

## ROBOT INVENTORS, ROBOT PATENTS, ROBOT EXAMINERS, AND ROBOT PATENT PROSECUTORS

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*The United States patent system is a strong candidate for wider deployment of generative AI. Even though the Patent Office so far has rejected the idea, generative AI systems are on the verge of being able to invent and thus qualify to be listed as inventors on patents. Specialized generative AI engines themselves qualify as patentable inventions, and the Patent Office has granted more than two dozen patents on generative AI. It has pending more than 100,000 applications that use the term “artificial intelligence.” Apart from the patentability of AI technology and its work product, generative AI already is a mainstay of patent prosecution, performing prior-art searches, drafting patent applications, checking their formats, and producing drawings. The power of the technology makes each of these changes in the way the patent system operates inevitable, but each presents legal and managerial issues. In particular, wider use of AI may cause the number of applications to proliferate, cause more of them to be submitted and prosecuted without the aid of skilled patent lawyers and marginalize human involvement at both the practitioner and examiner level. Early in 2024, USPTO issued policy guidance on AI inventorship and on use of AI in patent prosecution. Later in 2024 USPTO invited comment on the impact of generative AI on prior art. Controversy continues over the desirability of patents at all in the present legal regime. Justifications for defense of the status quo, particularly for the rule that only natural persons can be inventors, is thin, unpersuasive, and inconsistent with the way copyright law treats individuals when their creative work is sponsored by inanimate business entities.*

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#### I. INTRODUCTION

Lee Dresden and Kayden Miller were playing their weekly and very competitive game of squash at the YMCA’s Arlington, Virginia, Tennis and Racquet Club, not far from River House, at 1111 Army Navy Drive, where the two shared an apartment. Kayden was leading 10 to 9. Kayden had hit a dropping shot off the right front corner and Lee scrambled to reach it. He managed a looping shot off the middle of the front wall. He was sure that Kayden would return it to the opposite corner and would win the game. Instead, Kayden hit it hard, smacking Lee squarely in his right buttock. The hard little rubber ball stung like crazy. Whirling around, Lee demanded, “Why did you do that?”

Kayden was doubled over in laughter. “I just couldn’t resist. I decided that was better than winning the game. It was.”

“Hitting you with my racquet would be even more fun.”

“Calm down. Let’s go have a beer.”

Lee and Kayden had been classmates and Sigma Alpha Epsilon (“SAE”) fraternity brothers at MIT, both majoring in Course 6-2, electrical engineering and computer science. After they graduated, Lee went to work for the National Security Agency in Fort Meade, Maryland, and Kayden started law school at George Washington University in the part-time program while he worked for the United States Patent and Trademark Office (“USPTO”) as a patent examiner. He chose that arrangement because neither he nor his family had

substantial financial resources, and he did not want to burden himself with the hundreds of thousands of dollars in loans a law school like Harvard would have saddled him with.

Kayden recently graduated, passed both the Virginia bar and the patent bar, and went to work for the prestigious Georgetown law firm specializing in patent law, Milligan, Anderson, Jarrabow, and Ferret. Lee, restless under the endless self-protective bureaucracy of the NSA, resigned at the three-year mark and joined a small startup, Vater LLC, headquartered in Manassas, Virginia. Vater had raised substantial capital to develop generative AI solutions for industry.

“What’re you working on?” Kayden asked after they had showered, changed clothes, and had beers in front of them. He laughed. “For the longest time, I couldn’t ask you that—or there was no point asking, because you wouldn’t answer, but I trust that Vater LLC is not secretly intercepting Vladimir Putin’s cellphone calls. Anyway, you can trust me because I persuaded the firm to accept you as a client—even though no one there, including me, thinks you’re ever going to make anything of yourself.”

“Ha!” Lee said. “Trust you after what you just did to me on the squash court? I should know better, but I guess I do need your services, for what they’re worth.”

“I’ll have you know they’re billing me out at \$800 an hour,” Kayden said.

“What you rapacious lawyers charge has nothing to do with what you’re worth.”

“Stop the foolishness and tell me what you want my help on.”

“Our new generative AI system, which we have named, ‘Edison,’ has invented an agricultural cherry picker. We want to apply for a patent in its name.”

“What? The Patent Office doesn’t give patents to machines.”

“It should in this case,” Lee said. “Edison did all the work. Let me show you.” He pulled a couple of sheets of paper from his backpack and unfolded them on the table.<sup>1</sup> “As you can see, all I did was ask Edison to identify fruitful areas for invention, pick one of the areas it suggested, then asked it to invent something, and finally asked it to draft a patent application for its invention.”

Kayden looked over the transcript. “That’s not much of a patent application,” he said. “It’s pretty generic—it’s completely generic. Patent applications have to be specific and definite.”

“You didn’t read it all,” Lee said. “Flip the page. I asked it to fill in details.”

Kayden flipped the page and stared at Lee.

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1. See Appendix (transcript of generative AI session).

“Trying to calculate how much \$800 an hour amounts to for only five or ten minutes? Tune it up and submit it.”

“I don’t know,” Kayden said. “I would be more comfortable if you and the other nuts at Vater wanted to get a patent on Edison instead of on Edison’s work as an inventor.”

“I suppose that’s a possibility as well,” Lee said. “The venture capitalists are drenching us in money, and we have to spend it on something.”

“It’s not like this is a complete surprise,” Kayden said. “Most of the hype about generative AI is nonsense, but it sure is changing the practice of patent law. The law firm regularly uses two commercial AI products to lighten the load of drafting patent applications and to search for prior art that might show an invention is not novel and therefore not qualified for a patent. On the last couple of applications I’ve done, I didn’t have to do much more than dictate a fairly high level description, and the software drafted the claims, wrote the rest of the specification, the abstract, and even did a first cut of the drawings. The documents obviously weren’t ready for submission to the Patent Office, but it only took me a couple of hours to refine them and then send them off. The way lawyers send things to the Patent Office these days is all electronic—the Patent Office’s Web-based Patent Center checks the submission for completeness and correct formats and kicks it back with detailed, paragraph-by-paragraph feedback if the submission has errors.”<sup>2</sup>

“The patent examiners long have had a huge stock of standard form letters to communicate various kinds of objections and rejections to patent claims. Based on my experience with some applications and examiners, I suspect there’s no human examiner there, just a bot claiming to receive an application, to examine it, and then to reject it by sending a standard form letter.”

Lee laughed. “Does it pass the Turing Test?”<sup>3</sup>

“What? Oh you mean —”

“Right, you communicate with something that is shrouded so you cannot see it and assess whether it’s a human being or a machine by the nature of its responses to your questions. The machine is intelligent when you can’t tell the difference between its responses and those of a human being.”

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2. See *Patent Center Corrected Web-ADS Quick Start Guide*, U.S. PAT. & TRADEMARK OFF. (June 2023), <https://www.uspto.gov/sites/default/files/documents/PATENTCENTER-Corr-Web-ADS-QSG.pdf> [<https://perma.cc/83A6-AMUJ>].

3. Alan Turing, a distinguished World War II codebreaker, see Alan Cowell, *Overlooked No More: Alan Turing, Condemned Code Breaker and Computer Visionary*, N.Y. TIMES (June 5, 2019), <https://www.nytimes.com/2019/06/05/obituaries/alan-turing-overlooked.html> [<https://perma.cc/P8JR-8YU8>], proposed this test, which he called the “imitation game,” to explore the question, “Can machines think?” A.M. Turing, *Computing Machinery and Intelligence*, 59 MIND 433, 433–34 (1950). The test involves an interrogator trying to distinguish between a human and a machine based solely on their responses, assessing the machine’s ability to convincingly mimic human behavior. *Id.*

Kayden snickered and then started laughing so hard he knocked over his beer. Quickly grabbing it, he gasped, “Suppose we get a patent in Edison’s name, who would own it?”

“Edison, obviously.”

“No. Edison, however smart he pretends to be, is not a legal person. Vater LLC might own it because it owns Edison.”

“Or OpenAI or Sam Altman,” Lee said. “Edison is built on top of ChatGPT, which is a product of OpenAI.”<sup>4</sup>

“I don’t think so,” Kayden said. “OpenAI’s terms of service say that input to and output from ChatGPT both belong to the user.”<sup>5</sup>

Lee looked at him. “So this idea of something like Edison being an inventor is not the first time you’ve thought about this.”

As fictional Lee Dresden and Kayden Miller observe, generative AI can be especially productive when it is applied to patent law. In the business jargon of the day, the “use case” for patent AI is strong. Approximately 350,000 patents are granted in the United States each year.<sup>6</sup> USPTO received 457,500 new patent applications in FY 2022, an increase of 1.6% over the number received in FY 2021. The inventory of unexamined patent applications is anticipated to be approximately 694,600 for FY 2023, an increase of approximately 5,100 from FY 2022.<sup>7</sup> USPTO has a patent examiner corps numbering roughly 8,500.<sup>8</sup> Any activity with that kind of volume begs for computerization and, when it involves highly structured information formats, as the patent system does, it makes computerization easier.

The United States Patent and Trademark Office has been a pioneer in government automation. Its database of issued patents and patent applications was one of the earliest large-scale systems to manage government information in electronic form, spawning some controversies over public access in which

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4. See *Introducing ChatGPT*, OPENAI (Nov. 30, 2022), <https://openai.com/index/chatgpt/> [<https://perma.cc/78PP-4N9H>].

5. *Terms of Use*, OPENAI (Nov. 14, 2023), <https://openai.com/policies/row-terms-of-use/> (effective as of January 31, 2024).

6. U.S. Pat. & Trademark Off., FY Annual Performance Report/FY 2025 Annual Performance Plan 14 (2024), [https://www.uspto.gov/sites/default/files/documents/USPTO\\_FY23\\_FY25\\_APPR.pdf](https://www.uspto.gov/sites/default/files/documents/USPTO_FY23_FY25_APPR.pdf) [<https://perma.cc/34E3-KS7W>] (“Patent grants totaled 346,152.”).

