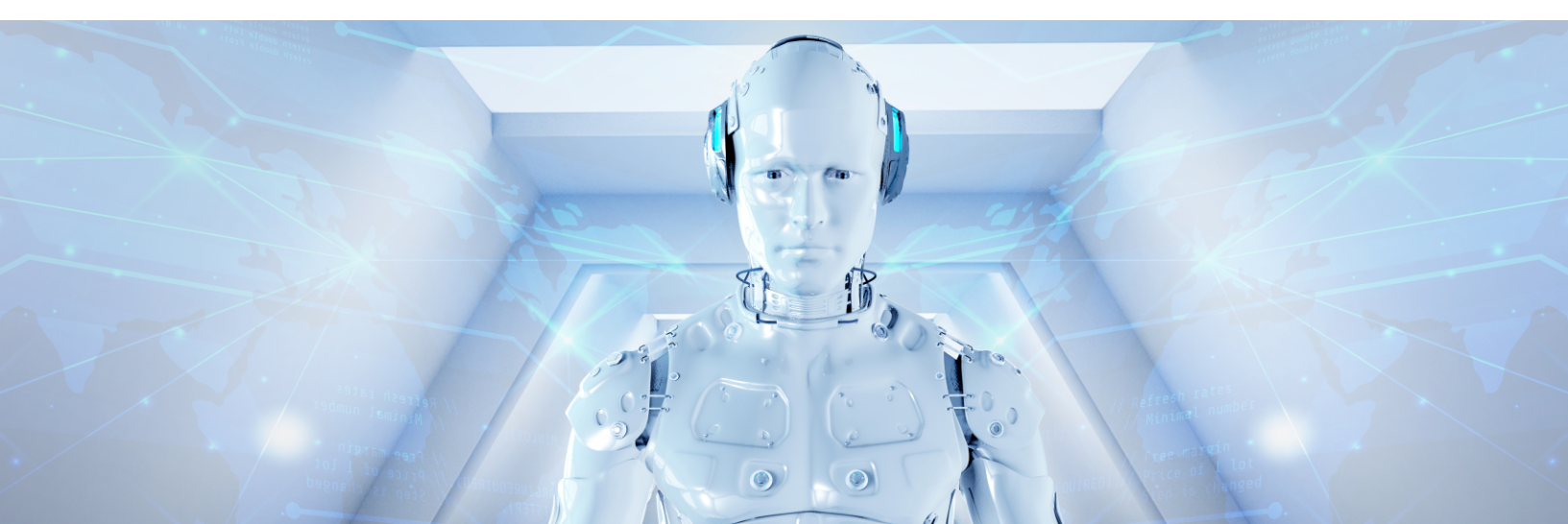
Mr. Hongzhan ZHANG has 13 years of working experiences in intellectual property. He worked in Beijing No.1 Intermediate People's Court and Beijing Intellectual Property Court for nearly 11 years, and tried nearly 1000 intellectual property cases and civil and commercial cases, including patents, trademarks, copyrights, monopolies, unfair competition, etc. Mr. HongZhan ZHANG is a veteran litigator in IP field with comprehensive experience in handling all kinds of IP-related disputes including but not limited to patent, trademark, copyright, trade secrets, unfair competition and anti-monopoly. With extensive experience in handling cases. Mr. HongZhan ZHANG has deep insights into the IP protection system in China and fully developed the ability to understand technical problems smoothly and properly. Being familiar with judicial requirements and standards, Mr. HongZhan ZHANG is particularly experienced in designing proper litigation strategy to achieve satisfactory results.

