Corporate Practice Portfolio Series ,Corporate Legal Departments Portfolios ,Portfolio 113_ Artificial Intelligence and Machine Learning ,Detailed Analysis ,II. Considerations for Prosecution Before the USPTO ,A. Patenting Eligibility Issues and Considerations for Artificial Intelligence Technologies

A. Patenting Eligibility Issues and Considerations for Artificial Intelligence Technologies

A. Patenting Eligibility Issues and Considerations for Artificial Intelligence Technologies

Vadim Braginsky, Esq.

(1) **Introduction** —

The field of Artificial Intelligence (AI) is wide-ranging, encompassing a spectrum of technologies from computing hardware and system architecture, to a variety of classes of algorithms and applications of data science. From the standpoint of patent eligibility in the United States, the treatment of AI inventions can vary widely, depending not only on the fundamental nature of the technology in question, but also on how that technology is described and claimed.

(a) **The challenges of patent practice under the present patent-eligibility rules** —

Subject-matter eligibility under Section 101[1] is perhaps the most unsettled area of U.S. patent law. Over half a century of Supreme Court and Federal Circuit decisions has produced a series of conflicting and arguably irreconcilable precedents affecting the eligibility of computer-implemented inventions.[2] The 2014 Supreme Court decision, *Alice v. CLS Bank,* [3] has further frustrated the patentability of computer-based inventions by holding that such an invention may be deemed to be an "abstract concept" and therefore not eligible for patenting, even when the tangible hardware machinery of the computer system is included in the claims. Moreover, inventions that contain mathematical concepts, certain methods of organizing human activity (e.g., commercial interactions), or mental processes (e.g., steps that can be performed by a human with a paper and pencil), even when automated with the use of computing technology, may still be deemed abstract and not patent-eligible if the underlying computer system is "well-understood, routine or conventional."[4] This line of Section 101 jurisprudence, which considers whether some portion of a claim in question is routine or conventional, appears to conflate the standard for subject-matter eligibility with aspects of obviousness patentability inquiry.[5]

[1] 35 U.S.C. § 101

[2] E.g., *The State of Patent Eligibility in America: Part I: Hearing before the Subcommittee on Intellectual Property, U.S. Senate Committee on the Judiciary* (June 6, 2019) (statement of Judge Paul R. Michel (Ret.) of the United States Court of Appeals for the Federal Circuit: "[R]ecent cases are unclear, inconsistent with one another and confusing. I myself cannot reconcile the cases. That applies equally to Supreme Court and Federal Circuit cases. Nor can I predict outcomes in individual cases with any confidence since the law keeps changing year after year. If I, as a judge with 22 years of experience

deciding patent cases on the Federal Circuit's bench, cannot predict outcomes based on case law, how can we expect patent examiners, trial judges, inventors and investors to do so?").

[3] *Alice Corp. v. CLS Bank Int'l*, 573 U.S. 208 (2014).

[4] *Id.* at 225-26.

[5] Lewis, Paxton M. (2017), *The Conflation of Patent Eligibility and Obviousness: Alice's Substitution of Section 103* , Utah OnLaw: The Utah Law Review Online Supplement: Vol. 2017: No. 1 , Article 1, *available at* http://dc.law.utah.edu/onlaw/vol2017/iss1/1.

Although the U.S. Patent and Trademark Office has undertaken substantial effort to fuse and implement the present legal landscape of patent eligibility, the oftentimes sweeping language of judicial decisions citing *Alice* has provided a steady stream of imprecisely worded grounds for challenging the patent eligibility of computer-implemented inventions. While the eligibility of computer-based technologies that are directed to improvements of the computer systems themselves (e.g., new types of data structures, security/antivirus, storage or computational efficiency improvements) has to a large extent been left intact, the allowance rates of patent applications directed to certain types of software applications and manipulation of information have plummeted to below 10% in some areas[6].

[6] USPTO Technology Center 3600 reported an allowance rate of 6.2% in fiscal year 2016, down from around 30% prior to the *Alice v. CLS Bank* decision. USPTO *Business Methods Statistics* webpage, *available at* https://www.uspto.gov/patents-getting-started/patent-basics/types-patent-applications/utility-patent/patent-business#Statistics.

Under the prevailing laws and examination guidelines, most AI technologies, particularly those in which the innovative aspects are algorithmic or mathematically expressed, are susceptible to eligibility challenges for being abstract concepts. Technologies that are claimed at higher levels of abstraction, such as those focused on new applications of AI, might be subject to invalidation or rejection for being directed to the ineligible category of "organizing human activity." Similarly, AI innovations that are claimed as combinations of well-known building blocks, or that may be carried out by a suitably programmed general-purpose computer (or an otherwise well-known computing platform), may be subject to rejection or invalidation for being a mathematical formula or mental process. Hence, practitioners must be well-versed in the rapidly evolving and oftentimes incoherent rules of patent eligibility.

Under the new leadership of Andrei Iancu,[7] the Patent Office published Patent Eligibility Guidance ("2019 PEG") in January 2019 in an effort, in part, to establish uniform application of the patent-eligibility rules among the examination corps.[8] The 2019 PEG was further supplemented in October 2019. According to the 2019 PEG, an invention is considered patent-eligible if the claim, as a whole, integrates the recited abstract concept into a practical application of that concept.[9] Separately, a claim is patent-eligible if it adds one or more limitations that are not well-understood, routine, or conventional activity in the field.[10] Since the promulgation of the 2019 Guidance, the allowance rate for patent applications having been rejected under Section 101 has increased substantially.[11] Although the 2019 Guidance has proven to be instrumental in improving the consistency and allowance rates of examination under Section 101, practitioners should note that the Federal Circuit Court of Appeals has specifically refused to give deference to the 2019 Guidance.[12]

[7] Sworn in on February 8, 2018, Andrei Iancu has served as the Under Secretary of Commerce for Intellectual Property and Director of the United States Patent and Trademark Office.

[8] Subject Matter Eligibility Page at uspto.gov, https://www.uspto.gov/patent/laws-and-regulations/examination-policy/subject-matter-eligibility.

[9] 2019 Guidelines pertaining to Step 2A.

[10] 2019 Guidelines pertaining to Step 2B.

[11] In the six months after the USPTO implemented the 2019 USPTO eligibility guidance, the percentage of applications for which subject matter eligibility rejections were issued dropped across all computer-related art units, with the most dramatic decline being in AI, as the percentage of applications in which subject matter eligibility rejections were issued dropped 33% for this area. Update on 101 Rejections at the

USPTO: Prospects for Computer-Related Applications Continue to Improve Post-Guidance, https://www.ipwatchdog.com/2019/08/13/update-101-rejections-uspto-prospects-computer-related-applications-continue-improve-post-guidance/id=112132.

