

Written Comments

by

**ASSOCIATION FOR THE PROTECTION OF INTELLECTUAL PROPERTY
(AIPPI)**

A. INTRODUCTION TO AIPPI

AIPPI, the International Association for the Protection of Intellectual Property, was founded in 1897 and is dedicated to the development, improvement, and legal protection of intellectual property. The acronym of the organization was derived from its name in French: Association Internationale pour la Protection de la Propriété Intellectuelle. AIPPI is a non-affiliated, non-profit organization headquartered in Switzerland, having over 9,000 members representing over 100 countries. The members of AIPPI include lawyers, attorneys, and agents working across all fields of intellectual property in corporate and private practice throughout the world, as well as academics, judges, government officials and other persons interested in intellectual property. AIPPI is organized into 68 National and Regional Groups.

The objective of AIPPI is to improve and promote the protection of intellectual property at both national and international levels. It does this by studying and comparing existing and proposed laws and policies relating to intellectual property, and working with both government and non-government organisations for the development, expansion and improvement of international and regional treaties and agreements, and national laws.

B. RESPONSES TO REQUEST FOR COMMENTS ON PATENING ARTIFICIAL INTELLIGENCE INVENTIONS

These Written Comments are responsive to the Request for Comments on Patenting Artificial Intelligence Inventions, as published in the Federal Register, Vol. 84, No. 166 on Tuesday, August 27, 2019 at p. 44889.

Our Written Comments are being submitted by and on behalf of AIPPI in its international capacity, and not for or on behalf of any one of more specific national or regional groups of AIPPI. As such, the positions stated in our Written Comments should not be taken to be the positions of any individual AIPPI national or regional group, such as, for example, the U.S. national group of AIPPI, which is a division of the American Intellectual Property Law Association ("AIPLA"). These Written Comments have been prepared by the AIPPI international Standing Committee on IT and the Internet, and represent the consensus views of the members

of that Standing Committee. The AIPPI Bureau has approved these Written Comments. Except where otherwise expressly noted, the views expressed herein are not supported by any formal resolution of AIPPI.

1. *Inventions that utilize AI, as well as inventions that are developed by AI, have commonly been referred to as “AI inventions.” What are elements of an AI invention? For example: The problem to be addressed (e.g., application of AI); the structure of the database on which the AI will be trained and will act; the training of the algorithm on the data; the algorithm itself; the results of the AI invention through an automated process; the policies/weights to be applied to the data that affects the outcome of the results; and/or other elements.*

In short, all of the above elements may receive recognition as an “Artificial Intelligence (AI) invention” in appropriate circumstances.

Artificial Intelligence has been applied to a wide range of applications, including machine vision, predictive analytics, natural language processing, translation, expert systems, classification, anomaly detection, and data generation. Since the very beginnings of computer science, artificial intelligence has been studied as a field of simulating human intelligence by machine.

Artificial Intelligence is often considered as a subset of data science, and is a term that has been used broadly for a range of intelligence machines, systems or algorithms. There is a wide range of algorithms and techniques under the field of data science that may be used to create intelligence machines, such as statistical methods, machine learning and neural networks. Artificial Intelligence may be defined as a branch of data science comprising a range of machine learning techniques involving training on existing or real-time data. In broader constructs, AI may be described as the design and implementation of intelligent objects or intelligent agents, which observe their environment, assess those observations according to a predictive schema and then act to maximize a goal or value. We do think it necessary for the purposes of this submission to adopt a closed-ended definition of AI although we prefer that the definitions attempted herein be viewed in inclusive terms.

Machine learning techniques adopt methodologies that go beyond the mere statistical analysis of data. Statistical analysis techniques include clustering, linear regression and other statistical methods. In a statistical approach, data is analyzed for finding a statistically significant relationship or pattern based on a data set; however, statistical analysis *per se* is not machine learning or AI.

