

Before the
United States Patent and Trademark Office
Alexandria, VA

In re

Request for Comments on Patenting Artificial
Intelligence Inventions

Docket No. PTO-C-2019-0029

**COMMENTS OF
COMPUTER & COMMUNICATIONS INDUSTRY ASSOCIATION**

In its Request for Comments, published in the Federal Register at 84 Fed. Reg. 44889 on Aug. 27, 2019, the USPTO solicited comments regarding patents and artificial intelligence (AI) inventions. The Computer & Communications Industry Association (CCIA)¹ submits the following comments.

I. Summary of CCIA’s Positions

CCIA’s members are leaders in AI innovation. Most modern AI technology utilizes hardware manufactured by CCIA member companies, and much of it relies on AI technology released as open source contributions by CCIA members. Because of this, CCIA members have a significant interest in ensuring that the various types of AI-related inventions are promoted, rather than suppressed, by the U.S. patent system.

There are three classes of “AI inventions” relevant to the USPTO’s inquiry: inventions that improve the functioning of AI, inventions that use AI, and inventions created by AI. Each presents its own set of concerns with respect to the questions asked in the Request for Comments. CCIA believes that existing patent rules are mostly sufficient for inventions of the first two types, while there is no reason that U.S. patent law can or should provide patent protection to inventions created by AI. Within the scope of existing patent law, there are specific concerns surrounding sufficient disclosure and enablement, and surrounding prior art search issues, that would justify specific guidance on how AI inventions can comply with U.S. patent law requirements. However, there is no need for drastic change to provisions such as inventorship or patent eligibility—existing law is sufficient to provide the necessary incentive to promote U.S. leadership in artificial intelligence.

CCIA’s detailed comments as to the questions asked in the Request for Comments follow.

¹ CCIA is an international nonprofit membership organization representing companies in the computer, Internet, information technology, and telecommunications industries. Together, CCIA’s members employ nearly one million workers and generate approximately a quarter of a trillion dollars in annual revenue. CCIA promotes open markets, open systems, open networks, and full, fair, and open competition in the computer, telecommunications, and Internet industries. A complete list of CCIA members is available at <http://www.ccianet.org/members>.

II. Issue 1: What Is an AI Invention?

There are three classes of invention relevant to the question of AI inventions. First, there are inventions that are directed to how AI functions, such as algorithms to improve deep learning. Second, there are inventions that utilize AI in achieving some other result, such as machine learning-based voice recognition. And third, there are inventions that are the output of an AI. Each such class of invention is meaningfully different for the purposes of the questions asked by the USPTO, and each will be addressed in its own turn.

A. *Class 1: AI Functionality*

Class 1 inventions are those that go to improvement of the functionality of the AI itself. Algorithms for machine learning, improved techniques for minimizing power, data, or computational requirements, and improvements to the general problem of providing an AI algorithm with data would all be examples of Class 1 inventions.

B. *Class 2: AI Applications*

Class 2 inventions do not address the functionality of the AI itself, but instead utilize AI technology to solve some other problem. Applying machine learning to image or voice recognition or to generating potentially relevant therapeutic compounds are all examples of Class 2 inventions. Note that, with respect to the therapeutic compound example, the compound itself would not be the subject of a Class 2 patent, the subject would be the technique of “using AI to produce potential therapeutic compounds.”

C. *Class 3: Invented by an AI*

Class 3 inventions are those where an AI technique was used to produce an invention, and the produced invention is what is sought to be patented. The aforementioned therapeutic compound generating technique might produce a novel compound on which a patent could be sought, or an AI could produce potentially any other type of invention depending on its complexity.

III. Issue 2: Contributions of Natural Persons to AI Invention

A recent update to the Compendium of U.S. Copyright Office Practices, adopting language from a 1966 Copyright Office report, sets forth the crucial question:

The crucial question is “whether the ‘work’ is basically one of human authorship, with the computer [or other device] merely being an assisting instrument, or whether the traditional elements of authorship in the work (literary, artistic, or musical expression or elements of selection, arrangement, etc.) were actually conceived and executed not by man but by a machine.” U.S. Copyright Office, Report to the Librarian of Congress by the Register of Copyrights 5 (1966).