[12] *Cleveland Clinic Found. v. True Health Diagnostics LLC*, 760 F. App'x 1013, 1020 (Fed. Cir. 2019).

The current state of the law with respect to eligibility has been widely criticized. [13] There is currently a bipartisan effort to reform Section 101 of the Patent Act. [14] An initial draft bill was circulated in May 2019, and three days of hearings were held the following month (with a distinct majority of the stakeholder feedback confirming that the state of the law is "a mess"). A key feature of the draft legislation would separate the questions of novelty and nonobviousness from the determination of eligibility. As of this publication, progress on this legislation has been largely deferred.

[13] *E.g.* , *The State of Patent Eligibility in America: Part I:, supra,* (Statement of Q. Todd Dickinson, former Under Secretary of Commerce and Director of the U.S. Patent and Trademark Office: "[A]ll four of the most recent §101 [Supreme Court decisions] have been criticized for various reasons, but primarily as articulating eligibility standards or analytic frameworks that are ambiguous and difficult to apply consistently (Bilski, Alice and Mayo) or which have led to inequitable results for valuable and health-improving technologies (Mayo and Myriad)"), *Id.* (Statement of David Kappos, former Under Secretary of Commerce and Director of the U.S. Patent and Trademark Office: " Our current patent eligibility law truly is a mess. The Supreme Court, Federal Circuit, district courts, and USPTO are all spinning their wheels on decisions that are irreconcilable, incoherent, and against our national interest.").

[14] *Sens. Tillis and Coons and Reps. Collins, Johnson, and Stivers Release Draft Bill Text to Reform Section 101 of the Patent Act*, THOM TILLIS (May 22, 2019), https://www.tillis.senate.gov/2019/5/senstillis-and-coons-and-reps-collins-johnson-and-stivers-release-draft-bill-text-to-reform-section-101-of-thepatent-act.

(2) **The law of patent-eligibility of computer-implemented inventions** —

Subject-matter exceptions to patentability are not codified in the statutes. Instead, various doctrines, such as the printed-matter, mental-process, and mathematical-algorithm exceptions, have been developed through the courts over decades. [15] Indeed, the question of patent eligibility of such exceptions has been litigated since before the 1952 Patent Act. [16] The historical development of this body of law is complex, multi-faceted, and seemingly incoherent. It has been reviewed extensively [17] and, aside from the brief summary of several selected points that are relevant to the discussion that follows, is outside the scope of this publication.

[15] *See, e.g.* , *Gottschalk v. Benson* , 409 U.S. 63 (1972) ("Phenomena of nature, though just discovered, mental processes, and abstract intellectual concepts are not patentable, as they are the basic tools of scientific and technological work."); *Parker v. Flook*, 437 U.S. 584 593 n.15 (1978) ("[A] scientific principle, such as that expressed in respondent's algorithm, reveals a relationship that has always existed."); *Diamond v. Diehr*, 450 U.S. 175 (1981) ("Excluded from such patent protection are laws of nature, physical phenomena and abstract ideas.").

[16] *See, e.g.* , *O'Reilly v. Morse*, 56 U.S. 62 (1854); *Rubber-Tip Pencil Co. v. Howard*, 87 U.S. 498, 507 (1874) ("An idea itself is not patentable . . . ."); *In re Abrams*, 188 F.2d 165 (CCPA 1951) (holding a petroleum prospecting method involving comparing sets of experimental data, to be non-statutory mental steps).

[17] *See, e.g.* , Lewis, Paxton M., "The Conflation of Patent Eligibility and Obviousness: Alice's Substitution of Section 103," *Utah OnLaw: The Utah Law Review Online Supplement* , Vol. 2017 : No. 1 , Article 1 (2017), a*vailable at*: http://dc.law.utah.edu/onlaw/vol2017/iss1/1; Taylor, David O., "Amending Patent Eligibility," 50 *University of California, Davis Law Review,* 2149 (2017), Chin, Andrew, "Software Patenting and Section 101's Gatekeeping Function," (July 26, 2019), *available at* https://law.depaul.edu/about/centers-and-institutes/center-for-intellectual-property-law-andinformation-technology/programs/ip-scholars-conference/Documents/ipsc_2019/Chin%20-%20Paper.pdf.; Kesan, Jay P. and Wang, Runhua, "Eligible Subject Matter at the Patent Office: An Empirical Study of the Influence of Alice on Patent Examiners and Patent Applicants," (March 17, 2020) *Minnesota Law Review, Vol. 105, Issue 2, 2020 (Forthcoming)* , *available at* SSRN: https://ssrn.com/abstract=3556216.

(a) **Formative Supreme Court decisions pertaining to software-based inventions** —

Traditionally, software algorithms, even when claimed together with the underlying computer system or machinery being controlled by such algorithms, were almost always not patentable.[18] The 1972 Supreme Court decision of *Gottschalk v. Benson* [19] held that a patent claim to a computation process using a mathematical formula to convert binary-coded decimal numerals into pure binary numerals is not patent-eligible because the formula "has no substantial practical application except in connection with a digital computer, which means that [if the patent application were granted] the patent would wholly preempt the mathematical formula and, in practical effect, would be a patent on the algorithm itself."[20] Notably, the holding of *Gottschalk v. Benson* is based on the Court's determination that the claims purported to cover any use of the claimed method in a general purpose digital computer of any type. They were not limited to any particular art or technology, to any particular apparatus or machinery, or to any particular end use.[21]

[18] *See, e.g.* , *Gottschalk v. Benson* , 409 U.S. 63; *Parker v. Flook*, 437 U.S. 584. One notable exception to this predominant outcome was the development of the "new machine" rationale in the appeals court decision of *In re Bernhart*, 417 F.2d 1395 (C.C.P.A. 1969), which held that a claim directed to a software-controlled plotting machine programmed to draw two-dimensional representations of three-dimensional objects was statutory under § 101. The U.S. Court of Customs and Patent Appeals reasoned that a machine that is programmed in a certain new and nonobvious way is physically different from the machine without that program, and therefore patent eligible.

[19] 409 U.S. 63

[20] *Id.* at 71-72.

[21] The Court made this determination notwithstanding that claim 8 of the patent application actually recited a reentrant shift register in which the BCD numerals are stored, and the conversion algorithm is particularly suited to this type of memory structure.

In *Parker v. Flook,* [22] a claim to a mathematical formula with an end use, namely, setting alarm limit values for a catalytic conversion process, was held unpatentable. The analytical framework adopted by the Court, later apparently overruled by *Diamond v. Diehr*, [23] examined the statutory and non-statutory parts of the claims, assumed the non-statutory part is conventional, and tested whether the statutory part merits patentability.[24] Perhaps most notably, the *Parker v. Flook* Court specifically rejected the notion that a "draftsman's art" of "incorporating a principle in some specific fashion," could save an otherwise patent-ineligible formula.[25] Hence, *Parker v. Flook* stands for the proposition that a "useful, though conventional, post-solution application of the formula" is not sufficient to bring the mathematical formula into the realm of patent-eligible subject matter.[26]

[22] 437 U.S. 584 (1978).