Machine learning techniques include random forest, support vector machines, decision trees, k-means, etc. and are closely related to computational statistics. In machine learning, however, usually a mathematical model is built based on training data or the analysis of data. The trained mathematical model can then be used for predictions.

A common method for creating an intelligence machine is machine learning. Learning methods include supervised, unsupervised and reinforced training. In supervised learning, a system is trained using input and output data. The goal is to produce a mapping function that can accurately predict the output when new input is given. In unsupervised learning, only input data is given, and the data is analyzed to uncover relationship of the data, such as clustering. In

reinforcement training, rewards and punishments are used to shape the behaviour of a model with the goal that the model to behave to maximize the overall reward.

In any of the training methods above, data is an important resource for machine learning. The quality or effectiveness of a trained machine is typically related to the quantity of quality data that is used in a training protocol for the intelligence machine at hand. A significant amount of work and effort is often required for collecting, transforming and formatting training data to a format that is suitable for the machine or model to be trained. See our response to Question 10 below for our comments regarding the potential patentability of training data.

Artificial neural networks and deep learning are also a type of machine learning. However, in neural networks, the model for processing inputs is treated as a black-box. The black-box is trained using sample data and is fine-tuned based on iterations of sample data by minimizing the distance (error) between the generated output and an expected output. The black-box usually is non-linear and cannot be programmed nor described by simple formulae and algorithms.

Artificial neural networks mimic the operation of the human brain, with an interlinked set of neurons that is trained by selected input data. Under supervised training, for instance, at the level of each input, the output of the neural network is compared with a desired output, and the parameters of the neurons are adjusted so as to minimize the error between the output and the desired output. If the neural network model is suitable, with sufficient training using supervised data, the neural network can be trained to produce the desired outputs.

As opposed to traditional sequential programming, the creator of an artificial neural network system does not generally create a neural configuration that 'programs' the machine, but instead allows the neural network to train itself based on data. However, the creator would have to design the layout and structure of the neural network model, such as number and types of layers of neurons, how neurons are connected, trigger functions for neurons, loss function algorithms, weights and biases, numbers of training and training methods. Furthermore, typically work and effort are required to verify a trained neural work.

In recent decades, AI technology based on algorithms and computer models which are of an abstract mathematical nature has become a science of its own representing a shift in technology by a number of mathematically different categories of AI with widely different fields of application and using many established algorithms and techniques. For example, it may be noted that important contributions to the development of AI techniques have been provided by open source software libraries – such as OpenCV, a platform originally introduced by Intel in 1999 that has become a *de facto* standard in developing computer vision programs for AI applications. Other development frameworks that are available to the AI community include those distributed under the names TensorFlow, Keras, and Theano.

In an initial period of exponential expansion of AI technology as well as of AI patents, established principles of patent law have been applied to this field of technology. Thus far, there has been no apparent indication of either a lessening of encouragement or a hampering of AI innovation taking place by the operation of the present patent system. In the latter respect, it may be noted that open source software libraries and other readily available tools, including many algorithms, have provided important contributions to the development of AI techniques. The patenting of AI innovations in multiple countries may however be hampered by regional differences in the legal principles that are applied in evaluating the patentability of computer-implemented inventions, which causes uncertainty and increases costs for businesses.

Breakthrough innovations in the mathematical methods that form the basis of AI techniques may not be as frequent in the future, but new applications in a wide variety of human activities will continue to increase and the number of AI patents is also likely to continue to increase rapidly. The encouraging effect of patent protection on continued innovation will therefore remain essential, in particular for inventors with limited resources to develop and exploit their innovations. We are of the view that the very same patenting principles should apply to AI inventions as to other computer-implemented inventions and inventions in general, taking into account the mathematical character of AI and the need to adapt patent protection thereto in order to balance the encouraging effects of the patent system on innovation, while protecting the public from the harm of improperly granted patents.

