IEEE-USA Response to USPTO Request for Comments on Patenting Artificial Intelligence Inventions

16 October 2019

Andrei Iancu
Director
United States Patent and Trademark Office
P.O. Box 1450
Alexandria VA 22313-1450

Via email: *AIPartnership@uspto.gov*

Re: USPTO *Request for Comments on Patenting Artificial Intelligence Inventions* (Docket Number: PTO-C-2019-0029)

IEEE-USA is pleased to submit the following comments in response to the USPTO's request for comments, published in 84 FR 44889 (27 Aug 2019) related to patenting Artificial Intelligence inventions (Docket Number: PTO-C-2019-0029). We commend the USPTO for its effort to create a plan for reliable, predictable, and robust patent protection for inventions related to Artificial Intelligence (AI) technologies.

IEEE-USA represents approximately 180,000 engineers, scientists, and allied professionals living and working in the US. Our members work in AI-related industries, developing and working with the emerging technologies used in artificial intelligence systems. This expertise provides us with a unique perspective on the benefits of these technologies.

We are pleased to provide the input requested by the USPTO. Many of our comments fall into one or more of the following general observations:

1. **As a type of computer-implemented technology, AI has already extant IP protection.**

   Because AI is a type of computer-implemented technology, to the greatest extent possible, the patent protection accorded to computer-implemented technologies should govern the patent protection accorded to AI-enabled technology.

   For example, inventions involving the aspects and features of AI technology raised by the USPTO (database structure, algorithms, training processes, applying weights to be applied to the data that affects the outcome of the results) occur in other computer-implemented technologies, so there is no need to carve out exceptions for AI's inventions in such areas. Therefore, the protection policies and procedures for patenting computer-implemented technologies are already available for governing patent protection for most aspects of AI. Therefore, at present, no new legal

protections need to be developed to provide robust patent protection for those aspects of AI-enabled technology.

If the IP protection developed for current computer-implemented technologies does not appear to be adequate or suitable for a selected aspect of AI-enabled technology, before new rules or procedures are developed, we suggest that the USPTO review the many forms of computer-implemented technologies for analogous models from which to model a solution for the special-case aspect of AI.

Rather than developing new forms of IP protection for an aspect of AI technology, efforts should be concentrated on improving the protection structure, policies, and procedures for all computer-implemented technologies. The urgent needs that are discussed below in the context of AI are also urgent needs for reliable, predictable, and robust patent protection for all computer-implemented technology.

One such urgent need is the institution of a stable and adequate scope for subject matter eligibility as it relates to computer-implemented technology. IEEE-USA notes with gratitude the leadership role that the USPTO has taken in crystalizing subject matter eligibility, and looks forward to continued progress in resolving the current uncertainty. IEEE-USA additionally suggests, as discussed in more detail below in question 5, that another urgent need for AI technology and all computer-implemented technology is a stable, predictable, and precise consensus on what constitutes adequate enabling disclosure.

Another area that merits additional discussion and consideration is raised by the USPTO in question 3 below, namely how to protect invention that is developed by an AI system without direct human intervention. IEEE-USA suggests that the focus of determining inventorship should be on the conception of the individual elements of the AI engine. When viewed through that lens, the designers of those elements of the AI engine that develops a new, useful, and non-obvious innovation are the inventors.

2. AI is a quickly developing area of technology; USPTO needs to be nimble.

Concepts and architectures that were significant even 20 years ago are being or have been superseded by new or earlier-undervalued concepts and architectures. The rules and procedures for AI patent protection must be nimble to allow for the speed and diversity of innovation in the field, and the training of patent examiners will have to keep up with the current developments in AI technology.

IEEE-USA urges the USPTO to focus on correcting the problems facing all computer-implemented technologies (such as ensuring effective injunctive relief, adjusting patent policy to be at least neutral and preferably favorable to independent inventors and small entities, and providing strong patent protection for computer-implemented technologies) as a primary approach to providing strong patent protections to AI-based inventions.

