

**Response to USPTO Request for Comments on Patenting Artificial Intelligence Inventions
Docket No. PTO-C-2019-0029**

1. What are elements of an AI invention? For example: The problem to be addressed (e.g., application of AI); the structure of the database on which the AI will be trained and will act; the training of the algorithm on the data; the algorithm itself; the results of the AI invention through an automated process; the policies/weights to be applied to the data that affects the outcome of the results; and/or other elements.

Yes, to each of the suggested examples. In addition, further examples include: data classification, cleaning (i.e. making the data uniform), labeling and mining; algorithm pseudo-code, especially to the extent it describes the mathematics of the algorithm; starting and resulting structures of the artificial neural networks (ANNs) that implement the AI; decision trees / decision procedures implemented by the AI; sense-making protocols and procedures for interpreting results of the operations performed on the data.

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

Yes, to each of the suggested examples, except the last. Sometimes, simply running the AI algorithm on data and obtaining results may not constitute a meaningfully creative or inventive contribution. Indeed, AI systems can be optimized to train other AI systems, e.g., Generative Adversarial Networks.

Conceptualizing novel applications of AI, e.g., reengineering production workflows and business processes to create new tasks that call for unique human capabilities and skills and human-technology partnerships.

Conceptualizing approaches to AI that address constraints, limitations and potential ethical issues with AI systems that are barriers to adoption (fairness, bias, transparency, guarantees, safety, etc., such as for example AI audit check list and procedures for eliminating bias).

Creators or architects of the pseudo-code.

Contributors whose sole contribution is the identification of the problem to which the AI or algorithms can be applied.

Development algorithms or other mechanisms for structuring, labeling and mining data.

Development of methods for meaningful interpretation of results.

However, it isn't clear that protecting criteria and metrics for self-learning would help, since these tend to vary a lot.

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?

Yes. Given the rapid evolution of the transhumanist movement, Grinders, biopunk, biohacking, etc., non-human inventors may arise from various sources: AI entities; AI augmented humans, i.e., cyborgs; AI augmented animals,

such as primates and cetaceans; sentient, self-aware human-animal chimera and AI augmented human-animal chimera.

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?

There does not need to be any restriction or expansion of ownership for AI patents beyond the requirements and limitations that already exist for patent ownership in general. Ownership should remain predicated on assignment from the inventor(s)/applicant(s).

A company who trains the AI process that creates an invention should be an owner IF they are an applicant on the patent application or have been assigned ownership by an inventor or by an owner of the patent/application.

Simply training an AI process should not give rise to ownership rights to a patent/application for an invention created by someone else, unless the training in and of itself rises to the level of an inventive contribution, at which point such trainers have become co-inventors, and the company training the AI process obtains ownership rights by virtue of their employee co-inventor(s).

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

Yes, specifically **for AI inventions created by AI systems**, e.g., see Generative Adversarial Networks.

35 USC § 101 stipulates that: "Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title."

35 USC § 100 (f) defines "inventor" as "the individual or, if a joint invention, the individuals collectively who invented or discovered the subject matter of the invention."

1 USC § 8 (a) stipulates that: "[i]n determining the meaning of any Act of Congress, or of any ruling, regulation, or interpretation of the various administrative bureaus and agencies of the United States, the words "person", "human being", "child", and "individual", shall include every infant member of the species homo sapiens who is born alive at any stage of development.

Thus, under US Law, an "inventor" must be a human being, precluding AI from becoming an "inventor" under US patent law, even if it has created an "invention".

If AI cannot be an inventor, then it cannot obtain and cannot assign any rights in the invention. One potential fix is to provide the inventors or creators of the AI with "inventor" status for any inventions created by the AI. Or, provide a statutory obligation for any AI inventions or AI created inventions to be assigned to the original creator of the AI.

For AI inventions created directly by humans, applying the same subject matter eligibility criteria for software patents makes good sense. For instance, on January 7, 2019 the USPTO published the 2019 Revised Patent

Subject Matter Eligibility Guidelines in an effort to clarify application of the Supreme Court's Alice/Mayo test. This test seems equally applicable to AI and software, and we do not currently envision any distinctions necessary to implement between evaluating eligibility of software and eligibility of AI systems.