In view of the wide variety of circumstances in innovations of different categories and applications of AI technology, it is particularly important that patentability – as for other inventions - be evaluated on the basis of all of the features of a claimed AI invention. When the claimed subject matter is novel and non-obvious, it should not matter whether the inventive contribution is a combination of features separately known in the prior art, provided that the combination of those features is novel and non-obvious to the skilled person. Nor should it matter whether the inventive contribution is a novel and non-obvious algorithm when the algorithm together with other features of the claimed subject matter, which may per se be known or obvious, represents a non-obvious practical solution of a concrete problem in the relevant art. By restricting the claim to include all of these features and subject to the sufficient-disclosure requirement, the encouraging effect of patentability will be achieved without hampering the use by others of the algorithm for any other purpose.

In addition to the AI system itself, inventive activity may reside in the identification of the problem to be solved, and in the practical application to solve it by an appropriate AI technique. In the context of machine learning, given the significance of the data on which the AI system will be trained and will act, the inventive activity may reside in the choice and/or structuring of the data and/or in the training protocol applied to the AI system using the data, including the policies/weights to be applied to that data, provided that these features are not obvious to the skilled person in the circumstances.

- 2. What are the different ways that a natural person can contribute to conception of an AI invention and be eligible to be a named inventor? For example: Designing the algorithm and/or weighting adaptations; structuring the data on which the algorithm runs; running the AI algorithm on the data and obtaining the results.*

A person who has contributed to any of the above-described aspects of an AI innovation in the response to Question 1 may qualify and be eligible to be a named inventor. For example, the ways in which a natural person may contribute inventively towards machine learning can include the identification and/or selection of an available intelligence model or models, in the selection or configuration of model parameters, the training methodology to be applied and the selection of appropriate training parameters. Moreover, inventive activity may present itself in the selection, collection, cleansing and formatting of training data, and/or in the preparation and transformation of data for a particular training model.

Furthermore, a contribution to an invention involving AI may reside in the decision to use AI for a specific purpose or problem and/or directing the development of a specific AI solution for such purposes. A further contribution can lie in the abstraction of a specific solution provided by the

AI, e.g. a specific design of a mechanical part, to a general concept, e.g. a design principle for certain mechanical parts.

3. *Do current patent laws and regulations regarding inventorship need to be revised to take into account inventions where an entity or entities other than a natural person contributed to the conception of an invention?*

Initially, we wish to note that our comments for this response and our response to Question 4 below should be considered tentative, given that AIPPI is embarking, as part of its annual Study Question process, on a worldwide review of the laws on “Inventorship of inventions made using artificial intelligence.” This review is expected to culminate in a resolution on the matter that will be prepared with the input and collaboration of our various national and regional member groups around the globe at our planned World Congress to be held in Hangzhou, China in October of 2020. We will share this resolution with the U.S. Patent and Trademark Office once it will have been ratified by our organization.

Turning to the question, the Standing Committee on IT and Internet is of the view that the current state of AI technology is not sufficiently advanced at this time and in the foreseeable future so as to completely exclude the role of a human inventor in the development of AI inventions. However, this may change in the future, and we offer the following comments in this regard.

Under U.S. law, identification of inventorship is important as it forms the basis of determining the initial owner of the underlying invention.

Currently, AI is treated as any other computer-implemented invention under U.S. practice. AI can very much be viewed as a sophisticated tool used to create and innovate – but under the current state of AI technology, this is always at the instance of, and under the governance of, one or more persons (inventors).

Moreover, AI generated activity in its current state of development is within the bounds of “learned information”, that is, it is predicated on the basis of known, pre-existing information that is provided to the AI system by a human actor. AI is programmed to analyze and reach conclusions based upon such learned information, and on other instructions or parameters that are also provided by the human actor. The conclusions reached by an AI system in this manner may include identifying and interpreting patterns in the learned information, as well as refining and optimizing those results, such that the AI continues seemingly to learn and evolve over time.

