Patentability Analysis of Artificial Intelligence and Big Data Patent Applications

Li Xiaoqing, Zhang Xiaoxia

China National Intellectual Property Administration, Beijing, China

Abstract: With the flourishing development of artificial intelligence and big data, the number of patent applications has also increased significantly. Since most improvements in the development of artificial intelligence and big data involve mathematical algorithms improvements, the patentability of such developments have been controversial in many countries. The purpose of the patent law is to protect technological innovation, but it does not clearly define what constitutes technology. Whether a patent application constitutes a technical solution is a major reason for the dispute over whether artificial intelligence and big data patent applications can be granted patent rights. This article discusses whether this type of applications can be granted patent rights from the standpoint of patent legislation and the three levels and three dimensions involved in the artificial intelligence patent applications, and gives the relevant analysis of the patentability.

1. Research on the patentability of artificial intelligence and big data patent applications

1.1 The legal basis for the patentability of artificial intelligence and big data patent applications in CNIPA

Most of the patent applications for artificial intelligence and big data involve algorithm innovation. However, algorithm innovation itself is not protected by patent law, which casts a shadow over the patentability of artificial intelligence big data patent applications.

According to Article 5, Article 25, and Article 2, Paragraph 2 of the Chinese Patent Law, the patentability of artificial intelligence and big data patent invention applications shall be examined [1]. Article 2, Paragraph 2 of the Patent Law defines inventions and technical solutions. Inventions refer to new technical solutions proposed for products, methods, or improvements thereof. A technical solution is a collection of technical means utilizing natural laws adopted to solve technical problems. Patent applications that conform to Article 5 and Article 25 of the Patent Law and patents that do not meet the provision of Article 2, Paragraph 2 of the Patent Law cannot be granted patent rights.

1.2 The legal Basis for Patentability of Artificial Intelligence and Big Data Inventions Patent Applications in Europe, America, Japan, and South Korea

In the object judgment, the European Office requires that the entirety of the claims shall not belong to the "non-invention" as defined in Article 52(2) and (3) of the EPC [2] (corresponding to Article 25 of the Chinese Patent Law) Unlike the judgment of the three elements (technical problem, technical means, and technical effect) used by CNIPA, the EPO has a lower standard when judging the object. Once the judgment scheme contains technical features, it will enter the step of inventiveness judgment, but the EPO has stricter standards for the judgment of inventiveness.

Since the 1970s, the rules for judging the subject of patent protection in the United States have undergone three important changes [3]: the first was the MoT standard, the second was the "useful, specific, and tangible" standard, and the third was the framework for judging patent eligibility established in the most influential Alice case has been followed by courts at all levels [4]. Compared with CNIPA, USPTO's current object judgment criteria also require the combination of algorithmic features and application fields reflecting the improvement of computer functionality. However, the US has enacted the "Restoring American Leadership in Innovation Act" and the "Patent Eligibility Restoration Act of 2022" in 2021 and 2022 respectively, aiming to restore patent protection to a broader range.

When conducting the substantive examination of patent applications involving algorithms, both the Japanese Patent Office and the Korean Intellectual Property Office base their judgment criteria on the "specific implementation of hardware resources for information processing using the software." The difference between the two lies in the fact that the Japanese Patent Office considers an algorithm a statutory invention as long as it can be implicitly inferred that it is implemented in hardware, while the Korean Intellectual Property Office requires software and hardware to work together to build a unique information processing method or device for implementation and use purposes, based on the algorithm being implemented in hardware.

From the above comparison, it can be concluded that each country has different standards for patent examination subject to the constraints of their respective legal systems. The handling of patent applications in the same family varies in different countries.

2. Analyze the three-level and three-dimensional analysis method from the source of patent law

Although major countries and regions have established the "technical" requirements for obtaining patent protection, they have not defined "technology". [5] The premise of patentability in China is a new technical solution for a product, method, or improvement, and the solution needs to be technical. To provide more effective protection for algorithmic innovations under the existing patent system, it is necessary to analyze the "technicality" requirement of patentable objects and the circumstances under which algorithmic innovations meet this requirement.