While discussed in reference to copyright, the same inquiry is relevant to patentable inventions—was the invention one conceived of basically by human ingenuity with the AI operating as an assistive tool, or was the invention conceived of by the AI while the human simply plucks it from the output?

Current inventorship laws adequately address Class 1 and Class 2 inventions. In each case, a human contributes the conceptual work—whether it be an improved way to conduct machine learning or an application for the machine learning to be applied to, a human contributes the essential conceptual aspect to the ultimate invention, while the AI acts as a tool, similar to a computer, a calculator, or a gene sequencing device. U.S. patent law does not presently allow or require a tool to be named as an inventor, nor is there a reason to do so. The human who conceived the invention—potentially with the assistance of AI as a tool—contributes the essential inventive work and is appropriately listed as the inventor.

With respect to Class 3 inventions—inventions that are “conceived of” by an AI tool—the present law is clear that such an entity cannot be listed as an inventor. The patent statute says that a “person shall be entitled to a patent”² and an inventor is required to sign an oath or declaration,³ a task an artificial entity is not permitted to do under U.S. law.⁴ In this circumstance, there is significant reason for the Patent Office to recognize that there is no permissible named inventor and thus no permissible patent.

Finally, inventions may exist where an AI has contributed to some portion of the conception of the invention while a human has contributed some other portion of the conception. In this circumstance, while the AI could not be listed as an inventor, that is effectively irrelevant. Whatever the AI has conceived effectively is part of the prior art, as no person can claim it as their own invention. At the same time, because the human has contributed some conception of their own, that inventive work supports the naming of the human as the inventor on a patent application. While the human could not claim conception of the entire invention, they would be entitled to claim conception of the portion of the invention that they contributed. The AI’s contribution, even if claimed, is no different than any other patent that claims an aspect of the art not contributed by the named inventor.

IV. Issues 3 and 4: Revision of Inventorship Laws

There is no need for revision of current inventorship laws. Class 1 and 2 inventions, as described above, appropriately name a human as inventor. A Class 3 invention where conception is contributed by both a human and AI can be conceived of as a mixed Class 3/non-AI invention. Such a mixed invention would similarly name the human as inventor. The sole situation in which inventorship laws would not presently permit a patent to issue are for Class 3 inventions where the entire inventive concept was created by an AI.

In that circumstance, there is no reason to issue a patent. The AI is not motivated by the prospect of a reward of exclusivity—it is not motivated at all. It would produce the idea upon being run regardless of the availability of a patent, suggesting that the essential value of a patent as an “encouragement to [] ingenious discoveries”⁵ is absent and suggesting that the “embarrassment [sic] of an exclusive patent”⁶ is unnecessary to cause the idea to be created. In

² 35 U.S.C. § 102(a).

³ 35 U.S.C. § 115.

⁴ See, e.g., *Rowland v. California Men’s Colony, Unit II Men’s Advisory Council*, 506 U.S. 194, 204 (1993) (“artificial entities cannot take oaths”); cf. *Invention of a Slave*, 9 Op. Att’y Gen. 171, 171-72 (1858).

⁵ Letter from James Madison to Thomas Jefferson (Oct. 17, 1788), available at <https://founders.archives.gov/documents/Madison/01-11-02-0218>.

