Patenting Artificial Intelligence General Algorithm in China: Tailored Solutions Needed

Featured Article

【**Abstract**】The landscape for protecting inventions relating to artificial intelligence general algorithms is still developing in China. This article analyzes two cases to illustrate the negative and positive implications of obtaining patent protection for inventions relating to general algorithms, and accordingly provides recommendations for drafting patent applications to meet the patentability criteria.

I. General Principles

Abstract algorithms belong to the rules and methods of mental activities, and thus are not patentable subject matter under the Chinese Patent Law.[1] When an algorithm is applicable to a specific application field and a claim recite both technical features and algorithmic features, the claims shall not be rejected for unpatentable subject matter under Article 25, paragraph 1(2) of the Patent Law. Rather, the claim shall be assessed regarding whether it is directed to a technical solution stipulated by the second paragraph of Article 2 of the Patent Law. The assessment involves a determination on whether the algorithm is closely integrated with the specific technical field, for example, various steps of the algorithm in the claim are closely related to a technical problem to be solved. In this aspect, the technical solution criteria would be met if the claim records that the technical problem to be solved adopts technical means using natural laws, and that the technical effect that conforms to the laws of nature has been achieved. [2]

With the development of artificial intelligence technology, applicants have submitted a large number of patent applications involving algorithms. Some algorithms can be applied to a variety of technical fields and thus belong to general algorithms. Many applicants are reluctant to recite a specific application field in claims for the purpose of not limiting the scope of patent protection, which, however, may result in the granted claims being amended to a narrower scope during substantive examination, or even in a final rejection for failure to comply with the provisions on patentable subject matter.

Therefore, issues arise regarding how to obtain an appropriate protection scope for inventions relating to general algorithms. The cases discussed below would shed some light upon the issues.

II. Case Analysis

To meet the technical solution criteria set forth in the Patent Law, some applicants combine algorithms with a computer technology field and hope that all solutions that execute the algorithm through computers would fall into its protection scope.

[1]Patent Law of the People's Republic of China 2009 [M]. Beijing：Intellectual Property Publishing House，2010

[2]State Intellectual Property Office：Guidelines for Patent Examination 2020 Intellectual Property Publishing House Chapter 9 Part II

【**case 1**】

This case involves the improvement of artificial neural network algorithms. The problem to be solved in the prior art is that the neural network will perform a reshape operation every time it forwards. For the processor, the reshape operation requires resetting all operators and tensors resources, and then calculate. Due to repeated reshaping, the amount of calculation is large, and the resource occupancy rate is high.

The independent claim of this case is：

1. A method of data processing, the method comprising:

obtaining a remodeling identification value corresponding to each layer of the network; wherein the remolding identification value is used for indicating whether each layer of the network executes remolding operation;

when the remodeling identification value is a first preset value, determining that the layer corresponding to the first preset value does not need to perform remodeling operation, and directly performing forward reasoning operation of each layer corresponding to the first preset value based on input data of the network.

The algorithm in this case is a typical general algorithm. The applicant's main product is an artificial intelligence chip, and the data processed by its product is not limited to specific application areas. Therefore, the applicant tried to apply the algorithm to computer technical fields during drafting the application.

In the process of substantive examination, the examiner pointed out that the method claimed in the claims of the application was not applied to specific technical fields to solve technical problems, did not include technical means, and did not achieve technical effects, and did not comply with the provisions of Article 2, paragraph 2 of the Patent Law. , In the end the application was not allowed.

This case reflects a misunderstanding that some applicants and patent attorneys may have: as long as the specification and claims add the limitation of "applied to computer/processor" or the executing body of each step of the method is a "computer", the requirement of combination of algorithms and computer technology is satisfied.

However, the examiner generally believes that such a solution does not meet the requirements of the close integration of algorithms and computer technology, and still regards it as an algorithm executed by a computer.

Specifically, regarding the technical problem, the applicant believes that the technical problem to be solved is that the neural network is repeatedly reshaped when processing data, resulting in a large amount of computer calculation and a high resource occupancy rate. Computer calculations and resource occupancy are objective and conform to the laws of nature, which are technical problems. The examiner believes that the problem it solves is that the algorithm itself causes a large amount of computer calculations and a high resource occupancy rate. What it solves is the problem of the algorithm itself, which is not a technical problem.

