13 May 2023

To: United States Patent and Trademark Office (USPTO)

From: Ed Palacio, President, IEEE-USA

Re: Response to USPTO Request for Comments Regarding Artificial Intelligence and Inventorship (Docket No. PTO–P–2022–0045]

IEEE-USA is pleased to submit the following comments in response to the USPTO's request for comments, published in 88 FR 9492 (14 February 2023) related to patenting inventions using artificial intelligence systems (Docket No. PTO-P-2022-0045). 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.

Although we use the common term "AI" – and more specifically, "AI systems" – in our response for convenience, we do this with the recognition that there is no commonly accepted definition of the term "AI," and with the understanding that "AI" encompasses a wide variety of technologies, including neural networks, machine learning, natural language processing, and evolutionary algorithms, and that such technologies themselves may overlap and not have clearly defined meanings.

IEEE-USA believes that AI systems are tools that humans use or might use in many industries as an aid in the inventive process – at this time even to propose combinations and structures or to simulate or even conduct experiments for screening for "novel" combinations and parts of "reduction to practice." However, in IEEE-USA's view, existing and foreseeable AI technologies are not capable of the kind of ideation that we have associated with the "conception" that was the sine qua non of "invention" before the American Invents Act shifted away from the "first to invent" framework. It was the creative ideation of *human* inventors and authors that guided the constitutional framers to empower Congress to grant exclusive patent and copyright rights "[t]o promote the Progress of Science and useful Arts." Tools for reduction to practice – including AI – need no incentive. Ever since the Patent Act was first enacted by Congress in 1790, humans have been envisioned as inventors. The current Patent Act continues the premise that only a natural person may be an inventor, as does the Court of Appeals for the Federal Circuit (CAFC), and as does the U.S. Supreme Court. IEEE-USA does not see the need or logic of recognizing an AI tool, in its use during reduction to practice, as an inventor or co-inventor, particularly in view of Congressional authorization.

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

IEEE-USA | 2001 L Street, N.W., Suite 700, Washington, D.C. 20036-4928 USA
Office: +1 202 785 0017 | Fax: +1 202 785 0835 | E-mail: ieeeusa@ieee.org | Web: http://www.ieeeusa.org

technologies used in artificial intelligence systems. This expertise provides us with a unique perspective on the benefits of these technologies.

Many of our comments submitted here are based on the general and specific observations that IEEE-USA presented in its response dated October 16, 2022, to the **USPTO *Request for Comments on Patenting Artificial Intelligence Inventions* (Docket Number: PTO-C-2019-0029).** While the observations are not repeated here for brevity's sake, they are still generally applicable. In summary:

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

Because AI systems are 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 technologies. 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, the USPTO should review the many forms of computer-implemented technologies for analogous models from which to model a solution for the special-case aspect of AI systems.

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

Concepts and architectures in AI technology and in other forms of computer-enabled technologies 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.

IEEE-USA respectfully submits the following observations and recommendations in response to the USPTO's questions:

1. How is AI, including machine learning, currently being used in the invention creation process? Please provide specific examples. Are any of these contributions significant enough to rise to the level of a joint inventor if they were contributed by a human?

First, we must stress the continued lack of agreement about the definition of "AI," and point out the risks of focusing on the term "AI" or on any narrow definition of AI. "AI" is used to refer to a wide variety of computer-implemented techniques, including neural networks, evolutionary algorithms, simulated annealing, and expert systems, among others. Although neural networks, especially deep learning and

neural network-based generative language models (such as the GPT family of language models used in ChatGPT), receive the most attention these days, "AI" extends to many other technologies. One distinction between the forms of older and current so-called "AI" technologies is that the newer versions are not strictly "algorithmic" as in earlier days of rules-based expert systems. For example, the assignment of weights to nodes on a simulated neural network, based on curve-fitting and diffusion techniques, may seem "stochastic" or non-deterministic compared to idealized (noise- and error-corrected) digital systems. The "black box" of a simulated neural network may not be strictly unobservable (similar in theory to a quantum computing qubit that must be simulated by supercomputers), but the number of connections in the network – particularly if they are dynamically weighted – is impractical to observe.

As AI systems evolve, there is a risk that if we focus too narrowly on any specific technology that happens to be predominant today, we will develop public policies that are tied to that specific technology and as a result, are too rigid. Instead, we suggest referring to "computer-implemented" or "computer-automated" techniques that are used in the inventive process. This approach places such techniques in the broader context of the wide variety of tools that have been used as part of the inventive process in a variety of technologies throughout history.

Ways in which computer-implemented techniques are used in the inventive process (for an invention as a whole, or for a component of an invention) include performing any one or more of the following, as an instance or iteratively:

- generating/specifying candidate inventions,
- simulating the operation of candidate inventions,
- evaluating the operation of candidate inventions,
- filtering out candidate inventions based on the evaluation results, and
- modifying the remaining candidate inventions based on the evaluation results.