2.1 The relationship between technical solutions and technical features

Technical solutions and technical features are commonly used terms in patents, but they have essential differences in legal certainty. Technicality is the primary condition for judging whether an artificial intelligence big data patent application is patentable. The technical solution is a collection of technical means that utilize the laws of nature to solve the technical problem. The technical means are composed of technical features. Technical features, technical problems, technical effects, and technical fields are all related factors under the concept of technical solutions, which do not have the legal significance of final judgment [3].

When examining whether a claim containing algorithmic features is a technical solution, all the features described in the claim need to be considered as a whole. If the claim records that a technical means utilizing the laws of nature is adopted for the technical problem to be solved, and thus a technical effect conforming to the laws of nature is obtained, the solution defined in the claim falls under Article 2, Paragraph 2 of the Patent Law. The technical solution [1] specifically in the field of artificial intelligence big data, technical features and algorithmic features, and ruled method features are considered as a whole. Whether technical features combined with algorithms constitute a technical solution needs to be considered in conjunction with whether the problem it solves is a technical problem and whether it achieves technical effects.

2.2 Three-level and three-dimensional analysis of artificial intelligence big data patent patentability and cases

The objects processed by the computer are divided into two types: external objects and internal objects. Artificial intelligence and big data invention patent applications generally involve three levels, namely algorithm level, external object level, and internal object level.

The first dimension of judging the patentability of a patent application for artificial intelligence big data is the technicality of the solution requested for protection, that is, judging whether the solution includes technical features and whether the technical features constitute a technical means, which is mainly used to analyze algorithmic layer applications. Such solutions belong to the rules and methods of intellectual activities, which do not comply with the provisions of Article 25 of the Patent Law, nor do they constitute technical solutions, and do not comply with the provisions of Article 2, Paragraph 2 of the Patent Law.[6]

The second dimension for judging the patentability of artificial intelligence big data patent applications is the relationship between "algorithms + technical features" and technical problems. Based on the solution including technical features, it is judged whether the technical problem is solved. It constitutes a technical solution, which is mainly used to analyze patent applications involving external objects in the field of artificial intelligence big data. Conversely, if the solution does not solve the specific technical problem, it is not patentable and does not meet the provisions of Article 2, Paragraph 2 of the Patent Law.

The third dimension for judging the patentability of artificial intelligence big data patent applications is the relationship between "algorithms + technical features" and technical effects. Based on the technical features of the solution, it is judged whether the technical effects have been obtained, whether the internal performance of the computer has been improved, etc. It is mainly used to analyze patent applications involving internal objects in the field of artificial intelligence big data. If the "algorithm + technical features" achieves the technical effect of improving the internal performance of the computer, it constitutes a technical solution as stipulated in Article 2, Paragraph 2 of the Patent Law.

Case 1 involves a neural network pruning method, which is characterized in that it includes: obtaining the target neural network; pruning each network layer in the target neural network separately; clustering each filter in any one of the network layers into a target number of categories; removing filters with non matching contribution from the number of target categories; training the pruned target neural network. According to the three-level three-dimensional analysis method, the analysis of the features described in the claims only involves the channel pruning algorithm, which belongs to the algorithm layer. The channel pruning of the original neural network model and the adjustment of the weights to obtain the pruned network model are the pruning of the neural network, etc. All are not technical features. The first dimension is not technical and belongs to the rules and methods of intellectual activities stipulated in A 25 of the Patent Law. A solution composed of a

combination of non-technical features cannot solve a technical problem, nor can it achieve a technical effect. A technical solution does not comply with the provisions of A2.2 of the Patent Law.

