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AI Inventions and Subject Matter Eligibility

By Jon Grossman

In June 2014, the U.S. Supreme Court decided *Alice Corporation Pty. Ltd. v. CLS Bank International, et al.*,[1] where it removed the presumption that software operating on standard hardware components could avoid being deemed an abstract idea. The *Alice* court articulated a two-part patent eligibility test for software inventions.

Step one, known as the "filter step," determines whether the patent claims at issue are directed to a patent-ineligible concept, such as an abstract idea. If the claims are considered abstract, the inquiry moves on to step two, which tests whether the elements of the claims contain an inventive concept sufficient to transform the abstract idea into a patent-eligible invention.

For the second step, a court assesses the individual or the ordered combination of claim limitations to test whether there is "something more" than the performance of well-understood routine and conventional activities.

As we wrote previously,[2] *Alice* dramatically impacted the legal software protection landscape with scores of software patents being rejected and invalidated both by the U.S. Patent and Trademark Office (PTO) and courts at all levels. *Alice*'s worldwide impact was also profound—influencing foreign patent offices such as the European Patent Office to scale back software patent eligibility. Not surprisingly, *Alice* has been highly controversial with widespread criticism by practitioners, judges, and former PTO commissioners, to name a few.

The purpose of this article is to look at the very hot AI sector of the software industry and *Alice*'s impact on it. As with our prior articles covering software patent eligibility, this article focuses on providing practical guidance tips for drafting AI-directed patent applications that pass muster under *Alice* before the PTO and U.S. tribunals.

PTO Guidance

The PTO released and revised its comprehensive Patent Subject Matter Eligibility Guidance (PEG) multiple times since the 2014 *Alice* decision.[3] The latest version of the Guidelines was updated in Summer 2022. With regard to AI, the PTO has been active since 2019 in seeking comments from the AI community as well as providing general position papers on various AI topics, including subject matter eligibility.[4]

As an initial matter, the AI patent landscape has been very active for many years. In its paper "Inventing AI Tracing the diffusion of artificial intelligence with U.S. patents,"[5] the PTO illustrated a steady rise in the number of AI patents to just over 60,000 by the year 2018.[6]

As to the issue of subject matter eligibility, the PTO provided an indication of its position in its

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October 2020 Q&A in its answer to the question "are there any patent eligibility considerations unique to AI inventions?"[7] The PTO responded by referencing its January 2019 Revised Patent Subject Matter Eligibility Guidance (PEG), in which the PTO concluded that all judicially created exceptions to the statutory categories apply equally to AI inventions. "AI inventions are treated like all other inventions that come before the Office." Claims to an AI invention that fall within one of the four statutory categories and are patent-eligible under the *Alice* test will be patent subject matter eligible under 35 U.S.C. § 101. "The basic PTO position, which has been consistent for many years, is that AI inventions are no different than any other software technologies, and must be treated along the same lines for subject matter eligibility as any other invention."

Despite the large number of AI patent filings, the current PTO Guidelines deal relatively lightly with AI itself. The PTO provides a single example (Example 39 or example (vii) under MPEP Section 2106.04(a)(1)) that deals directly with a patent subject matter eligible AI invention covering a "Method for Training a Neural Network for Facial Detection Background." Specifically, the exemplified invention involves a neural network face detection model which can detect faces having distorted images while limiting the number of false positives. The exemplified patent-eligible claim reads as follows:

> A computer-implemented method of training a neural network for facial detection comprising:
>
> collecting a set of digital facial images from a database;
>
> applying one or more transformations to each digital facial image including mirroring, rotating, smoothing, or contrast reduction to create a modified set of digital facial images;
>
> creating a first training set comprising the collected set of digital facial images, the modified set of digital facial images, and a set of digital non-facial images;
>
> training the neural network in a first stage using the first training set;
>
> creating a second training set for a second stage of training comprising the first training set and digital non-facial images that are incorrectly detected as facial images after the first stage of training; and
>
> training the neural network in a second stage using the second training set.

After determining in PEG Step 1 that the exemplified claim recites a protected process under 35 U.S.C. § 101, the PEG concludes that the exemplified claim passes muster under Step 2A, Prong 1 since it does not recite any of the "judicial exceptions enumerated in the 2019 PEG." In other words, the claim does not recite any mathematical relationships, formulas, calculations, or any mental processes "because the steps are not practically performed in the human mind." Example 39 also notes that the neural networks claim does not recite any method of organizing human activity.