At this juncture, then, it would appear that AI technology is not autonomously capable of inventive conception under current U.S. laws, and is instead a sophisticated tool operating as a surrogate for one skilled in the art to carry out instructions acting under the direction and dominion of a human actor.

4. *Should an entity or entities other than a natural person, or company to which a natural person assigns an invention, be able to own a patent on the AI invention? For example:*

Should company who trains the artificial intelligence process that creates the invention be able to be an owner?

At the current stage of development of AI technology, and based upon the response provided for Question 3 above, the answer should be “no” with regard to any result generated by an AI system.

5. Are there any patent eligibility considerations unique to AI inventions?

We do not believe there are patent eligibility considerations that are unique to AI inventions, but as with other forms of computer-implemented inventions, challenges will be faced with ensuring full and due recognition for inventors for their innovations in this important field of technology. For example, to the extent that an AI innovation is solely grounded on mathematical or algorithmic techniques without an accompanying practical application, it may be expected that such innovations will need to satisfy the same requirements of patent eligibility as other computer-implemented inventions. In the case of AI innovations based on training data collection, classification and use, such innovations may also be challenged on the basis of patent eligibility requirements if for instance they are expressed as mere “printed matter”, or if they cannot be cast to something beyond an abstract idea.

6. Are there any disclosure-related considerations unique to AI inventions? For example, under current practice, written description support for computer-implemented inventions generally require sufficient disclosure of an algorithm to perform a claimed function, such that a person of ordinary skill in the art can reasonably conclude that the inventor had possession of the claimed invention. Does there need to be a change in the level of detail an applicant must provide in order to comply with the written description requirement, particularly for deep learning systems that may have a large number of hidden layers with weights that evolve during the learning/training process without human intervention or knowledge?

We do not believe that any change in the written description requirement is necessary for AI inventions. Rather, the level of disclosure will have to adapt to the type of AI technology that is sought to be patented. In the specific example given in this question of a deep learning system with hidden layers and weights that evolve during the training protocol for the system, sufficient disclosure of the starting design, layout and structure of the particular deep-learning system prior to subjecting it to training would have to be made, together with the training data and training protocol that cause the deep learning system to evolve to its novel and non-obvious functionality or applied use. Alternatively, where a deep learning system is commercially available but is configured by the inventor to arrive at an AI invention, disclosure of the specific source for the commercially available system would be made together with any specific configuration details made by the inventor.

See also our answer below regarding meeting the enablement requirement for AI inventions.

7. *How can patent applications for AI inventions best comply with the enablement requirement, particularly given the degree of unpredictability of certain AI systems?*

Compliance with the enablement requirement will be dependent on the particular AI technology that is sought to be patented. Generally, enablement requires that a person skilled in the art has all necessary information to practice the invention. The amount of information needed especially depends on the type of invention at hand. If the invention is essentially the use of a generic or state of the art AI for a new purpose, little information about the AI may be needed. If the invention relates to an improvement to an existing AI, detailed information may be necessary to reproduce the AI claimed in an application or patent.

For instance, in the case of an intelligence engine based on a neural network that is akin to the “black box” model discussed above, enablement would require disclosure of the particular intelligence engine at play, as well as the training data and training protocol involved to achieve the resulting purpose or functionality of the AI invention. The latter may involve making a reference to a commercially available intelligence engine if such an engine forms part of the invention or, if the engine is original to the inventor, then the details of the design, layout and structure of the neural network model, such as the number and types of layers of neurons, their interconnections and trigger functions, loss function algorithms and associated weights and biases would have to form part of the patent disclosure for enablement purposes. Moreover, where the AI invention resides in the functionality or applied use of the intelligence engine, the training data and specific training protocol would also have to be disclosed to satisfy the enablement requirement.