Case 2 involves an image classification method, which is characterized in that it includes: obtaining at least one image sample; using a preset image classification model to obtain a feature map; performing area division on the feature map, and calculating the sampling probability of each feature area; sampling the target feature area; filtering out other feature areas; clearing the feature values of the other feature areas to obtain the cleared feature map; the preset image classification model is trained to obtain the image classification model after training. According to the three-level three-dimensional analysis method, an image classification method involves image processing of external objects. Then analyze whether the technical feature combination algorithm included in the claim solves the technical problem of external object processing. In this case, firstly determine whether the "feature map" has a technical meaning. According to the technical feature "using the preset image classification model to perform feature extraction on the image sample to obtain the feature map corresponding to the image sample", it can be seen that the feature map is the feature map of the image sample, which has an exact technical meaning and clarifies the definition of the image classification method. The data processed in each step is the feature map of the image data and how each step processes the image data. This solution solves the problem of inaccurate image classification by an image classification model caused by a random selection of image feature map elements, which belongs to the technical problem in the field of image processing.It can be seen from the analysis that the technical features in the solution of this application combined with the algorithm solve the technical problem of external object processing, constitute a technical means, and belong to the technical solution.[7]

Case 3 relates to a model pruning method for reducing the power consumption of a ReRAM-based CNN accelerator. It comprises the following steps: determining the number of layers of the CNN convolutional neural network and setting the pruning order of the layers of it; performing a slice sparse of the convolutional neural network for each layer in order at the granularity of the array size of the ReRAM accelerator; obtaining the pruning strategies of each said network block respectively according to the weight corresponding to each said network block, and each said pruning strategy determining the pruning quantity and pruning amount of said network block location, filtering said pruning strategy for bit pruning using said performance constraints of said network block as optimization conditions; freezing the pruning scheme that has been pruned. According to the three-level three-dimensional analysis method,the model pruning method includes technical features: segmenting and sparsing the convolutional neural network of each layer in sequence with the array size of the ReRAM accelerator as the granularity, obtaining multiple network blocks and obtain the corresponding weight of each network block. The model pruning method has a specific technical relationship with the internal structure of the computer system, and ReRAM is not just an algorithm execution carrier. The effect achieved is: the data conversion and array power consumption overhead of ReRAM are greatly reduced, and the automatic optimization efficiency based on model accuracy and power consumption overhead is higher, thereby obtaining the technical effect of improving the internal performance of the computer system. Therefore, the claim complies with the provision of Article 2, Paragraph 2 of the Patent Law and is patentable.

3. Conclusion

Artificial intelligence big data patent applications generally involve three levels: algorithm, external object, and internal object layers. The first dimension is the technicality of the recorded

features; The second dimension is to judge the relationship between technical features and technical problems, i.e., whether "algorithm + technical features" solves technical problems. The third dimension is to judge the relationship between technical features and technical effects, that is, whether "algorithm + technical features" has achieved technical effects. Only when the three dimensions are satisfied at the same time can a patent application be granted. (See Table 1)

Table 1: Three levels and three dimensions patentability judgement mehod for Al patent applications

Three Levels	Three-Dimensional Relationship	Analyzing Conditions	In Conclusion
External Object Layer	Whether the first and the second dimension meet technical requirements	"Technical Features + Algorithm" solves technical problems for external object processing	Technical solutions comply with Article 2, Paragraph 2 of the Patent Law
		"Technical Features + Algorithm" does not solve the technical problems of external object processing	Technical solutions do not meet the provision of Article 2, Paragraph 2 of the Patent Law
Algorithm Layer	The first, second, and third dimensions meet technical requirements	Contains only algorithm improvements	Belong to Article 25 of the Patent Law and do not meet the requirements of technical solutions stated in Article 2, Paragraph 2 of the Patent Law
Inner Object Layer	Whether the first and the third dimension meet technical requirements	"Technical features + algorithm" achieves the technical effect of improving the internal performance of the computer system	Technical solutions comply with Article 2, Paragraph 2 of the Patent Law
		"Technical features + algorithm" did not achieve the technical effect of improving the internal performance of the computer system	Technical solutions do not meet the provisions of Article 2, Paragraph 2 of the Patent Law

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