These steps may be performed individually, or the functional equivalent of multiple steps may be performed by a single function. Specific examples of the use of computer-implemented techniques in the inventive process include:

- Moderna's claims that its COVID vaccine was significantly accelerated using AI systems,
- researchers at MIT using machine learning to develop an antibiotic compound that is effective against many antibiotic-resistant bacteria, and
- Dr. Stephen Thaler's use of software known as DABUS (Device for the Autonomous Bootstrapping of Unified Sentience) to develop a beverage container and a light-emitting device.

Whether or not any of the AI contributions are significant enough to rise to the level of a joint inventor if they were contributed by a human is highly dependent on the facts. Pre-AIA interference practice awarded inventorship to "the first to conceive and work diligently to reduce to practice" and did not award inventorship to technicians who reduced to practice; however, the first of three requisites for joint

inventorship in *Pannu v. Iolab Corp.*, 155 F.3d 1344, 1351 (Fed. Cir. 1998) is that "he or she (1) contribute in some significant manner to the conception or reduction to practice of the invention."

Over time and in certain areas (such as in works for hire), the US has moved at least partially to entity authorship. However, the U.S. has not moved completely to entity inventorship. Although it is possible to argue that some of the AI functions mentioned above (e.g., generating, simulating, evaluating, filtering, and modifying) *might* constitute a "significant contribution" to "conception or reduction to practice" under *Pannu*," would merely performing the function with an available AI tool/model be a significant contribution on "his or her" part? How does the obviousness bar to patenting apply to automated processes of specification/design, simulation, evaluation, filtering and modifying?

Humans have used a wide variety of tools throughout history to assist in the inventive process, ranging from mathematical formulae to tools for constructing prototypes to tools for measuring and evaluating designs, and US law has not assigned inventorship to such tools. Although current AI systems seem more "generative" than previous tools, in their complexity, computational speed, and ability to handle a range of parameters and a huge amount of data not manageable by the human mind, patent law has treated the humans who conceive of (as opposed to merely performing) the experiments that produce such an actual reduction to practice as the inventors. Although the *Pannu* requisites for human joint inventors might be further tailored to use of today's more powerful tools, we see no reason to upset the law of human inventorship in light of today's AI systems.

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.

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.

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.

2. How does the use of an AI system in the invention creation process differ from the use of other technical tools?

To reiterate when we speak of "AI," we are referring to computer-implemented techniques. The use of AI tools is similar to the use of other technical tools, including computer-implemented tools. For example, mathematics generally has been used as a tool in the inventive process for as long as humans have been inventing. Many tools have been used for constructing, measuring, testing, and evaluating prototypes. While computer-implemented tools may or may not differ from earlier computer-implemented tools in their increased complexity and computational speed and ability, and AI tools may or may not differ from other computer-implemented tools in potentially even more increased complexity, computational speed, and computational ability, those are differences in scale, not type. AI tools and computer-implemented tools perform the same types of functions as earlier tools. For example, AI and computer-implemented tools are notable in their ability to iterate oversteps automatically, in contrast to most older tools, where a human is required to provide manual effort at each step in certain earlier tools, even if the tool assists with that step in some way.

As the speed of such iterations increases, and the amount/quality/organization of the data that are processed in each step increases and improves, computer-implemented and AI techniques can produce results which are significant advances over what could have been achieved manually (or using other non-iterative tools) in reasonable amounts of time and/or using practical amounts of resources.

In cases in which computers can perform simulations of sufficient quality, computer-implemented techniques can assist in inventing without the need to physically build, test, and evaluate candidate designs.

3. If an AI system contributes to an invention at the same level as a human who would be considered a joint inventor, is the invention patentable under current patent laws? For example:

a. Could 35 U.S.C. 101 and 115 be interpreted such that the Patent Act only requires the listing of the natural person(s) who invent(s), such that inventions with additional inventive contributions from an AI system can be patented as long as the AI system is not listed as an inventor?

IEEE-USA suggests that the focus of determining inventorship in cases of "inventions" that are specified as using an AI system without substantial direct human intervention should be on the distinguishing

conception/selection of efficient elements/parameters of the AI system, whether those elements take the form of hardware, software, parameters, and/or inputs, such as the pre-processing (cleaning-up) of training data and prompting processes (including possibly the specific prompt) for GPT systems. When viewed through that lens, the inventors of an invention developed using an AI system would be the human inventors preparing and applying a tool for specification and possibly evaluation.