⁶ Letter from Thomas Jefferson to Isaac McPherson (Aug. 13, 1813), available at <https://founders.archives.gov/documents/Jefferson/03-06-02-0322>.

addition, the output of such a machine should never qualify as non-obvious for the reasons described in Section VIII, *infra*, suggesting there is no circumstance in which such an AI generator of an idea would qualify as the inventor of a patent. The creation of an idea-creating machine would still be incentivized, as it would be patentable (unless it was itself the output of an AI), but there is no need for the economic incentive of a patent to sufficiently incentivize operation of such a machine. In fact, the Supreme Court has suggested that this is an impermissible rationale for providing exclusive rights.⁷ Other economic incentives, such as first-mover advantage, network effects, and competitive necessity will be sufficient to justify any resources expended in operating such a machine. And there is no need to incentivize disclosure by the operator of such a machine as any other operator of a similar machine would be able to obtain the same invention, suggesting that the disclosure-based justification for the patent bargain is weak at best with respect to Class 3 inventions.

Similar to any other obvious but worthwhile invention or activity, there is simply no need to provide the extreme incentive of a patent monopoly for Class 3 inventions.

Assigning inventorship to the owner of the AI—assuming they have not themselves contributed an inventive concept—is unjustified as well. The owner of the machine that outputs an invention has not themselves performed any act worthy of recognition as inventive and would receive a windfall extracted from others based on the output of something that anyone could have bought.

To the extent that technology reaches a point at which it would be correct to say that an AI is self-motivated and contains sufficient indicia of consciousness to justify treatment as a person, such a change would implicate issues far beyond the expertise and scope of any Patent Office proceeding and would need to be made by the United States Congress.

V. Issue 5: Unique Patent Eligibility Concerns

Class 3 inventions do not raise unique eligibility concerns, as they may conceivably be inventions directed to any type of subject matter. While a Class 3 invention might be patent-ineligible, it would not be for any unique reason exclusive to it being an invention of an AI.

Class 1 and Class 2 inventions raise similar patent-eligibility considerations to computer-related inventions. Class 1 inventions, directed to improving how AI functions, are analogous to the “improvement in the functioning of the technology” inventions held to be generally patent-eligible in the computer context.⁸ In contrast, Class 2 inventions, directed to using AI in some fashion, may be patent eligible if the claim taken as a whole is inventive, but not if the claim is effectively a claim to “implement a law of nature or abstract idea using AI” analogous to the “do it on a computer” claims of *Alice* and *Bilski*.⁹ Beyond eligibility considerations, these claims would also raise serious questions of obviousness—the use of a known AI technique to solve a known problem in another domain is something any artisan of ordinary skill would be able to

⁷ See *Feist Publications v. Rural Telephone Service Co.*, 499 U.S. 340 (1991) (rejecting “sweat of the brow” theory of intellectual property protection).

⁸ See, e.g., USPTO Patent Eligibility Guidance, 84 Fed. Reg. 50, 55 (Jan. 7, 2019); *DDR Holdings v. Hotels.com*, 773 F.3d 1245 (Fed. Cir. 2014) (“the claimed solution is necessarily rooted in computer technology in order to overcome a problem specifically arising in the realm of computer networks”).

⁹ See *Alice Corp. Pty. Ltd. v. CLS Bank Intern.*, 573 U.S. 208 (2014); *Bilski v. Kappos*, 561 U.S. 593 (2010).

conceive of and implement. The Office should ensure that examiners apply particular scrutiny to whether a claim of this type is obvious during examination.

Similar eligibility concerns to those described above arise in other emerging technologies, such as quantum computing (improvements to the quantum computer vs. “do it with quantum computing” claims), nanotechnology (improvements to the technology vs. “do it using nanotechnology”), robotics (improvements to robots vs. “have a robot do it”), and more. The general framework of improvement to the technology vs. utilization of the technology is sufficient and there is no need for technology-specific rules for eligibility in any of these areas, including AI.

VI. Issue 6: Disclosure-Related Concerns

Sufficient disclosure for an AI invention is dependent on the class of invention and the type of AI in question. Much of current AI is based on machine learning techniques, and these comments focus on the disclosures that are most relevant to machine learning. However, other forms of AI exist and will likely be developed, and distinct disclosure considerations may apply to other AI architectures.