However, the PTO example fails to distinguish the exemplified claim from other AI-based patent claims that have been deemed to not constitute eligible subject matter. This article provides more guidance on this point.[8]

Court and Tribunal Opinions on the Subject Matter Eligibility if AI Patents and Tribunals

The Federal Circuit

The principal source of guidance regarding AI subject matter eligibility comes from the PTO Board of Patent Appeals and U.S. district courts. To date, only one known case by the U.S. Court of Appeals for the Federal Circuit deals directly with technology involving AI.

In *In re: Board of Trustees of the Leland Stanford Junior University*,[9] the Federal Circuit reviewed and affirmed a subject matter eligibility final rejection that was upheld by the PTO's Patent Trial and Appeal Board (PTAB) of the claims of U.S. Patent application serial number 13/486,982 ('982 application).

The '982 application is drawn to a method and system for the Accurate Construction Of Long Range Haplotype.[10] The '982 application involves determining haplotype phase[11] through the use of a Hidden Markov Model (HMM). The HMM is an

AI statistical technique that is often used in machine learning for its predictive outputs.[12]

The Federal Circuit analyzed '982 claim 1 which recites the following method steps:

> A computerized method for inferring haplotype phase in a collection of unrelated individuals, comprising:
>
> receiving genotype data describing human genotypes for a plurality of individuals and storing the genotype data on a memory of a computer system;
>
> imputing an initial haplotype phase for each individual in the plurality of individuals based on a statistical model and storing the initial haplotype phase for each individual in the plurality of individuals on a computer system comprising a processor a memory [sic];
>
> building a data structure describing a Hidden Markov Model, where the data structure contains:
>
> > a set of imputed haplotype phases comprising the imputed initial haplotype phases for each individual in the plurality of individuals;
> >
> > a set of parameters comprising local recombination rates and mutation rates;
>
> wherein any change to the set of imputed haplotype phases contained within the data structure automatically results in re-computation of the set of parameters comprising local recombination rates and mutation rates contained within the data structure;
>
> repeatedly randomly modifying at least one of the imputed initial haplotype phases in the set of imputed haplotype phases to automatically re-compute a new set of parameters comprising local recombination rates and mutation rates that are stored within the data structure;
>
> automatically replacing an imputed haplotype phase for an individual with a randomly modified haplotype phase within the data structure, when the new set of parameters indicate that the randomly modified haplotype phase is more likely than an existing imputed haplotype phase;
>
> extracting at least one final predicted haplotype phase from the data structure as a phased haplotype for an individual; and
>
> storing the at least one final predicted haplotype phase for the individual on a memory of a computer system.

In upholding the PTAB's 101 rejection, the Federal Circuit noted that claim 1 was directed essentially to a method of calculating and otherwise involves only the general steps of "implementing and processing calculations with a regular computer" and "recites no application, concrete or otherwise, beyond storing the haplotype phase."[13] Our review of the '982 specification confirms the court's conclusion: There does not appear to be a detailed description of how computer hardware is impacted by HMM, and to the extent computer hardware is described, the description appears more along the lines of using generic components in a generic manner to implement the HMM algorithm.[14] Indeed, the Federal Circuit easily distinguished the '982 application's disclosure from that of other more technical patents such as those in *Enfish v. Microsoft*[15] and *McRO v. Bandai Namco Games America*.[16] However, without knowing more, it is somewhat hard to reconcile the *Stanford* result with PEG Example 39 since the latter does not, at least in terms of the claim language, provide any detail regarding computer hardware either.

A number of articles have reported some Federal Circuit dicta, concurring opinions, and dissenting opinions where concerns by particular judges about AI subject matter eligibility were raised. Some of those opinions are summarized below.[17]

In *IP Engine, Inc. v. AOL Inc.*,[18] the Federal Circuit in a per curiam non-precedential ruling reversed the lower court's non-obviousness ruling concerning two patents that were asserted by a non-practicing entity against, among others, Google's AdWords and AdSense products.[19] While the per curiam decision focused on the 35 U.S.C. § 103 issue, Judge Mayer added a concurring opinion regarding Section 101 which was neither part of the per curiam decision, or for that matter, pleaded by either party. In his

opinion Judge Mayer noted that had the *Alice* test had been made in the first instance, as directed by the Supreme Court, "unnecessary litigation and nearly two weeks of trial and imposition on citizen jurors, could have been avoided." Judge Mayer went on to further state that IP Engine's patent specification included the use of neural networks as part of its disclosed content and collaborative filtering technology and that the "complexity of the implementing software or the level of detail in the specification" does not transform a claim reciting only an abstract concept into a patent-eligible system or method.[20]

