Bloomberg Law

Corporate Practice Portfolio Series - Portfolio 113: Artificial Intelligence and Machine Learning

Detailed Analysis, Section IV.D. Japan

Introductory Material

IV. International Considerations

Mark Richardson, Esq.
Richard Lawrence, Esq.
Dr. Toby Mak, Esq.
Tad Itoh, M.I.P., Esq.
Alex (YoungGun) Song, Esq.
Pravin Anand, Esq.
Ms. Vaishali Mittal
Santosh Chari, Esq.

Detailed Analysis IV.D. Japan

D. Japan

Tad Itoh, M.I.P., Esq.

1. "Statutory invention" issues related to patenting artificial intelligence and machine learning inventions

a. Statutory Invention —

The scope of claims for AI/machine learning-related inventions (hereinafter referred to as "AI-related inventions") is often described as computer software-related inventions (i.e., inventions using computer software in the working of the inventions) and thus the patentability of the subject matter is determined in the same way as other computer software-related inventions by the following procedure.

First, in the Examination Guidelines of the Japanese Patent Office (JPO), "Part III Chapter 1 Eligibility for Patent and Industrial Applicability" sets forth six categories of patent ineligible subject matter. If the claimed AI-related invention does not fall under any of the categories of patent ineligible subject matter, the invention is deemed to satisfy the requirements for patent eligible subject matter without further need to consider the subject matter from the viewpoint of computer software. Claimed inventions are not patent eligible if they fall within any of the following six categories: (1) they are directed to laws of nature as such; (2) they are mere discoveries and not creations; (3) they are contrary to the laws of nature; (4) they do not utilize the laws of nature; (5) they are not regarded as technical ideas; or (6) it is clearly impossible to solve the problem at issue by any means presented in a claim.

Second, if it cannot be clearly determined whether the claimed invention falls within any of the categories (1) to (6) above, it is considered according to 2.1.1.2 of Appendix B of the Examination Handbook of the JPO ("Idea based on the standpoint of software") and if "information processing by software is concretely realized using hardware resources" in the claimed AI-related invention, that is, calculation or processing of information specific to the purpose of use is realized by concrete means or specific procedures in cooperation with software and hardware resources, it satisfies the requirements for eligibility for a patent.

Inventions utilizing the laws of nature as a whole and being considered as a "creation of a technical idea utilizing

the laws of nature" constitute a statutory "invention" without being examined for subject matter eligibility from a viewpoint of computer software, even though they utilize computer software. For example, (i) those concretely performing control of an apparatus (e.g., rice cooker, washing machine, engine, hard disk drive, chemical reaction apparatus, nucleic acid amplifier, etc.), or processing with respect to the control, and (ii) those concretely performing information processing based on the technical properties such as physical, chemical, biological or electric properties of an object (e.g., rotation rate of engine, rolling temperature, relation between gene sequence and expression of a trait in a living body, physical or chemical relation of bound substances, etc.), are recognized as "a creation of technical ideas utilizing a law of nature" and thus constitute a statutory "invention".

b. Case Examples —

(1) Case A: Sugar Content Data of Apples and a Method for Predicting Sugar Content Data of Apples

[Claim 1]

Sugar content data of preharvest apples on trees measured by a portable sugar content sensor for apples which performs reflective near-infrared spectroscopic analyses.

[Claim 2]

The sugar content data of apples as described in Claim 1 received by a receiving unit of a server and stored in a memory unit of the server.

[Claim 3]

A method for predicting sugar content data of apples comprising:

> a step in which an analyzing unit of the server analyzes the relationship between sugar content data of preharvest apples for specified periods and data on meteorological conditions, and sugar content data of apples at the time of their shipping, based on past performance;
>
> a step in which the receiving unit of the server receives the sugar content data of apples for specified periods as described in Claim 1; and
>
> a step in which a prediction unit of the server predicts and outputs sugar content data of apples at the time of future shipping using the received sugar content data of apples for specified periods and data on past and future meteorological conditions as inputs, based on the analyzed relationships.

Claim 1 does not specify any means for presenting sugar content data of apples or methods for presenting the sugar content data. It can be said that the apple sugar content data recited in Claim 1 is characterized only by the content of information such as "sugar content data of preharvest apples, measured by a portable sugar sensor for apple that performs reflective near-infrared spectroscopy." Accordingly, the apple sugar data as recited in Claim 1 does not relate to a technical feature regarding the presentation of information, but instead only relates to the content of presented information, and the main purpose of the presentation is to present information to a user.

Accordingly, the sugar content data of apples described in Claim 1 merely relates to the presentation of information, and is not considered to be an "invention" as a whole, or a creation of technical ideas utilizing a law of nature.