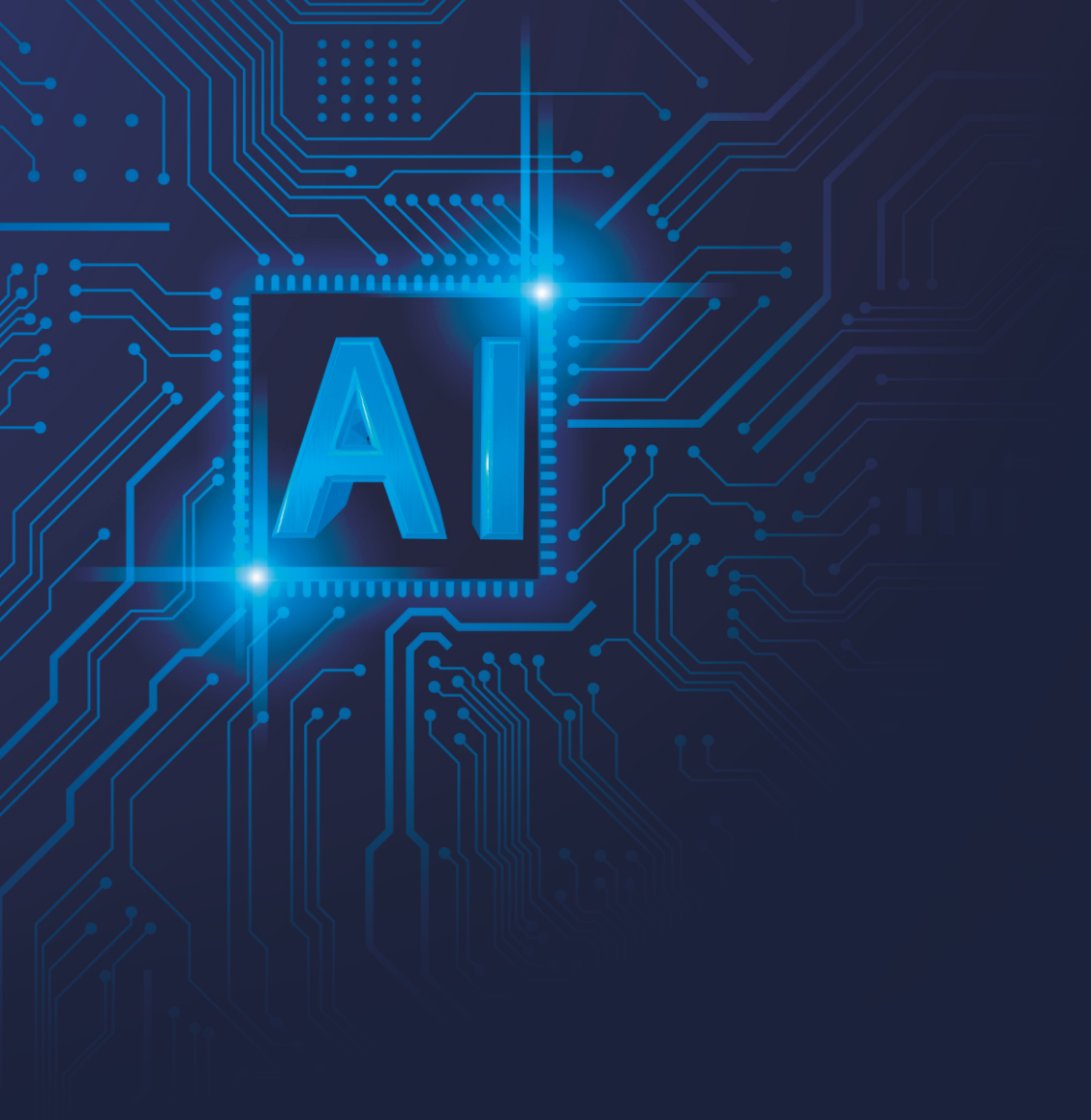
Postscript

With the benefit of the development of three basic elements of the artificial intelligence field, namely, the computing power, the data and the algorithm under the Moore's law, the artificial intelligence technology becomes a strategic technology for leading a new round of technological revolution and industrial change. Under the drive of new theories and new technologies, for example mobile internet, big data, super-computing, sensor networks, brain science, etc., the artificial intelligence develops rapidly and presents the new characteristics such as deep learning, cross-border fusion, man-machine cooperation, group intelligence openness, autonomous control and the like, which is exerting great and profound influence on the aspects such as economic development, social progress, international political and economic situation and the like.

With the coming of the artificial intelligence era, a plurality of brand new subjects are brought into the field of intellectual property protection. How are the subject of intellectual property associated with artificial intelligence techniques defined within the framework of existing intellectual property systems? Which branches of the artificial intelligence technique belong to which rights objects? How does the innovative body of artificial intelligence select and acquire the appropriate rights forms in a stereoscopic scheme for intellectual property protection? How to apply the acquired relevant intellectual property rights while avoiding the risk of possible infringement of intellectual property rights? And how can artificial intelligence techniques be developed and deployed legally and conformably within the legal systems? What are the differences in the related patent practices of the artificial intelligence technology in the main jurisdictions of China, US, Europe, Japan, and Korea? The above concerns of the innovative body of the artificial intelligence industry and the intellectual property practitioners all involved in this report and it is desirable to provide beneficial inspirations to the readers.

Under the current global economic integration trend, the intellectual property rights may exceed the tangible assets to become the key factors for promoting economic development, and the protection of the intellectual property rights also becomes an inevitable trend of scientific and technological competition. The intellectual property law is deemed as a constitution of the property world and can promote harmony of the intellectual property world and even the joint development of global economy and technology. What intellectual property law is needed is a problem to be considered in the artificial intelligence era. The global legal professionals and intellectual property practitioners have worked extensively and deeply around this problem, which has also become the basis of the report. For the intellectual property protection of artificial intelligence, we have taken a great step, however, everything may just start.





Intellectual Property Protection of Aritfical Intelligence

（2021年）

LIU SHEN
Intellectual Property
柳沈律师事务所