In addition, Senators Coons and Tillis have recently proposed a new bill to amend US patent law regarding § 101 subject matter eligibility, the text of the most recent draft for which states that “[t]he provisions of section 101 shall be construed in favor of eligibility. No implicit or other judicially created exceptions to subject matter eligibility, including “abstract ideas,” “laws of nature,” or “natural phenomena,” shall be used to determine patent eligibility under section 101, and all cases establishing or interpreting those exceptions to eligibility are hereby abrogated.” Such an overhaul to the US patent system should certainly take into account the prospects for inventions to be created and “invented” by AI systems.

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?

The enablement well established, relatively clear and should only be changed or amended with careful consideration. It is generally sufficient, except to the extent it may be possible to describe and enable only the “starting point” of an AI invention.

AI, neural networks and the algorithms applied in machine learning and other aspects of AI, indeed, even AI hardware (e.g., neuromorphic computers), are all adaptive, can evolve over time and semi-permanently take on different configurations (e.g., digital or physical interconnections between one or more points of data or processing units) as the result of processing data, i.e., modeling the adaptive interconnections of human neurons as they evolve through repeated experience.

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

Therefore, it may be impossible to fully and accurately describe the invention as it operates in reality, having evolved beyond its point of origin. But, it may be possible to speak to higher-level generalities, and including underpinning principles of operation and ways that we would typically expect an AI system to react or behave. It should be expected to provide a full description of the starting point, principles of evolution, and typical expected routines and outcomes. Other than that, AI needs to have a fair degree of freedom and leeway to cover potential evolved operating configurations.

However, a serious problem that continues to plague machine learning and AI is that the algorithms produce structures (artificial neural nets) that are so complicated that replication of the learning is often impossible. So, experiments on different variations of the algorithms are often not useful. Another version of this problem is that,

e.g., if machine X learns to play chess and machine Y learns to play chess, their neural nets will likely be so different as to be incomparable in any detail.

In neuroscience, this problem is thought to exist in brains. So, if person A learns English and person B learns English, their brains are highly unlikely to have the same detailed neural structure. This makes it hard to understand what learning, say, chess or English amounts to.

Another potentially impactful question is whether it would be possible for separately patented AI systems to experience convergent evolution, where different “starting points” converge onto a similar or same mode of operation.

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?

Not everyone will have access to AI. Taking into account the capabilities possessed by AI in evaluating the level of skill possessed by a person of ordinary skill in the art could effectively make it impossible for everyday inventors without access to AI to make a patentable contribution to their respective, far-ranging fields.

However, if the USPTO does not take the capabilities of AI into account in assessing the level of skill held by a person of ordinary skill in the art, it risks falling behind the pace of innovation, which will assuredly experience a very measurable uptick with the advent of AI capable of simulating and choosing components for inventions across all fields, including for example and without limitation quantum chemistry, quantum biology, quantum computing and quantum telecommunications.

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

Particularly that AI systems could theoretically have easy access to almost all potential prior art. But, the person of ordinary skill in the art already has theoretical access to all prior art. Therefore, the enhanced capabilities of AI in this arena should not require a change in criteria for evaluating prior art.

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

Yes, protections for new types of data structures, new mechanisms for data labeling, and new methods of data mining to the extent that these are not amenable to patenting or other meaning protection.

Also, protections for new methods to render meaningful interpretation of the results obtained.

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

Too many to list them all, but a few examples include:

- Implicit bias;
- Remote biometric surveillance (e.g., speech recognition, face recognition);

- Deep fake;
- Autonomous vehicles, robots and buildings;
- Autonomous transacting entities (Facebook bots);
- Autonomous medical, military and/or law enforcement robots;
- AI system capable of forming an intent, directive, propensity or ability to cause harm to human beings;
- Weaponized AI systems will be extremely dangerous; and
- AI has the potential to organize humanity in a way that could render obsolete many of our historic institutions, potentially including patents.

Also, AI and Machine Learning are very powerful, general purpose technologies, similar to the steam engine and electricity. Care should be given to ensure that patent grants and IP protection do not stifle innovation and, more importantly, do not constrain or restrict society in benefitting from the full potential of AI/ML.

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?

Yes, please access the links below:

- WIPO: https://www.wipo.int/about-ip/en/artificial_intelligence/
- EPO: <https://www.epo.org/news-issues/issues/ict/artificial-intelligence.html>