7. *Oversight of the U.S. Patent and Trademark Office: Hearing Before the Subcomm. on Cts., Intell. Prop., & the Internet of the H. Comm. on the Judiciary*, 118th Cong. (2023) (statement of Kathi Vidal, Under Secretary of Commerce for Intellectual Property and Director of the United States Patent and Trademark Office).

8. U.S. PAT. & TRADEMARK OFF., FISCAL YEAR 2025 BUDGET ESTIMATES CONGRESSIONAL SUBMISSION 110 (2024), <https://www.commerce.gov/sites/default/files/2024-03/USPTO-FY2025-Congressional-Budget-Submission.pdf> [<https://perma.cc/G6X4-9EWP>] (employing 8,500 examiners in fiscal year 2024 and estimating 8,833 examiners for fiscal year 2025).

this author was a participant.<sup>9</sup> Now, USPTO has implemented its Patent Center, which requires patent applications and supporting documentation to be submitted electronically,<sup>10</sup> and has deployed a number of tools automating the functions of patent examiners.<sup>11</sup> Patent practitioners routinely use sophisticated computer software applications that assist in searching for prior art that can defeat the novelty required for a patent, and that automate the routine parts of application drafting and responding to office actions by examiners.<sup>12</sup>

The excitement about generative AI and highly publicized efforts by at least one applicant to apply for a patent naming a computer program as the inventor has focused attention on the relationship between AI and patent law.<sup>13</sup> More broadly, a few industry leaders and activists claim that generative AI is an existential threat to human society. In fact, the world is not about to come to an end, and civilization as we know it is not going to be brought to its knees by this latest increment in natural language processing.

Nevertheless, despite the unlikelihood of societal revolution, generative AI has the potential to revise significantly the way patent law is practiced, patent applications are reviewed, and patents are issued and enforced.

Part II, following this Introduction, provides an overview of patent law and then explains generative AI.

Part III explores the role of generative AI systems as inventors, as subjects of patents, as aids in patent prosecution, as aides to patent examiners, and as stimuli for more pro-se applications. Many of the results reported in this part arose from the author's own use of AI-enabled tools.

Part IV asks whether the changes likely to result from the uptake of generative AI matter.

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9. See HENRY H. PERRITT, JR., ELECTRONIC ACQUISITION AND RELEASE OF FEDERAL AGENCY INFORMATION, REPORT PREPARED FOR THE ADMINISTRATIVE CONFERENCE OF THE UNITED STATES 620, 689 (1988) (describing Automated Patent System, providing for electronic search of some 900,000 patent files to patent examining groups and planning for replacement of microform storage with electronic formats).

10. *Patent Center*, U.S. PAT. & TRADEMARK OFF., <https://patentcenter.uspto.gov> [<https://perma.cc/5MPE-T67V>].

11. Vidal, *supra* note 7 (reporting on search tools available to examiners).

12. See, e.g., *Octimine – Intelligent Patent Analysis Software*, DENNEMEYER, <https://www.dennemeyer.com/ip-software/octimine-patent-analysis-software> [<https://perma.cc/XUK5-PEEG>].

13. See *Commissioner of Patents v. Thaler* [2022] FCAFC 62, 62, [2], [123] (13 Apr. 2022) (Austl.) (reversing primary judge). “The central question in this appeal is whether a device characterized as an artificial intelligence machine can be considered to be an ‘inventor’ within the meaning ascribed to that term in the *Patents Act 1990* (Cth) and the *Patents Regulations 1991* (Cth).” *Id.* at [1]. The Australian patent office denied a patent. *Id.* at [4]. On appeal, the primary judge concluded that an inventor can be an artificial intelligence system or device. *Id.* at [5].

An Appendix reproduces the transcript of an invitation for a generative AI system to create an invention and to draft a patent application for it.

The patent system is international in scope. This article focuses on U.S. patent law only because extending beyond American borders would needlessly complicate it and because the U.S. is a reasonable model for the rest of the world regarding the relationship between AI and patents.

## II. BACKGROUND

### A. Patent Law

Patent law is a bargain struck between opponents of crown monopolies that proliferated under Stuart kings and proponents of industrial progress who wanted incentives to encourage inventors and to induce them to make their secret inventions available to everyone.<sup>14</sup> The result was the Patents and Copyrights Clause, Article 1, Section 8 of the United States Constitution, which invites the Congress “[t]o promote the Progress of Science and the useful Arts, by securing for limited Times to . . . Inventors the exclusive Right to their respective . . . Discoveries.”<sup>15</sup>

The Congress accepted that invitation in its very first session by enacting the Patent Act of 1790,<sup>16</sup> which authorized a committee of the cabinet, the Secretary of State, the Secretary of War, and the Attorney General, to grant patents “if they shall deem the invention or discovery sufficiently useful and important.”<sup>17</sup>

The statute was replaced in 1793,<sup>18</sup> to define eligible subject matter and to vest authority in the Secretary of State alone;<sup>19</sup> and amended in 1836,<sup>20</sup> to establish an examination system by a federal agency called the United States Patent Office;<sup>21</sup> in 1870,<sup>22</sup> to codify a number of separate statutes, among other things, transferring the Patent Office to the Department of the Interior,<sup>23</sup> to require that examiners be technically skilled,<sup>24</sup> requiring applicants to

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14. See Peter Wells & Tilaye Terrefe, *A Brief History of the Evolution of the Patent of Invention in England*, 35 CAN. INTELL. PROP. REV. 65, 67–68 (2020).

15. U.S. CONST. art I, § 8, cl. 8.

16. Patent Act of 1790, ch. 7, 1 Stat. 109 (repealed 1793).

17. § 1.

18. Patent Act of 1793, ch. 11, 1 Stat. 318 (repealed 1836).

19. § 1.

20. Patent Act of 1836, ch. 357, 5 Stat. 117 (current version at 35 U.S.C. § 1).

21. § (a).

22. Patent Act of 1870, ch. 230, 16 Stat. 198 (current version at 35 U.S.C. § 1).

23. *Id.*

24. See §§ 2–3.

submit written descriptions,<sup>25</sup> and providing for printing of patents and those descriptions for use of the public.<sup>26</sup>

The Patent Act of 1952,<sup>27</sup> codified the requirement that subject matter be “inventive” in order to qualify for a patent, now known as the nonobvious requirement.<sup>28</sup> Most recently, the America Invents Act of 2011 repealed the traditional first-to-invent system of priority with a new first-inventor-to-file system similar to that in use by the rest of the world.<sup>29</sup>

The substantive requirements have not changed much over the life of the different patent statutes. All of the statutory requirements are aimed at protecting the public domain against unnecessary enclosure by assuring that patents are granted only for certain subject matter, and for inventions that are novel and nonobvious. Inventors must set forth the metes and bounds of the property interest they seek clearly and do so in a way that enables others to practice their invention once their monopoly expires.

Under current law, the subject matter of an invention must qualify for a patent under section 101.<sup>30</sup> Even when an invention involves a process, machine, manufacture, or composition of matter—the categories enumerated in section 101—it nevertheless is non-patentable if it falls within one of the judicial exceptions to section 101: if it comprises a law of nature, a natural phenomenon, or an abstract idea.<sup>31</sup> In *Alice Corporation Party, Ltd. v. CLS Bank International*,<sup>32</sup> the Supreme Court reiterated these three “judicial exceptions,” noting that they have applied for “more than 150 years.”<sup>33</sup>

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25. § 26.

26. § 20.

27. The Patent Act of 1952, ch. 950, 66 Stat. 792 (“An Act [t]o revise and codify the laws relating to patents and the Patent Office.”).

28. See 35 U.S.C. § 103; P.J. FEDERICO, COMMENTARY ON THE NEW PATENT ACT (1954) reprinted in 75 J. PAT. & TRADEMARK OFF. SOC’Y 161, 177 (1993) (“If this difference [between the subject matter sought to be patented and the prior art] is such that the subject matter as a whole would have been obvious at the time to a person skilled in the art, then the subject matter cannot be patented.”).

29. Leahy-Smith America Invents Act, Pub. L. 112-29, § 146, 125 Stat. 284, 293 (2011).

30. 35 U.S.C. § 101.

31. *Alice Corp. v. CLS Bank Int’l*, 573 U.S. 208, 216 (2014).

32. See *id.* at 224–26 (holding that a computer program designed to facilitate financial transactions by acting as an intermediary was un-patentable because it merely implemented the abstract idea of intermediated settlement using a generic computer, without adding any inventive technological improvement beyond conventional computer operations).

33. *Id.* at 216.



Applying the judicial exceptions is known as Step I<sup>34</sup> of the *Alice*<sup>35</sup>/*Mayo*<sup>36</sup> analysis. Even if an invention flunks Step I of *Alice/Mayo*, it nevertheless may be patentable if it includes something else, an extra step beyond the mere judicial exception.<sup>37</sup> This is Step II of the *Alice/Mayo* analysis.<sup>38</sup>

The concern that animates the judicial exceptions is preemption: upholding a patent covering these exceptions,

would pre-empt use of this approach in all fields, and would effectively grant a monopoly over an abstract idea . . . . Laws of nature, natural phenomena, and abstract ideas are the basic tools of scientific and technological work. Monopolization of those tools through the grant of a patent might tend to impede innovation more than it would tend to promote it, thereby thwarting the primary object of the patent laws.<sup>39</sup>

After quoting *Mayo* on the preemption concern, the Court then described and embraced the two-step analysis articulated two years before in *Mayo*:

First, we determine whether the claims at issue are directed to one of those patent-ineligible concepts. If so, we then ask, “[w]hat else is there in the claims before us?” To answer that question, we consider the elements of each claim both individually and “as an ordered combination” to determine whether the additional elements “transform the nature of the claim” into a patent-eligible application. We have described step two of this analysis as a search for an “inventive concept”—i.e., an element or combination of

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34. While the *Alice/Mayo* analysis refers to applying judicial exceptions as Step I, the USPTO numbers the steps differently. See MPEP §§ 2106.03–2106.05 (9th ed. rev. July 2022). In the USPTO’s framework, Step I involves determining if an invention falls within one of the four statutory categories: processes, machines, manufactures, or compositions of matter. § 2106.03. Step IIA asks “whether a claim is directed to a judicial exception.” § 2106.04. Step IIB asks “whether a claim amounts to significantly more” than the judicial exception. § 2106.05.

