**NSIP Law's Response to USPTO Request for Comments
on Patenting Artificial Intelligence Inventions**

November 8, 2019

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

NSIP Law is pleased to submit the following comments in response to the USPTO's request for comments, published in 84 FR 44889 (August 27, 2019) related to patenting Artificial Intelligence inventions (Docket Number: PTO-C-2019-0029). We thank the Director for USPTO's effort to create more reliable, predictable, and robust patent protection for inventions related to Artificial Intelligence (AI) technologies.

NSIP Law secures enforceable intellectual property for companies and inventors, including securing AI-related innovation. Described below are our comments on patenting AI inventions:

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.**

We agree with the focus of IEEE-USA's response that "[b]ecause 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."

Also, the collective characterization of all 'AI' inventions is not appropriate, as AI has dissimilar application in various fields. For example, an Artificial Intelligence article of

NSIP Law's Response to USPTO Request for Comments on Patenting Artificial Intelligence Inventions (Docket Number: PTO-C-2019-0029)

Page # 2

The Encyclopedia Britannica site refers to AI as "the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. The term is frequently applied to the project of developing systems *endowed with the intellectual processes characteristic of humans*, such as the ability to reason, discover meaning, generalize, or learn from past experience." During a 2018 Google AI event Google's Andrew Moore stated that "AI is currently very, very stupid . . . It is really good at doing certain things which our brains can't handle, but it's not something we could press to do general-purpose reasoning involving things like analogies or creative thinking or jumping outside the box."

Some machine learning techniques may perform a supervised training of a system to recognize, classify, or otherwise act, based on training data until the system performs the designed task with sufficient accuracy or minimal loss. Other machine learning techniques may be generated with an architecture and design, so the system is at least partially trained through some other unsupervised approach. The resultant trained system would not appear to be performing a task commonly associated with a human being, or reflect an endowment of human intellect or characteristics. It may merely be a computer or hardware implemented machine that has become trained to perform a task. There is no human endowed intellect in the implementation. While various designs of functions or neuron/synapse interactions in 'neural' networks may have found some general inspiration from the observations of how human neurons work or how other animals' neurons work, e.g., with the work of Hubel and Wiesel with respect to cat and monkey optical neurons leading to their suggestion of a cascading model on which a basic convolutional layer was ultimately introduced, the underlying implementation in the computational world is a machine implementation that does not reflect human intellect because of the general neuron/synapse inspirations. It also does not reflect some biological or law of nature merely because of the initial inspirations behind the concept coming from the animal optical neuron operations. Thus, though the terms 'learning', 'memorizing,' 'remembering,' 'inferring,' or 'intuiting' may be commonly used, along with neuron, synapse, etc., they are terms of art with respect to the computational approaches to cause a computer to perform one or more tasks.

As another example, while a human may learn through trial and error, or children may be taught through rewards for good behavior, there is substantial inventiveness with respect to the AI field of reinforcement learning (RL), where a reward system is implemented with respect to actions of agent(s) while balancing exploitation and exploration, and while considering real world data. While this field and technology may be referred to in the context of an AI that performs trial and error, their unique computational implementations have required substantial research and investment, that naively cannot be considered as reflecting human intellect. An AI system or implementation may achieve similar results as those achieved by human intellect, but that does not mean that they are achieving those results in the same way.

Any consideration of the various queries regarding inventive entities in this Question

NSIP Law's Response to USPTO Request for Comments on Patenting Artificial Intelligence Inventions (Docket Number: PTO-C-2019-0029)

Page # 3

must take into account the *respective* implemented AI technique, application, and field with respect to the referenced AI invention, i.e., each entity query consideration should not be made at a high or generalized level where the term 'AI' can be conflated to the most sophisticated and narrowest fields of AI what could potentially be interpreted equating to human intellect and reason, and thus, should not be made at such a level that would suggest an entity situation that would not or could not be applicable to almost all or any AI inventions, or an entity situation that is not even currently at issue.

WIPO recently published "WIPO Technology Trends 2019: Artificial Intelligence" report discussing trends in AI, including discussions of the evolution of AI and scientific publications, geography and market trends, and policy issues involving AI. FIG. 3.1 of the WIPO publication illustrates that there were at least 50 thousand AI related patent families in existence as of 2017, with "44 percent of all AI patents mention at least one AI technique, while 75 percent mention a functional application and 62 percent an application field." FIG. 3.3 of the WIPO publication demonstrates the there is substantial overlap between techniques, functional application, and application field, e.g., with over 47 thousand patents overlapping all three categories.