[23] 450 U.S. 175 (1981)

[24] 437 U.S. 584, 594 ("Respondent's advance is unpatentable under § 101, not because it contains a mathematical algorithm as one component, but because once that algorithm is assumed to be within the prior art, the application, considered as a whole, contains no patentable invention.").

[25] *Id.* at 590

[26] *Id.* at 593

Diamond v. Diehr was a turning point as the first Supreme Court decision holding that a process for curing rubber featuring a computer-controlled software component (the latter being a key distinguishing part of the claimed invention) was patent-eligible.[27] The opposite outcomes of *Parker v. Flook* and *Diamond v. Diehr* have invited debate as to whether the former has been overturned, particularly in view of the general similarity of the subject matter between the patent applications of these cases.[28] The claims in both of these cases relied upon a mathematical formula to complete some, but not all, of the claimed operations. However, the Court distinguished the claims as between the respective patent applications: in *Parker v. Flook*, the claims were primarily directed to the algorithm for determining the alarm limit values;[29] whereas in *Diamond v. Diehr*, the claims were primarily directed to the process of curing rubber.[30] Indeed, the claims of *Parker v. Flook* simply name the application for the algorithm,

namely, the process comprising the catalytic chemical conversion of hydrocarbons, in the preamble. Step 4, “adjusting said alarm limit to said updated alarm limit value,” recited at the bottom of the representative claim, is nothing more than a setting of a value—it is not really a part of the catalytic chemical conversion process itself. In contrast, representative claim 1 of the patent application of *Diamond v. Diehr* included not only the algorithm, but also recited steps relating to heating rubber, and removing the rubber from the heat. The *Diamond v. Diehr* Court stated that the invention was not merely a mathematical algorithm, but was a process for molding rubber, and thus patentable.

[27] 450 U.S. 175 at 187-190

[28] *See, e.g.* , Jur Strobos, *Stalking the Elusive Patentable Software: Are There Still Diehr or Was It Just a Flook?* , 6 HARV. J.L. & TECH. 363, 387 (1993). *See also* 450 U.S. 175 at 193, *et seq*. (Stevens, J. dissenting).

[29] Claim 1 of the patent application of *Parker v. Flook* states the method as follows:

> 1. A method for updating the value of at least one alarm limit on at least one process variable involved in a process comprising the catalytic chemical conversion of hydrocarbons wherein said alarm limit has a current value of
>
> Bo + K
>
> wherein Bo is the current alarm base and K is a predetermined alarm offset which comprises:
>
> (1) Determining the present value of said process variable, said present value being defined as PVL;
>
> (2) Determining a new alarm base B1, using the following equation:
>
> B1=Bo(1.0-F) + PVL(F)
>
> where F is a predetermined number greater than zero and less than 1.0;
>
> (3) Determining an updated alarm limit which is defined as B1 + K; and thereafter
>
> (4) Adjusting said alarm limit to said updated alarm limit value.

[30]

> Claim 1 of the patent application of *Diamond v. Diehr* states the method as follows:
>
> 1. A method of operating a rubber-molding press for precision molded compounds with the aid of a digital computer, comprising:
>
> providing said computer with a database for said press, including at least,
>
> natural logarithm conversion data (ln),
>
> the activation energy constant (C) unique to each batch of said compound being molded, and
>
> a constant (x) dependent upon the geometry of the particular mold of the press,
>
> initiating an interval timer in said computer upon the closure of the press for monitoring the elapsed time of said closure,
>
> constantly determining the temperature (Z) of the mold at a location closely adjacent to the mold cavity in the press during molding,
>
> constantly providing the computer with the temperature (Z),
>
> repetitively calculating in the computer, at frequent intervals during each cure, the Arrhenius equation for reaction time during the cure, which is
>
> ln v = CZ + x

where v is the total required cure time,

repetitively comparing in the computer at said frequent intervals during the cure each said calculation of the total required cure time calculated with the Arrhenius equation and said elapsed time, and

opening the press automatically when a said comparison indicates equivalence.

(b) **Expansion of eligible subject matter by the Federal Circuit** —

In the three decades that followed the *Diamond v. Diehr* decision, the U.S. Court of Appeals for the Federal Circuit carried the baton for developing patent-eligibility jurisprudence for computer-based inventions. The trend over this period showed a steady liberalization of patent-eligibility criteria, much of which was later reined in by the Supreme Court. For instance, the Federal Circuit held that memory storing a data structure is patent eligible over the printed-matter exception to patentability;[31] that software executing on a general-purpose computer hardware can transform the general-purpose hardware into a special-purpose machine;[32] and that business methods in which there is a useful, concrete, and tangible result, are statutory.[33]

[31] *In Re Edward S. Lowry,* 32 F.3d 1579 (Fed. Cir. 1994); *In Re Gary M. Beauregard, Larry K. Loucks, Khoa Dang Nguyenand Robert J. Urquhart*, 53 F.3d 1583 (Fed. Cir. 1995).

[32] *In Re Kuriappan P. Alappat, Edward E. Averill and James G. Larsen*, 33 F.3d 1526 (Fed. Cir. 1994).

[33] *State Street Bank & Trust Co., v. Signature Financial Group, Inc.,* 149 F.3d 1368 (Fed. Cir. 1998).

The Federal Circuit's approach suggested a general policy, or at least an aspiration, to create clear and definite rules that could be followed predictably by the courts and the U.S. Patent and Trademark Office. A number of these rules were ultimately abrogated by the Supreme Court, such as the “useful, concrete, and tangible results” eligibility test of *State Street Bank & Trust Co., v. Signature Financial Group, Inc.,* 149 F.3d 1368 (Fed. Cir. 1998), and the “machine-or-transformation” eligibility test of *In re Bilski.*[34]

[34] 545 F.3d 943 (Fed. Cir. 2008) (judgment aff'd, 561 U.S. 593).

The Federal Circuit's jurisprudence, and the Patent and Trademark Office's policymaking that followed, fostered an explosion of patenting activity in the software realm. This resulted in the granting of, and litigation involving, numerous broadly drawn patents in various fields of endeavor extending well outside the traditional purview of the patent system, such as financial transactions, organizational workflow, and the like.