35. See *Alice Corp.*, 573 U.S. 208.

36. *Mayo Collaborative Services v. Prometheus Laboratories, Inc.*, 566 U.S. 66 (2012); see also MPEP, *supra* note 34, § 2106 (citing *Mayo*, 566 U.S. at 101) (“The first part of the *Mayo* test is to determine whether the claims are directed to an abstract idea, a law of nature or a natural phenomenon (i.e., a judicial exception).”).

37. MPEP, *supra* note 34, § 2106 (citing *Mayo*, 566 U.S. at 72–73) (“If the claims are directed to a judicial exception, the second part of the *Mayo* test is to determine whether the claim recites additional elements that amount to significantly more than the judicial exception.”).

38. *Id.*

39. *Alice Corp.*, 573 U.S. at 216 (internal quotations and citations omitted).

elements that is “sufficient to ensure that the patent in practice amounts to significantly more than a patent upon the ineligible concept itself.”<sup>40</sup>

Patent applications typically attempt to come within the ambit of the text of section 101 by using one of the magic words: *process*, *machine*, *manufacture*, or *composition of matter*.<sup>41</sup> They typically try to bypass Step I of *Alice/Mayo* or satisfy Step II by identifying concrete physical or conceptual steps in a method or concrete features of an apparatus that distinguish it from an abstract algorithm or law of nature.<sup>42</sup>

The Patent Office published guidance on subject matter eligibility under section 101 in January 2019.<sup>43</sup> The Office published examples to be used with the 2019 guidance.<sup>44</sup> Example 39 pertains to an AI invention.<sup>45</sup>

To qualify for a patent, inventions also must be novel under section 102.<sup>46</sup> This means that they must not be anticipated by any prior art reference.<sup>47</sup> A prior art reference defeating novelty is said to *anticipate* the invention.<sup>48</sup> The statute defines prior art as “patented, described in a printed publication, or in public use, on sale, or otherwise available to the public.”<sup>49</sup> In *Helsinn*,<sup>50</sup> the Supreme Court made it clear that secret sales may nonetheless constitute prior art.<sup>51</sup>

Novelty is defeated when a single prior art reference contains every element of the claimed invention.<sup>52</sup> An initial screening for such anticipatory prior art can be and frequently is conducted by constructing natural language

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40. *Id.* at 217–18 (internal citations omitted); *see also* MPEP, *supra* note 34, § 2106.05 (expanding on the meaning of various terminology used, including “inventive concept” and “significantly more”).

41. 35 U.S.C. § 101.

42. *See* MPEP, *supra* note 34, §§ 2106.03-2106.04.

43. 2019 Revised Patent Subject Matter Eligibility Guidance, 84 Fed. Reg. 50-01 (Jan. 7, 2019).

44. *Subject Matter Eligibility Examples: Abstract Ideas*, USPTO, 1 (Jan. 7, 2019), [https://www.uspto.gov/sites/default/files/documents/101\\_examples\\_37to42\\_20190107.pdf](https://www.uspto.gov/sites/default/files/documents/101_examples_37to42_20190107.pdf) [<https://perma.cc/V789-YTCZ>].

45. *Id.* at 8; *see also infra* Section IV.B (discussing Example 39 in more detail).

46. 35 U.S.C. § 102.

47. § 102(a)(1)-(2).

48. MPEP, *supra* note 34, § 2131.

49. § 102(a)(1).

50. *Helsinn Healthcare S.A. v. Teva Pharms. USA, Inc.*, 586 U.S. 123 (2019).

51. *Id.* at 125–26, 131 (reaffirming the Court’s holding in *Pfaff v. Wells Electronics, Inc.*, 525 U.S. 55, 67 (1998) that an invention is “on sale” within the meaning of section 102(a) when it is commercially offered and ready for patenting and clarifying that this includes sales where the details of the invention remain secret).

52. MPEP, *supra* note 34, § 2131 (explaining that a “claimed invention may be rejected . . . when the invention is anticipated (or is ‘not novel’),” which means “each and every element” in the claim is found “in a single prior art reference”).

search terms made up of language fragments from the claims in the patent application and searching for those terms in a database containing the full text of issued patents, patent publications, and publications qualifying as prior art.<sup>53</sup> Similarly, prior art in the form of use or other public availability can be searched for in databases likely to contain reports of such activity, press releases, advertisements, and other announcements.<sup>54</sup>

In addition to novel, an invention must be nonobvious under section 103.<sup>55</sup> Obviousness under section 103 results when one or more prior art references collectively contain all of the elements of the claimed invention and something motivates a person skilled in the relevant art to combine those references to come up with the invention.<sup>56</sup> The Supreme Court, in *Graham v. John Deere Company*,<sup>57</sup> offered what the Patent Office understood to be a relatively simple formula; in addition to the elements of the claimed invention, prior art had to contain some teaching, suggestion, or motivation (“TSM”) to combine them.<sup>58</sup> The *John Deere* Court also accepted the idea that “secondary considerations” could play a role in assessing obviousness:

Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented. As indicia of obviousness or nonobviousness, these inquiries may have relevancy.<sup>59</sup>

That TSM test was applied as the core analytical principle of obviousness analysis until the Supreme Court decided *KSR International Company v. Teleflex Inc.* (“KSR”)<sup>60</sup> in 2007. In *KSR*, the Supreme Court rebuked the United States Court of Appeals for the Federal Circuit, the appeals court with

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53. See *Patent Searching and Search Resources – An Introduction*, USPTO, <https://www.uspto.gov/sites/default/files/documents/Basics-of-Prior-Art-Searching.pdf> [<https://perma.cc/W5JS-QDRS>].

54. See *id.* (listing video websites, magazines, newspapers, and associated databases as examples of databases likely to contain reports of prior art).

55. 35 U.S.C. § 103.

56. Henry H. Perritt, Jr., *Literary Fantasies as Prior Art: Eclipsing True Invention*, 104 J. PAT. TRADEMARK OFF. SOC’Y 453, 460 (2024).

57. 383 U.S. 1 (1966).

58. *Id.* at 17 (rejecting argument that new section 103 was meant to change the law; instead “the section was intended merely as a codification of judicial precedents embracing the *Hotchkiss* [*Hotchkiss v. Greenwood*, 11 How. 248 (1851)], condition”); see also *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398, 407 (2007) (explaining USPTO’s “teaching, suggestion, or motivation” test (“TSM Test”), under which a patent claim is only proved obvious if “some motivation or suggestion to combine the prior art teachings” can be found in the prior art, the nature of the problem, or the knowledge of a person having ordinary skill in the art.”).

59. 383 U.S. at 17–18.

60. 550 U.S. 398 (2007).

exclusive jurisdiction over patent appeals, for applying too simplistic and rigid a test and held that a more flexible assessment of obviousness was required.<sup>61</sup>

USPTO synthesized *KSR* as requiring examiners to consider:

(A) Combining prior art elements according to known methods to yield predictable results;

(B) Simple substitution of one known element for another to obtain predictable results;

(C) Use of known technique to improve similar devices (methods, or products) in the same way;

(D) Applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;

(E) “Obvious to try” – choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success;

(F) Known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art;

(G) Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.<sup>62</sup>

The consistent theme in all of the examples is whether a person having ordinary skill in the art (“PHOSITA”)<sup>63</sup> would have a “reasonable expectation of success,” in combining elements from the prior art references.<sup>64</sup> If a PHOSITA would not have a reasonable expectation of success in combining

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61. *Id.* at 415.

62. *See* MPEP, *supra* note 34, § 2141(III).

63. *See* § 2141.03(I) (defining a person of ordinary skill in the art).

64. *See* § 2141.02(I); *see also* *Saliix Pharmaceuticals, Ltd. v. Norwich Pharms. Inc.*, 98 F.4th 1056, 1062–63 (Fed. Cir. 2024) (applying reasonable expectation of success standard in affirming finding of obviousness).

elements of different sources, the invention is not obvious. This reasonable-expectation-of success-standard is similar in many respects to the without-undue-experimentation test for enablement under section 112.<sup>65</sup>

An application for a patent, even for a novel and non-obvious invention, must be accompanied by a specification to be published as part of the patent. The specification must be sufficiently clear and definite that one can know what the inventor is claiming as his invention and sufficiently detailed and concrete to enable someone skilled in the art to make and use the invention with little more than reading the specification.<sup>66</sup>

Section 112 is interpreted to impose two requirements: first, that the specification “particularly point[] out and distinctly claim[] the subject matter which the inventor or a joint inventor regards as the invention,”<sup>67</sup> and that it describe “the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable [one] skilled in the art” to make and use the invention.<sup>68</sup> The first function is largely performed by the claims section of the specification, required to be separated and labeled as such.<sup>69</sup>

Section 112 requires that the applicant make the metes and bounds of a claimed invention clear.<sup>70</sup> That requirement is performed by the claims, but is not limited to the claims; the more discursive description is intended to flesh out an understanding of the claims of the patent.<sup>71</sup> The enablement requirement of section 112 is exported into section 102 in section 103 analysis: a prior art reference is not anticipatory under section 102 unless it is enabling,<sup>72</sup> permitting person skilled in the relevant art to build and use an invention without undue experimentation,<sup>73</sup> and a combination of prior art references do not make an invention obvious unless they are collectively enabling.<sup>74</sup>

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65. See 35 U.S.C. § 112(a) (requiring a sufficient enough description such that “any person skilled in the art” could make or use the invention); MPEP, *supra* note 34, § 2164.01 (explaining that section 112’s enablement requirement “has been interpreted to require that the claimed invention be enabled so that any person skilled in the art can make and use the invention without undue experimentation”).

66. 35 U.S.C. §§ 111(2)(A), 112(a).

67. § 112(b).

68. § 112(a).

69. See MPEP, *supra* note 34, §§ 608.01(k), (m) (describing form required for claims).

70. § 2173.02(III)(B).

71. See § 2173.

72. Enablement, however, is presumed. § 2121(I).

73. MPEP, *supra* note 34, § 2164.01. *But see* Perritt, *Literary Fantasies*, *supra* note 56, manuscript at 31 (criticizing presumption that prior art that anticipates is enabling).