FIG. 1.1 of the WIPO Publication illustrates some of the different AI techniques, including: expert systems, description logistics, the field of Logic Programming, the field of Fuzzy Logic, the field of Ontology Engineering, the field of Probabilistic Reasoning, and the field of Machine Learning, which is suggested to include machine learning (general), supervised learning, unsupervised learning, reinforced learning, multi-task learning, classification and regression trees, support vector machines, neural networks, deep learning, logical and relational learning, probabilistic graphical models, rule learning, instance-based learning, latent representation, and bio-inspired approaches, for example.

Likewise, FIG. 1.2 of the WIPO publication illustrates some of the AI functional applications, including: planning and scheduling knowledge representation and reasoning, speech processing (phonology, speech processing in general, speech synthesis, speech-to-speech, and speaker recognition), predictive analytics, distributed AI, natural language processing (natural language processing in general, information extraction, machine translation, dialogue, natural language generation semantics, morphology, sentiment analytics), robotics, computer vision (scene understanding, object tracking, character recognition, image and video segmentation, biometrics, augmented reality, computer vision in general), and control methods. Here, each of these functional applications will also be suggestive of implementation in many fields where such computational solutions would not have previously been considered.

FIG. 1.3 of the WIPO publication illustrates, with many sub-categories, some of the various current AI application fields, including: networks, banking and finance, business, physical sciences and engineering, personal devices, arts and humanities, agriculture, energy management, law-social-behavioral sciences, industry and

NSIP Law's Response to USPTO Request for Comments on Patenting Artificial Intelligence Inventions (Docket Number: PTO-C-2019-0029)

Page # 4

manufacturing, security, education, transportation, document management and publishing, entertainment, telecommunications, computing in government, live and medical sciences, military, and cartography. Figures 4.5-4.11 of this WIPO publication further demonstrating the various Applicants submitting patent applications in the diverse AI techniques, functional applications, and fields.

The variety of AI technique and their implementation illustrate that AI is not a monolithic field that can be pigeonholed into a narrowly defined technical field. Accordingly, the USPTO should not institute some generalized definition of the 'elements' of an AI invention, but should recognize the rich tapestry created by the different techniques, applications, and fields of AI inventions. Rather, the 'elements' of any technique in an AI application should be treated similarly as applications in other fields with respect to patent eligibility and patentability. For example, processor, or computer-implemented AI concept, or AI technique should be considered, along with the remaining claimed features, in a similar manner with respect to patent eligibility and patentability as these elements and the remaining claimed features and elements are considered in non-AI implemented approaches in the underlying application or field.

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.**

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?**

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?**

With respect to Questions 2-3, as we noted above, we believe that there are many different techniques, applications, and fields in which many different AI inventions may be implemented to provide technological benefit, improvement, or option for performing a task and/or solving a problem. Thus, there is no need for any special laws or regulations, or change in existing laws or regulations, based on a situation where an AI algorithm or AI invention or process purportedly 'invents' something that the AI algorithm or AI invention was not trained or intended to derive.

NSIP Law's Response to USPTO Request for Comments on Patenting
Artificial Intelligence Inventions (Docket Number: PTO-C-2019-0029)

Page # 5

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

No. AI inventions should be considered analogous to how patent eligibility is applied to other technologies with respect to technological improvements, especially when solving a technological problem and/or providing a technological improvement or benefit. If the AI invention includes a processor element, processor, or computer-implemented aspect involving any of the aforementioned techniques, applications, and/or fields, the AI invention should be considered under the current Step 2A and 2B analyses interpreted from *Alice Corp. Pty. Ltd. v. CLS Bank Intern.*, 134 S. Ct. 2347 (2014).

Whether implemented as a machine or a method, a trained model or trained neural network that has unique parameters, resulting from training for a designed purpose or task results in a new and novel machine or method due to such unique parameters, whether the model or neural network is claimed from the technique, application, or field perspective. A different model or neural network with different parameters will at some point provide different results or provide different result characteristics, e.g., with different speed, accuracy, or timing. The training of the model to generate such unique parameters should also be considered inventive. A model or neural network designed and trained with respect to one type of training data, or training data from a particular perspective, for a particular purpose or task, will provide a different and most likely irrelevant or useless output for other types of input data or input data from another perspective, or if the input data is input in a different form, timing, or sampling.

