MCLE Self-Study Article

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DO I HAVE A PATENTABLE TECHNOLOGY IN ARTIFICIAL INTELLIGENCE?

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This article presents a systematic, tiered approach to assessing patentability of technologies related to artificial intelligence ("AI"). This article first describes the recent increasing developments in AI and the need for guidance in assessing patentability of eligible AI-related technologies. Next, this article shows a systematic, tiered approach, based on a classification of AI-related technologies. This article further offers advice on effective approaches to assessing patentability of AI-related technologies.

Surge of AI-Related Technologies

AI has attracted tremendous attention both in technical research and the popular media. AI typically refers to the apparent intelligence exhibited by a computer that has been programmed to simulate natural functions of the human brain. The main reason that AI has become so popular is the desire for a "smarter" world that requires less human intervention and the explosion of digital data that triggers and further fuels such a desire. Right now, a main approach towards achieving a smarter world is to deploy computer programs that automatically update data models and thus "learn" from large amounts of data that capture human behavior that can be derived from interaction with online services, applications, or databases. As time goes on, inventors and developers likely will focus more efforts on simulating aspects of human intelligence more advanced than learning, such as reasoning or problem solving.

AI has been a research field in computer science since at least the 1950s,[1] and machine learning has been a fundamental branch of AI since the research field's inception.[2] Without knowing precisely how humans convert external signals into internal information, the research field has modeled the human learning process at various levels. Interestingly, knowledge-based approaches representing the human learning process at a higher, conceptual level, such as rule-based inference engines, did not dominate until later,[3] while symbolic methods representing the human learning process at a lower, physiological level, such as artificial neural networks, came into existence early on.[4] While the knowledge-based approaches might be more human-understandable, the symbolic methods might better capture the intricacies of human cognition, which partly explains why they are regaining popularity.

Uncertainty in Determining Patentability of AI-Related Technologies

Machine learning typically involves creating and applying a data model that takes an input set of items, each having a list of features, and produces an output set of items indicating classifications of or relationships among the input set of items.[5] The input set of items may correspond to existing human actions, and the output set of items may correspond to a prediction of human behavior as a result of a machine learning from the human actions. As noted above, the data model may represent the human learning process at one of different levels. The treatment of a machine learning method generally involves a design phase followed by a building (creation) phase and an execution (application) phase. An AI-related technology may be an invention that fits anywhere within the overall paradigm for machine learning, as further discussed below.

As AI becomes more involved in technological advances, the prospect of patent protection for an AI-related technology may have increased interest. Beyond the enthusiasm, however, the question of how to seek patent protection for AI-related technologies also arises more frequently. One reason for such uncertainty is that because AI involves simulating natural intelligence, whether an AI-related technology merely replicates existing human behavior (and thus possibly ineligible under 35 U.S.C. § 101) or goes beyond replication to deserve the right to exclude others from using that technology may be

unclear. In particular, people start to conceive AI-related technologies to resolve all sorts of issues as they begin to realize the potential of AI or specifically machine learning. While these technologies might sometimes be novel, whether they are obvious (and thus possibly unpatentable under 35 U.S.C. § 103) remains a question that is often not easily answered. The fact that AI may be involved to different extents in AI-related technologies tends to further complicate the situation, as further discussed below.

Inventors have filed close to one thousand applications with the United States Patent and Trademark Office (USPTO) for AI-related technologies (class 706) since 2015, including close to four hundred specifically related to machine learning (subclasses 12, 14, 16, and 25). The Federal Circuit has not heard many cases involving AI-related technologies but recently upheld dismissal under 35 U.S.C. § 101 of the claims related to machine learning on appeal from *PurePredictive, Inc. v. H2O.AI, Inc.*,[6] as further discussed below. The Patent and Trial and Appeal Board (PTAB) also appears to be still grappling with eligibility issues for AI-related technologies in general. As the continued rise of AI-related inventive (both subject-matter eligible and patentable) activity is inevitable, the ability to discern patentable subject matter from numerous AI-related technologies can be especially valuable or advantageous to practitioners at this time.

Categories of AI-Related Technologies and Approaches to Determining Patentability

This article proposes evaluating patentability of AI-related technologies using the following categories:

New Design of Techniques

In this first category, a technology includes designing a brand-new computational method, such as developing a new type of artificial neural network or genetic algorithm, or an entirely new analytical framework. A technology in this category does not occur very often given the general complexity of the techniques in the research field of AI and the maturity of the research field. When such a technology does occur, the ingenuity and rigor that gives shape to the technology tends to deserve patent protection.