Claim 2 specifies that the sugar content data of apples recited in Claim 1 is "received by the receiving section of the server and stored in the memory section of the server." However, because no means or method for presenting

sugar content data of apples are specified, it can be said that only the content of the information is characterized. Accordingly, the sugar content data of apples described in Claim 2 does not have a technical feature that relates to the presentation of information (presentation means or method of presentation per se), but only relates to the content of the presented information, and the main purpose of the presentation is to present information.

Accordingly, the sugar content data of apples in Claim 2 does not relate to a technical feature regarding the presentation of information, but instead only relates to the content of presented information, and the main purpose of the presentation is to present information to a user.

The invention according to Claim 3 relates to a specific method of information processing based on technical properties, in this case the chemical properties and biological properties of the apple.

Accordingly, the invention of Claim 3, as a whole, constitutes a creation of technical ideas utilizing a law of nature, and is therefore a “statutory invention.”

Whether the invention according to Claim 3 is classified as an “invention” is determined in accordance with “Part III: Chapter 1: Eligibility for Patent and Industrial Applicability,” and, therefore, no examination from the viewpoint of computer software is conducted.

(2) Case B: Trained Model for Analyzing Reputations of Accommodations

[Claim 1]

> A trained model for causing a computer to output quantified values of reputations of accommodations based on text data on reputations of accommodations, wherein:
>
> the trained model comprising a first neural network and a second neural network connected in a way that the second neural network receives output from the first neural network;
>
> the 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 are trained in a way that each value input to the input layer and each corresponding value output from output layer become equal;
>
> weights of the second neural network are trained without changing the weights of the first neural network; and
>
> the trained model causes the computer to perform a calculation based on the trained weights in the 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 first neural network, and to output the quantified values of reputations of accommodations from the output layer of the second neural network.

The trained model of Claim 1 is what “causes a computer to output quantified values of reputations of accommodations based on text data on reputations of accommodations” as well as what “causes the computer to perform a calculation based on the trained weights in the 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 first neural network and to output the quantified values of reputations of accommodations from the output layer of the second neural network.” Therefore, it is clear that the trained model of Claim 1 is a “program” even though the claimed subject matter of Claim 1 is described as a “model”.

Moreover, it is determined, from the statement of Claim 1, that specific calculation or processing of specific

information depending on the intended use which is accurate analysis of reputations of accommodations, is implemented by concrete means or procedures on which software and hardware resources cooperate, which is for a computer to "function to perform a calculation based on the trained weights in the 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 first neural network and to output the quantified values of reputations of accommodations from the output layer of the second neural network." For this reason, in the trained model of Claim 1, a specific information processing system depending on intended use is constructed through cooperation of software and hardware resources.

Therefore, because the information processing by software is concretely realized by using hardware resources, the trained model of Claim 1 is a creation of the technical idea utilizing a law of nature, and thus falls under "invention."

2. Article 36, "Description Requirements" issues related to patenting artificial intelligence and machine learning inventions

a. Introduction —

Japanese patent applications need to satisfy the description requirements in order to be allowed, similar to applications in other countries as explained in the other chapters in this book. In Japan, the description requirements are stipulated in Article 36 of the Japanese Patent Law.

b. Description requirements —

The description requirements (enablement, support and clarity requirements) explained in detail in the JPO Patent Examination Guidelines shall also be applied to artificial intelligence and machine learning inventions in the same manner as for other technological inventions. Only unique features of the description requirements peculiar to AI and ML inventions are explained below, from a practical perspective.

c. Enablement and support requirements —

AI-related inventions include inventions that take advantage of AI-related technology in various technical fields and product inventions with certain AI-based improved functions. Generally, training data containing multiple types of data are used for machine learning of AI, and such training data may be recited in the claims. Regarding the relationship among the training data recited in the claims—especially the relationship between the input data and the output data—the enablement and support requirements for the training data in AI inventions would be considered satisfied by meeting any of the following conditions:

- the specification shall describe that there exists a certain relation such as a **correlation** among the multiple types of data, especially between the input data and the output data (may be referred to as "Correlation" hereinafter);

- the specification shall describe statistical information supporting the existence of the Correlation;

- the specification shall describe experimental evaluation (e.g., comparison between a value estimated by the AI model and an actually measured value) of trained AI model supporting the Correlation; or

- it can be presumed in view of a common general technical knowledge that there exists a Correlation, even if the specification does not describe the Correlation (this argument can be submitted in response to an official rejection indicating the above enablement requirement).

Relying on a common general technical knowledge in order to show the existence of a Correlation may involve a

risk that the combination of the input data will be considered to be obvious.