(c) **Contemporary wave of Supreme Court jurisprudence** —

Beginning in 2010, the Supreme Court has exhibited a renewed interest in patent eligibility. In *Bilski v. Kappos*,[35] the Court rejected the “machine-or-transformation” test as the sole test for patent eligibility as articulated by the Federal Circuit in prior proceedings, though it may still serve as a useful and important clue or investigative tool in the eligibility analysis.[36] In so doing, the Court revived some of the standards set forth in the *Gottschalk v. Benson* , *Parker v. Flook* , and *Diamond v. Diehr* decisions, effectively revoking any eligibility tests established by the Federal Circuit that were inconsistent with the holdings of these decisions, such as the precedents of *In Re Kuriappan P. Alappat, Edward E. Averill and James G. Larsen*, 33 F.3d 1526 (Fed. Cir. 1994), and *State Street Bank*.

[35] 561 U.S. 593 (2010) (invalidating the claims, directed to a process of hedging risk in commodities trading by investing in other segments of the energy industry, on grounds of being a "fundamental economic practice" — an abstract idea).

[36] *Id.* at 604.

In 2012, the Supreme Court decided *Mayo Collaborative Services v. Prometheus Laboratories, Inc.*, [37] in which it introduced a two-step framework to determine validity under Section 101 of a claimed method for determining drug dosing. Under this framework, the first step determines if the claim at issue is directed to a law of nature and, if such is the case, the second step asks if the patent claims add enough to their statements of the application of the natural laws to qualify as patent-eligible processes. The *Mayo v. Prometheus* Court unanimously concluded that the patent claimed a law of nature. [38] In its further analysis (step 2), the *Mayo* Court concluded that the claims were unpatentable because "the steps in the claimed processes (apart from the natural laws themselves) involve well-understood, routine, conventional activity" that amounts to insignificantly more than a step that calls for some application of the law of nature. [39]

[37] 566 U.S. 66.

[38] *Id.* at 74 (Namely, relationships between concentrations of certain metabolites in the blood and the likelihood that a dosage of a thiopurine drug will prove ineffective or cause harm; the relation is a consequence of the ways in which thiopurine compounds are metabolized by the body—entirely natural processes).

[39] *Id.* at 79 ("The claim before us presents a case for patentability that is weaker than the (patent-eligible) claim in *Diehr* and no stronger than the (unpatentable) claim in *Flook*. Beyond picking out the relevant audience, namely those who administer doses of thiopurine drugs, the claim simply tells doctors to: (1) measure (somehow) the current level of the relevant metabolite, (2) use particular (unpatentable) laws of nature (which the claim sets forth) to calculate the current toxicity/inefficacy limits, and (3) reconsider the drug dosage in light of the law. These instructions add nothing specific to the laws of nature other than what is well-understood, routine, conventional activity, previously engaged in by those in the field. And since they are steps that must be taken in order to apply the laws in question, the effect is simply to tell doctors to apply the law somehow when treating their patients. The process in *Diehr* was not so characterized; that in *Flook* was characterized in roughly this way").

The *Mayo* holding did not address a software-based invention, but its principles were carried over into the software technology space by the 2014 *Alice v. CLS Bank* [40] decision, which clarified that the rationale underlying the Court's prior decision in *Mayo* concerning laws of nature also applies to abstract ideas. The claims at issue involved an electronic escrow service that mitigates settlement risk for financial transactions, implemented on a computer system, which the Court held to be unpatentable as an "abstract idea of intermediated settlement." [41] As such, the Court concluded that "[l]ike the risk hedging in *Bilski*, the concept of intermediated settlement is 'a fundamental economic practice long prevalent in our system of commerce,'" [42] thus meeting the condition of *Mayo v. Prometheus* Step 1 . The *Alice* decision instructs that fundamental economic practices, and methods of organizing human activity (such as the concept of risk hedging of *Bilski)* , are both abstract ideas. Applying Step 2, the *Alice* court concluded that the claims calling for merely a generic computer implementation of an abstract idea do not contain an "inventive concept" sufficient to transform the abstract idea into a patent-eligible invention. [43]

[40] *Alice Corporation Pty. Ltd. v. CLS Bank International, et al.*, 573 U.S. 208.

[41] *Id.* at 215.

[42] *Id* . at 217 (quoting *Bilski*, 561, U.S. 593, 611).

[43] *Id.* at 218.

The *Alice* court held that if a patent's claim of a computer amounts to a mere instruction to implement an abstract idea on a computer, the recitation of such a computer does not impart patent eligibility. [44] Therefore, a claim that is directed to an abstract idea must have additional features (beyond a generic computer implementation) to prevent the monopolization of a patent ineligible subject matter. [45] The Court viewed a generic computer implementation of an abstract idea as merely a drafting effort

designed to monopolize the abstract idea itself (akin to the “apply it” step in the context of *Mayo*).

[44] *Id.* at 221.

[45] *Id.* at 218.

Also, notably, the *Alice* court specifically ruled that system claims and claims to a computer-readable medium, at least for purposes of determining eligibility, are not different from method claims in substance.[46] The recitation of specific hardware, such as a communications controller, data storage unit, or the like, are deemed to be part of the technological environment.

[46] *Id.* at 224.

The *Alice* decision includes some suggestions for what claimed features might transform an abstract idea into a patent-eligible invention[47]:

[47] *Id.* at 223.

- Express language to define the computer's participation (e.g., improvements to the functioning of the computer itself); and
- An improvement in another technology or field (citing *Diamond v. Diehr*).

(d) **Synthesis and lessons from the current jurisprudence** —

The “preemption” rationale articulated in *Gottschalk v. Benson* remains a mainstay of current jurisprudence under Section 101 and, as will be discussed below, features prominently in the USPTO's Manual of Patent Examination Procedure (MPEP). Determining whether a claim preempts a mathematical formula, or other abstract idea, is ultimately a question of breadth of scope of the claim at issue. More particularly, the preemption analysis asks whether the claim is so overly broad that the claim would effectively cover all practical uses of the abstract concept. In practice, this type of analysis is rather challenging. Unlike prior-art-based patentability assessment under standards of anticipation[48] or obviousness[49] (which compare the limitations of a claim against prior-art references or events), preemption assessment appears to examine whether the claimed abstract concept at issue is limited to some bounded “practical application.” This type of comparison is amorphous and indeterminate, and it is no surprise that it produces inconsistent outcomes that are difficult to predict.

[48] 35 U.S.C. § 102.

[49] 35 U.S.C. § 103.

What can be gleaned from the series of Supreme Court decisions summarized above is the over-arching principle that an eligible claim that is based on a law of nature, fundamental economic principle, mathematical formula, method of organizing human activity, or other type of abstract concept, must articulate features that are specific to a technological application in which the abstract concept is used, or features that are specific to an implementation of the abstract concept into a process, device, or system. Thus, in the context of computer-based inventions, if the claim is recited so broadly that the computer system is used

conventionally as merely a tool for executing instructions to carry out the concept which is determined to be abstract, the claim should further recite the computer's role in interacting with some external system or process (i.e., the application), or it should recite ways in which the computer system's functionality is optimized to execute those instructions (i.e., the implementation).

