

Responses to USPTO Request for Information on Patenting Artificial Intelligence Kate Gaudry¹

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

It is important not to conflate artificial intelligence with machine learning. Not all AI techniques use a machine-learning technique. Machine-learning techniques use data to learn parts of an underlying algorithm (e.g., to learn values of a set of parameters). Some AI techniques refrain from using deep learning and may instead rely on (for example) sophisticated queries, logic and/or a knowledge base. For example, Deep Blue used symbolic AI (or “Good Old-Fashioned Artificial Intelligence”) to beat Garry Kasparov at a chess match in 1997. Deep Blue is generally considered to correspond to an AI system, even though this technique merely involved comparing (a large number of) potential sequences, which does not equate to “learning”. The USPTO seemed to have previously realized that AI is broader than machine learning, as Class 706 has a machine-learning subclass and a knowledge-processing-system subclass.

AI is thus actually quite a broad term. I would recommend avoiding setting up programs or other initiatives for which it would be necessary to specifically characterize individual patent applications as either pertaining to AI or not. As it currently stands, AI-related definitions are used in the classification process, but it is well known that patent applications may pertain to multiple classes. Thus, there is no expectation that the AI class would include *all* of the AI patent applications or that all classes assigned to the AI class actually relate to AI. Further, some would argue that entire fields are parts of the AI field. For example, an argument could be made that the entire fields of computer vision, speech detection and natural language processing are a subfield of the field of AI. Thus, I would again recommend using caution in establishing a definition for “AI inventions” that would be used to differentially process AI-invention patent applications as compared to other patent applications.

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.

Developing a machine-learning tool can include various steps, such as:

1. Determining that machine learning can be used to address a specific problem to identify a specific type of solution (which may then be translated to a particular use);
2. Identifying one or more types of machine-learning algorithms that would be appropriate for the machine learning in #1;

¹ Opinions expressed in this document are those of the author and are not represented as reflecting any opinions of her law firm.

3. Determining how to collect and/or process training data (e.g., in an automated manner and/or to implement controls to inhibit bias in the machine-learning model);
4. Identifying various additional pre- and/or post-processing to be performed (e.g., to implement a de-identification technique, to refine a dimensionality, to implement data-security measures, etc.); and/or
5. Setting hyperparameters and/or objective functions.

A machine-learning tool can be used to:

- Identify structure in input data based on learned parameters;
- Identify relationships between variables based on learned parameters; and/or
- Detect outputs of interest.

A natural person can contribute to the conception of an invention relating to any of these bullet points and can then be eligible as a named inventor. However, to be patented, the claimed invention must comply with the statutory patent requirements. Thus, it may be more difficult for a natural person to obtain a patent for merely determining that machine learning may be used in a given context.

Some may consider Question #2 of the PTO's Request for Information to be most interesting when considering whether a person can be a named inventor if the claimed invention relates to parameter values that were learned and/or an output by a trained model. Some may argue that, in this context, the person has not "conceived" of anything. I would submit that there are strong parallels here to high-throughput screening. In both of these cases, one or more people decided to use a particular type of model/screen, configured in a particular manner, (e.g., by setting hyperparameters and/or defining an objective function or by identifying a particular target) to process particular data/chemicals. Further, one or more people determined how to access and/or quality control training data to use for training the model. In each of the machine-learning and high-throughput-screening instances, the results of the model/screen were then reviewed by a person and determined to be useful in a particular context. Thus, I submit that a natural person can be an inventor in both instances.

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?

No. I believe that the only time at which an entity other than a natural person could potentially conceive of an invention is when we are on the cusp of general intelligence. Then we may query whether patents remain the appropriate tool to use to provide incentives of value. However, I think that general intelligence is a very long ways off, such that we need not worry about adjusting patent law now for this distant and remote possibility. Before then, the ingenuity comes from a human's defining of a problem; selection and configuration of a model; determining appropriate pre-processing, post-processing and hyperparameters; collecting training data and assessing results.

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?

As noted in my answer to Question 2, I believe that an entity may be an inventor if (for example) he/she contributes to conception of selecting, developing and/or configuring a machine-learning model and/or he/she detects an output of interest from the machine-learning model. Suppose now that a first entity contributes to conception of selecting, developing and/or configuring a model and a different second entity uses the model and detects an output of interest.

If each of the model's configuration and use of a model output are new and non-obvious, potentially, each entity can secure their own invention. Returning to the biology example, it is common that Entity #1 will develop a tool, which will be used by Entity #2 to identify a result of commercial interest, and each of these entities can seek secure a patent.