Regarding the technical means, the applicant believes that the various steps of the algorithm executed by the computer include technical features and can solve the above technical problems as a whole, so it has technical means. From the examiner's point of view, although the executive body of each step is defined as an electronic device in each embodiment, the algorithm is described in detail in combination with multiple flowcharts in the specification, but the solution is described from the perspective of the algorithm. In this way, the disclosed solution is essentially an algorithm, and does not reflect the close integration of the algorithm and the technical field.

Regarding the technical effect, the applicant argued that by running the algorithm-related program through the computer, the technical effect of less calculation amount, fast processing speed, and less resources such as memory usage was achieved. The examiner believes that the

effect is due to the algorithm improvement itself and is not a technical effect.

Some applicants tried to argue that through the above-mentioned solutions, the effects of less computation, fast processing speed, or less memory occupation were achieved, which belonged to the improvement of the internal performance of the computer system specified in the guidelines for patent examination, and therefore belonged to the technical solution. However, the examiner believes that the internal performance improvement effect of the computer system must be obtained by improving the computer system, architecture, hardware, or instructions, etc. based on the algorithm. If the disclosed solution does not disclose the setting or adjustment of the various components of the computer system based on the algorithm, the effect obtained is determined, by the examiner to be the effect of the algorithm improvement itself, and does not belong to the improvement of the internal performance of the computer system as stipulated in the guidelines for patent examination.

【Case 2】

This case provides an enhanced neural network with external memory, neural networks are machine learning models that employ one or more layers of nonlinear units to predict the output for a received input. Some neural networks include one or more hidden layers in addition to an output layer. The output of each hidden layer is used as input to the next layer in the network, i.e. the next hidden layer or output layer. Each layer of the network generates an output from the received input in accordance with current values of the respective set of parameters.

The independent claim of this case is as follows：

1. An augmented neural network system for processing a sequence of system inputs to produce a sequence of system outputs, the augmented neural network system comprising:

A neural network, wherein the neural network is configured to receive a sequence of neural network inputs and to process each neural network input to generate a neural network output from the neural network inputs; an external memory; and

A memory interface subsystem, wherein the memory interface subsystem is configured to: performing, for each of the neural network outputs, operations comprising: providing an output derived from a first portion of the neural network outputs as a system output in the sequence of system outputs; for each of a plurality of locations in the external memory, determining one or more sets of write weights from a second portion of the neural network output; Writing data defined by a third portion of the neural network output to the external memory according to the set of write weights; for each of the plurality of locations in the external memory, determining one or more sets of read weights from a fourth portion of the neural network output; Reading data from the external memory according to the read weight set; and combining the data read from the external memory with a next system input in the sequence of system inputs to generate a next neural network input in the sequence of neural network inputs.

The subject matter of claim 1 of this case is a neural network system, which includes a general neural network and an external memory. The improvement is mainly in the operation performed by the memory interface subsystem, which is essentially a general algorithm.

In the process of substantive examination, the examiner did not raise objections of patentable subject matter and directly evaluated the novelty and inventive step of the solution, and the application was finally granted. Let's look at how to overcome the patentable subject matter objection through an analysis.

In the specification of the application, it is clearly stated that the enhanced neural network system is a machine learning system that receives system input sequences and generates system output sequences from system inputs; the enhanced neural network system can be

configured to receive any kind of digital data input and to generate any kind of score or classification output based on the input. Moreover, it also describes by way of example, the input of images, Internet resources (for example, web pages), documents, impression scenes of specific advertisements, characteristics of personalized recommendations for users, texts, spoken words, spoken word sequences, etc., and the resulting output. It's also pointed out that the enhanced neural network system can be a part of speech synthesis system, video processing system, dialogue system, automatic completion system, text processing system, or reinforcement learning system.

Through the above content recorded in the specification, on the one hand, it discloses the combination of the algorithm and the specific technical fields, and on the other hand, it provides example support for the larger protection scope of the claims, so that the examiner is more likely to accept claims with larger protection scope.

The specification describes the implementation of the algorithm steps based on the system architecture in combination with each flow chart. The entire solution seems to be based on the hardware system. If it is regarded as the realization of a computer system (for example an artificial intelligence chip), the neural network operates the external memory through the memory interface subsystem, and discloses the settings or adjustments of the various components of the computer system based on algorithms, rather than pure algorithms. It satisfies the combination of algorithms and computer specific fields, thus it meets the requirements of patentable subject matter examination.