A claim that articulates both application-specific features and implementation-specific features would be better positioned from an eligibility standpoint. Moreover, these articulated features must be meaningful limitations on the scope of the claim, lest they be deemed "draftsman's art" *a la Parker v. Flook*. The sufficiency of such articulated features is certainly a question of degree and, unavoidably, is susceptible to differing subjective considerations that may be brought to bear by different decision makers. This reality is borne out in the numerous inconsistent eligibility outcomes in lower-court decisions. [50]

[50] *See, e.g* ., Lewis, Paxton M., *supra* note 5 at 25.

As guideposts, practitioners might consider that a sufficient set of articulated features to overcome the "abstract idea" exception resides somewhere between the claims of *Parker v. Flook* and those of *Diamond v. Diehr*. [51] Notably, the claims of each respective patent application could have been written like the other: the *Flook* claims could have recited the use of the determined alarm limits to adjust or interrupt the chemical process in response to measured parameters exceeding a determined limit; and the *Diehr* claims could have been written to produce the rubber-molding process control inputs without expressly articulating the integration of the inputs into the process itself. Presumably, in this hypothetical example, the outcomes of *Flook* and *Diehr* would have each been inverted. This example underscores the reality that, for essentially the same invention, the way that a claim is written is indeed critical to the outcome of an eligibility determination. Hence, the espoused "draftsman's art" rationale of the Supreme Court decisions should therefore be viewed as requiring the articulated features to be meaningful and limiting to the scope of the claim.

[51] Examples of each provided *supra* notes and.

The Court's discussions of "well-understood, routine, or conventional activity" or "inventive concept" in the context of eligibility determination appear at first to call for an assessment of novelty or nonobviousness. However, as recognized by the U.S. Patent and Trademark Office in its Revised 2019 PEG (incorporated in the Manual of Patent Examining Procedure as of June, 2020), the more correct understanding of the Supreme Court's reasoning with respect to these points may be that the eligibility inquiry should examine whether the claim at issue *attempts* to place meaningful limits on the application or implementation of an abstract concept, and not necessarily whether the claim actually succeeds in stating a novel or nonobvious application or implementation of the abstract concept. This understanding is consistent with the gatekeeping purpose of Section 101. [52] As other commentators have pointed out, the qualifications that the *Mayo* opinion places on *Flook*'s language about conventionality are both deliberate and meaningful: unconventionality of additional features in a claim can suggest their significance to the subject-matter eligibility analysis, but conventionality of those steps does not necessarily establish their insignificance. [53]

[52] *See* Bruce Wexler and Edwin Mok, *The Gatekeeping Function of Patent Eligibility as Part of a More Complete Understanding of § 101 Principles* , PatentlyO Blog (April 24, 2016), *Available at* https://patentlyo.com/patent/ 2016/04/wexler-gatekeeping-eligibility.html

[53] John M. Golden, *Flook Says One Thing, Diehr Says Another: A Need for Housecleaning in the Law of Patentable Subject Matter*, 82 George Washington Law Review 1765, 1792.

(3) **USPTO guidance and practice** —

The relevant sections of the Manual of Patent Examination Procedure (MPEP) for subject-matter eligibility under Section 101 are Sections 2103, 2104, 2105, 2106 and 2106.03 through 2106.07(c). The Office of Patent and Legal Administration at the USPTO

maintains a comprehensive set of materials [54] specific to patent eligibility for use by examiners and applicants. These materials include the 2019 PEG, examples of applications of the USPTO's rules and guidance, summary of court decisions concerning eligibility, memoranda, training materials, and more.

[54] USPTO Subject Matter Eligibility Web Pages, https://www.uspto.gov/patent/laws-and-regulations/examination-policy/subject-matter-eligibility.

(a) **2019 Patent Eligibility Guidance Incorporated into the MPEP** —

The 2019 PEG includes a set of Guidance issued January 7, 2019 [55], and additional materials (including a PEG update and additional examples) issued October 17, 2019 [56] following public comment. The 2019 PEG made significant clarifications to the USPTO's prior examination guidance following the *Alice* decision. In the discussion below, reference to the "2019 PEG" refers to the collective set of materials, including the January 7 and October 17 publications.

[55] United States Patent and Trademark Office, *2019 Revised Patent Subject Matter Eligibility Guidance*, 84 Fed. Reg. 50.

[56] United States Patent and Trademark Office, *October 2019 Update: Subject Matter Eligibility*.

The MPEP was updated in June 2020 to incorporate the 2019 PEG. The current MPEP version with these incorporated materials is indicated as [R-10.2019]. MPEP § 2106 now contains a comprehensive and fully detailed set of instructions for evaluating patentability in light of the judicial exceptions, including a flowcharted step-by-step procedure with numerous references to applicable case law and hypothetical examples. The latest MPEP revision is perhaps the first complete authoritative [57] and practical guide for applying the judicially developed law of subject-matter eligibility under Section 101. This work presents an overview and a curated set of highlights that are pertinent to the patentability of AI-based inventions.

[57] Insofar as proceedings at the USPTO are concerned. Although the MPEP does not have the force of law or the force of the rules in Title 37 of the Code of Federal Regulations, it "is well known to those registered to practice in the PTO and reflects the presumptions under which the PTO operates." *Critikon, Inc. v. Becton Dickinson Vascular Access*, Inc., 120 F.3d 1253, 1257 (Fed. Cir. 1997).

The USPTO has promulgated a simplified algorithmic approach to determining eligibility. [58] Initially, the broadest reasonable interpretation [59] of the claim as a whole is established. Examination of the broadest reasonable interpretation ("BRI") [60] methodology is beyond the scope of this work, but it is worth noting that the USPTO's use of the BRI for patent examination differs from the claim construction methodology that has been established by the courts for use in patent litigation. [61]

[58] MPEP § 2106 [R-10.2019].

[59] MPEP § 2111.

[60] MPEP § 2111

[61] *E.g.* , *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005).

Once the BRI is established, the USPTO recognizes three "pathways to patentability." [62] Pathway A represents a streamlined analysis in which most of the work of analyzing eligibility is bypassed when the claim eligibility is self-evident (e.g., because the claim clearly improves a technology or computer functionality). [63] Pathway B leads to a finding of patentability when the claim is determined to not be "directed to" a judicial exception (even though the judicial exception may be present in the claim). [64] Pathway C may be used when the claim includes additional subject matter besides the judicial exception that is "unconventional." [65]

[62] MPEP § 2106(III) [R-10.2019].

[63] MPEP § 2106.06 [R-10.2019].

[64] MPEP § 2106.04(II)(A) [R-10.2019].