74. See *Raytheon Techs. Corp. v. General Electric Co.*, 993 F.3d 1374, 1376–77 (Fed. Cir. 2021) (“[T]here is no absolute requirement for a relied-upon reference to be self-enabling in the § 103 context, so long as the overall evidence of what was known at the time of invention establishes that a skilled artisan could have made and used the claimed invention.”).

Patents are issued to “inventors.”<sup>75</sup> The inventorship concept was refined in U.S. patent law during its first 223 years, when priority was determined based on when invention occurred.<sup>76</sup> Priority disputes turned on who was the first to invent, and resolving those disputes necessitated rules for deciding when an invention was complete.<sup>77</sup> Was conception enough, or must there be reduction to practice? And what constitutes reduction to practice?

Those refinements still apply, now that the America Invents Act (“AIA”) makes priority depend on when an inventor files an application for a patent.<sup>78</sup>

The two key events in the birth of an invention are *conception* and *reduction to practice*. The distinction between conception and reduction to practice emerged early in patent cases. In *Perry v. Cornell*,<sup>79</sup> an inventor claimed that a competing inventor, even if he did conceive of an invention first, did not qualify as an inventor because “it was merely an intellectual invention, based on theory, and not an invention in the meaning of the law.”<sup>80</sup> The court rejected the argument. “There is no law requiring the applicant to reduce his invention to actual use before he can obtain a patent.”<sup>81</sup>

The statute defines how USPTO reviews applications and interacts with applicants,<sup>82</sup> and the Patent Office has, by rule, filled in the details<sup>83</sup> and requires use of a sophisticated digital processing system for handling claims in the interactive process.<sup>84</sup> Decisions by examiners can be reviewed in an administrative appeal by the Patent Trial and Appeals Board (“PTAB”).<sup>85</sup>

Patents last twenty years from the date of the first application,<sup>86</sup> extendable to compensate for delays caused by the Patent Office.<sup>87</sup>

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75. 35 U.S.C. § 101 (“Whoever invents or discovers . . . may obtain a patent . . .”).

76. See George E. Frost, *The 1967 Patent Law Debate—First-to-Invent vs. First-to-File*, 1967 DUKE. L.J. 923, 933–34 (1967).

77. *Id.* at 935, 938.

78. Leahy-Smith America Invents Act, *supra* note 29; see also LAMAR SMITH, AMERICA INVENTS ACT, H.R. REP. NO. 112-98, at 40 (2011) (describing first-inventor-to-file system to replace older first-to-invent system).

79. 19 F. Cas. 267 (C.C. D.C. 1847) (No. 11,002).

80. *Id.* at 268.

81. *Id.* at 271. Prior use would be prior art, defeating novelty. See *supra* Part II.A.

82. See 35 U.S.C. §§ 131-133.

83. See generally MPEP, *supra* note 34, chs. 600, 700, 2100 (providing sections where the Patent Office has expanded on USPTO’s requirements for reviewing applications and interacting with applicant).

84. See *Patent Center*, *supra* note 10; *Patent Center User Guide*, U.S. PAT. & TRADEMARK OFF. 18–28 (Dec. 2021), [https://www.uspto.gov/sites/default/files/documents/Patent\\_Center\\_User\\_Guide\\_Mar.pdf](https://www.uspto.gov/sites/default/files/documents/Patent_Center_User_Guide_Mar.pdf) [<https://perma.cc/55GX-TDT6>] (explaining process for filing new application through the eFiling system and describing validation errors that will occur with technological requirements and limitations are not followed).

85. 35 U.S.C. § 134.

86. 35 U.S.C. § 154(a)(2).

87. See § 154(b).

After patents are issued, they may be revised by being withdrawn and re-issued,<sup>88</sup> or in ex parte re-examinations triggered by the patent owner or a third party.<sup>89</sup> Since 2021, they also can be challenged in administrative litigation before PTAB in Post Grant Review on almost any grounds for nine months after issuance,<sup>90</sup> and after nine months, in Inter Partes Review<sup>91</sup> when a challenger can marshal patents or printed publications<sup>92</sup> that establish a “reasonable likelihood that the petitioner would prevail with respect to at least [one] of the claims challenged in the petition.”<sup>93</sup> The validity of issued patents also can be reviewed by United States district courts adjudicating actions brought by patent holders for infringement<sup>94</sup> or in declaratory judgment actions brought by potential infringers.<sup>95</sup>

The system in the United States is integrated with other systems around the world by providing for international filings and recognition of filings in one country by the patent offices in other countries.<sup>96</sup>

### B. *What is AI?*

“Although ‘AI’ is nearly ubiquitous, it has no agreed upon definition.”<sup>97</sup> Little doubt exists, however, that artificial intelligence is a form of computer programming.<sup>98</sup> Like other programming, it relies on abstraction,<sup>99</sup> representing real-world things and their behaviors by algorithms. Its hardware

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88. See 35 U.S.C. § 251; MPEP, *supra* note 34, § 1400.01 (explaining procedure for revising patent by reissue).

89. See 35 U.S.C. §§ 302-307; MPEP, *supra* note 34, § 2209 (explaining procedure for revising patent by re-examination).

90. See 35 U.S.C. §§ 321-329.

91. See § 311.

92. § 311(b).

93. § 314(a).

94. See § 282(b)(2) (providing that although patents are presumed valid, an accused infringer may assert an affirmative defense that the patent is invalid).

95. See *Medimmune, Inc. v. Genentech, Inc.*, 549 U.S. 118, 137 (2007) (holding that party seeking declaratory judgment of patent invalidity need not breach license agreement first).

96. See 35 U.S.C. §§ 361-368, 371-372, 374-376. See generally MPEP, *supra* note 34, ch. 1800 (implementing Patent Cooperation Treaty).

97. Nikola L. Datzov, *The Role of Patent (In)Eligibility in Promoting Artificial Intelligence Innovation*, 92 UMKC L. REV 1, 15 (2023).

98. See Jeffrey Shallit, *A Very Brief History of Computer Science*, UNIV. OF WATERLOO (Summer 1995), <https://cs.uwaterloo.ca/~shallit/Courses/134/history.html> [<https://perma.cc/J32B-R5FV>] (providing a history of artificial intelligence development in the field of computer programming).

99. See Stephen M. Walker II, *AI Abstraction*, KLU, <https://klu.ai/glossary/abstraction> [<https://perma.cc/KN2X-2DVZ>].

“understands” information represented as data organized in structures<sup>100</sup> that associate values with attributes of things and characteristics of behaviors. Its software makes use of iteration<sup>101</sup> to perform repetitive calculations rapidly and infers conclusions by applying algorithms<sup>102</sup> to appropriate data. It accomplishes these things and much more by stringing together simple operations like “fetch this value from memory,” “compare it with that one,” and “if they are the same, add them and put them somewhere else in memory.”<sup>103</sup> These characteristics of computer programming had crystallized reasonably well by the late 1930s and were the principal tools of computer programmers by the time the first digital computers became useful during and after the Second World War.<sup>104</sup> Computer science theory developed around these practices in the 1950s and 1960s.<sup>105</sup>

Digital computers sped up the computation of statistics according to formulas developed in the nineteenth century, and facilitated tagging, sorting, and comparing information artifacts—operations at the heart of ChatGPT.

The term “artificial intelligence” first became popular right after the Second World War when the popular press fueled excitement over the new “electronic brains.”<sup>106</sup> British cryptographer Alan Turing popularized the still-

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100. See NIKLAUS WIRTH, *ALGORITHMS + DATA STRUCTURES = PROGRAMS* xii (1976) (explaining that all computer programming is comprised of abstract algorithms based on particular representations and structures of data).

101. *What are the Basic Fundamental Concepts of Programming?*, EDUCATIVE, <https://www.educative.io/answers/what-are-the-basic-fundamental-concepts-of-programming> [<https://perma.cc/L5SN-3Y9G>] (identifying iteration as one of the fundamental concepts).

102. *What Is an Inference Engine in Machine Learning?*, RUN:AI, <https://www.run.ai/guides/machine-learning-inference/inference-engine> [<https://perma.cc/QNE9-L9SM>] (“Reasoning algorithms are the logic that the inference engine uses to analyze the data and make decisions. The algorithms take the data from the knowledge base and apply logical rules to it to infer new information.”).

103. See, e.g., PHILIP M. SHERMAN, *PROGRAMMING AND CODING THE IBM 709-7090-7094 COMPUTERS* 6, 10 (1963) (providing examples of operations like “LOAD MQ,” which fetches the specified value from memory, and “TNZ Y,” which compares that value with the one already in memory and stores it in memory location Y if the two values are the same).

104. See, e.g., *A Whirlwind Instruction Set*, O'REILLY, [https://www.oreilly.com/library/view/anfsq-7-the-computer/9783486990911/e9783486727661\\_bm02.html](https://www.oreilly.com/library/view/anfsq-7-the-computer/9783486990911/e9783486727661_bm02.html) [<https://perma.cc/8GM7-X5Z2>] (listing instructions for Whirlwind computers including “bi x 00010,” which transfers a block of characters from input interface to core memory, and “ck x 01011,” which compares the contents of the accumulator with a memory location); *Whirlwind: Preparing the Way for SAGE*, COMPUT. HIST. MUSEUM, <https://www.computerhistory.org/revolution/real-time-computing/6/123> [<https://perma.cc/LXV8-ETTJ>] (noting that Whirlwind was one of the first digital computers, developed by Jay Forrester at MIT during World War II).

105. Shallit, *supra* note 98 (noting developments in computers in the 1940s to 1950s by people like Jay Forrester and discussing the first expressions of computer science in the 1960s, which included the Turing Test).