As for product inventions with certain improved functions because of AI, in order to satisfy the enablement and support requirements, the specification must describe at least one embodiment in which the function is evaluated using a product that has actually been made.

d. Clarity (definiteness) requirements —

In Japan, computer program claims can be patented in addition to computer readable media claims for storing a computer program. On the other hand, program signal claims, data signal claims, and program product claims are usually rejected if it is unclear whether the claims relate to method or apparatus.

e. Best mode requirement —

There is no best mode requirement in Japan.

3. Article 29 (1), "novelty" issues related to patenting artificial intelligence and machine learning inventions

a. Novelty —

Novelty of AI-related inventions is determined in the same way as for inventions related to other technologies. JPO examiners find that an AI invention lacks novelty if the claimed invention was (i) publicly known, (ii) publicly worked, (iii) or described in a distributed publication or made available to the public through electric telecommunication lines, in Japan or a foreign country prior to the filing date, the international filing date, or the priority date of the patent application.

b. Identifying the matter described in a cited document —

In interpreting the subject matter described in a cited document, it is possible to take the common general technical knowledge into consideration. It is also possible to use, as the basis of identifying the invention described in the cited document, what a person skilled in the art can deduce from the matter described in the cited document by taking into consideration the common general technical knowledge at the time of filing of the application.

c. Identifying the vited invention —

In assessing the novelty of the claimed invention, the invention that a person skilled in the art would understand based on the subject matter that is described in a single cited document or that is equivalent to the subject matter described in a single cited document is identified as a "cited invention." If a cited document describes multiple inventions, the invention closest to the claimed invention is identified as the cited invention. It is not permissible to identify a cited invention from a combination of the descriptions in multiple cited documents in assessing the novelty of the claimed invention.

d. Classification of AI inventions —

The JPO generally classifies AI inventions in two categories: (1) AI core inventions, such as various machine learning methods, including neural network, deep learning, support vector machines, reinforcement learning, etc., and (2) AI-applied inventions, such as image processing, speech processing, natural language processing, device control/robotics, various diagnosis/detection/prediction/optimization systems, etc. The AI core inventions are classified in IPC: G06N, and are examined by AI group examiners, whereas AI-applied inventions are classified in G06T, G06F, G06Q, etc. and examined by various groups of examiners.

e. Grace period against loss of novelty —

In December 2018, the grace period for filing an application after initial disclosure was extended from 6 months to 12 months. Thus, a Japanese patent application must be filed within 12 months of the initial disclosure in order to utilize the grace period (note, however, that this does not affect the priority date). In the case of a Patent Cooperation Treaty (PCT) application, the international filing date is deemed to be the Japanese filing date, and, therefore, the PCT application should be filed within 12 months after the initial disclosure.

4. Article 29 (2), "inventive step" issues related to patenting artificial intelligence and machine learning inventions

a. Inventive step —

The inventive-step analysis for AI-related inventions is the same as for inventions related to other technologies. When the JPO rejects a patent application for lack of an inventive step, they usually combine a primary reference and one or more secondary references by considering factors against an inventive step and factors in support of an inventive step.

Factors that weigh against an inventive-step finding include:

1. Motivation for combining the secondary reference with the primary reference, such as:

   (1) relation of technical fields;

   (2) similarity of problems to be solved;

   (3) similarity of operations or functions; or

   (4) suggestions shown in the content of the references.

2. Mere aggregation of prior art

Factors that support an inventive-step finding include:

1. Advantageous effects which can be obtained by the present invention, but cannot be obtained by the prior art.

It is recommended that the specification describe advantageous effects resulting from embodiments regarding particular output information obtained from specific trained models, modification of training data, preprocessing of training data, and post-processing estimated data of AI model, etc.

2. Obstructive factors (preventing factors, teaching away factors)

Example: An explicit or implicit expression in the prior art that discourages the combination of the primary reference with the secondary reference.

b. Hypothetical case examples for inventive step of AI inventions —

(1) Hypothetical Case A: System for Estimating Hydroelectric Generating Capacity

[Claim 1] A system for estimating a hydroelectric power generating capacity of a dam comprising:

an information processor;

a neural network having an input layer and an output layer, in which input data including a precipitation amount of an upstream portion of a river, a water flow rate of the upstream portion of the river, and a water inflow rate into a dam during a predetermined period between a reference time and a predetermined time before the reference time that are input to the input layer, and output data including a hydroelectric power generating capacity in the future after the reference time that are output from the output layer;

a machine learning unit that trains the neural network using training data corresponding to actual values of the input data and the output data; and

an estimation unit that inputs the input data in which a current time is set as the reference time to the neural network trained by the machine learning unit, and calculates an estimated value of a future hydroelectric power generating capacity based on the output data of which reference time is the current time.