[65] MPEP § 2106.05 [R-10.2019].

(1) **USPTO's "Step 1"** —

Step 1 of the USPTO's eligibility determination is taken regardless of which pathway is ultimately used. Step 1 calls for determining whether the claim is drawn to a statutory category (process, machine, manufacture, or composition of matter). If no statutory category is discernable from the claim, the claim is deemed ineligible. Otherwise, the process proceeds to Step 2A - determining if the claim is directed to any judicial exceptions to patentability. If no judicial exception is discernable, the claim is deemed eligible. Otherwise, if the claim is directed to a judicial exception, Step 2B inquires whether the claim recites additional elements that amount to significantly more than the judicial exception (i.e., representing an inventive concept).

(2) **USPTO's "Step 2A"** —

Step 2A[66] is a component of pathway B and is composed of two prongs. In Step 2A-1 examiners are to evaluate if the claim recites[67] a judicial exception, such as an abstract idea, a law of nature, or a natural phenomenon. If such is the case, the inquiry proceeds to Step 2A-2 to determine whether the claim is directed to the recited judicial exception.

[66] MPEP § 2106.04 [R-10.2019].

[67] A claim "recites" a judicial exception when the judicial exception is "set forth" or "described" in the claim. While the terms "set forth" and "describe" are thus both equated with "recite," their different language is intended to indicate that there are two ways in which an exception can be recited in a claim. For instance, the claims in *Diamond v. Diehr* clearly stated a mathematical equation in the repetitively calculating step, such that the claims "set forth" an identifiable judicial exception, but the claims in *Alice Corp. v. CLS Bank* , "described" the concept of intermediated settlement without ever explicitly using the words "intermediated" or "settlement." *October 2019 Update: Subject Matter Eligibility, supra* at 1-2.

The judicial exception most often implicated with AI subject matter is the abstract concept exception. The MPEP specifies an extensive rule set for abstract ideas in section 2106.04(a)(2). In particular, examiners are trained to identify an abstract idea if it falls under one (or more) of the following enumerated groupings[68] :

[68] MPEP § 2106.04(a) [R-10.2019].

I. Mathematical concepts, including mathematical relationships, mathematical formulas or equations, or mathematical calculations;

II. Certain methods of organizing human activity, including fundamental economic practices or principles, commercial or legal interactions, managing personal behavior or relationships or interactions between people; or

III. Mental processes, such as concepts that may be practically performed in the human mind or by a human using a pencil and paper or other physical aid (even if that physical aid is a computer).

With only rare exception, claims that do not recite matter that falls within these enumerated groupings of abstract ideas are not treated as reciting abstract ideas.

When an abstract concept is identified in Step 2A-1, Step 2A-2 is performed to determine if the claim is truly "directed to" a judicial exception. A claim is not "directed to" a judicial exception, and thus is patent eligible, if the claim as a whole integrates the recited judicial exception into a practical application of that exception.[69] The underlying policy, consistent with *Gottschalk v. Benson* and the subsequent Supreme Court holdings, is to ensure that the claim applies, relies on, or uses, the judicial exception in a manner that imposes a meaningful limit on the judicial exception, such that the claim is more than a drafting effort designed to monopolize the judicial exception. Examiners are to evaluate integration into a practical application by: (a) identifying whether there are any additional elements recited in the claim beyond the judicial exception(s); and (b) evaluating those additional elements individually and in combination to determine whether they integrate the exception into a practical application, using one or more of the considerations based on judicial precedent, such as:

[69] MPEP § 2106.04(d) [R-10.2019].

• whether an additional element reflects an improvement in the functioning of a computer, or an improvement to other technology or technical field;

• whether an additional element applies or uses a judicial exception to effect a particular treatment or prophylaxis for a disease or medical condition;

• whether an additional element implements a judicial exception with, or uses a judicial exception in conjunction with, a particular machine or manufacture that is integral to the claim;

• whether an additional element effects a transformation or reduction of a particular article to a different state or thing; or

• whether an additional element applies or uses the judicial exception in some other meaningful way beyond generally linking the use of the judicial exception to a particular technological environment, such that the claim as a whole is "more than a drafting effort designed to monopolize the exception."

Notably, revised Step 2A specifically excludes consideration of whether the additional elements represent well-understood, routine, conventional activity. Accordingly, in revised Step 2A, examiners are instructed to ensure that they give weight to all additional elements, whether or not they are conventional, when evaluating whether a judicial exception has been integrated into a practical application.

In the context of AI, the consideration of whether an additional claim element amounts to an improvement in the functioning of a computer or an improvement to other technology or technical field is particularly pertinent for analysis under Step 2A-2. The MPEP instructs that consideration of improvements is relevant to the integration analysis regardless of the technology

of the claimed invention. Thus, the consideration applies equally whether it is a computer-implemented invention, an invention in the life sciences, or any other technology. However, the MPEP cautions that an improvement in the judicial exception itself (e.g., a recited fundamental economic concept) is not an improvement in technology.

In addition, there is no requirement for the judicial exception to provide the improvement. The improvement can be provided by one or more additional elements, or by the additional element(s) in combination with the recited judicial exception. Examiners are instructed to analyze the “improvements” consideration by evaluating the specification and the claims to ensure that a technical explanation of the asserted improvement is present in the specification, and that the claim reflects the asserted improvement. Generally, examiners are not expected to make a qualitative judgment on the merits of the asserted improvement. If the examiner concludes the disclosed invention does not improve technology, the burden shifts to applicant in prosecution to provide persuasive arguments supported by any necessary evidence to demonstrate that one of ordinary skill in the art would understand that the disclosed invention improves technology.

Furthermore, the MPEP instructs that the improvement needs to be “reflected” in the language of the claim, but not necessarily stated directly. Instead, the improvement should be apparent from a reading of the specification by one or ordinary skill in the art. Here, too, there is no requirement for the improvement to be set forth explicitly in the specification; rather, the description of the inventive subject matter should be sufficient to make the improvement apparent. In turn, a claim “reflects” the improvement if it includes the underlying components or steps of the invention that facilitate the improvement made apparent by the description in the specification.

MPEP § 2106.04(a)(1) lists several examples of claims that do not recite abstract ideas. Notably, an example of a hypothetical claim to a machine-learning technology is provided:

> [A] method of training a neural network for facial detection comprising: collecting a set of digital facial images, applying one or more transformations to the digital images, creating a first training set including the modified set of digital facial images; training the neural network in a first stage using the first training set, creating a second training set including digital non-facial images that are incorrectly detected as facial images in the first stage of training; and training the neural network in a second stage using the second training set.