In another case that had even less direct analysis than *IP Engine,* Judge Moore's dissent to a per curiam denial for a petition for an en banc hearing[21] raised concerns regarding the subject matter eligibility of AI inventions. Although the claims at issue had nothing to do with AI,[22] Judge Moore's dissenting opinion decried the overly-broad application of *Mayo v. Prometheus* to medical diagnostic kits and in doing so, cited to the following congressional testimony by Henry Hadad, president of the IPO: "[C]onfusion about what is patent-eligible discourages inventors from pursuing work in certain technology areas, including discovering new genetic biomarkers and developing diagnostic and artificial intelligence technologies."[23] Other than a passing reference, this case offers no other guidance regarding the proper drafting of AI inventions.[24]

U.S. District Courts

In contrast to the Federal Circuit, there have been a number of U.S. district court cases that deal directly with the issue of AI subject matter eligibility and which provide useful information and guidance to the practitioner.

For example, in *Angel Technologies Group v. Facebook,*[25] Angel brought suit against Facebook for infringing its U.S. Patent No. 10,417,275 (the '275 Patent). The claims at issue directly recited AI technology. Representative claim 6 of the '275 Patent, recites in pertinent part, "applying artificial intelligence algorithms to image data of other images accessible to said computer system to locate images matching characteristics of a subset of image data bound by the set of coordinates corresponding to the location of the named user within the image." In its motion to dismiss, Facebook argued that representative Claim 6 is directed towards the "abstract and commonplace idea of identifying people in photos with a unique tag containing some of pieces of information." The court found that applying artificial intelligence algorithms was itself an abstract idea since the claim failed to disclose any details on how to implement or operate these algorithms or their improvements. Specifically, the court concluded its *Alice* step 1 analysis by stating "all this claim discloses about artificial intelligence is that it will be used which is the very essence of an abstract idea." The tribunal's conclusion regarding *Alice* step 2 was ultimately no different.

Was there more that the practitioner could have done to guard against this issue? Looking at the specification of the '275 Patent, there appears to be little else regarding the AI features and more critically, its impact on the computer or other hardware. In fact, the main clause describing the use of AI states: "However, once an object has been identified as described above, the invention also contemplates the use of other mechanism[s] to further extend object definition. For instance, artificial intelligence algorithms (e.g., image recognition system) may be applied against images and utilized to further define characteristics of images, obtain identifying information, and/or search a database for other possible matches to a named object."[26] Nonetheless, this relatively short treatment of AI unfortunately leaves little for the practitioner to use as support in the claims to detail specific logic used in a unique way to further improve operational efficiency in the database search feature. By contrast, the non-AI *Enfish* data logic case provided a very detailed description of its logic beyond the above-quoted clause.[27] For at least this reason, the court's hesitancy to declare the claims in *Angel* subject matter eligible under *Alice*, Step 1 seems well placed.

A closer call regarding the issue of AI subject matter eligibility arose in *Health Discovery Corp. v. Intel Corp*.[28] Health Discovery Corporation filed suit against Intel Corporation for infringement of its four patents. Among the four patents, U.S. Patent No. 7,117,188 (the '188 patent) discloses a Support Vector Machine and a Recursive feature elimination (SVM-RFE) machine learning algorithm. The '188 patent specification discloses conventional methods for reducing "feature size in data sets by ranking and eliminating features based on . . . correlation coefficients" and describes the RFE functions in detail rather than how the SVM-RFE improves

existing computer hardware or logic. The claims at issue recite "[producing] data with improved quality relative to that produced by conventional mathematical methods."