Again, Class 3 inventions would not create distinct disclosure considerations beyond those typical to the subject matter of the invention—*e.g.*, a novel compound identified by an AI would need to comply with typical written description constraints for chemical compounds.

Class 1 inventions will generally implicate the same disclosure concerns as computer-implemented inventions.¹⁰ The written description must describe not just the desired aspect of AI, but how it is achieved—typically, by disclosing the algorithm or implementing structure and how to utilize it. For example, a patent application for a new deep learning structure could describe the number of layers, the number of units per layer, data flows between units or layers, and activation functions. A patent application for a new training algorithm would likely describe the structure to be trained, initial weights, learning rates, and other relevant information.

Class 2 inventions present additional unique considerations with respect to disclosure. Beyond the computer-implemented concerns described above with respect to Class 1 inventions, which would also apply to most Class 2 inventions, Class 2 inventions are particularly likely to be described in functional terms and would require disclosure of a suitable AI structure in order to avoid invalidity.¹¹ Such a structural description in the specification would need to ensure replicability by a reader by requiring that the inventor provide access to sufficient information to replicate the invention. That could be in the form of the training data and the training methodology, or in the form of the trained model itself, such as the hidden layer weights post-training. As discussed in the Request for Comments, applications relying on modern AI techniques may implement a well-known structure (*e.g.*, a deep learning network) with the application-specific aspect contained within the weights of the relevant layers, in which case the relevant disclosure is of the weights and layer structures.

¹⁰ See USPTO Guidance on Examining Computer-Implemented Functional Claim Limitations for Compliance With 35 U.S. 112, 84 Fed. Reg. 57, 61 (Jan. 7, 2019); *cf. Vasudevan Software, Inc. v. MicroStrategy, Inc.*, 782 F.3d 671 (Fed. Cir. 2015).

¹¹ See USPTO Guidance on Examining Computer-Implemented Functional Claim Limitations for Compliance With 35 U.S. 112, 84 Fed. Reg. 57 (Jan. 7, 2019); *cf. Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1349 (Fed. Cir. 2015) (en banc).

The exact way in which written description is provided for a Class 1 or 2 invention could likely be left to the inventor’s discretion, so long as the inventor provides sufficient description to enable replication of the claimed AI. While some inventors might wish to keep such information out of public view, that would be incompatible with the issuance of a patent—non-replicability is *prima facie* evidence of insufficient disclosure, and replicability of a Class 1 or Class 2 invention essentially requires disclosure of either sufficient training data to produce the model or else of the trained model itself. An inventor’s assertion that such data is unnecessary to replication would need to be supported by additional evidence before it could be accepted.

VII. Issue 7: Enablement Concerns

With respect to enablement, Class 3 inventions would again not create specific enablement issues beyond those natural to the claimed subject matter.

Class 1 and Class 2 inventions raise distinct enablement considerations from other types of inventions. In particular, as the Request for Comments notes, AI systems can be unpredictable. Seemingly minor changes in training data or algorithm can produce wildly varying output models.

Given this, it is crucial—particularly for Class 2 inventions—that the specification enable the full scope of the claim and that the area of AI be treated as an “unpredictable art” like chemistry, rather than a predictable art like mechanical inventions. This means that the disclosure of a single species would not generally be sufficient to support a generic claim—*e.g.*, disclosure of a deep learning model that recognizes images of dogs would not be sufficient to support a claim that claims “using a deep learning model to recognize images by type” without additional support in the specification to provide modeling for generic image recognition. Claims to “do a function with AI” should only be considered enabled if they teach how to do the function with respect to any form of AI, not just a particular model of AI. To treat such claims otherwise would effectively, and unjustifiably, imply that the patent could predictably enable the use of novel AI architectures to perform the claimed function.