3. AI is an enabling technology that needs to be nurtured.

AI touches or will touch most, if not all industries, and **research and development must be nurtured**. AI-based inventions must have value so as to provide companies and venture capital firms an incentive to invest further in AI R&D. Accordingly, reliable, predictable, rapid, cost-effective, and robust patent protection for AI inventions is urgently needed.

With the above in mind, IEEE-USA respectfully submits the following observations and recommendations:

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?***

   - AI is a computer-implemented technology that perform tasks by leveraging computational models or algorithms that, to an untrained observer, may appear to mimic or simulate human intelligence. AI may be implemented in a wide variety of systems, devices, businesses, and processes to produce significant improvements in performance, operation, and efficiency. Accordingly, AI is a type of computer-implemented technology and one of many broadly applicable enabling technologies.

     It does a disservice to all computer-implemented inventions to make a distinction between AI and other computer-implemented technologies. The rules and procedures governing the patent protection of computer-implemented technology and broadly applicable enabling technologies should govern patent protection of AI.

     IEEE-USA urges the USPTO to focus on correcting the problems facing all computer-implemented technologies (such as ensuring effective injunctive relief, adjusting patent policy to be at least neutral and preferably favorable to independent inventors and small entities, and providing strong patent protection for computer-implemented technologies) as a primary approach to providing strong patent protections to AI-based inventions.

     As in all computer-implemented technologies, certain areas of AI technology are strong candidates for patent protection. Without limitation, examples include:

     - Many AI inventions spring from features found in other computer-implemented technologies, so there is no need to carve out exceptions for AI's inventions in such areas. Examples of such features include database structure (especially data structures for large collections of data), algorithms, processes for data preparation and data learning, training processes, and applying weights to be applied to the data that affects the outcome of the results.
     - A formulation of a particular application-oriented problem into an AI solution, and unique selection of features for AI data training are examples of AI inventions that are good candidates for patent protection. Also, plenty of room exists for invention in AI-enabled automated operation and communication for vehicles and other IoT instrumentalities.
     - Inventions related to how "AI" (initial, intermediate and resultant data/algorithms) interacts with a "real," filtered, synthetic, or augmented world – using sensors, displays, servo and other output signaling, especially to the extent that they can be characterized as an improvement in technology over generic functions executed by generic computers.
     - No less important, AI technology is not always predominantly embodied in software associated with digital computers. Even within the digital realm, AI's innovation can often be found in hardware, such as in chips or integrated circuits with AI embedded software which target high speed

computation or perform dedicated AI tasks. Hardware implementation will be a large part of AI inventions. Moreover, other forms of information processing, including analog and biological, are areas for AI invention.

Within the digital realm as an example, some aspects of AI inventions may require more insightful examination, such as AI systems that demonstrate some randomness in data, including timing and sequence of consideration, that do not result in precisely determined "results." Similar considerations apply to certain "algorithms." A distinction exists between an algorithm that executes or guides the learning process and a "model" (sometimes a "black box" that is not observable in some details) that produces "results" and itself may be evolve with "experience." Another area of AI-related technology that is undergoing rapid development is the application of AI to neuron science and cognitive science in investigations of human brain intelligence.

In such areas of AI, IEEE-USA suggests that the elements of an AI invention are either the same as or analogous to the elements of computer-implemented technology inventions and broadly applicable enabling technology inventions, and, if an element of AI does not appear to fit into conventional computer-implemented technology, before new rules or procedures are developed to address that element of AI specifically, the elements of the many forms of computer-implemented technologies should be reviewed for analogous models for the element of AI under scrutiny from which to model a solution for the special-case element of AI.

- In addition, AI is a quickly developing area of technology, and the set of elements of an AI invention today are not the set of elements of an AI invention of 10 years ago, nor will it necessarily be the set of elements of future AI inventions. For example, concepts and architectures that were significant even 20 years ago, (such as training of learning systems or development of training sets) are being or have been superseded by new or earlier-undervalued concepts and architectures.