After conducting a detailed review of the claims, the specification, and relevant Federal Circuit guidance, the court (in an opinion by Judge Albright) concluded that the claims were an abstract idea that failed to transform the claimed method into a patent-eligible invention. According to the court, the asserted claims were merely an enhancement of mathematical processes with a combination of different steps providing more accuracy than the previous mathematical techniques. The written description explained how conventional methods reduced feature size in data sets by ranking and eliminating features based on, for example, correlation coefficients, whereas the claimed invention ranks and eliminates features using SVM-RFE: a "purportedly novel but nevertheless mathematical technique. According to the written description, this feature-reduction method could produce subsets of genes that are smaller, more discriminant, and less burdened with noise. See id. at 24:51–60; 48:66–11; 49:46–58; 44:31–35." The court went on to note that like the claims in *Stanford II* and *SAP*—both cases where the inventions were deemed to be abstract ideas—"the claims [at issue] here merely produce data with improved quality relative to that produced by conventional mathematical methods."[29]

Had the HDC patent specification included a more technical description of a novel way to train, for example, a neural network to achieve processing efficiencies, it may have passed muster under *Alice* Step 1. Moreover, the context of the invention also had a bearing on whether or not the claims survived *Alice* Step 1.[30]

Another district court case involving AI is *Purepredictive, Inc.* (PPI) *v. H20.AI, Inc.*[31] and U.S. Patent No. 8,880,446 (the '446 Patent). PPI accused H20 of selling a machine learning platform called H20 with AutoML which infringed claim 14 of its '446 Patent. In its motion to dismiss, H20 argued that the '446 patent was patent ineligible. Claim 14 is representative of the claimed method and recites, in pertinent part, "a method for a predictive analytics factory" generating a learned function for training data and then following an evaluation process to make a prediction. As will be further discussed below, the court concluded that "performing predictive" analytics is an abstract idea because it was a mental process and a mathematical concept, which uses a basic mathematical process of regression via generated learned functions—all of which are functions or steps which a human can perform, albeit more slowly than a computer.

In reviewing the '466 patent's written specification the AI functions were described in terms of a "function generator module" for "[generating] hundreds, thousands, or millions of learned functions, or more." The court characterized this module as being nothing more than a mental process in which a computer can perform the mathematical calculations faster than a human. The court also interpreted the evaluation process to select the most effective learned function to create a rule as a mental and mathematical process falling under an abstract concept.

After identifying the claim as a mental process and a mathematical concept, the court articulated two important points.

First, the court noted disclosures referring to computers without showing an improvement of any previously existing technology related to the claimed matter and merely showing the use of the computer as a tool for automation for the processing of the claimed matter did not overcome the claims being directed to an ineligible patent subject matter. The court explained that PPI's claims failed to recite any improvement to previously existing AI technology or if it did, it was nothing more than a mathematical concept of regression analysis by the learned functions.

Second, PPI stated that the metes and bounds of the claims were generating "a predictive ensemble in an automated manner" with "little or no input from a user or expert," while still offering customization and finely tuned predictive ensembles." The court countered by noting that "brute force, trial-and-error approach to generating learned functions" in the specification was merely "the running of data through a machine." The court also noted that the disclosure of "an apparatus, system, method, and computer program product [that] would comprise a predictive analytics factory configured to generate a predictive ensemble regardless of the particular field or application" in the specification shows that the claimed matter was a general characteristic of a

predictive analysis technique rather than a specific application of such technique.

PTAB Decisions

In *Ex Parte Gomez*,[32] the Patent Trial and Appeal Board (PTAB) concluded that the claims of Patent Application No. 16/828,697 did not recite patent-eligible subject matter. Representative Claim 1, specifies a "method for managing traffic on a roadway comprising" "[c]ollecting a set of training data," "[t]raining an anomaly detection model," and "[t]raining a clustering model" based on historical data. The terms of Claim 1 fail to include AI-specific language, such as machine learning, a neural network, or deep learning. However, the specification discloses "[c]alculated traffic data [including] predicted future information . . . can be . . . produced as the result of a predictive machine learning system (e.g., an artificial neural network, SVM, or other decision model),"[33] the performance of traffic prediction "using an artificial neural network . . . [that] can utilize architectures intended to predict time series information, such as a recurrent neural network, or long-term/short-term memory (LTSM) network,"[34] and the predetermined decision-making algorithm "can comprise a machine learning model, such as an artificial neural network, decision tree, support vector machine."[35]

Although AI technology was disclosed in detail in the specification the PTAB refused to draw parallels with PEG Example 39. Although appellant argued that its claim 1 recited "the training and use of a ML (machine-learning) model for detecting anomalies in the traffic management context, in the same way that the claim of Example 39 discloses a neural network used for facial recognition," the PTAB concluded that the claim failed to include language like training a neural network or applying a machine-learning algorithm.