When one or more individuals conceive of and direct the application of an AI system, those individuals should be the named inventors of an invention that has been reduced to practice by a system in which the AI system is employed as a tool that meets the requirements under 101 and 112 and not barred by the patentability requirements of 102 and 103 without naming the AI system as an inventor. Listing the AI system as an inventor is contrary to current law and the original constitutional purpose and should require compelling reasons for changing that law.

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.

As previously stated, conception, not reduction to practice, has long been the touchstone of inventorship, and that does not change for an AI system that, for example, specifies a novel (under 102) combination upon some prompting of the conceiver.

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 candidates for being considered inventors if they have contributed to the conception of the system that produced the resultant work product, with the determination of whether they are inventors being fact-specific. For example, the designer of an automated analyzer should not be an inventor of the material analyzed.

Analogously, AI designers who created an AI system's specifications, objectives, and input/output architectures, who "train" the AI system (or specify that training), and who provide input to the AI system are potentially inventors of inventive output of the AI system, assuming their contributions rise to the level of "inventorship" (for example, not merely reduction to practice or at another person's direction).

As an example, in many systems, humans may contribute different features of different components of a system and at different steps in a process that the system employs, and at different levels of granularity. There can be situations in which it is "downstream" humans who are the inventors. When Human A trains a

neural network, Human A isn't necessarily an inventor of *any* output of the neural network. For example, Human B might provide inventive input to the neural network to produce inventive output, where Human A never conceived of or contemplated that input or output. In that case, Human B would likely be the inventor of the output.

To provide an analogy to computer-implemented technology, the inventor of a computer isn't necessarily the inventor of all software that is subsequently created using that computer.

Individual conception constitutes the proper standard for eligibility for the constitutional reward for invention without deciding whether or not an AI system "conceives" in some sense of human ideation (distinguished from reduction to practice). 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. It is highly doubtful that the Framers in the constitutional authorization contemplated anything other human inventors, and taking a new 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. While the copyright situation is in some ways different from the patent questions due to the Copyright Act's authorization of "works for hire" and entity (corporate) authorship, the copyright 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). In the Kashtanova, Zarya of the Dawn case, Registration No. VAu001480196, the Copyright Office canceled a copyright claim to the images generated by the divvusion generative AI system Midjourney. The Copyright Office set down guidelines that refuse authorship for such AI-generated images, even with recursive involvement. 88 Fed. Reg. 16190, 37 CFR Part 202, Copyright Registration Guidance on Works Containing Material Generated by AI (Library of Congress Mar. 16, 2023).

b. Does the current jurisprudence on inventorship and joint inventorship, including the requirement of conception, support the position that only the listing of the natural person(s) who invent(s) is required, such that inventions with additional inventive contributions from an AI system can be patented as long as the AI system is not listed as an inventor?

Yes.

c. Does the number of human inventors impact the answer to the questions above?

No.

4. Do inventions in which an AI system contributed at the same level as a joint inventor raise any significant ownership issues? For example:

a. Do ownership rights vest solely in the natural person(s) who invented or do those who create, train, maintain, or own the AI system have ownership rights as well? What about those whose information was used to train the AI system?

The rules and procedures governing ownership of computer-implemented technology and broadly applicable enabling technologies, which allow both natural persons (through inventorship or assignment) and entities (through assignment) to own patents, should govern ownership of AI-assisted patented inventions. It is not appropriate to provide ownership via inventorship to the creator, trainer, maintainer, or owner of the AI tool or to the provider of the training data, unless the creator, trainer, maintainer, or owner at contribution was sufficiently "substantial" in the sense of *Pannu* to impart inventorship. Remuneration of "ingestion" of training information for generative AI is being considered under other law.

b. Are there situations in which AI-generated contributions are not owned by any entity and therefore part of the public domain?

There are cases in which AI systems are involved in generating output which is obvious, therefore not patentable. Asking if it is in the public domain is the wrong question. Being unpatentable does not mean something is in the public domain.

5. Is there a need for the USPTO to expand its current guidance on inventorship to address situations in which AI significantly contributes to an invention? How should the significance of a contribution be assessed?

The rules and procedures governing inventorship of computer-implemented technology and broadly applicable enabling technologies, which define when natural persons should be deemed inventors, should govern inventorship of AI tool technology patents. It is not necessary to identify or further define inventorship of an AI tool technology asset.

6. Should the USPTO require applicants to provide an explanation of contributions AI systems made to inventions claimed in patent applications? If so, how should that be implemented, and what level of contributions should be disclosed? Should contributions to inventions made by AI systems be treated differently from contributions made by other (i.e., non-AI) computer systems?

The contributions to inventions made using AI systems should not be treated differently from contributions made to inventions made using other computer-implemented technologies (which themselves may or may not be AI systems-enabled), for example, in those technologies noted above in the response to question 3.a. regarding systems in which designers set up all the procedures and processes that allowed the systems run or used by the system to operate to generate inventive work product.