[Claim 2] The estimation system of a hydroelectric power generating capacity as in Claim 1, wherein the input data to the input layer further contains a temperature of the upstream portion of the river during the predetermined period between the reference time and the predetermined time before the reference time.

Claim 1 would be considered to lack an inventive step in view of a primary reference that discloses an estimation system of a hydroelectric power generating capacity that carries out a multiple regression analysis by an information processor, having all the features recited in Claim 1 but ML and AI estimation, in combination with well-known art that an estimation process of an output in the future is carried out based on an input of time series data in the past, by using a trained neural network which has been trained with a training data containing an input of time series data in the past and a certain output in the future.

In contrast, in view of the same art, Claim 2 has an inventive step in the feature which recites “a temperature of the upstream portion of the river during a predetermined period between a reference time and a predetermined time.” There is not any additional art that disclosed such use of a temperature of the upstream portion of the river, and a correlation between a temperature and a hydroelectric power generating capacity is not within the common general technical knowledge. The use of a temperature of the upstream portion of the river enables a highly accurate estimation of a hydroelectric power generating capacity, taking an increase of inflow rate due to meltwater in the spring into consideration, as described in the specification. Thus, in this case, the additional features of Claim 2 may be considered to produce a significant effect that a person skilled in the art cannot expect.

(2) Hypothetical Case B: Dementia Stage Estimation Apparatus

[Claim 1] A dementia stage estimation apparatus comprising:

a speech information obtainment means that obtains speech information of a conversation between a questioner and a respondent;

a speech information analysis means that analyzes the speech information, and that identifies speech by the questioner and speech by the respondent in the obtained speech information;

a speech recognition means that uses speech recognition to convert the speech information on the speech by the questioner and the speech by the respondent into text and that outputs a character string based on the recognized speech;

a question topic specification means that identifies 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 in association with the character string of the speech by the respondent, 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 the input of the character string of the speech by the respondent in association with the question topic by the questioner.

According to the invention of Claim 1, speech information on a conversation between a questioner and a respondent is analyzed, and then speech by the questioner and speech by the respondent are identified, respectively. The speech information on the speech by the questioner and the speech by the respondent are converted into text through speech recognition, and a character string is obtained. Based on the result of the speech recognition of the speech by the questioner, a question topic by the questioner is identified. The question topic by the questioner in association with the character string of the speech by the respondent to the question topic is input to a neural network. The neural network is configured to carry out machine learning and output a dementia stage. Meanwhile, according to a primary reference, a neural network is configured to output a dementia stage, based on an input of a character string that has been converted into text through speech recognition without a classification between speech by a questioner and speech by a respondent.

The difference is assessed as follows.

A person skilled in the art would conceive a modification of a training data, which is an input to a neural network for machine learning, through a certain pre-processing in order to improve an accuracy of estimation by the neural network.

However, there is not additional art that discloses a specific technique related to dementia stage assessment, in which a speech information on a conversation between a questioner and a respondent is converted into text, a question topic by the questioner is identified in a character string in the text, and the identified question topic and a response to the question by the respondent is associated with each other to assess a dementia stage. The specific technique is considered to be not within the common general technical knowledge at the time of filing.

5. Others —

During the first half of the 1990s, a boom in the number of patent applications for AI-related inventions occurred, but the number of applications for the 20 years since that period remained low. Many of the applications filed during the first half of the 1990s related to technologies such as knowledge-based models and expert systems, but the boom came to an end due to the difficulty of teaching computers the rules of all events in advance. In addition, due to the limitations in the performance, the old neural net, which was actively studied at that time, was also a temporary boom. In the first half of the 1990s, the greatest increase in the number of applications occurred in IPC main groups G06N3/ (Neural Net), G06N5/ (Knowledge Base), G06N7/ (Fuzzy Logic, etc.), and G06N20/ (Machine Learning). However, the number of applications for G06N5/ and G06N7/ has remained low.

Since 2014, the number of applications for AI-related inventions is again on the increase, with the main driver this time being machine learning technology, including Neural Net (especially deep learning technology). An increase in the number of applications in main groups G06N3/ and G06N20/ is the primary factor behind the increase in the number of applications related to machine learning. It is said that the current AI boom is due to the development of methods to curb over-learning in machine learning and the realization of AI-related theories through improved computer performance and increased data flow. In 2012, a team at the University of Toronto in Canada won an overwhelming victory using deep learning at the ImageNet Large Scale Visual Recognition Competition (ILSVRC), a global image recognition contest.

This is one of the factors that led to the current AI boom.