The appellant also argued that failing to recite "terms such as 'training' and 'ML model[,]" did not preclude the fact that the actual limitations recited in the claim were supported in the specification describing training an ML model or an equivalent. Again, the PTAB was not persuaded since these AI terms were not directly incorporated into claim 1. The PTAB suggested that claim 1 could have been written to include "training [of] a neural network or algorithm . . . and . . . identifying and responding to such anomalous conditions using a set of machine learning ('ML') models trained on historical data." As such, the claim would have treated AI terminology more directly – along the lines shown in PEG Example 39.

Gomez should therefore guide practitioners to incorporate AI technology language directly into their patent claims and that a reliance on an indirect or implicit recitation AI terms is not enough to meet the threshold language exemplified in PEG Example 39. Again, to pass muster under *Alice* Step 2A, Prong 1, the claim *must* recite specifically and explicitly AI technology, such as neural networks, and detail how such networks are trained.

In *Ex Parte Audhkashi*,[36] appellants appealed a Patent Examiner's 101 rejection, arguing that the claims of Patent Serial No. 14/816,999 ('999 application), including claim 1, did not recite an abstract idea for the same reason as PEG Example 39. Representative claim 1 recites in pertinent part "a learning computer system that has a configuration for updating parameters and states of an unknown system." As the appellants pointed out, like PEG Example 39, the title of the application refers to neural networks[,] and the specification discloses various embodiments for training neural networks.

The PTAB disagreed with applicant's assertion, noting that the claims of a patent application "are read in light of the specification" without importing the disclosure of the specification into them to determine the patent eligibility." The PTAB then compared PEG Example 39 with claim 1 of the '999 application and noted that Example 39 recites a "computer-implemented method of training a neural network for facial detection" comprising specific steps of training the neural network in two stages using a "collected set of digital facial images, the modified set of digital facial images, and a set of digital non-facial images." On the other hand, '999 claim 1 lacked neural network language, did not include the parameters and states of the claimed system, and did not state what the data represents. The PTAB concluded that the collective impact of these missing terms, rendered the rationale underlying PEG Example 39 inapplicable to '999 claim 1.

The appellants further contended that additional elements recited in claim 1 comply with the *Alice* test since they integrate the abstract idea into a practical application. In other words, the learning computer system of '999 claim 1 encompassed the

disclosure of the Noise Expectation-Maximization (NEM) algorithm that could increase "the speed and accuracy at which a computing system trains backpropagates a neural network." Again, the PTAB found that claim 1 failed to recite a neural network and lacked the requisite specificity tying claim 1 to the NEM algorithm for training a neural network.

Based on these two PTAB decisions a claim appears to only pass muster under *Alice* when it recites the specifics of the AI technology at hand, such as a neural network, without reciting any of the enumerated judicial exceptions (e.g., mathematical concepts, a mental process, and human activity).

The PTAB took a different tack in *Ex Parte Bushmitch*,[37] where it reversed the examiner's rejection based on lack of subject matter eligibility. Claim 22 of Bushmitch's application 14/499,427, recites a method comprising an adaptive learning system that is a deep learning system with at least five layers using different sets of data to train it. The specification discloses that the purposes of the functions using the deep learning system are for "successful prediction of operational performance factors of complex systems"[38] and "greatly reduce event evaluation costs by eliminating human evaluators for the entire event duration."[39] As such, the PTAB concluded that it was possible to achieve an operation effectiveness prediction, which is an "improved technological result . . . use of the abstract idea of collecting data to a particular technological environment" via the functions of the deep learning system.

In *Ex Parte Adjaoute*,[40] appealed a subject matter eligibility rejection. The claim at issue (Claim 1 of U.S. Patent Application No. 14/815,940) recites in part "monitoring operation of machines using neural networks, logic decision trees, confidence assessments, fuzzy logic, smart agent profiling, and case-based reasoning." The '940 specification also discloses "methods for protecting groups of digital electronic appliances used collectively for monitoring the operation of machines . . . that use computer data processing systems to [impanel] several artificial intelligence (AI) classification technologies into a "jury" that renders "verdicts" about the need for service and impending equipment failures." The PTAB reversed the patent examiner's subject matter eligibility rejection concluding that the claimed AI matter was a response to the "problem specifically using several artificial intelligence classification technologies to monitor the operation of machines and to predict preventative maintenance needs and equipment failure." The PTAB indicated that the claim's terms falls into the realm of solving a problem of computer-related technology. The PTAB concluded that the claims at issue were similar to in PEG Example 39.