VIII. Issue 8: AI and Ordinary Skill in the Art

The availability of AI as a tool raises the ordinary skill in the art. Much like the availability of computation and computer-aided design tools has affected what is reasonable to treat as ordinary skill, the availability of AI tools will affect what is reasonable to treat as the ordinary skill in the art. An ordinary artisan, relying on the output of an AI tool, has not created anything beyond the ordinary skill unless they contribute something to the combination that rises above what any ordinary artisan could do with the same AI tool.

Further, to the extent Class 3 AI inventions become a realistic phenomenon, they should by definition be treated as inventions that fall within the ordinary skill in the art. Even “ordinary creativity” is considered to be within the scope of a person of ordinary skill, and “the results of ordinary innovation are not the subject of exclusive rights under the patent laws.”¹² And as ordinary creativity exceeds the creativity of “an automaton”—exactly what a Class 3 AI invention is the result of—the results of an automaton’s innovation are likewise not the subject

¹² *KSR Intern. Co. v. Teleflex Inc.*, 550 U.S. 398, 421, 427 (2007).

of exclusive rights under the patent laws.¹³ Further, the creation of an invention by an AI requires the pre-existence of an invention-creating AI. The pre-existing AI is itself part of the prior art and the mechanical output of a prior art invention created to mechanically output ideas is obvious. Sufficient protection is available to novel AIs that generate inventions under Class 2 protections, where AI is being applied to the application of generating new ideas.

As such, patents to Class 3 AI inventions are presumptively obvious and should never issue.

IX. Issue 9: Unique Prior Art Considerations

Much like software before it, AI presents the potential for unique issues with obtaining and searching prior art. While standard AI techniques are more likely to be described in the literature than is the case in software, there is still a significant proportion of AI technology that is undocumented except in source code. This source code may or may not be available and is generally considered difficult to search for. USPTO Director Kappos spoke about this issue with respect to software in 2012, noting difficulties with respect to “software, where much prior art is in the form of previously written software, which is difficult to find and more difficult to understand unless you wrote it.”¹⁴ An FTC report received similar comments from stakeholders, arguing that time constraints do not allow adequate searches for software prior art.¹⁵ AI is likely to present the same search issues.

This is relevant because examiners are less likely to identify and cite sources of prior art that are more difficult to access and search. Consistent with Director Kappos’s comments, a recent GAO study of examiner behavior, based in part on examiner interviews, found that software-related non-patent literature was the prior art source examiners were most likely to search “rarely” or “never.”¹⁶ Examination in AI technology is likely to proceed similarly, with AI-related non-patent literature infrequently searched or cited. Given the existing gap between the USPTO and peer patent offices with respect to the use of non-patent literature, this is a key area for the Office to improve.¹⁷

Searching patent prior art for AI inventions is likely to involve difficulties similar to those in the software space. Software patents have traditionally been classified according to the end use of the software, meaning that software for controlling the temperature of a pizza oven and software for controlling the temperature of a kiln would be classified differently even though

¹³ *Id.* at 421.

¹⁴ USPTO Director David Kappos, *An Examination of Software Patents* (Nov. 20, 2012), available at <https://www.uspto.gov/about-us/news-updates/examination-software-patents>.

¹⁵ See FTC, *To Promote Innovation: The Proper Balance of Competition and Patent Law and Policy* at 10 n. 35 (Oct. 2003), available at <https://www.ftc.gov/sites/default/files/documents/reports/promote-innovation-proper-balance-competition-and-patent-law-and-policy/innovationrpt.pdf>.

¹⁶ See GAO, *Patent Office Has Opportunities to Further Improve Application Review and Patent Quality* 4-5 (Sept. 16, 2016), available at <https://www.gao.gov/assets/680/679830.pdf>; cf. Cohen, *Reverse Engineering and the Rise of Electronic Vigilantism: Intellectual Property Implications of “Lock-Out” Programs*, 68 S. Cal. L. Rev. 1091, 1178 (1995) (“In an area that relies so heavily on published, ‘official’ prior art, a rejection based on ‘common industry knowledge’ that does not appear in the scholarly literature is unlikely.”).