The rules and procedures governing applicants providing an explanation of contributions that other computer-implemented tools have made to assist in the inventive process should govern the extent and type of explanations of contributions that AI systems have made to assist the inventive process.

9. What statutory changes, if any, should be considered as to U.S. inventorship law, and what consequences do you foresee for those statutory changes?

None.

For example:

a. Should AI systems be made eligible to be listed as an inventor? Does allowing AI systems to be listed as an inventor promote and incentivize innovation?

There is no benefit to listing AI as an inventor. AI, not being a human, has no incentive to invent. Listing an AI tool as an inventor on a patent would not provide that AI tool with any additional incentive to invent because AI cannot be motivated by patents and the benefits they provide. AI does not need or respond to the incentives provided by the constitutional quid pro quo.

b. Should listing an inventor remain a requirement for a U.S. patent?

Yes.

11. The USPTO plans to continue engaging with stakeholders on the intersection of AI and intellectual property. What areas of focus (*e.g.,* obviousness, disclosure, data protection) should the USPTO prioritize in future engagements?

Related to the following issues, IEEE-USA refers the USPTO to its comments in its response dated October 16, 2022, to the **USPTO *Request for Comments on Patenting Artificial Intelligence Inventions* (Docket Number: PTO-C-2019-0029)**.

Disclosure

Just as in existing computer-implemented technology inventions, well-known processes need not be described in detail. However, case law such as *Williamson v. Citrix*, 792 F.3d 1339 (Fed. Cir. June 16, 2015), which is described in more detail below, has disrupted the disclosure requirements for well-known processes, especially for software-intensive inventions. The rules and procedures governing disclosure requirements for computer-implemented technology inventions and broadly applicable enabling technology inventions govern enablement requirements for inventions using AI systems, which will accordingly face the same challenges related to sufficient disclosure of well-known processes.

Enablement

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 inventions using AI systems.

IEEE-USA suggests that patent applicants – especially independent inventors and small entities – using computer-implemented technologies including but not limited to AI systems 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) held that enforcement-time construction of so-called "nonce" words like "module" and "configured to" (which often invokes structure) invokes the limitation of patent protection to means-plus-function language of 35 U.S.C. § 112, para. 6. *Williamson* has caused deep uncertainty in the amount of disclosure that is necessary to adequately describe a module having conventional functionality.

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

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 must 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".

<u>The level of a person of ordinary skill in the art (POSITA)</u>

As a tool, an AI system is an instrument. Even if "autonomous" in some respect, the AI system will remain a tool of human inventiveness. Any invention is still considered relative to a POSITA who will have available known AI systems and technicians to implement the conception. To the extent that the particular AI system's implementation is unknown, the POSITA will not have that particular capability.

AI technology 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.

An issue may arise when a person knows how to prompt a particular AI system to specify combinations that are "novel" under 102. If it is obvious for the person to know how to prompt such AI system to specify such combinations, is that combination obvious under 103?

<u>Data privacy, data protection, and cybersecurity</u>

IEEE-USA respectfully suggests that the USPTO, in its capacity as the national patent office and trademark registration authority for the United States, might consider whether it should place high priority on issues in

fields such as data privacy, data protection, and cybersecurity, other than to consider the patentability of innovative features in the technologies of such fields or the trademark registrability of products and services in such fields.

For one, it is not necessary to address many issues in data privacy, data protection, and cybersecurity because the intellectual property protections for computer-implemented technology and broadly applicable enabling technology are available to reward the inventor or creator of systems, processes, and devices related to the technologies in such fields.

As for the patentability of data protection itself, 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. However, IEEE-USA submits that any IP protections provided to data collectors should be developed with consideration of the interests of all parties, including the prospective data collectors, users, data sources (those from whom the data is collected or to whom the data relates), and other stakeholders (as the term is applied broadly), who might be non-developers/non-users/non-data sources but who may be impacted by the technology, to ensure that rights to data collections are balanced across all parties.

Need for clarity in Prior Art Rules and Procedures

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 inventions made using AI systems. However, IEEE-USA suggests that the difficulties that plague searching in computer-implemented technologies (such as lack of transparency of algorithms (and their interchangeability for specified functions) and the use of non-standard terminology) will be difficulties in search in AI technologies.

Need for reform in U.S. Patent Policy

No matter in what technology an invention is based or what technologies the invention enables, current U.S. patent policy is unfavorable to independent inventors and small entities.

Harmonization

IEEE-USA cautions against further attempts to harmonize patent laws and procedures. Recent attempts at harmonization and changes to the U.S. patent system for the last decades have resulted in a weakening of patent protection, especially for computer-implemented technology; they have also rebalanced the U.S. patent system in favor of large, multinational, market incumbents, and against highly innovative companies.