Finally, *Ex Parte Chari*,[41] involves a machine learning algorithm. According to the PTAB, the claims at issue successfully integrated the abstract idea into a practical application. The PTAB thereby reversed the examiner's 101 rejection under PEG Step 2A, Prong 1.

The claim at issue recites in part a "machine learning algorithm trained to learn the sensitivity level" of an information technology asset based on meta-level features, without having to directly access the asset. Various disclosures of the specification about the machine learning algorithm supported that the machine learning algorithm improved the capabilities of the computer or its function. The specification discloses that "[s]emi-automatic machine learning algorithms may be provided to automatically estimate the sensitivity of assets" without "[requiring] direct access to the target assets or privileged knowledge about the assets,"[42] the "instance-based learning approaches . . . [enables] the system domain independent and easy to adapt to new sensitive asset types,"[43] and "[e]xtracting of the meta-level features does not require direct access to the target assets or privileged knowledge about the assets, and, thus, allows the methods of the present disclosure in one embodiment to be efficient and easily scalable to a large set of heterogeneous assets."[44] The PTAB found that these various disclosures showed that the claimed machine learning algorithm was not a mere application of gathering, applying, and presenting information without "any particular assertedly inventive technology for performing those functions" or a mere program that a computer executes. Instead, the PTAB stated that these specification descriptions supported the improvement of the capabilities of the computer or its function by the machine learning algorithm.

Conclusion

Based on this landscape, a mindful practitioner must be aware of two principles when drafting a claim reciting an AI technology:

First, it is not the terms used in AI technology itself but the meaning and scope of those terms in the claims and specifications that govern the result of the *Alice* test. Depending on the claims and the specification, a claimed AI technology can be a machine learning algorithm, a neural network training method, or an additional component connected to other elements.

Second, it is important to look into the caselaw rationale regarding eligible AI subject matter to see a pattern that is applicable to your patent subject matter, and then follow the claims and specification examples associated with each pertinent case. Based on those two guiding principles, the following is a list of suggestions that a practitioner can consider using in drafting AI claims to pass muster under 35 U.S.C. § 101.

A. Draft a claim that recites the specific function(s) or the improvement(s) explicitly tied to the AI features.

B. Draft a claim explicitly reciting the AI technology.

C. Draft a claim and a specification that do not merely improve the abstract idea of the claimed AI technology, but can directly associate the AI technique with improved hardware performance.

D. Draft a specification that discloses and supports hardware tied to the claimed AI technology not in terms of listing that hardware as generic components but as an improvement or a solution for a problem tied to the performance of such components.

Notes

1. Alice Corp. v. CLS Bank International, 573 U.S. 208 (2014).
2. Out of Wonderland from Diehr to Aatrix: Three Steps to Overcoming 101 Rejections—Part I; Jon Grossman, Anastasia Dodd, and Alexander S. Perry; Intellectual Property Technology Law Journal (IPTLJ); VOLUME 30 • NUMBER 8 • August 2018; Part 2 at IPTLJ VOLUME 30 • NUMBER 9 • September 2018; Part III at IPTLJ VOLUME 35 NUMBER 6, June 2023.
3. The Office's current eligibility guidance is found in the Ninth Edition of the Manual of Patent Examination Procedure (MPEP), and particularly Sections 2103 through 2106.07(c).
4. As we have previously noted, the PEG defines the test for subject matter eligibility differently than the Alice two-step test by dividing the eligibility test into Steps 1, 2A (Prongs 1 & 2) and 2B. The PEG's Step 1 requires a determination by the examiner whether or not the claimed subject matter falls within the four statutory categories delineated under 35 U.S.C. § 101, i.e., whether the claim recites a machine, process, manufacture, or composition of matter. If one of those categories is contained in the claims, then the claim is further analyzed under PEG Step 2A, which is subdivided into two prongs: In Prong 1, the claim is evaluated to determine whether it recites an abstract idea, law of nature, natural phenomenon, or other previously established judicial exception to subject matter eligibility. If the answer in Prong 1 is yes, then the PEG test proceeds to Step 2A, Prong Two where an examiner must determine whether the claim recites additional elements that integrate the judicial exception into a practical application. If PEG step 2A, Prong 2 is answered in the negative, then the examiner proceeds to PEG Step 2B to determine whether or not an "inventive concept" is furnished by an element or combination of elements recited in the claims in addition to (beyond) the judicial exception and is sufficient to ensure that the claim as a whole amounts to significantly more than the judicial exception itself.
5. Oct. 2020, PTO Office of the Chief Economist.
6. See ibid., Figs. 3–4.
7. See Public Views on Artificial Intelligence and Intellectual Property Policy, Question No. 5 pp. 7–8.
8. While the PEG serves as the primary source of guidance for patent examiners, the Federal Circuit as well as lower courts have held that the PTO Guidelines have no precedential authority, and applicants should not rely on them when enforcing their claims in court. *See* In re Rudy, 956 F.3d 1379 (Fed. Cir. 2020), Cleveland Clinic Foundation v. True Health Diagnostics 859 F.3d 1352 (Fed. Cir. 2017)(non-precedential), and CxLoyalty, Inc. v. Maritz Holdings, Inc. 986 F.3d 1367, 1380 (Fed. Cir. 2021).
9. In re: Board of Trustees of the Leland Stanford Junior University, 991 F.3d 1245 (Fed. Cir. 2021).
10. A haplotype is a grouping of variants in the genome that are often inherited together on a single chromosome.
11. Haplotype phase is an "indication of the parent from whom a gene has been inherited. Haplotype phasing is a process for determining the parent from whom alleles – i.e., versions of a gene – are inherited." (*Id.* at 1247).