The protection scope of the claims is further analyzed. The neural network has little limitation. Memory is an indispensable feature for data storage. Although the "external" limitation is added in front of the memory, since the neural network itself is not clearly defined,

the "external memory" can be interpreted with greater flexibility; the protection scope of the claims is mainly limited based on the steps executed by the memory interface subsystem, and the protection scope is large, and the solutions involving algorithms are relatively well protected.

The above case provides enlightenment to patent attorneys when drafting patent applications involving general algorithms: solutions involving general algorithms usually include data reading and algorithm-related data processing. Referred to case 2, a claim that includes a main body of the algorithm (such as neural network), data reading interface system and memory part, can not only overcome the patentable subject matter issues, but also obtain a larger scope of protection.

III. Recommendations to Drafting

In view of the cases above, when drafting an application on inventions involving general algorithms in drafting applications, one should include the following processing methods:

(i) Provide examples of combining algorithms with various application fields in the specification, such as image processing, voice processing, text processing, network data processing, database data processing, etc.; and make a high-level summary of various application fields, or a technical fields defined by the specification itself , such as the field of artificial intelligence, to include as many application fields as possible through examples and explanations. It is recommended to adopt different levels for the upper level of the application field, so as to have more freedom and flexibility in the substantive examination process, and strive for the most beneficial scope of protection for the applicant.

(ii) Closely integrate algorithms and computer/processor/chip (or artificial intelligence chip) technology fields. The so-called close integration of algorithm and computer/chip technology requires a description of how to implement the algorithm

under the computer/processor/chip system and architecture, so that the solution containing the algorithm becomes a function/part of the computer/processor/chip.

For example, for case 1, the implementation of interfaces/API/instructions can be provided based on the computer/processor/chip architecture, so that any neural network, if necessary, can be set by calling the specific interface/API/instruction And obtain the reshaping identification value corresponding to each layer of the network, so as to determine whether each layer of the network performs the reshaping operation according to its corresponding reshaping identification value.

Or the artificial intelligence chip provides the function of performing the reshaping operation, the API/interface corresponding to the reshaping operation, by adding the reshaping identification value parameter in the realization of the reshaping operation API/interface, and determining the various layers of the network according to the parameter whether to perform the reshaping operation, to realize the close integration of the algorithm and the specific technical field.

(iii) Refer to case 2, provide an algorithm implementation including hardware (such as memory). The solution realized in this way includes the interaction of hardware and various main parts, and is no longer a pure algorithm, so that it is possible to overcome the subject matter objection and obtain a larger scope of patent protection.

Through the above-mentioned various methods, we can strive for a relatively large scope of patent protection while avoiding the patentable subject matter issue.

IV. Conclusion

Artificial Intelligence (AI) is a new technological science that studies and develops theories, methods, technologies, and application systems used to simulate, extend, and expand human intelligence. Artificial intelligence is a branch of computer science. It attempts to understand the essence of intelligence and produce a new intelligent machine that can respond in a similar way to human intelligence. Research in this field includes robotics, language recognition, image recognition, Natural language processing and expert systems, etc.[3]

Although it has been recognized academically that artificial intelligence is a technical science, in the practice of patent examination, artificial intelligence is an attempt to realize human intelligence through computers, and it cannot completely fall into the category of natural laws, therefore, solutions involving artificial intelligence are not of course deemed to be technical solutions.

Of course, there is a gradual process of technological development and human cognition. It is believed that as artificial intelligence technology is more and more deeply integrated into all aspects of human production and life, it will be recognized as a technical solution like computer and image processing technology. Solutions that include artificial intelligence algorithms will also get better and more comprehensive protection.

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[3]Baidu Encyclopedia: Artificial Intelligence

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Mr. Sun's practice mainly focuses on patent prosecution. He has successfully represented major corporations, especially telecommunications, computer software and hardware companies, in patent prosecution. He has handled hundreds patent filings and prosecuting cases covering various technical fields, particularly the fields of artificial intelligence, pattern recognition, computer software and networks, telecommunications, semiconductor, e-commerce and automation technologies in China and many countries outside of China, such as the USA, Europe and India etc. since 2005 when he started his patent profession. He also provides Intellectual property legal services to clients, such as patent search, patent infringement analysis, patent design around, patent reexamination, patent invalidation and patent litigation etc.

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