8. *Does AI impact the level of a person of ordinary skill in the art? If so, how? For example: Should assessment of the level of ordinary skill in the art reflect the capability possessed by AI?*

AIPPI approved a Resolution at its Munich Congress in 1978 (Q69) that a person of ordinary skill in the art has the following attributes:

- a) is skilled in the art corresponding to the technology with which the invention is concerned;
- b) is of average knowledge and average ability in the relevant technologies; and
- c) does not have the whole technology at his/her fingertips, but knows the state of the art which is part of the average knowledge required in his/her professional work.

Following that, AIPPI approved another Resolution at its Paris Congress in 2010 (Q213) that a person of ordinary skill in the art also possesses the following characteristics:

- a) This person possesses common general knowledge as well as knowledge in the field (or fields) to which the invention relates that the average person in that field (or fields) would be expected to have or which would be readily available to that average person through routine searches;
- b) This person possesses the skills that are expected from the average person in the field (or fields) to which the invention relates.

c) This person is able to perform routine experimentation and research and can be expected to obtain predictable solutions as compared to the prior art.

d) Depending on the technical field and the complexity of the invention, the person skilled in the art may correspond to a team of people from different disciplines, provided that would have been a common practice in the technical field of the invention at the relevant time.

As set forth in the response to Question 3 above, the impact of AI should be treated no differently than the use of any other software tool available and used by a person of ordinary skill in the art. Because it is proposed in the response to Question 3 that AI could not be an inventive entity under the current state of development of AI technology, an AI machine or AI software tool could not be one of the team of people corresponding to the hypothetical person of ordinary skill in the art, as set forth in the AIPPI Paris Resolution. Therefore, the capability of AI software to have access to a library of the whole technology, access to large volumes of data and capability to make predictions based on such access, should only be viewed as a productivity enhancement to augment and perhaps raise the hypothetical average level of skill of a person of ordinary skill. However, this productivity enhancing use of AI software to determine the average level of skill may be considered only to the extent that such AI software is readily available to the person of ordinary skill in the art and such a person is skilled in the use of the AI software.

On a general note, the skills of an average person skilled in the art encompass the use and assistance of technical devices commonly known and used in the art, notably the use of a computer or a computer system. To the extent that AI is commonly used, its use needs to be attributed to the skills of an average person skilled in the art. In particular, claimed subject matter that can be found by the routine application of commonly available AI should be considered obvious, in the same way as for example an improved device that can be obtained by using standard computer-assisted optimization techniques is likewise obvious.

9. Are there any prior art considerations unique to AI inventions?

We do not believe there are unique prior art considerations for AI inventions. However, much like occurred with the evolving recognition of patent protection for computer-implemented inventions over the last decades, it will be important for the examining authorities such as the U.S. Patent and Trademark Office to develop and locate appropriate sources of patent and non-patent prior art to ensure that proper examination of AI inventions takes place in the public interest, and to make such sources of prior art available to Examiners who will need to have appropriate training to be versed in AI technology.

A specific issue that may arise with AI is that it will be difficult or impossible to determine, without experiments or other detailed analysis, whether an AI, e.g. a neural network described in the prior art, is functionally and/or structurally identical to an AI that is claimed in a patent application. Typically, the results of an analysis or of experiments establishing identity or similarity with an intelligence machine according to the prior art may only become available in the course of post-grant proceedings or in litigation.

10. Are there any new forms of intellectual property protections that are needed for AI inventions, such as data protection?

Initially, we wish to note that our comments for this response should be considered tentative, given that AIPPI is embarking, as part of its annual Study Question process, on a worldwide review of the laws on “IP rights in data.” This review is expected to culminate in a resolution on the matter that will be prepared with the input and collaboration of our various national and regional member groups around the globe at our planned World Congress to be held in Hangzhou, China in October of 2020. We will share this resolution with the U.S. Patent and Trademark Office once it will have been ratified by our organization.

Turning to the question, the Standing Committee on IT and Internet does not believe new forms of intellectual property are required for the protection of AI inventions, for the reasons set out below.