12. Specifically, HMM is a statistical model that is used to describe the probabilistic relationship between a sequence of observations and a sequence of hidden model states.
13. Id. at 1250.
14. Here is an example of the hardware disclosure from the '982 application (page 2): "Computer system 100 may further include other components 116 that may be generally available components as well as specially developed components for implementation of the present invention. Importantly, computer system 100 incorporates various data buses 116 that are intended to allow for communication of the various components of computer system 100. Data buses 116 include, for example, input/output buses and bus controllers." Other than laying out a basic description of the hardware components, there is no discussion regarding the interaction of those components with HMM or a detailed technical explanation of the impact of HMM of the operations of those components.
15. Enfish v. Microsoft, 822 F.3d 1327 (Fed. Cir. 2016).
16. McRO v. Bandai Namco Games America 837 F.3d 1299 (Fed. Cir. 2016). For an interesting discussion regarding the Stanford case and ways to avoid examination by the bioinformatics art unit at the PTO, *see* "Examining Art Units to Avoid Subject Matter Eligibility Challenges for Bioinformatics and AI-related Patents" by Terri Shieh-Newton and Mark D. Hammond, Mintz Insights. November 18, 2021.
17. See e.g., Brookings TechTank, Patents and AI inventions: Recent court rulings and broader policy questions. By John Villasenor, August 25, 2022; Plasseraud IP, Patent eligibility for Artificial Intelligence inventions in the United States, by Robert Mathias, September 20, 2021; Marshall Gerstein PATENTNEXT, Ryan N. Phelan on March 12, 2021, How the Courts treat Artificial Intelligence (AI) Patent Inventions: Through the Years since Alice.
18. IP Engine, Inc. v. AOL Inc. 576 F.Appx 982 (Fed. Cir. 2014).
19. Full disclosure, this co-author previously worked for IP Engine on matters related to this litigation.
20. It should be noted that neural networks were not claimed with specificity, and in fact, the specification indicated that while neural networks were available as a tool, the filtering techniques described in the specification were simpler. It would therefore be somewhat doubtful that the invention at issue would have supported claims similar to Example 39 in the 2019 PEG.
21. Athena Diagnostics v. Mayo Collaborative Services 927 F.3d 1333 (Fed. Cir. 2019).
22. Claim 1 of the patent at issue, for example reads: 1. A method for diagnosing neurotransmission or developmental disorders related to muscle specific tyrosine kinase (MuSK) in a mammal comprising the step of detecting in a bodily fluid of said mammal autoantibodies to an epitope of muscle specific tyrosine kinase (MuSK). And dependent claim 7 reads: A method according to claim 1, comprising contacting MuSK or an epitope or antigenic determinant thereof having a suitable label thereon, with said bodily fluid, immunoprecipitating any antibody/MuSK complex or antibody/MuSK epitope or antigenic determinant complex from said bodily fluid and monitoring for said label on any of said antibody/MuSK complex or antibody/MuSK epitope or antigen determinant complex, wherein the presence of said label is indicative of said mammal is suffering from said neurotransmission or developmental disorder related to [MuSK].
23. Athena Diagnostics at 1358.
24. *See also* Judge Linn's dissent in Smart Systems Innovations v. Chicago Transit Authority, (873 F.3d 1364, 1378 (Fed. Cir. 2017)) which also was a case that did not involve AI technology. Judge Linn wrote: "[Alice] Step one cannot be a hunt for the abstract idea underlying the claim, because underlying virtually every claim is an abstract idea. And if the task under step one is to assess whether the claim is directed to no more than an abstract idea, what is left for determination under [Alice] step two? Where do you draw the line between properly determining what the claim is directed to and improperly engaging in an overly reductionist exercise to find the abstract idea that underlies virtually every claim? . . . . Despite the number of cases that have faced these questions and attempted to provide practical guidance, great uncertainty yet remains. And the danger of getting the answers to these questions wrong is greatest for some of today's most important inventions in computing, medical diagnostics, *artificial intelligence*, the Internet of Things, and robotics, among other things." (emphasis added).
25. CV 21-8459-CBM(JPRX), 2022 WL 3093232, (C.D. Cal. 2022).
26. U.S. Patent No. 10,417,275 col. 13 ll. 31-39 (filed Mar. 23, 2018).
27. Enfish v. Microsoft 822 F.3d 1327 (Fed. Cir. 2016). The claims alone in Enfish provided a detailed disclosure of the database lookup logic of the invention: "A data storage and retrieval system for a computer memory, comprising: means for configuring said memory according to a logical table, said logical table including: a plurality of logical rows, each said logical row including an object identification number (OID) to identify each said logical row, each said logical row corresponding to a record of information; a plurality of logical columns intersecting said plurality of logical rows to