106. See Hannah Grenham, *The Mechanical Monster and Discourses of Fear and Fascination in the Early History of the Computer*, 7 *HUMANS. & SOC. SCIS. COMM.*, Nov. 23,



used test for intelligence: whether a human being interacting through an opaque communication mechanism can tell whether what is on the other end is a human being or a machine.<sup>107</sup>

Artificial intelligence enjoyed another upsurge in popularity in the 1980s. Experts in various fields trained computers to act as “expert systems,”<sup>108</sup> working with knowledge engineers, specialists skilled in human processing of information, to attempt to get computers to mimic them.<sup>109</sup>

Most recently, the press and policymakers have excited each other over artificial intelligence once again after an extremely successful public relations and marketing campaign by Sam Altman,<sup>110</sup> the CEO of OpenAI, an enterprise funded largely by Microsoft.<sup>111</sup> The natural language processing capability of his ChatGPT,<sup>112</sup> a publicly released, free generative AI system astounded reporters and others with its fluency in understanding and responding to natural language queries and its ability to generate relevant responses from machine learning applied to the enormous store of information available through the Internet. Celebrated for its glibness,<sup>113</sup> the generative AI

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2020, at 5–6 (describing reaction from the 1940s to “electronic brain” represented by Whirlwind, Erica, and Univac).

107. See Turing, *supra* note 3, at 434 (describing Turing Test).

108. See generally *e.g.*, An Intelligent Question Answering Method and Device Based on Large Language Model, Patent No. CN 117,520,491 A (filed Oct. 27, 2023) (“The background of intelligent question-answering systems can be traced back to early expert systems and information retrieval techniques. Expert systems are artificial intelligence systems based on rules and a knowledge base that answer the user’s questions by reasoning and matching rules. The information retrieval technology is to find out the answers related to the user questions by indexing and retrieving the document library. With the rapid development of natural language processing and machine learning, intelligent question-answering systems are gradually moving from rule-based and retrieval-based approaches to statistical and machine learning-based approaches. The method utilizes large-scale corpus data for training, and improves the accuracy and naturalness of the system through pattern recognition and probability calculation.”) (China).

109. See generally *e.g.*, Henry H. Perritt Jr., *Artificial Intelligence Techniques for Evaluating Employee Terminations on a Personal Computer*, 13 RUTGERS COMPUT. & TECH. L.J. 341 (1987) (describing development and use of expert system for employment law).

110. See Samantha Kelly, *Sam Altman Warns AI Could Kill Us All. But He Still Wants the World to Use It*, CNN: RISK TAKERS (Oct. 31, 2023, 6:00 AM EDT), <https://www.cnn.com/2023/10/31/tech/sam-altman-ai-risk-taker/index.html> [<https://perma.cc/J4VS-L3MG>].

111. Jordan Novet, *Microsoft’s \$13 Billion Bet on OpenAI Carries Huge Potential Along with Plenty of Uncertainty*, CNBC (Apr. 9, 2023, 10:40 PM EDT), <https://www.cnbc.com/2023/04/08/microsofts-complex-bet-on-openai-brings-potential-and-uncertainty.html> [<https://perma.cc/CU32-6U82>].

112. Jingshan Huang & Ming Tan, *The Role of ChatGPT in Scientific Communication: Writing Better Scientific Review Articles*, 13 AM. J. CANCER RSCH. 1148, 1149 (2023).

113. Here is a transcript of a short session between the author and ChatGPT, OpenAI, Apr. 29, 2024, at 8:27 PM:

**Prompt**

of the 2020s represents merely incremental improvements in computer processing techniques that have been rapidly evolving over the past seventy-five years. In *Ex Parte* Daniel J. Ferranti, the Board rejected a claim limitation of “natural language processing (NLP) algorithms” because they are “well-known, conventional, and routine,” going back into the 1950s.<sup>114</sup>

Claims of doom because computers have suddenly become intelligent and willful<sup>115</sup> are based on ignorance of how generative AI works, based on marketing efforts by vendors, or reflect efforts by policy makers and commentators to get attention.<sup>116</sup>

Although the power of generative AI to upend society is greatly exaggerated, the capabilities of the technology mesh well with the nature of the patent system. The technology excels at understanding verbal queries and instructions. It has a powerful ability to extract and organize ideas and expressions from knowledge verbally expressed and recorded and accessible through the Internet and other digital means. It deals most comfortably with structured information formats.

All of these characteristics are present in the patent system. The full text of millions of patents and patent applications is available for free.<sup>117</sup> The questions and instructions relevant to patent applications and their prosecution are predictable. The formats of communications between applicants and the Patent Office and of patents themselves are settled and highly stylized. A good fit exists between generative AI and patent practice.

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would a law review article on ai and patents be interesting? Please give me a short answer, no more than five sentences

**ChatGPT**

Yes, a law review article on AI and patents would be quite interesting. It could explore the evolving role of AI in the invention process, the implications for patent law, and the challenges posed by AI-created inventions. Such an article could offer valuable insights into how the legal system might adapt to technological advancements. The intersection of AI and intellectual property is a fertile ground for academic discussion and could influence future legal frameworks.

114. *Ex parte* Daniel J. Ferranti, No. 2022-00279, 2023 WL 9061302, at \*10 (P.T.A.B. Dec. 28, 2023).

115. Matt Egan, *AI Could Pose ‘Extinction-Level’ Threat to Humans and the US Must Intervene, State Dept.-Commissioned Report Warns*, CNN (Mar. 12, 2024, 8:38 PM EDT), <https://www.cnn.com/2024/03/12/business/artificial-intelligence-ai-report-extinction/index.html> [<https://perma.cc/7ZM5-HU3Q>].

116. See Oscar Schwartz, *‘The Discourse is Unhinged’: How the Media Gets AI Alarmingly Wrong*, GUARDIAN (July 25, 2018, 06:00 EDT), <https://www.theguardian.com/technology/2018/jul/25/ai-artificial-intelligence-social-media-bots-wrong> [<https://perma.cc/XQ3K-N34A>]. The press is an echo chamber, managed by lemmings. It has consistently stoked public hysteria over new technologies, starting with the power loom and the spinning Jenny. It would have done the same with the printing press, except that the press did not exist before that innovation.

117. See, GOOGLE PATS., <https://patents.google.com/> [<https://perma.cc/ERJ4-GG74>] (“Search and read the full text of patents from around the world.”).

The most relevant AI technology involves natural language processing and large language models developed through machine learning.<sup>118</sup> Of secondary importance, but helpful in understanding how the technology works, is image processing. Generative AI also can write music, by predicting sequences of notes, chords, and rhythmic patterns according to musical works recorded in the past.<sup>119</sup> But musical AI is of less relevance to the subject of the article, except, perhaps, when an inventor of a music composition AI program seeks a patent. Generative AI and its predictive capabilities can be applied to music: in Western twelve-tone tonal music is a G more likely to be followed by a C or a C-sharp?<sup>120</sup> Is an imperfect cadence or deceptive cadence likely to be followed by a perfect cadence?<sup>121</sup> Is a rhythmic pattern likely to be repeated in the next measure?<sup>122</sup> The most visible of the recent advances involves pattern matching applied by cheap and powerful new semiconductor chips to the huge stock of information available through the Internet. Machine learning in large language models enables the systems to develop algorithms that predict what comes next in information artifacts.<sup>123</sup> At the lowest level, these algorithms predict what characters are likely to come next in the words of a particular language, what words are likely to come next in a grammatically correct sentence, what ideas (semantics) are likely to be associated with particular strings of words, and what ideas are likely to be associated with each other.<sup>124</sup> The “machine-learning” label applies to the process of identifying the relevant features, as many as have statistical

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118. See Jim Holdsworth, *What is NLP (Natural Language Processing)?*, IBM (June 6, 2024), <https://www.ibm.com/topics/natural-language-processing> [https://perma.cc/SWP6-VHH7] (describing the relationship between natural language processing and large language models, and their importance).

119. *The Ultimate Guide to Generative AI in Music Production*, SOUNDFUL, <https://soundful.com/en-us/ultimate-guide-to-generative-ai-music-production> [https://perma.cc/SR3W-V6DU].

120. A G is more likely to be followed by a C, because that movement is part of an authentic cadence: V-I. ANDRE MOUNT, *FUNDAMENTALS, FUNCTION, AND FORM: THEORY AND ANALYSIS OF TONAL WESTERN ART MUSIC* at ch. 22 (2020) (ebook).

121. See *Phrases and Cadences*, MUSICTHEORY.NET, <https://www.musictheory.net/lessons/55> [https://perma.cc/KL8Y-B9JW]. A cadence in music is a two-chord progression. *Id.* If a cadence ends with a V in the scale, it is a half cadence, and sounds incomplete, begging for resolution. *Id.* If a cadence ends with a VII going to the I, it is an authentic cadence, giving a sense of final resolution. *Id.*

122. See *Songwriting Tutorial: Part Four—Rhythmic Considerations*, MUSICTECH (Jan. 30, 2015), <https://musictech.com/tutorials/songwriting-4-rhythm/> [https://perma.cc/LUN4-DFS4] (discussing considerations in writing good song rhythms, including repetition).

123. See *What Are Large Language Models (LLM)?*, AWS, <https://aws.amazon.com/what-is/large-language-model/> [https://perma.cc/7ASP-6DQN] (explaining how neural networks and other machine learning techniques are used to build LLMs).

124. See *id.*

significance.<sup>125</sup> There is nothing magical about the analysis: it is factor analysis,<sup>126</sup> which has been used as a social science methodology for more than 100 years.<sup>127</sup>

Machine learning trains large language models on large quantities of text data, and acquires knowledge of vocabulary, grammar, and semantics by analyzing and developing statistical rules of language.<sup>128</sup> Training data for large language models may come from a variety of sources, including Wikipedia, news articles, electronic books, and web page content on the Internet.<sup>129</sup> Through this enormous data store, a large language model can learn knowledge in different fields, so that the model is capable of wide application.<sup>130</sup> “Once the large language model is trained, it can be used for a variety of natural language processing tasks, such as text generation, machine translation, sentiment analysis, question answering systems” and the like.<sup>131</sup>

Large language machine learning models work by breaking words in a sentence into tokens, taking nearby words into account, aggregating these clusters of neighboring tokens into an enormous database, and using statistical methods to construct a vector (a list of values) representing each word’s relationship to other words and its connection with concepts.<sup>132</sup> It constantly adjusts the vector as its learning progresses.<sup>133</sup> Before transformers, the state

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125. See, e.g., Paul Viola, *The Viola/Jones Face Detector*, UNIV. B.C. COMPUT. SCI. DEP’T (2001), <https://www.cs.ubc.ca/~lowe/425/slides/13-ViolaJones.pdf> [<https://perma.cc/JP4C-3MY8>] (explaining the methodology of one popular method, the Viola/Jones approach); Paul Viola & Michael Jones, *Rapid Object Detection using a Boosted Cascade of Simple Features*, PROC. 2001 IEEE COMP. SOC’Y CONF. ON COMPUT. VISION AND PATTERN RECOGNITION, Dec. 8-14, 2001, at 1–3 (describing the Viola/Jones method in a more formal paper).