  Today's AI technology is more stochastic in approach than deterministic. Current AI technology requires extensive assessment of likelihoods of interim and end results. Accordingly, AI has become more "compute"- intensive and inference intensive. IEEE-USA is concerned that the application of probability and inference processes to decision making systems that employ AI may be found to raise issues of subject-matter eligibility; and stability, predictability, and precision in determining subject-matter eligibility are critical to having a reliable and robust patent protection for inventions related to Artificial Intelligence (AI) technologies.

  Going forward, the rules and procedures for AI patent protection must be nimble to allow for the speed and diversity of innovation in the field, and the training of patent examiners will have to keep up with the current developments in AI technology and the ever-changing elements of an AI-enabled system.

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?

The ways that a natural person can contribute to conception of an AI invention are either the same as or analogous to the ways that a natural person can contribute to conception of an invention in computer-implemented technology or in other broadly applicable enabling technologies.

As with IEEE-USA's response to Question 1, when a question arises as to whether an AI activity qualifies as a contribution to a "conception of an AI invention," the USPTO

should look at least toward other areas of computer-implemented technologies and other inference technologies for models to find a solution for a special-case element of AI.

For example, developers of a formulation of a particular application-oriented problem into an AI solution, and unique selection of features (including possible methods for data set acquisition or filtering) for AI data training are eligible to be named inventors.

As with inventions in other areas of computer-implemented technology, certain contributions to AI system design may not rise to the level of conception of a patentable invention. The contribution of "AI technicians" who build and test (reduce to practice) will still not constitute "conception of a patentable invention." For example, simply "running the AI algorithm on the data and obtaining the results" where the "algorithm" and "data" are given may not constitute conception of a patentable invention.

However, it is possible that conceiving a process for acquisition of a data set and filtering or selecting it as a training data set for a "generic" pattern-identifying algorithm may constitute "conception" of an invention. Whether the invention is otherwise patentable should remain an independent issue.

As with other computer-implemented systems, patent protection of an AI-enabled system may arise in several features or regions of the system; and in those systems in which the end result is not necessarily "determined," such protection may arise less frequently from those parts of the system or process by which the end result is determined and more frequently from the parts by which the input into such AI-enabled system is developed. As an example, the patent eligibility of a process for acquisition/filtering of a data set for an AI-enabled system to which stochastic analyses are applied and from which the inferences are developed may be modeled on the protection of processes for developing improved training sets for AI-powered systems, which have long been held to be patentable.

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?

When one or more individuals designs an AI system, it should be the designers of the AI systems who are named inventors.

As with the issues addressed in the earlier questions, the rules and procedures governing inventorship of computer-implemented technology and broadly applicable enabling technologies govern the rules and procedures governing inventorship of AI technology.

Historically, conception has been the touchstone of inventorship, and that does not change for an AI system that, for example, develops a new, useful, and non-obvious machine.

In other computer-implemented technologies (which themselves may or may not be AI-enabled), one or more natural persons design:

- systems that create unique integrated circuits or chips that perform a task;
- systems of systems for developing unique capabilities for other complex systems such as weaponry; and
- systems for automated drug discovery and simulations.

Such designers, who set up all the procedures and processes that allowed the system to operate to generate inventive work product, are considered inventors if they have contributed to the conception of the system that produced the resultant work product. Analogously, AI designers who created an AI's system's specifications, objectives, and input/output architectures, and who "trains" the AI system (or specifies that training) should be named the inventors of any inventive output of the AI system.

Individual conception constitutes the proper standard for eligibility for the constitutional reward for invention without positing whether or not an AI system "conceives." Revising the current patent laws and regulations regarding inventorship to allow AI machines to be named inventors could conflict with the constitutional authorization to reward inventors in the U.S. Constitution at Article 1, Section 8, Clause 8. An argument could be made that the constitutional authorization contemplated human inventors, and taking a further legislative step to allow machines to be named inventors could be interpreted as non-constitutional.