define a plurality of logical cells, each said logical column including an OID to identify each said logical column. . . ."

28. Health Discovery Corp. v. Intel Corp. 577 F.Supp.3d 570 (W.D. Texas 2021).
29. Id. at 585.
30. Judge Albright noted: "Guided only by Koninklijke and CardioNet, the court would likely uphold the claims here at Alice's first step. But SAP and Stanford II – which deal with subject matter much closer to that at issue here – preclude that outcome. Given the inconsistency riddling § 101 jurisprudence, a district court's surest guidance rises from cases analyzing patents most like those under review. Cf. Enfish, LLC v. Microsoft Corp., 822 F.3d 1327, 1334 (Fed. Cir. 2016) [B]oth this court and the Supreme Court have found it sufficient to compare claims at issue to those claims already found to be directed to an abstract idea in previous cases."). With that in mind, Stanford II is this case's North Star, with SAP nearby." (Id. at 584.)
31. Purepredictive, Inc. v. H20.AI, Inc., 2017 WL 3721480 (N.D. Cal. Aug. 29, 2017).
32. Ex Parte Ricardo Sanchez Gomez, John Francis Brady, & Vamsi Krishna Nadimpalli, No. APPEAL 2021-005115, 2021 WL 5358751, at *128 (P.T.A.B. Nov. 15, 2021).
33. Spec. ¶ 54.
34. Spec. ¶ 62.
35. Spec. ¶ 63.
36. Ex Parte Kartik Audhkhasi, Osonde Osoba, & Bart Kosko, No. APPEAL 2021-002827, 2022 WL 3212245, *6 (P.T.A.B. Aug. 5, 2022).
37. Ex Parte Dennis Bushmitch & Richard Cozby, No. APPEAL 2018-008667, 2020 WL 1286048, at *5 (P.T.A.B. Mar. 12, 2020).
38. Spec. ¶ 17.
39. Spec. ¶ 34.
40. Ex Parte Akli Adjaoute, No. APPEAL 2018-007443, 2019 WL 6208072, *1 (P.T.A.B. Oct. 10, 2019).
41. Ex Parte Suresh N. Chari, Christopher Gates, Stephen C. Gates, Youngja Park, & Wilfried Teiken, No. APPEAL 2018-009014, 2020 WL 5525702, *7 (P.T.A.B. Sept. 10, 2020).
42. Spec. ¶ 18.
43. Spec. ¶ 20.
44. Spec. ¶ 21.