126. See generally *Comprehensive Guide to Factor Analysis*, STAT. SOLS., <https://www.statisticssolutions.com/factor-analysis-sem-factor-analysis/> [<https://perma.cc/J4FH-YJC4>] (providing background information about factor analysis, which involves reducing a large number of variables into a smaller set of factors by extracting common variance among variables).

127. See C. Spearman, *Demonstration of Formulæ for True Measurement of Correlation*, 18 AM. J. PSYCH. 161, 161–62 (1907).

128. Haziqa Sajid, *A Comprehensive Overview of Large Language Models*, WISECUBE: THE WISECUBE BLOG (June 1, 2023), <https://www.wisecube.ai/blog/a-comprehensive-overview-of-large-language-models/> [<https://perma.cc/7CT5-2AXZ>].

129. See *What Are Large Language Models (LLM)?*, *supra* note 123.

130. Humza Naveed et. al., *A Comprehensive Overview of Large Language Models*, ARXIV 2 (Apr. 11, 2024), <https://arxiv.org/pdf/2307.06435> [<https://perma.cc/U3QA-FJ3C>].

131. An Intelligent Question Answering Method and Device Based on Large Language Model, Patent No. CN 117,520,491 A (filed Oct. 27, 2023).

132. See generally Robert Bergman, *Understanding Large Language Models: A Long but Simple Guide*, MEDIATE (Oct. 15, 2023), <https://mediate.com/understanding-large-language-models-a-long-but-simple-guide/> [<https://perma.cc/F3VS-5UJM>] (explaining the process of turning words into tokens and then vectors).

133. See *id.* (“At each of the 96 layers of the transformation, the word vectors are modified slightly.”).

of the art in natural language processing was a recurrent neural network (“RNN”), which processed each word in a sentence sequentially.<sup>134</sup> Transformers take entire sentences and “remember” the relationship of each word with all the others. Transformers allow models to take context from beyond sentence boundaries.<sup>135</sup>

Models of semantic relationships are developed by interactive comparison of sentences separately deconstructed by neural networks and computing a loss function that represents their similarity or lack thereof.<sup>136</sup>

It is a bottom-up learning process: first distinguishing individual words, then evaluating the frequency with which words appear together in phrases, then associating the phrases with concepts, and then building a hierarchy of concepts, a semantic tree,<sup>137</sup> not unlike a conventional thesaurus.<sup>138</sup> A loss function reflects how well the network does in predicting. Sophisticated networks feed back their results to compare them with actual data, permitting loss functions to be computed and then improved.<sup>139</sup>

A recent patent for generative AI<sup>140</sup> explains in some detail how machine learning is used to train a system for natural language output in a style that “write[s] like me.”<sup>141</sup> At a fundamental level, natural language analyzers and generators use an ontological network: a sophisticated, computerized thesaurus, which classifies linguistic concepts and organizes them according to their relationship with each other.<sup>142</sup> The result is a semantic framework for

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134. Madhumita Murgia, *Generative AI Exists Because of the Transformer*, FIN. TIMES (Sept. 12, 2023), <https://ig.ft.com/generative-ai/> [<https://perma.cc/4RE8-QDV2>].

135. *Id.*

136. See Patent No. WO 2018/212584 A2 Claim 1 (filed Nov. 11, 2018) (S. Kor.).

137. See Jesús Giménez & Lluís Màrquez, *Linguistic Measures for Automatic Machine Translation Evaluation*, 24 MACH. TRANS'L 209, 209, 214–18, 232, 236 (2010) (noting use of semantic trees in machine translation of languages); Hyejin Youn, et al., *On the Universal Structure of Human Lexical Semantics*, 113 PROC. NAT'L ACAD. SCIENCES 1766, 1767 (2016); Jean-Pierre Koenig & Anthony R. Davis, *The KEY to Lexical Semantic Representations*, 42 J. LINGUISTICS 71, 73 (2006).

138. See Warren Sack, *Conversation Map: An Interface for Very-Large-Scale Conversations*, 17 J. MGMT. INFO. SYS. 73, 79–80 (2000) (explaining analysis of email messages and Usenet posts with reference to semantic trees and thesauri).

139. See Jason Brownlee, *Loss and Loss Functions for Training Deep Learning Neural Networks*, MACH. LEARNING MASTERY (Oct. 23, 2019), <https://machinelearningmastery.com/loss-and-loss-functions-for-training-deep-learning-neural-networks/> [<https://perma.cc/9S8L-Q5NY>] (explaining loss functions).

140. Applied A.I. Tech. for Using Nat. Language Processing & Concept Expression Templates to Train a Nat. Language Generation Sys., U.S. Patent No. 11,042,713-B1 (issued June 22, 2021).

141. *Id.* at col. 1 1. 47–54.

142. See *id.* at [57]; MILOŠ SAVIĆ ET AL., *Analysis of Ontology Networks*, in COMPLEX NETWORKS IN SOFTWARE, KNOWLEDGE, AND SOCIAL SYSTEMS 143, 143 (2019) (“Ontology networks are directed graphs showing relationships and dependencies between ontological

a particular language. Particular words are slotted into their appropriate ontological classes, thus organizing the entire vocabulary of the language.<sup>143</sup>

The system parses training text into sentences,<sup>144</sup> uses pattern matching to classify concepts expressed in each sentence and then assigns semantic tokens accordingly.<sup>145</sup> Deictic<sup>146</sup> context is developed using anchor words, which signify that the surrounding syntactical units should be processed as teaching examples. Examples of anchor words signifying comparison include “increase[,] reduction[,] decrease[,] decline[,] rise[,] fall[,] raise[,] and] lower[.]”<sup>147</sup> Anchor words are specified for each semantic concept. A complete system may use scores of separately patented methods.<sup>148</sup>

The most sophisticated machine learning systems employ transformers—the “T” in ChatGPT.<sup>149</sup> Transformers are a type of neural network architecture that “remembers” what came before, maybe long before, in a sequence of words, ideas, sounds, or images.<sup>150</sup> They enable a better and more efficient prediction of “what comes next” than the common alternative, recurrent neural networks.<sup>151</sup> Transformers use convolutional neural networks combined with attention models.<sup>152</sup>

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entities – ontologies and terms defined within ontologies such as classes (concepts) and properties (roles).”).

143. See Applied A.I. Tech. for Using Nat. Language Processing & Concept Expression Templates to Train a Nat. Language Generation Sys., U.S. Patent No. 11,042,713-B1, at col. 2 l. 4–55 (issued June 22, 2021).

144. See *id.* at fig. 7.

145. See, e.g., *id.* at figs. 7, 8A–8I.

146. *Deictic*, CAMBRIDGE DICTIONARY, <https://dictionary.cambridge.org/us/dictionary/english/deictic> [<https://perma.cc/UEL7-JFP>] (defining “deictic” as “relating to a word or phrase whose meaning depends on who is talking, who they are talking to, where they are, etc., for example ‘me’ and ‘here’”).

147. Applied A.I. Tech. for Using Nat. Language Processing & Concept Expression Templates to Train a Nat. Language Generation Sys., U.S. Patent No. 11,042,713-B1, at col. 12 l. 28–38 (issued June 22, 2021).

148. The ‘713 Patent lists twenty patents and twenty-six patent applications. *Id.* at col. 5 l. 58–col. 7 l. 9.

149. Dev, *The T in GPT Stands for Transformer. but What Exactly Does It Do?*, MEDIUM (Oct. 20, 2023), <https://medium.com/hackrlife/the-t-in-gpt-stands-for-transformer-but-what-exactly-doe-it-do-5916f86a0b81> [<https://perma.cc/83KG-4Y2H>].

150. See *id.*

151. See *id.*

152. See Giuliano Giacaglia, *How Transformers Work*, MEDIUM (Mar. 10, 2019), <https://towardsdatascience.com/transformers-141e32e69591> [<https://perma.cc/APZ4-H53A>] (explaining transformers and comparing them with recursive neural networks; giving examples of language translation systems); Rick Merritt, *What Is a Transformer Model?*, NVIDIA (Mar. 25, 2022), <https://blogs.nvidia.com/blog/2022/03/25/what-is-a-transformer-model/> [<https://perma.cc/Y843-2HGJ>] (explaining that “[a] transformer model is a neural network that learns context and thus meaning by tracking relationships in sequential data like the words in this sentence” and discussing how transformers “pay attention”); Alexander Amini, *MIT 6.S191:*

The performance of machine learning systems based on neural networks can be improved by constructing attention vectors, which rate the importance of each word in a cluster of semantically related sentences.<sup>153</sup>

Natural language user queries can be preprocessed to chunk a set of sentences of the natural language user query into a set of smaller sentences while retaining the references between chunks of the set of sentences. For each chunk of preprocessed user query a Name Entity Recognition (“NER”) ensemble extracts a domain-specific name entity from the chunked preprocessed user query.<sup>154</sup>

Classification techniques model the topics of each chunk. Then, in appropriate applications, sentiment analysis can determine a sentiment of each chunk of the user query.<sup>155</sup> User queries are converted to system queries by a combination of different natural-language-processing functions, such as NER, sentiment analysis, part of speech tagging, canonicalization,<sup>156</sup> classification, and translation.