Modified Design of Known Techniques

In this second category, a technology includes designing a new computational method by modifying an existing computational method. Some examples include weighting and eliminating existing filters in an artificial neural network or updating an existing metric or even creating a new one in a decision tree. Patentability of a technology in this category generally depends on how obvious the modification is. Given the existing computational method or the encompassing analytical framework, is there sufficient motivation for the modification? In general, the greater the complexity or the advantage of the modification is, the less obvious the modification might be.

The claims in U.S. Patent 9,015,093 issued on April 21, 2015 may serve as an example.[7] The claims recite a hierarchical stacked neural network comprising neural networks at different levels. The patent states that while the prior art may teach that the higher-level neural networks provide feedback to the lower-level neural networks to adjust connection weights, the present claims recite that the lower-level neural networks return a result of processing a search query to higher-level neural networks for further processing. Therefore, patentability of the present claims can depend on how difficult it is to return data from lower levels to higher levels, how non-obvious it is reverse the prior direction of data flow, or other factors in the given context.

Novel Training for Known Techniques

In this third category, a technology includes preparing a training set for building a data model in a certain manner. Given the three basic types of learning, namely supervised, unsupervised, and reinforcement learning, a technology in this area is often at a meta level concerning some combination of different types of learning to create and refine the training set. Patentability of a technology in this category mainly depends on how obvious the training is. A technology that incorporates an often-applied cross-over technique will not go far in a patentability analysis. In addition, when the training process applies across multiple existing computational methods, a technology in this category is less likely to be non-obvious and thus un-patentable.

The patent claims in the *PurePredictive* case mentioned above may fall in this category. The claims essentially recite building separate digital models for randomly selected features and combining the separate digital models into a meta digital model, which can then be used to determine which features to extract from different input sets.[8] It may be considered "abstract" in that the recited training process sounds high-level and generic without concrete details that are somewhat unusual and thus non-obvious.

Renewed Applications of Known Techniques

In this fourth category, a technology includes re-applying an existing computational method to resolve a specific issue in a certain manner. Some examples include setting parameters of an existing method to specific values to control how the existing method is executed, applying an existing method in an iterative fashion, and applying different versions of an existing method (*e.g.*, built from different training datasets) in combination to different portions of a new dataset. Patentability of a technology in this category mainly depends on how obvious the execution is. Because an execution process tends to be generally applicable rather than specific to an existing computational method, a technology in this category is less likely to be non-obvious and thus patentable.

Novel Selection of a Known Technique to Resolve a Specific Issue

In this fifth category, a technology includes selecting one or more distinct computational methods to resolve an issue. It may be com-

mon to apply certain techniques to solve certain problems. For example, as noted above, the application of artificial neural networks to model relationships among variables is now commonplace. Specifically, application of a convolutional neural network to analyze images is well known. However, a description of an issue to be resolved may not immediately reveal how to formulate a corresponding computational problem, whether a commonly used computational method is directly applicable to or most appropriate for solving the computational problem, or whether any existing computational method can be applied to solve the computational problem. Patentability of a technology in this category depends on how obvious the selection is. For example, when the effort taken to translate a general issue description to a formulation of a known computational problem is significant, obviousness may not follow. On the other hand, when a selected technique is a minor variant of a commonly adopted technique or when an exhaustive list of potentially applicable techniques is relatively small, obviousness may be apparent. This rationale generally extends to a combination of techniques. For example, when a common technique or a minor variant is used to solve each independent sub-problem of a computational problem, the combination of techniques would tend to be obvious.

The claims in U.S. Patent 9,037,519 issued on May 19, 2015 may serve as an example.[9] The claims recite applying a support vector machine (SVM) classifier and a multilayer perceptron (MLB) classifier in a cascading manner to detect and predict traffic condition. The patent states that the prior art methods tend to be time-consuming, leading to traffic congestion or unsafe driving conditions.[10] The claims of the '519 patent recite this two-tiered approach that is expected to work more efficiently without losing accuracy apparently by using the first classifier that can quickly detect a traffic state and using the second classifier for further, detailed processing only when the detected traffic state is undesirable. Therefore, patentability of the present claims can depend on how obvious such a cascading framework is, how obvious it is to select the SVM as the first classifier and the MLB as the second classifier, or other factors in the given context.