IEEE-USA suggests looking to other areas of Intellectual Property law for models, particularly U.S. copyright law that shares the same constitutional basis as U.S. patent law. A recent decision in copyright area, *Naruto v. Slater,* No. 15-cv-04324, 2016 WL 362231 (N.D. Cal. Jan. 28, 2016), *aff'd* 888 F.3d. 418 (9th Cir. 2018), denied a monkey copyright authorship of a self-photograph taken by the monkey. The rulings were based in part on the constitutional authorization to reward human authors and inventors. A photographer who sets (poses) the stage for predictable intervention (even if expectedly random like time-elapsed recording of clouds) is considered the author. *See Compendium of U.S. Copyright Office Practices* § 313.2 (3d ed. Sept. 29, 2017) (reciting the monkey selfie situation).

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

   The rules and procedures governing ownership of computer-implemented technology and broadly applicable enabling technologies, which allow natural persons and entities to own patents, should govern ownership of AI technology patents. It is not necessary to identify or define other entities who can own an AI technology asset.

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

   The rules and procedures governing patent eligibility considerations for computer-implemented technology inventions and broadly applicable enabling technology inventions should govern patent eligibility considerations for AI inventions.

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?***

Just as in existing computer-implemented technology inventions, well-known processes need not be described in detail. Providing an enabling disclosure is at the heart of the quid pro quo for being rewarded patentability. There has always been a tension between making a sufficient disclosure of a functional embodiment(s) of the actual invention and withholding well known details or details that the inventor does not believe needs to be spelled out to provide a functional embodiment of the claimed invention. Resolution of the tension has always been fact-specific and has led to the construct of the Person of Ordinary Skill in the Art (POSITA). Software patenting has the same challenges, and applies the same principles, and AI patenting should be no exception.

For example, in general deep learning neural networks, disclosing how many hidden layers or neurons seems not to be necessary nor patentable and so their disclosure may not be necessary. On the other hand, for some types of neural networks, such as convolutional neural networks, the hidden layer designs for a particular perception problem may be unique and may need to be disclosed as part of invention.

It has been suggested that AI systems occasionally produce unexpected or unpredictable output and so are inherently unpatentable. However, other systems in computer-implemented technology, such as systems that employ "fuzzy logic," may produce unexpected or unpredictable output, yet have been adequately described to merit patenting.

Determining whether an AI feature is adequately described is not dissimilar to determining whether a software feature is adequately described. For example, a relevant data set that forms a part of an AI invention claimed is not very different from a particular data set that forms a part of another computer-implemented system. Whether the data set changes and the results converge (or not) at different modalities, or whether the data set fails to adequately model or approximate reality should not affect either enablement or utility.

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

As with IEEE-USA's answer to question 6, the rules and procedures governing enablement requirements for computer-implemented technology inventions and broadly applicable enabling technology inventions should govern enablement requirements for AI inventions.

IEEE-USA suggests that patent applicants, especially independent inventors and small entities, in computer-implemented technologies such as AI would benefit from increased certainty around the amount of disclosure that is enabling for computer-implemented technology. *Williamson v. Citrix,* 792 F.3d 1339 (Fed. Cir. June 16, 2015) which holds that the use of the word "module" invokes the means-plus-function language of 35 U.S.C. § 112, para. 6, has caused uncertainty in what amount of disclosure is necessary to adequately describe a module having conventional functionality.

Requiring disclosure of the features and operation of conventional computer hardware/software, which any computer system developer (even persons with less-than-ordinary skill in the art) would know is especially unfair to start ups and solo inventors (who too often have to decide whether to patent at all because of the expense of drafting a "sufficient disclosure") and to their attorneys (who often find

themselves in the awkward and frustrating positions of donating their time to create specifications that have "sufficient disclosure").

If AI patent applications, like those for other computer-implemented technologies, are to be held to the *Williamson* disclosures standard, they are all going to difficult and expensive to prepare, effectively putting a chill on patent protection for AI inventions.