Then, pattern matching techniques are used to compare the system query to the knowledge model to determine a closest state in the knowledge model.<sup>157</sup> The system returns a set of decisions scored according to their degree of match with the system query.<sup>158</sup> A winner state in the knowledge model is the knowledge state with the highest score.<sup>159</sup>

Systems can be fine-tuned by taking large language models trained on the full array of data usually used for training such models and then connecting

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*Recurrent Neural Networks, Transformers, and Attention*, YOUTUBE, at 47:20 (May 6, 2024), <https://www.youtube.com/watch?v=dqoEU9Ac3ek> [<https://perma.cc/U3WJ-CJCE>]. See also generally Jakob Uszkoreit, *Transformer: A Novel Neural Network Architecture for Language Understanding*, GOOGLE RSCH. (Aug. 31, 2017), <https://research.google/blog/transformer-a-novel-neural-network-architecture-for-language-understanding/> [<https://perma.cc/AB9N-Y2HU>] (explaining how transformers work, compared to RNNs; summarizing work of eight Google AI researchers).

153. A Text Recognition Method Based on Convolutional Neural Network Matching with Enhanced Attention, Patent No. CN 110,298,037 A ¶[0004] (filed June 13, 2019) (China).

154. NER detects semantic entities such as names, locations, business enterprises, events, products, themes, topics, monetary values, and percentages. Once they are detected, the entities are tagged and linked to an overarching neural network. See Nick Barney, *Named Entity Recognition (NER)*, TECHTARGET, <https://www.techtarget.com/whatis/definition/named-entity-recognition-ner> [<https://perma.cc/NKD9-Q2WT>] (Mar. 2023).

155. See *What is Sentiment Analysis?*, AWS, <https://aws.amazon.com/what-is/sentiment-analysis> [<https://perma.cc/7HQE-DQX4>] (“Sentiment analysis is the process of analyzing digital text to determine if the emotional tone of the message is positive, negative, or neutral.”).

156. *Canonicalization*, DEVX (Oct. 16, 2023), <https://www.devx.com/terms/canonicalization/> [<https://perma.cc/63PE-ELSL>] (“Canonicalization, in technology, refers to the process of converting diverse data representations into a single, standard format.”).

157. Convolutional State Modeling for Planning Natural Language Conversations, U.S. Patent Pub. No. US 2020/0387672 A1 ¶ [0006] (filed Aug. 25, 2022).

158. *Id.*

159. *Id.*

them with more specialized learning databases.<sup>160</sup> The machine learning system constructs new concept vectors enabling a branching by subject matter before more finely grained responses are constructed.<sup>161</sup>

These predictions are organized in a hierarchy through neural networks using *transformers*.<sup>162</sup>

A natural language processing system using a large language model makes statistically robust predictions to construct words, then sentences, then to associate sentences with concepts, and to put the concepts together logically according to the way they have occurred in the store of information recorded in the past.<sup>163</sup> Image recognition and creation systems assemble pixels coherently into visual objects, which can be associated with animals or inanimate things like trees or rocks, and recreate movement by predicting where an object will be from one frame of a video recording to the next.<sup>164</sup>

Generative AI and machine learning work with images similarly, although the raw material is digitized images rather than text.<sup>165</sup> Images can be processed by predicting whether the next pixel to the right, scanning horizontally, is likely to be lighter or darker, the same or a different color, and if a different color, which.<sup>166</sup> The techniques work by scanning the lines of an image, much as a laser printer or office scanner does, and looking for discontinuities in brightness and color.<sup>167</sup> A model of an image then is constructed identifying the locations of those discontinuities.<sup>168</sup> Then,

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160. Josep Ferrer, *An Introductory Guide to Fine-Tuning LLMs*, DATACAMP, <https://www.datacamp.com/tutorial/fine-tuning-large-language-models> [https://perma.cc/RW67-YANC] (Aug. 2024).

161. See An Intelligent Question Answering Method and Device Based on Large Language Model, Patent No. CN 117,520,491 A, at ¶ [0008] (filed Oct. 27, 2023).

162. See *supra* notes 149-152 and accompanying text.

163. See AWS, *supra* note 123.

164. See Rob Matheson, *Recovering “Lost Dimensions” of Images and Video*, MIT NEWS (Oct. 16, 2019), <https://news.mit.edu/2019/model-lost-data-images-video-1016> [https://perma.cc/2E5D-RLKY]. The disaggregation of movement was pioneered by Walt Disney’s animators in the 1930s. See *Walt Disney: Animation Pioneer*, NAT’L INVENTORS HALL OF FAME (Oct. 21, 2022), <https://www.invent.org/blog/inventors/walt-disney-multiplane-camera> [https://perma.cc/4HGZ-5TG3] (describing early animation techniques, involving inking each animation frame by hand). Generative AI has just digitized it and sped it up.

165. Rachel Gordon, *3 Questions: How AI Image Generators Work*, MIT CSAIL (Oct. 27, 2022), <https://www.csail.mit.edu/news/3-questions-how-ai-image-generators-work> [https://perma.cc/FS2Y-62FC].

166. See Mohit, *Image Processing Using CNN: A Beginner’s Guide*, ANALYTICS VIDHYA (May 31, 2024), <https://www.analyticsvidhya.com/blog/2021/06/image-processing-using-cnn-a-beginners-guide/> [https://perma.cc/UES7-WTZD].

167. See *id.*

168. A line connecting the discontinuities represents an “edge” in the image, such as the edge of a cheek in a human face. See *Digital Image Processing – Concept of Edge Detection*, TUTORIALSPPOINT, [https://www.tutorialspoint.com/dip/concept\\_of\\_edge\\_detection.htm](https://www.tutorialspoint.com/dip/concept_of_edge_detection.htm) [https://perma.cc/4HGZ-5TG3].



statistical algorithms, enabled by a complex hierarchy of neural networks,<sup>169</sup> compare the location of different types of discontinuities between images, and thus identify images that are most similar, and then, at a higher level, whether a lip is likely to be followed by a cheek or an ear, or a steer’s nose by a mouth or a tail.<sup>170</sup> A very large number of image samples are processed by machine learning.<sup>171</sup> Some of the samples contain the target image, and others contain something else.<sup>172</sup> Thus, a robocowboy<sup>173</sup> might be trained to recognize cattle by presenting hundreds of thousands of images of different kinds of animals, tagging only those that represent cows, bulls, steers, and calves.<sup>174</sup> The indicia of similarity are the particular facial features that discriminate a cow from a wolf—or one face from another.<sup>175</sup>

Machine-learning techniques can be used to accommodate the challenges associated with recognizing the target image despite different orientations, different lighting conditions, and different backgrounds.<sup>176</sup>

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[://perma.cc/W94J-7SY7](https://perma.cc/W94J-7SY7)] (“Most of the shape information of an image is enclosed in edges. So first we detect these edges in an image and by using these filters and then by enhancing those areas of image which contains edges, sharpness of the image will increase and image will become clearer.”).

169. See Divyanish Dwivedi, *Face Recognition for Beginners*, MEDIUM (Apr. 28, 2018), <https://towardsdatascience.com/face-recognition-for-beginners-a7a9bd5eb5c2> [<https://perma.cc/2CMC-ZWWX>] (explaining how neural networks can facilitate the use of statistical techniques such as Principal Component Analysis, Linear Discriminant Analysis, Independent Component Analysis, Discrete Cosine Transforms, Gabor Filters, and Markov Models for face recognition). See also generally Arun Alvappillai & Peter Neal Barrina, *Face Recognition Using Machine Learning*, <http://noiselab.ucsd.edu/ECE285/FinalProjects/Group7.pdf> [<https://perma.cc/3QXT-WS3H>] (explaining briefly, but formally face recognition algorithms).

170. See Henry H. Perritt Jr., *The 21st Century Cowboy: Robots on the Range*, 43 U. ARK. LITTLE ROCK L. REV. 149, 162 (2020).

171. See U.S. Patent Pub. No. 2014/0105467 A1 ¶¶ [0017-0026] (filed Dec. 2, 2023); Henry H. Perritt Jr., *Defending Face-Recognition Technology (And Defending Against It)*, 25 J. TECH. L. & POL’Y 41, 46 (2020) (explaining how image recognition systems use machine learning).

172. Perritt, *21st Century Cowboy*, *supra* note 170, at 165.

173. Autonomous Vehicle and Method for Detecting Strays and Managing Herds, Notice of Allowance dated Mar. 18, 2024, U.S. Patent App. No. 18/608,136.

174. Perritt, *21st Century Cowboy*, *supra* note 170, at 165 (exploring feasibility of robot cowboy who herds cattle; describing machine learning aimed at recognition of cattle).

175. This is the “feature extraction” step. Some commentators call this identifying “landmarks.” See Ragil Prasetyo, *Simple Face Recognition with Facial Landmark and K-Nearest Neighbors*, MEDIUM (July 2, 2023), <https://medium.com/@ragilprasetyo310/simple-face-recognition-with-facial-landmark-k-nearest-neighbors-ad5ae733adba> [<https://perma.cc/Q2P-L8SZ>].

176. This involves the second step in most typologies: “alignment.” See *id.* (“Facial landmarks provide a foundation for tasks such as face alignment . . . enabling a deeper understanding of the intricate details and dynamics of the human face.”).

The techniques were developed for image matching applications such as face-recognition.<sup>177</sup> But the models developed through machine learning can be used in generative AI to create new images. The most important features for facial representation are “the gap between the eyes, the width of the noses, the length of the nose, the height and shape of the cheekbones, the width of the chin, the height of the forehead and other parameters.”<sup>178</sup> The feature measurements can be expressed as a “feature vector,” or “faceprint,” which represents a particular face.<sup>179</sup>

The ability to predict used in both large language models and in image processing is called *generative*, referring to the capacity of the systems to generate new patterns of expression.<sup>180</sup> Generative AI can respond to complex natural language prompts running to several paragraphs or many pages. It can capture the subject matter inquired about, and then generate sentences, paragraphs, or pages of relevant results.<sup>181</sup> They can summarize data, synthesize reports and other information artifacts such as statutes, judicial opinions, and patents.<sup>182</sup> They can accept instructions and generate visual portrayals, synthesizing photographs or caricatures. They can write poetry, some of it evocative, and music, some of it entertaining.<sup>183</sup>

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177. See generally H.S. Prasantha, *Detailed Survey of Machine Learning Algorithms for Face Recognition*, INT'L J. CREATIVE RSCH. THOUGHTS, Nov. 2023.