The training of the AI machine or the training method may be considered a 'method of manufacture' for the implemented AI machine or method, just as the unique selection/generation of training data that makes such training available may be an inventive aspect. For each implementation the unique characteristics should also be considered with respect to whether the claimed invention recites an abstract idea, is integrated into a practical application of the purported abstract idea, or contains an inventive concept that is sufficient to transform the purported abstract idea into a patent-eligible application, e.g., such as when implementing the 2019 Revised Patent Subject Matter Eligibility Guidance, published by the USPTO on January 4, 2019 ("January 2019 PEG") and the "October 2019 Update: Subject Matter Eligibility," published by the USPTO on October 17, 2019 ("October 2019 Updated PEG")

As another example, on page 31, the WIPO publication discusses that "[w]hile computer vision, natural language, and speech processing] functional applications are the most important in terms of the total number of filings, others are emerging and growing fast. AI filings concerning both robotics and control methods have increased by 55 percent [from 2013 to 2016], for example, while those for planning/scheduling have grown by 37 percent." Such functional application filings in the control methods is demonstrative of why the term "AI invention" should not *only* be considered as models being claimed without any technical grounding to the real world. Based on the 55 percent increase from 2013 to 2016 in filings of patents in control methods as AI inventions, such

NSIP Law's Response to USPTO Request for Comments on Patenting Artificial Intelligence Inventions (Docket Number: PTO-C-2019-0029)

Page # 6

implementation may further increase in the future. This statistic demonstrates that other fields will also have new or increased use of AI concepts or techniques.

Using the AI-based control system (or control AI invention) as an example, even in a controller type environment where parameters of a control system model are dynamic, e.g., through machine learning based on inference operations or through other techniques, the AI-based control system may produce a control or control-inducing output based on input data, just as a non-AI implemented control may similarly produce a control or control-inducing output data. The AI-based control system would merely be performing a different controlling approach for a same or similar control theory that is integrated into a corresponding controller or a practical application of the control theory, but providing an improved, faster, more efficient, or cost-effective control approach.

In another example, a typical hardware or processor implemented machine controller may implement control through feedback signaling to reduce error or to derive next/different control operations. If this machine controller using feedback signaling is patent eligible because such logic programming or logic circuitry of the machine controller dynamically adjusts the output of the machine controller dependent on the input and the feedback according to a control theory, then an AI model implementing method or AI model implementing machine that performs learning (or re-learning) to adjust parameters of the model based on past output or fed back information, to dynamically adjust generation of the output should also be patent eligible. Both machine controller and AI model-based approaches result in practical or real-world applications of the underlying control theory, and depending on the level of uniqueness claimed, each control approach could contain inventive concepts that could transform any interpretable abstract control theory into substantially more than the control theory alone.

As another analogy, a machine controller may generate control output based on a collective operation of gears and springs that operate dependent on an input. This machine controller is a practical and real world application of an underlying interpretable control theory and provides a real world solution to a technological problem with previous gear/spring mechanisms, for example, just as an electrical-based machine controller that generates control output based on a fixed collection of electric inductors, capacitors, resistors, and various transistors responding to some input. This electrical-based machine controller may be able to provide a technological improvement over the gear/spring machine controller, and may also be available for many other applications where the gear/spring machine controller is not practical or was not previously envisioned applicable. Likewise, a machine controller that includes circuitry implementing a configurable processor, can provide technological improvements over the fixed electrical-based machine controller, and may be available for applications across various technologies. Accordingly, a machine controller that now implements a trained AI model or other AI technology provides further improvements over previous

NSIP Law's Response to USPTO Request for Comments on Patenting Artificial Intelligence Inventions (Docket Number: PTO-C-2019-0029)

Page # 7

circuitry based machine controllers, such as being more accurate, faster, easier to update, and/or being more dynamic, predictive, or intuitive with respect to the AI-based machine controller's environment. Thus, if the non-AI machine controller applications were interpreted as representing arguable control theory integrated into practical or real world applications, then the AI-based machine controller should similarly be considered as being integrated into practical or real world applications of the underlying control theory, instead of any interpretable 'mathematical concept' or 'mental operation' that the claimed AI model is still being interpreted as reciting.