If non-obviousness and/or novelty of one of the model's configuration and use of a model output depends on the other of the model's configuration and/or use of a model output, the entities may entertain forming a Joint Ownership Agreement or agreeing to some other contractual relationship. Perhaps the first entity patents the trained model and then licenses it to the second entity with particular IP provisions that identify ownership of patents resulting from use of the model. Similar arrangements could be explored in the AI concept.

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

No. The current patent-eligibility framework is a mess as it stands. It is frequently being used by courts as a convenient means by which to quickly deem a patent as being invalid, despite the fact that judges' underlying issues with the patents seem to actually relate to other patent requirements. If we start to carve out eligibility considerations that are unique to a given technology, the confusion surrounding patent eligibility will be further compounded.

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?

As noted in MPEP 2161:

The level of detail required to satisfy the written description requirement *varies depending on the nature and scope of the claims* and on the *complexity and predictability* of the relevant technology. ... The critical inquiry is whether the disclosure of the application relied upon reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date. (Citations omitted.)

As noted in the answer to Question 1, AI technology is very broad. Some would interpret it to envelope the entire fields of computer vision and natural language processing (and much more). Thus, it would not be appropriate to set forth any blanket requirements specifying what must be disclosed in “AI invention” patent applications. Rather, *it is essential to perform an application-specific assessment that is highly rooted in the claim language*. Consider two situations:

Situation 1. Suppose that a patent application claims using a deep neural network that was trained on a new collection of data, in which individual inputs were associated with a label assigned in a new manner. Perhaps it would be convenient if the inventor disclosed a number of hidden layers, a number of nodes per hidden layer, etc. Or perhaps that is irrelevant to the improvement offered by the new labeling of the training data. In the latter instance, there may be no need to disclose the specifics about how individual nodes in the network work and/or how the nodes are interconnected. This is because the structure and operation of feedforward neural networks are quite well known, and the prominent part of the invention may be able to integrate in with deep neural networks having various hidden layers and/or various hidden nodes per hidden layer. Thus, solid disclosure of the new labeling may suffice to indicate to one of skill in the art that the inventor possessed the claimed subject matter.

Situation 2. Suppose that a patent application claims using a deep neural network to process image data to predict a mood of a person pictured. Suppose other references that the examiner finds indicates that neural networks (or even deep neural networks) cannot be used to predict mood based on image data with reasonable accuracy. Because one of skill in the art may have then doubted that the inventor had actually possessed the claimed subject matter, it may be appropriate to determine that disclosure of specifics of the neural network are required.

- 7. How can patent applications for AI inventions best comply with the enablement requirement, particularly given the degree of unpredictability of certain AI systems?**
- 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?**
- 9. Are there any prior art considerations unique to AI inventions?**

I am collectively responding to Questions 7-9. It is important to evaluate (1) the skill of one of ordinary skill in the art; (2) the enablement requirement; and (3) the non-obviousness requirement. Thus, suppose that an application’s claims relate to applying a type of AI to a problem in a particular field to generate an output that is useful in a particular field. If one of skill in the art is assumed to have high skill in configuring and using AI models, the application would likely need to include fewer specifics about the AI model. However, he/she may have been less likely to combine disclosures from references in the particular field. Meanwhile, if one of skill in the art is assumed to have high skill in the particular field, a patent application may need to have a fair amount of detail pertaining to how to build and use an AI model.

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

Data protection is very important in the field of AI. Training data sets can be very expensive and time-consuming to collect, though accuracies and efficiencies of machine-learning models are often highly tied to the size and quality of the training data set. Accordingly, many companies are highly protective of this data. It is even an open question as to the extent to which training data should be shared and/or described for purposes of FDA approval for medical devices that rely on use of AI.

Though training data is highly coveted, there are also valid arguments to promote open access. If a training data set is skewed, too small or confounded, the integrity of the results of an AI algorithm is questionable. Thus, the degree to which a user may want to rely upon a result may depend on a degree to which the training data is of highly quality and/or properly vetted.

Deriving a type of intellectual property that would promote publication of training data while limiting or preventing others' use thereof may have immense value. Notably, I am not recommending that the US adopt the European database protection. In large part, I find that latter protection to be compromised by the fact that the protection is tied to the investment expended to collect and/or verify the data. As indicated, a key benefit for promoting data sharing is to support AI results and serve as metric by which users can gauge confidence. The outcomes can occur regardless of whether substantial expended effort to collect the data or not.

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

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?