The MPEP provides examples in which a judicial exception has not been integrated into a practical application under Step 2A-2. These include claims in which an additional element merely recites “apply it” (or something equivalent) with the judicial exception (e.g., omitting details pertaining to an improvement to a technology or technical field, or omitting details about the implementation of the judicial exception). Instructions to implement an abstract idea on a computer, or simply using a computer as a tool to perform the abstract idea, are likewise considered insufficient integrations into practical applications to meet the criteria of Step 2A-2. Similarly, an additional element that adds insignificant extra-solution activity to the judicial exception (e.g., a data-gathering step, or adjusting an alarm limit as in *Flook*), or does no more than generally link the use of the exception to a particular technological environment or field of use, is insufficient under Step 2A-2 to amount to an integration of the judicial exception into a practical application.

(3) **USPTO's “Step 2B”** —

Step 2B of the eligibility analysis described in the MPEP implements the second step of the *Alice/Mayo* test, which is

referred to as a "search for an inventive concept."[70] Accordingly, if the claim in question has additional elements that amount to "significantly more" than the judicial exception itself, such as if those additional elements are unconventional (e.g., not well-understood, routine, conventional activity in the field) either individually or in combination, a claim directed to a judicial exception may still be eligible for patenting under § 101.

[70] MPEP § 2106.05 [R-10.2019].

In Step 2B, examiners are to consider the claim as a whole.[71] The inquiry asks whether an additional element or combination of elements:

[71] Hence, the prescribed analysis differs from the defunct "point-of-novelty" test applied in *Parker v. Flook* and abrogated by *Diamond v. Diehr*.

- adds a specific limitation or combination of limitations that are not well-understood, routine, conventional activity in the field, which is indicative that an inventive concept may be present; or

- simply appends well-understood, routine, conventional activities previously known to the industry, specified at a high level of generality, to the judicial exception, which is indicative that an inventive concept may not be present.

The MPEP recognizes that there is substantial overlap in the analysis of Step 2A-2 and Step 2B. Examiners are instructed to reevaluate, under Step 2B, any features in the claims that were deemed to be "extra-solution activity" or otherwise insufficient to meaningfully integrate the judicial exception into a practical application under Step 2A-2.

Notably, the search for an inventive concept under Step 2B is a different standard than the evaluations for patentability under sections 102 or 103 of the Patent Act. According to the MPEP, an additional element (or combination of additional elements) that is known in the art can still be unconventional or non-routine for purposes of evaluation under Step 2B.[72] For example, claims may exhibit an improvement over conventional computer functionality even if the improvement lacks novelty over the prior art. A corollary to this rule is that if an additional element (or combination of elements) is novel or nonobvious over prior art, it should suffice to be an inventive concept under Step 2B.

[72] MPEP § 2106.05(d)(I)(1) [R-10.2019] (citing *Diamond v. Diehr,* 450 U.S. 175, 190).

The MPEP instructs examiners to determine that an element (or combination of elements) is well-understood, routine, conventional activity only when they can readily conclude, based on their expertise in the art, that the element is widely prevalent or in common use in the relevant industry. The analysis as to whether an element (or combination of elements) is widely prevalent or in common use is the same as the analysis under 35 U.S.C. § 112(a) as to whether an element is so well-known that it need not be described in detail in the patent specification.[73] Examiners are to rely on what the courts have recognized, or those in the art would recognize, as elements that are well-understood, routine, conventional activity in the relevant field when making the required determination. Section 2106.05(d)(II) of the MPEP lists numerous cases and fact patterns to which analogies may be drawn as evidence of a feature being "common," "conventional," or "well-known" within the meaning of Step 2B.

[73]

[73] MPEP § 2106.05(d)(I)(2) [R-10.2019]

Any statements by the applicant in the specification indicating that some feature is “common,” “conventional,” or “well-known” are important indicators that are to be considered (and are likely to be given substantial weight) in the assessment of the presence of an inventive concept under Step 2B.

(4) **Reconciling PTO guidelines with Federal Court precedent** —

The 1029 PEG and the June 2020 MPEP revisions have been carefully and methodically written with comprehensive citations to the judicial decisions. As a casual observation, the density of citations to federal precedent in MPEP § 2106 far exceeds that of the rest of the MPEP. This is no accident: the USPTO set out to create a clear and repeatable process for determining eligibility from a judicial record that is anything but clear and repeatable. The authors properly recognized that MPEP § 2106 may reach different results regarding eligibility in non-clear-cut cases than some courts would.

MPEP § 2106 sets forth a specific framework for examiners to properly carry out in order to maintain an eligibility rejection, and provides three distinct pathways to eligibility, mapping out numerous arguments that applicants may raise, based on the merits or the procedures that examiners are required to follow. By comparison, judges have no such paradigm. They may elect in their discretion to follow, or at least refer to the USPTO's procedures, or they may dismiss them entirely as not binding on the courts. [74]

[74] *Cleveland Clinic v. True Health*, 760 F. App'x 1013, 1020.

For example, courts have a comparatively less-restricted path to finding that a feature in a claim is well-understood, routine, or conventional, while examiners are required to follow the detailed and lengthy procedure set forth in MPEP § 2106.05(d). We can safely predict that the USPTO will continue to be more biased towards finding claims to be eligible under § 101 while the courts will continue to be less so [75].

[75] *See, e.g.* , Andrew A. Toole and Nicholas A. Pairolero, *Adjusting to Alice, USPTO Patent Examination Outcomes after Alice Corp. v. CLS Bank International*, 3 IP DATA HIGHLIGHTS, U.S. Patent and Trademark Office, Office of the Chief Economist (2020).

(5) **Examples of AI subject matter and application of the law and examination procedures concerning eligibility** —

An AI-based invention may be described and claimed in various aspects. For instance, an AI invention might be expressed in terms of its application, its architecture, its implementation, its functionality, data preparation to utilize the AI invention, or data adaptation performed as part of its operation, to name a few.

(a) **AI claims focusing on application** —

The application of an AI technology may include its end use, such as machine vision in a particular context (e.g., self-driving

vehicle, robotic movement, object detection/recognition, face recognition, surveillance); radiologic data analysis; regression/trend detection/prediction; synthesis of imagery, audio, literature, or other creative work; search engine; semantic analysis; product recommendation generation; sentiment analysis; fraud detection; predictive maintenance; quality control; logistics and inventory management; genotyping/phenotyping; drug development; and countless others. Depending on the type of application, an AI-based claim that focuses on the application may be susceptible as possibly reciting a mental process or organizing human activity. For instance, a claim directed to assessing a loan applicant's credit worthiness using a broadly formulated classification algorithm may be deemed to be directed to a fundamental economic practice or commercial interaction. Thus, the analysis may turn to whether the claim improves a technology, has a specific technological implementation, or has some other feature that is an inventive concept.