There are many other similar parallels between generational approaches to solving a problem in various technologies and fields, with the AI based model implementing methods or AI model implementing machines merely being the latest generational approach. If a previous generational approach was interpretable as capable of integration of an abstract idea or concept into a practical application, or interpretable as containing inventive concepts that would transform such an idea into substantially more than the abstract idea, then the latest generational approach of a corresponding AI invention should be interpreted as patent eligible. Regardless of the more computational or math related approach of a corresponding AI invention, a claim of the AI invention should still be found patent eligible under the *Alice* Steps 2A and 2B, just as the previous generational approaches were interpretable as containing their own inventive concepts in the respective generational approaches.

Thus, while several of these Questions appear premised on consideration of some self-aware, conscious, or inventive AI, e.g., the computer thereby being 'capable of thinking like a human' according to the Turing Test, a very high and super majority of patent applications that involve some AI concept will be directed to more mundane and task related inventions to solve many real-world problems without inventing things by themselves.

UK's Intellectual Property Office's 2019 publication "Artificial Intelligence: A Worldwide Overview of AI Patents and Patenting by the UK AI Sector," explains that the "term 'Artificial Intelligence' (AI) refers to those computer systems capable of performing tasks that would normally require some intelligence if done by humans." Thus, in the context of patent eligibility, various technologies that perform operations or tasks that 'may normally require some intelligence if done by humans' should consistently be interpreted as not being directed to abstract ideas because these technologies produce real world improvements to any interpretable underlying abstract ideas or concepts. If the AI invention improves previous processes and machines, AI inventions should be understood to not be directed to any interpretable abstractness of the claimed AI concept or technique, but should be found to contain inventive concepts capable of transforming the underlying abstract idea into the 'substantially more'. A claim that includes AI concepts or claims an AI technique should be treated similar to alternate patent eligible techniques in the same functional application or same application field.

NSIP Law's Response to USPTO Request for Comments on Patenting
Artificial Intelligence Inventions (Docket Number: PTO-C-2019-0029)

Page # 8

Thus, there is no need for a special rules or guideline with respect to patent eligibility, beyond those already applicable to the underlying technologies, applications, and/or fields, or beyond how the USPTO currently considers other processor element, processor, or computer implemented 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?**

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?**

The Questions appear to be directed to a category of AI that is far removed from the invention or designed purpose of the AI. For example, if an AI model is trained to be dynamic and to retrain parameters of the model based on real world information, or to generate new parameters of the model, or to consider select or alternate inputs, or to generate select or alternate outputs, or if the AI generates anticipated or potential varieties of outputs based on many thousands of potential combinations of input information, then the AI would still be performing its designed purpose. The fact that the AI model can process more information and simulate many more potential combinations of information, faster than other non-AI based approaches should not be considered a suggestion of patent ineligibility or considered as a basis to judge obviousness, enablement, written description, or definiteness. Rather, it should merely be evidence of technological improvement over the other non-AI based approaches.

Most, if not all, AI that will be considered by the PTO in the near future will be of the former example, of some type of AI machine that is designed and trained to perform one or more designed tasks, or various combinations of such AI components to collectively perform various tasks. The task could be as straight forward as extracting features from a face image and then outputting those extracted features as a vector to compare to the stored feature vectors to recognize a person, or the task could be to recognize a battery's

NSIP Law's Response to USPTO Request for Comments on Patenting Artificial Intelligence Inventions (Docket Number: PTO-C-2019-0029)

Page # 9

state-of-charge for a proper display of the driver's remaining power in an electric vehicle, or the task could be to control stopping of a vehicle when certain objects are detected from an image within a stopping distances.

The person of ordinary skill in the art for each of these existing and future applications of AI will be the inventors of the AI, e.g., for the designed task, and the technology, application, and/or field that the AI is being implemented in. Thus, the only potential change in the consideration of the person of ordinary skill in the art could be that the person of ordinary skill in the art will be the person of ordinary skill in the underlying claimed application or field that the AI is applied in and the corresponding AI, e.g., the corresponding AI technique.

Similarly, with respect to Questions 6 and 7, whether disclosure requirements need to changed or whether enablement could be questioned because of the reasonable expectations of success, both of these questions also would appear premised on the answer to Question 8 being that the person of ordinary skill in the art is at a level beyond or different from the level of skill in the art of the inventors of the AI.