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?**

No. AI is an instrumentality and even if "autonomous" in some respect, will remain an agent. Any invention is still considered relative to a POSITA who will have available known AI and technicians to implement the conception. To the extent that the particular AI implementation is not known, the POSITA will not have that particular capability.

AI is similar to computer technology when it first emerged as a new technology. As a technology matures and advances, the skill of the POSITA is often found to mature and advance commensurately. As with all disclosures of technology, the inquiry remains fact-specific.

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

The rules and procedures governing prior art considerations for computer-implemented technology inventions and broadly applicable enabling technology inventions should govern the prior art considerations for AI inventions.

Most current commercial applications of AI use core approaches explored in the literature for decades and only relatively recently enabled by increased processor power. However, modifications to those approaches in many cases are inventions to be rewarded. A perennial difficulty with software patents has been the lack of transparency of algorithms (and their interchangeability for specified functions) and the use of non-standard terminology, making it difficult to locate prior art (even in the IEEE or ACM libraries). It may be that the difficulty is less acute for AI, which today is largely looked at as having "black box" cores – specified by inputs and outputs, including recursion. Where there is an important modification, the inventor should identify it to meet the enablement requirement.

As in most cases, only when the patent is asserted will there be a more thorough search for prior art.

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

It is not necessary to define new forms of intellectual property protections for AI. While users of AI-technology may benefit from other forms of legal protections that may have IP issues associated with them, such as laws directed to data privacy, data protection, and cybersecurity, the intellectual property protection for computer-implemented technology and broadly applicable enabling technology are available to reward the inventor or creator of systems, processes, and devices related to AI, which, as noted above, is a type of computer-implemented technology and is one of many broadly applicable enabling technologies.

A distinction may be made between data protection and database protection. Features of databases have long been found to be patentable subject matter, but data

collections themselves have not been found to be patentable. Collections may be protectable under other laws and regulations. One example is E.U. *sui generis* protection of data bases, Directive 96/9/EC of the European Parliament and of the Council of 11 March 1996 on the legal protection of databases, O.J. L077 (March 27, 1996). Another example is the U.S. S.B.I.R.'s regulations specifying periods of data exclusivity to promote disclosure in certain technological fields. The American Law Institute is considering making policy recommendations related to protection for and availability of data collections (see its press release: https://www.ali.org/projects/show/data-economy/), but IEEE-USA is not prepared at this time to take a specific position on protection of data collections.

However, IEEE-USA, as the U.S. arm of the world's largest technical professional organization, respectfully submits that any protections provided to data collectors take into account all parties, including the prospective data collectors and users, and ensure that rights to data collections are balanced across all parties.

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

- No matter in what technology an invention is based or what technologies the invention enables, current U.S. patent policy is not favorable to independent inventors and small entities. One example of need for reform in U.S. patent policy that would significantly benefit AI is ensuring that patent owners, particularly independent inventors and small entities have a strong presumption of and availability to effective injunctive relief.

  In pre-*eBay* days, patents provided a barrier to entry that had some teeth for smaller entities. Today, with the cost of litigation – including AIA administrative challenges – without presumption of an injunction, there is no business rationale for respecting the patent of a small entity. Established companies compensate for the loss of injunctive relief (and avoid challenge thereby by new entrants) by developing large portfolios often based on minor variations of claims on a base disclosure. Independent inventors and small entities cannot begin to afford that strategy (or defend against assertion of a portfolio), and so are forced to compete in the marketplace at a disadvantage

  Another example of how unfavorable the current U.S. patent policy is to independent inventors and small entities is found in the post-grant reviews provided by the AIA. The incumbent companies benefit from the "industrial property" approach of Europe with which AIA helped to harmonize. The AIA compromised with complete harmonization by ensuring that independent inventors and small entities were permitted to decline to publish pending applications and by providing them with the right to pre-grant opposition. However, independent and small patent owners have been greatly disadvantaged by the AIA's post-grant reviews procedures, which allow established companies an increased opportunity to invalidate inconvenient patents owned by competitors with significantly smaller patent portfolios.