¹⁷ See Colleen Chien, “Comparative Patent Quality and the Prior Art Gap”, *Patently-O* (Oct. 1, 2019) (showing that U.S. examiners are *more than 80% less likely* than EPO examiners to cite non-patent literature), available at <https://patentlyo.com/patent/2019/10/comparative-patent-quality.html>.

the underlying software concepts are identical.¹⁸ AI patents may be treated similarly. As a result, classification-based examiner search techniques are more difficult to employ with respect to AI and often miss relevant prior art.

The combination of these factors means that documentation of AI prior art may be difficult or impossible to obtain, leading examiners to be more likely to issue patents on AI inventions that are not actually novel or non-obvious, threatening U.S. leadership in this important area of technology.

X. Issue 10: New Forms of Intellectual Property Protection for AI Inventions

CCIA does not believe new forms of intellectual property protection are required for AI inventions. Existing forms of protection are sufficient. Patents are available for many Class 1 and Class 2 inventions, while there is no need for intellectual property protection of Class 3 inventions at all. Many current AI systems are based on open source AI technologies applied to proprietary training data. For inventions where the primary advance is in the training data and the resulting model would not be patentable, trade secret protection is available for the training data and copyright provides a potential avenue of protection for the trained models.

XI. Issue 11: Other Issues

In general, careful consideration of issues of AI patentability is necessary, including issues not typically considered when revising patent law or regulation. For example, if an AI is sufficiently a person to be able to be considered to be an inventor, then assigning the inventive output of the AI to the “owner” of the AI risks violating the 13th Amendment by permitting a human or corporation to own another person.¹⁹ Providing a data protection right for training data or trained models risks violating the Constitutional grant of protection for “*their* respective writings and discoveries”²⁰ by protecting unoriginal data created by others. Other such issues are likely to arise when providing special law or regulation for AI. Because of the potential for serious implications of other areas of law, caution is warranted when making any changes to patent law regarding AI inventions.

In addition, there are Patent Office issues that should be considered. For example, ensuring examiners have access to relevant technical training to ensure that they can understand the inventions in front of them is important. In addition, the classification issue discussed above with respect to Issue 9 will likely return for AI inventions. Having examiners with no knowledge of AI examining a Class 2 AI invention because the problem AI is being applied to is within their issue area is likely to lead to improvidently issued patents. For example, an examiner in the medical device arts examining a device that incorporates machine learning to optimize a treatment parameter is unlikely to have the necessary background to truly understand whether the AI aspect of the invention is novel. At the same time, an examiner with expertise in Class 1 AI technology might not sufficiently understand the relevant medical technology. It might prove useful to assign this sort of cross-cutting invention to multiple examiners, each of whom examines with an eye towards their specialty. Revision of the classification system to

¹⁸ See Lemley et al., *Software and Internet Law* 332 (2000).

¹⁹ See U.S. Const. Amendment XIII (“Neither slavery nor involuntary servitude ... shall exist within the United States.”); *cf.* *Invention of a Slave*, 9 Op. Att’y Gen. 171, 171-72 (1858).

²⁰ U.S. Const., Article I, Section 8 Cl. 8.

reflect modern areas of technology might also be useful. Finally, if it is incorrectly determined that it is permissible to patent Class 3 inventions, it is likely that this will result in a flood of Class 3-created inventions at the Patent Office. Before permitting such applications, developing provisions to manage a large increase in non-human inventions would be reasonable. If it is correctly determined that Class 3 inventions are not patentable, such provisions would be unnecessary.

XII. Conclusion

CCIA believes that existing law is generally capable of addressing issues related to artificial intelligence. Within that existing law, useful guidance could be provided regarding disclosure and enablement requirements, as well as setting forth a rule that inventions created by an AI are *per se* obvious. This guidance and existing law are sufficient to ensure continued U.S. leadership in artificial intelligence.

Respectfully submitted,

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