Mapping the Problem Domain to Input Data for Execution of a Known Technique

In this sixth category, a technology includes mapping certain aspects of a given issue to a selected computation method. The mapping may include selecting those aspects as training data in the building phase or as input data in the execution phase of a machine learning method. Oftentimes, the technology involves identifying specific aspects of human actions as new items or new features of known items for machine learning, or removing specific aspects of human actions as items for machine learning. For example, one technology may be to study the issue of why people go to bed late. If that issue was studied previously based on a specific set of factors that contribute to why people sleep late as an input set of items for a machine learning method, the technology may be to consider a different set of factors. The different set of factors may include more, entirely different, or even fewer factors. Patentability of a technology in this category depends on how the mapping is performed. For example, identifying specific aspects of human actions as new items or new features of items is often based on human observation and judgment and likely considered obvious or even abstract. More broadly, however, whether certain aspects can fit into an existing analytical framework so as to be analyzed in a specific order might not be apparent at all because an entity involved in a given issue is not normally evaluated with respect to a list of features, as required for an item to be analyzed in machine learning, or because two entities involved in the issue that are related in a certain way do not readily correspond to two items of the input data that are subject to certain constraints in machine learning. On the other hand, filtering existing items or features of items is often supported by computational analysis, so that patentability of the technology may then depend on the obviousness related to such computational analysis.

The claims in U.S. Patent 9,037,521[11] may serve as an example. The claims recite feeding various types of data to a data model for profiling the threshability of crops to be harvested. The patent describes the challenge in assessing, daily, field-level weather conditions that are important to determining harvesting conditions.[12] The present claims recite considering expected weather conditions (including historical, real-time, and long-range forecast; climatological and meteorological; and so on), crop-specific information, and field-specific (or additional cross-field) information in building the data model. Therefore, patentability of the present claims can depend on whether considering all of historical, real-time, and long-range forecast data for a short-range prediction is unusual, whether predict local data using global data is non-obvious, or other factors in the given context.

ADVICE ON ASSESSING PATENTABILITY OF AI-RELATED TECHNOLOGIES

Practitioners will be challenged to identify, capture, and foster inventiveness in a technical field that is both complex and well established, yet is still fast evolving. The mixture of new and old components that interact in various manners often blurs the line between patentability and obviousness.

A practitioner must be adequately proficient in the foundational technology and keep abreast of new developments in AI, as determination of the obviousness of an AI-related technology rests on an understanding of how the technology operates and knowledge of how mature and popular related techniques are. The complexity of AI provides plentiful opportunities to achieve inventiveness by modifying or utilizing existing techniques, which may not be appreciated without a proper grasp of the nature and structure of those techniques. In addition, a related technique that was relatively unknown might become commonplace a short while later, which needs to be taken into consideration to have a proper assessment of the patentability of

the technology. For example, while the application of deep learning might have been uncommon not too long ago, these days the precise details concerning how deep learning is involved in the technology will matter in assessing patentability.

Analysis of an AI-related technology should start with determining the general disposition of the technology, with respect to the list of categories discussed above, for example. The treatment of each category in this article is meant to reveal, for example, that an AI-related technology that involves applying an existing computational method does not necessarily lack inventiveness. By utilizing these categories, practitioners may be better equipped in evaluating the mapping or transformation of data, the selection of a computational method, or the interaction with other computational methods. Overall, such a systematic, tiered approach where the general disposition of a technology is first identified before the technology is fully analyzed tends to focus the analysis, making it easier to home in on patentable subject matter within the technology and appreciate the full scope of patentability.

For a new AI-related technology, the practitioner should carefully evaluate the development of the technology, including studying the context of an issue which the technology was created to resolve, in additional to the operation of the technology itself. The context can confer certain specificity, narrowing the scope of the technology or manifesting the distinctness of the technology as a solution to the issue. In general, the nature of the effort involved in achieving desired effects with the technology coupled with the extent of the desired effects can be a good indicator of the degree of ingenuity required for developing the technology and thus whether the invention is non-obvious and patentable.

With the approach outlined in this article, patent attorneys in particular should be well prepared to assess a new disclosure for suitability for patenting.

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Endnotes

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9. Urban Traffic State Detection Based on Support Vector Machine and Multilayer Perceptron, U.S. Patent No. 9,037,519 (filed Oct. 18, 2012) (issued May 19, 2015).
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11. Modeling of Time-Variant Threshability due to Interactions between a Crop in the Field and Atmospheric and Soil Conditions for Prediction of Daily Opportunity Windows for Harvest Operations Using Field-Level Diagnosis and Prediction of Weather Conditions and Observations and User Input of Harvest Condition States, U.S. Patent No. 9,037,521 (filed Jan. 23, 2015) (issued May 19, 2015).
12. *Id.*, col. 1, line 23 through col. 2, line 34.