- Independent inventors and small entities in computer-implemented technologies such as AI would benefit from increased certainty around the amount of disclosure that is enabling for computer-implemented technology. As noted above in IEEE-USA's response to Question 6, the holding of *Williamson v. Citrix,* 792 F.3d 1339 (Fed. Cir. June 16, 2015) has caused uncertainty in what amount of disclosure is

necessary to adequately describe a module having conventional functionality, which effectively put a chill on patent protection for AI inventions.

- As a software-intensive form of computer-implemented technology, AI would benefit from resolving the current uncertainty in the scope of patentability of computer-implemented technology. For almost a decade, since *Bilski v. Kappos*, 561 U.S. 593 (2010), court decisions have whittled away at the scope of patentability of computer-implemented inventions. Ending the uncertainty in patentability scope that computer-implemented inventors, IP owners, and investors face would go a long way to encourage investment and innovation in this critical technology.

  The uncertainty in the scope of available patent protection problem is becoming more serious in AI technology because today's AI is more stochastic in approach than deterministic; assessing likelihoods of interim and end results is increasing in importance in today's AI. The movement in AI methodology from deterministic techniques to the more computational/statistical approaches of stochastic analyses means that AI is becoming more "compute"-intensive, which may make AI inventions even more prone to receiving rejections for lack of the eligible subject matter (the so-called "101 rejections"). Accordingly, it is becoming more important than ever to AI inventors, owners, and investors to have certainty in a scope of subject matter eligibility that is favorable to protection of innovative software.

In summary, AI Research and Development has an urgent need to be nurtured. For example, the current concentration in AI R&D is in the nascent field of autonomous system safety. Safety AI R&D needs to be funded, and, in our capitalistic society, such funding usually comes from the firms in the field or from venture capitalists willing to invest in such firms. In either case, the AI-based safety inventions that form the output of the AI R&D need to have value so as to provide an incentive to invest further in the R&D. Accordingly, patent protection for the AI-based safety inventions is urgently needed.

IEEE-USA urges the USPTO to focus on correcting the problems facing all computer-implemented technologies (such as ensuring effective injunctive relief, adjusting patent policy to be at least neutral and preferably favorable to independent inventors and small entities, and providing strong patent protection for computer-implemented technologies) as a primary approach to providing strong patent protections to AI-based inventions.

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?

The USPTO may be able to obtain valuable information related to patenting software, particularly AI, in several countries from the reports and surveys published by the European Patent Office, but IEEE-USA cautions against further attempts to harmonize patent laws and procedures, especially as it relates to patenting AI.

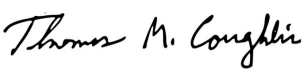
U.S. patent law has long been the gold standard for patent protection and a major driver in the success of the U.S. innovation economy. Since 2005, changes to the U.S. patent system have both weakened IP rights and discriminated against certain IP holders and classes of IP. These changes have also rebalanced the patent system in favor of large, multinational, market incumbents, and against highly-innovative companies in several ways.

When the patent system is weakened, the U.S. innovation economy suffers, resulting in decreased new technologies, new business, and news ideas. Recent attempts at harmonization has resulted in a weakening of patent protection, especially for computer-implement technology.

The weakening of the U.S. patent system has harmed entrepreneurs and highly-innovative companies of all sizes and type. Entrepreneurs, and highly innovative companies, along with sole inventors, startups, and small businesses, are typically the engines of the U.S. innovation economy. They need to be nurtured and not disadvantaged by well-intentioned but harmful harmonization.

IEEE-USA thanks the USPTO for consulting interested stakeholders with expertise in developing and working with the emerging technologies used in AI systems. The USPTO has raised significant policy issues, many of which may need to be addressed eventually by Congress, but, until that happens, IEEE-USA welcomes the opportunity to engage in these discussions with the USPTO today and in any follow-on discussions that the USPTO arranges.

Respectfully submitted,



Thomas M. Coughlin
2019 IEEE-USA President