The presence of the classifier certainly constitutes an improvement in the field of lending, but this is not a technological field. The broadly formulated classification algorithm may or may not be sufficient to constitute a technological implementation. In this example, the result is likely to turn on the degree of specificity of the classification algorithm as recited in the claim. The challenge with classification and other decision methodologies is that, at a high level, these may be abstract ideas (e.g., mental processes) since the human mind tends to perform such operations. Consider the following hypothetical claim:

Example 1

A method for assessing credit worthiness of a prospective borrower, comprising:
training a classifier based on a first labeled training set to produce a trained classifier;
testing the trained classifier using a second labeled training set to produce a test result;
refining the trained classifier to reduce any errors in the test result and to produce a refined classifier;
receiving input data by the refined classifier; and
processing the input data by the refined classifier to produce a classification label for each item of the input data; wherein the input data represents financial information about the borrower and the classification label represents a measure of credit worthiness of the borrower.

In this example, the operations are essentially a restatement of the basic human learning process. Hence, this claim may be

deemed as being directed to an abstract idea without a practical application of the abstract idea.

Consider the addition of a generic machine-based implementation of the classifier to the claim. For instance, “wherein the classifier is executed on a computer system”: this addition would most likely not suffice to overcome the problem with eligibility. It is clear from *Alice v. CLS Bank* that simply requiring the classification to be carried out on an unspecified (generic) computer is essentially linking the abstract idea of a classifier or the credit-scoring application to a technological environment. This does not transform the abstract idea into a practical application.

Next, consider the addition of features that further specify the nature of the classifier. For instance, “wherein the classifier includes a deep neural network”: this example incorporates technological features of the implementation of the classifier. Whether or not it is sufficient to be a practical application will depend on whether the deep neural network (recited broadly) is considered to be analogous to a “generic computer system.” Considering the example of the MPEP excerpted above, it would seem that the USPTO considers it to be a practical application. However, a court may see things differently. Ultimately, the determination of the “genericness” of a computer system as a technological environment for an algorithm is a question of degree. It should be noted that deep neural networks have been known for decades, and there are a multitude of textbooks, websites, videos, and other sources describing them, which tends to support the position that deep neural networks, at a high level of abstraction, are ubiquitous.

In a further example where the deep neural network is defined with specificity, such as “the deep neural network comprising a linear layer as an input layer having a first layer output directed to an input of a transformation and activation layer having a second layer output directed to an input of a pooling layer having a third layer output directed to an input of a fully-connected and activation layer having a fourth layer output directed to an input of a fully-connected and probability layer having a main neural-network output,” it would appear that such an implementation describes a “particular machine” or an improvement to the functioning of a classifier, thus unequivocally stating a practical application.

As another example of an application-focused claim, consider the following:

Example 2

A method for testing mechanical properties of a widget, comprising:
training a classifier based on a first labeled training set to produce a trained classifier;
testing the trained classifier using a second labeled training set to produce a test result;

refining the trained classifier to reduce any errors in the test result and to produce a refined classifier;
receiving input data by the refined classifier; and
processing the input data by the refined classifier to produce a classification label for each item of the input data; wherein the input data represents a set of dimensional measurements of the widget and a set of metallurgical measurements performed on the widget, and the classification label represents an indication of at least one mechanical property of the widget.

Here, the classifier is the same as in the previous example, but the recited application is a technological one (determining mechanical properties from dimensional and metallurgical measurements). The classifier recited so broadly is likely abstract, as discussed in the Example 1 above. Example 2 arguably falls in the gray area between *Parker v. Flook* and *Diamond v. Diehr* . There is some degree of integration of the classifier into the application by virtue of the input data and classification label relating to the testing application, more so than in *Parker v. Flook* ; however, the claim does not require any processing of the widget based on the outcome of the test results; thus, it arguably falls short of *Diehr* in terms of the degree of integration between the algorithm and the application. In a litigation scenario, the outcome of this example would be difficult to predict. However, under the current practices of the USPTO, the application of the claim of Example 2 is arguably an “additional element that reflects an improvement to other technology,” namely, mechanical properties evaluation. Practically speaking, this example highlights the potential benefits of thoughtfully writing the specification in such a way that the patent application is classified by the USPTO as a mechanical properties testing technology and assigned to a mechanical-technology art unit rather than a machine-learning art unit.

(b) **AI claims focusing on architecture or implementation** —

As Example 1 above and its variations illustrate, the same AI technology may be described and claimed in terms of its architecture, such as the type of machine-learning model (e.g., deep neural network, deep belief network, generative adversarial network, autoencoder, Bayesian classifier, recurrent neural network, recursive neural network, support vector machine, multilayer perceptron), and may include details or attributes of the relevant neural-network layers, connections, input locations, filters, activation functions, and the like. In general, these types of features are technological in nature and tend to fall outside of the judicial exceptions to patent eligibility, such as the enumerated groupings discussed at length in the MPEP.

However, as a practical matter, as illustrated in Example 1 above, if the application triggers a judicial exception (e.g., finance-related, legal interaction, or other method of organizing human activity), the whole claim may be subjected to greater scrutiny and, in turn, if the architecture is recited broadly at a high level of abstraction, the claim may be deemed to lack a practical application of the judicial exception. Patent applicants would be well served to have robust fallback positions in the claims that reach some of the detailed features of the preferred embodiments in order to ensure that the claimed architecture amounts to a practical application that is integrated with the other features.

Implementation details can include such features as efficient computing algorithms, specific training processes, loss function representations, backpropagation algorithm variations, varied structures for training vs. inference mode, and the like. Such features, if their scope is not too narrow to be useful within the patenting strategy, would be expected to steer the claims toward eligibility.

(c) **AI claims focusing on data preparation or data adaptation** —

Certain AI-related innovations may be directed to input data preparation techniques, such as normalization, compression, culling, diversification, and the like. Similarly, other innovations may focus on adaptation of input or output data to the particular application, such as specific feature vectors. These types of features tend to be technological in nature, but they tend to be math-heavy and, hence, run the risk of being deemed mathematical concepts. As such, it may be important in practice to draft such claims in a way that connects the loss function and input/output feature vectors to real-world things that they represent.

Parker v. Flook continues to be cited in *Alice, Mayo*, and recent Federal Circuit decisions, and must be dealt with proactively, if possible. Therefore, the integration of data-preparation and data-adaptation features with the application, and with the architecture or implementation features of the claims, is essential to avoid the problem of "extra-solution activity." For instance, applicants would be well served to have data-preparation inventions described in the specification within the context of improvement to the computational performance of the AI system. This approach would steer the eligibility determination to finding that the claim improves the operation of the underlying computing system. For data-adaptation claims, consider ways in which input or output feature vectors are handled by the intermediate portions of a machine learning (ML) system in inference mode or training mode.[76]

[76] Importantly, broadest claims should separate inference mode from training since the latter may never be performed by a deployed ML system.