However, though examination of applications may require a higher level of skill and understanding by Examiners and practitioners with respect to a claimed AI implementation, or claimed AI implementation in a particular application or field, for example, the USPTO should not impart a greater requirement on Applicants to submit more disclosure or provide more evidence than required to with respect to the person of ordinary skill in other technological arts.

Thus, with respect to the Question 7 suggestion that further written description may be required "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," there should not be any greater requirement for written description than would be required for the person of ordinary skill in the art. If the person of ordinary skill in the art would understand the description regarding any suggested hidden layers or many suggested hidden layers that may have parameters that can dynamically change, and thus understand the subsequently claimed features, then the written description requirement should be understood to have been met regardless of the fact that an invention aspect is directed to, or implements, AI.

With respect to enablement, after an understanding of the level of the person of ordinary skill in the art, it is not believed that there are sufficient examples of AI that represent the 'degree of unpredictability of certain AI systems' suggested by Question 7. An AI could be trained on training information for particular designed task(s), e.g., through supervised training or unsupervised training, and though the implementation of an example AI model may result in changes to parameters of an example AI model or may result in the AI model considering substantially more information or combinations of information than traditional computers, and thus, have the capability to output

NSIP Law's Response to USPTO Request for Comments on Patenting
Artificial Intelligence Inventions (Docket Number: PTO-C-2019-0029)

Page # 10

various new outputs. This should not be considered as an indicium of unpredictability.

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

Greater encouraged level of skill of practitioners and Examiners may be beneficial to prosecute applications with greater expediency, because when extra rounds of rejections and traversals are required to be presented until both practitioners and Examiners are of similar level of understandings with respect to the relied upon references this is wasteful of PTO and practitioners resources, and increases pendency of other applications as they could have been acted on earlier.

There should be general understandings of the techniques and technologies of AI across all examining groups, including chemical, natural, and material sciences, in addition to the potential processor element, processor, or computer implementations in the mechanical and electrical arts. Such general understandings should also exist in those art units involving business or financial fields. As explained above, there are many applications and fields that implement AI inventions, and the applications and fields where AI aspects are utilized will only expand. The general understanding will make the Examiner's search more accurate and speedier, and will help to promptly clarify whether a reference's disclosure is applicable and appropriate.

In addition, bulk of prior art may be non-patent literature (NPL) considering the recentness or sophistication of AI invention. NPLs are more 'loose' with discussions, explanations, and conclusions, and thus, more likely to provide only a generalized support for any feature or aspect of the NPL that the Examiner relies upon.

When multiple NPLs are considered more care is needed in deciphering or deriving exactly what the respective NPLs are discussing, and discerning whether the respectively relied upon features are actually combinable, or whether the Examiner can present an explanation of why there would be a reasonable expectation of success with their combination. Whether one NPL, or multiple NPLs, are being relied upon for a missing feature and/or for a reason for combination, substantial evidence should require that more explanation of the reason for rejection be required when the NPLs are deficient in explanation.

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

A primary issue should be the current uncertain atmosphere surrounding the patenting of AI inventions stemming from the unpredictability infused by the Supreme Court's *Alice* decision, which muddies the water on the enforceability of issued patents and how or whether to attempt to patent an AI invention. There is a need for statutory change to clarify that AI inventions are patentable, and patents that include or are directed to such AI aspects will be enforceable.

NSIP Law's Response to USPTO Request for Comments on Patenting Artificial Intelligence Inventions (Docket Number: PTO-C-2019-0029)

Page # 11

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 should consider how other countries are accelerating their AI investment and protection, which may provide greater support toward the health of their underlying economies compared to economies without such nimble and aggressive approaches toward investment in AI technologies. Such nimble and aggressive approaches is hindered and investment is discouraged when inadequate patent protection is provided for AI inventions to.

One example is Singapore's recent Accelerated Initiative for Artificial Intelligence (AI2) that expedites the application-to-grant process for AI patent applications to as fast as 6 months. This is a proactive approach that could be paralleled with much greater application with respect to US patent application examination, with as little as changes to the USPTO hiring and pendency goals being adjusted to expedite examination, or a new categorization for prioritized applications in addition to the categories of age and PPH, or a substantially reduced fee for Track One prioritized examination along with an increase in the current limit on the number of prioritized examination applications.

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NSIP Law thanks the USPTO for consulting interested stakeholders with expertise in securing protection for emerging technologies used in AI. NSIP Law would welcome the opportunity to engage in any follow-on discussions with the USPTO.

Respectfully submitted,

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