In the case of training data, the availability of appropriate training data is crucial to the continuing development and deployment of AI technology. Such data may be available from existing commercial sources, or from free and open sources. However, training data may need to be newly collected specifically for the purpose of training an AI model and such activity may, in certain instances, require a threshold degree of skill and effort. In such cases, the training data itself may attract copyright protection. If adequate protective measures are taken, such training data may also be protected as a trade secret or as confidential information.

However, training data *per se* will not be expected to receive patent protection as such, i.e. separate and apart from any novel and non-obvious method for its collection, classification and use in training an intelligence engine, or separate and apart from a system that includes an intelligence engine and its underlying training data in combination and for a technical purpose that is otherwise patentable. In those instances, the method or system in question will nevertheless have to meet the requirements for patent eligibility.

Provided that, in any given jurisdiction, there is adequate protection currently available by way of one or more of patents, copyright, data protection or trade secrets, it does not appear necessary to supplement such existing forms of protection with any new *sui generis* IP protection that is specific to AI technology or its associated training data.

11. Are there any other issues pertinent to, patenting AI inventions that we should examine?

None, in our respectful submission.

12. Are there any relevant policies or practices from other major patent agencies that may help inform USPTO’s policies and practices regarding patenting of AI inventions?

To date, the European Patent Office (“EPO”) has issued limited official guidance on the patentability of AI inventions, where this is to be understood as inventions which comprise AI as opposed to inventions that are conceived by AI. There is no official EPO guidance as of yet in respect of inventions conceived by AI.

Part G, Chapter II, Section 3.3.1 of the November 2019 version of the EPO Guidelines for Examination is directed to the patentability of AI and machine learning. AI and machine learning are considered to relate to computational models and computer algorithms. Computational models and algorithms are considered per se to be of an abstract mathematical nature, irrespective of whether they are “trained” based on training data. Accordingly, the EPO applies the same guidelines for assessing the patentability of AI and machine learning inventions as is currently applied in respect of other computer-related inventions. The exclusion of mathematical methods from patentability only applies if the subject matter of the claim applies to an abstract mathematical method as such, having regard to Section 52(3) of the European Patent Convention. This restriction is overcome if the invention as claimed is implemented using “technical means”. In the assessment of inventive step it is required that the computer implementing the AI solves a technical problem or that a technical problem is otherwise solved by technical means. It follows that AI and machine learning inventions are potentially patentable under European practice, provided that the claims in question are directed to technical means.

Examples such as the classification of digital images, videos, audio or speech signals based on low-level features (e.g. pixels for images) are considered technical applications of classification algorithms, and are therefore patentable subject matter. Interestingly, the EPO administrative position is that the classification of text documents solely in respect of their textual content, is not regarded per se as a technical purpose but instead a linguistic one, citing Technical Board of Appeal Case T1358/09. Similarly, the EPO provides the further example of the classification of abstract data records such as telecommunication network data records, where no indication of the technical use is given for the resulting classification. In the latter instance, the EPO administrative position is that this is also not considered per se a technical purpose, even if the algorithm has beneficial mathematical properties, such as robustness, citing Technical Board of Appeal Case T1784/06.

Lastly, according to the EPO Guidelines for Examination, where an AI or machine learning system serves a technical purpose, the steps of generating the training data set, and the process of training the AI or machine learning system, may also contribute to the technical character of the invention, if those steps support achieving the technical purpose.

Turning to China, the China National Intellectual Property Administration (CNIPA) is currently in the process of drafting amendments to Part II, Chapter 9 of its Examination Guidelines in order to add commentary regarding the examination on AI and business method related inventions in their jurisdiction. These amendments are expected to be finalized towards the end of 2019.

In view of the global implications of the adaptation of the patent system to the technology shift occasioned by the rapid development of AI inventions, it is our desire as an organization of international scope to see that the respective laws and administrative practices of IP5 are evolving in a common direction.

November 12, 2019