178. Deepak Patel, *Machine Learning Helps Face Recognition by Amazon Rekognition API*, WHATECH (Mar. 6, 2020), <https://www.whatech.com/og/security/blog/639294-machine-learning-helps-face-recognition-by-amazon-rekognition-api.html> [<https://perma.cc/E8T8-M5LP>]; see also Dwivedi, *supra* note 169 (presenting computer program in the Python language that performs the basic steps).

179. U.S. Patent Pub. No. 2014/0105467 A1 ¶¶ [0009], [0034] (filed Dec. 2, 2023) (explaining feature vector and faceprints).

180. Adam Zewe, *Explained: Generative AI*, MIT NEWS (Nov. 9, 2023), <https://news.mit.edu/2023/explained-generative-ai-1109> [<https://perma.cc/8YNG-E6EB>].

181. See *id.*

182. See *What Is Generative AI?*, MCKINSEY & CO. (Apr. 2, 2024), <https://www.mckinsey.com/featured-insights/mckinsey-explainers/what-is-generative-ai> [<https://perma.cc/9TE2-NJF2>]; Natalie Rodgers, *Generative AI for Legal: Revolutionizing Law Firm Practices and Outcomes*, ABSTRACTA (Aug. 22, 2024), <https://abstracta.us/blog/ai/generative-ai-for-legal> [<https://perma.cc/TY9N-C6EU>].

183. For examples of the user interface for ChatGPT, showing that prompts can include fairly long passages of text, see *infra* Appendix; CORNELL UNIV. COMM., *GENERATIVE ARTIFICIAL INTELLIGENCE FOR EDUCATION AND PEDAGOGY*, at 16, 20 (2023), [https://teaching.cornell.edu/sites/default/files/2024-01/Cornell-GenerativeAIForEducation-Report\\_2.pdf](https://teaching.cornell.edu/sites/default/files/2024-01/Cornell-GenerativeAIForEducation-Report_2.pdf) [<https://perma.cc/55PF-DNJM>] (discussing the capabilities of writing poetry and generating music, images, and video). GPT 4 can accept prompts of up to 25,000 words. Murgia, *supra* note 135.

What they cannot do is think. They cannot create beyond the boundaries of what has been created in the past. They are incapable of the flashes of genius that sometimes are thought to be characteristic of good inventors.<sup>184</sup>

They are, however, very good at routine clerical and office tasks. Just as USPTO was able to use the computer programming of the mid-1980s to move files around between applicants and examiners, so it can use the computer programming of 2025 to automate many of the clerical task inherent in implementing a highly stylized document review process.<sup>185</sup> Already, USPTO uses what most people would call artificial intelligence to screen electronic applications to make sure they have all their parts, formatted in the proper ways.<sup>186</sup> It uses full-text and semantic search programs to search for prior art.<sup>187</sup> These have been in use by Westlaw and Lexis, and by Google and other search engines for nearly thirty years, and are now quite sophisticated in accepting free text queries.<sup>188</sup>

Patent practitioners routinely use patent prosecution assistants, advertised as embodying AI, to draft patent applications and to vet them to assure consistency and appropriate internal references necessary for antecedent bases

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184. See Sergio Brotons, *The Limitations of Generative AI, According to Generative AI*, LINGARO, <https://lingarogroup.com/blog/the-limitations-of-generative-ai-according-to-generative-ai> [<https://perma.cc/785C-TACD>] (“[G]enerative AI cannot replace human creativity completely as it lacks the ability to come up with novel ideas or recognize abstract concepts such as humor or irony — all things which require a human touch.”); cf. *Graham v. John Deere Co.*, 383 U.S. 1, 15 (1966) (“It also seems apparent that Congress intended by the last sentence of § 103 to abolish the test it believed this Court announced in the controversial phrase ‘flash of creative genius,’ used in *Cuno Engineering Corp. v. Automatic Devices Corp.* . . . .” (emphasis added)).

185. *History of the European Patent Office in the 1980s*, EUR. PAT. OFF., <https://epo.org/en/about-us/timeline/1980s> [<https://perma.cc/CTR5-EMF5>]; Madison Alder, *U.S. Patent Office Eyes Using AI to Improve ‘Prior Art’ Searches*, FEDSCOOP (Aug. 29, 2023), <https://fedscoop.com/patent-office-eyes-ai-prior-art-searches/> [<https://perma.cc/F98C-9UMA>].

186. Christina Sperry, *Artificial Intelligence (AI) Takes a Role in USPTO Patent Searches*, MINTZ (Nov. 8, 2022), <https://www.mintz.com/insights-center/viewpoints/2231/2022-11-08-artificial-intelligence-ai-takes-role-uspto-patent> [<https://perma.cc/N987-F2UC0>].

187. See *id.*

188. See generally *Making Once Nearly Impossible Legal Research Tasks Possible*, THOMSON REUTERS, <https://legal.thomsonreuters.com/en/products/westlaw-edge/features> [<https://perma.cc/C93S-5C6J>] (discussing Westlaw’s use of AI); Suzanne McGee, *Generative AI and the Law*, LEXISNEXIS, [https://www.lexisnexis.com/html/lexisnexis-generative-ai-story/?srsltid=AfmBOop0FCIN9SAcmO7f5RmXjyuF0h\\_s6LELLNIUGTpEAUWRVvMbNzgy](https://www.lexisnexis.com/html/lexisnexis-generative-ai-story/?srsltid=AfmBOop0FCIN9SAcmO7f5RmXjyuF0h_s6LELLNIUGTpEAUWRVvMbNzgy) [<https://perma.cc/EM5F-BGUC>] (discussing Lexis’ use of AI); *Supercharging Search with Generative AI*, GOOGLE (May 10, 2023), <https://blog.google/products/search/generative-ai-search/> [<https://perma.cc/J3WT-YGRP>].

for claims language.<sup>189</sup> They also use specialized prior art search engines building on the techniques developed by Westlaw, Lexis, and Google.<sup>190</sup>

Some of the same tools can compare patent applications against prior art to flag anticipation and obviousness or can check specifications for compliance with section 112. They already spit out form objections and rejections by patent examiners and draft responses to those by patent practitioners.<sup>191</sup>

They can review specifications, drawing labels, and the language of claims already drafted to suggest additional claim language in patent applications. The same techniques that enable obviousness analysis also can be used to suggest new inventions.

How widely these capabilities will be adopted depends, not only on their capabilities in a day-to-day practice environment, but also on cost. The cost of these systems is just being encountered. Huge databases of information and enormous computing power are required to accomplish the machine learning necessary for useful predictive algorithms. Not only is the hardware expensive and available from only a few vendors, it uses large amounts of electricity.<sup>192</sup>

It is also not yet completely clear how sophisticated prompts can be handled in large language models without compromising confidentiality.

### III. POTENTIAL USES

The story at the beginning of this article<sup>193</sup> touches on the principal ways that generative AI can be used in the patent system: as an inventor, as the subject of an invention, to prosecute applications, to perform examiner functions and to aid pro-se applicants. USPTO issued two policy statements

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189. See Laura Berwick, *Tips to Prep Office Actions for Rowan Prosecution*, ROWAN, <https://intercom.help/rowanpatents/en/articles/4968655-tips-to-prep-office-actions-for-rowan-prosecution> [<https://perma.cc/5GTP-9TRU>] (explaining how to ensure that an office action from USPTO is properly formatted for processing by office-action-response module of Rowan Patents).

190. See generally THOMSON REUTERS, *supra* note 188; McGee, *supra* note 188; GOOGLE, *supra* note 188.

191. See Berwick, *supra* note 189.

192. See Jonathan Vanian, *ChatGPT and Generative AI Are Booming, but the Costs Can Be Extraordinary*, CNBC, <https://www.cnbc.com/2023/03/13/chatgpt-and-generative-ai-are-booming-but-at-a-very-expensive-price.html> [<https://perma.cc/EP5N-RV2U>] (Apr. 17, 2023, 2:09 AM EDT); Tom Cox, *The Rise of Generative AI and the Impending Energy Crisis*, CONNECTED NATION (Apr. 9, 2024), <https://connectednation.org/blog/the-rise-of-generative-ai-and-the-impending-energy-crisis> [<https://perma.cc/M7J8-GCMS>] (“Generative AI systems . . . require vast amounts of data and computational power. The training process for these models is incredibly energy-intensive, often running on thousands of high-performance GPUs for weeks or even months.”).

193. See *supra* Part I.

on generative AI in 2023,<sup>194</sup> addressing the first and the third of these, intensifying public discussion already underway. Each of the following sections addresses one of these uses, explaining how the technology is already being deployed, analyzing legal issues presented by the use, and predicting how the technological capabilities are likely to be expanded.

#### A. *To Invent*

Most of the excitement in the general press claims that a new era is dawning in which creative humans will be replaced by robots. Some of the loudest cries have come from authors and writers.<sup>195</sup> Authors' claims that robots using AI would replace them was a theme of the 2023 writers' strike against Hollywood.<sup>196</sup> One can imagine extending their alarm: AI will replace human inventors. This is nonsense. The clamor by authors and writers has little connection either with copyright law or with the way large language models learn.<sup>197</sup> It has more to do with the political power and organization of Hollywood writers, compared with AI engineers.

The February 2024 USPTO policy statement addressed the fantasy that AI inventors would replace human ones. Earlier, the United States Court of

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194. Inventorship Guidance for AI-Assisted Inventions, 89 Fed. Reg. 10043, 10044 (Feb. 13, 2024); Guidance on Use of Artificial Intelligence-Based Tools in Practice Before the United States Patent and Trademark Office, 89 Fed. Reg. 25609, 25609 (Apr. 11, 2024).

195. See, e.g., Molly Kinder, *Hollywood Writers Went on Strike to Protect Their Livelihoods from Generative AI. Their Remarkable Victory Matters for All Workers.*, BROOKINGS (Apr. 12, 2024), <https://www.brookings.edu/articles/hollywood-writers-went-on-strike-to-protect-their-livelihoods-from-generative-ai-their-remarkable-victory-matters-for-all-workers> [<https://perma.cc/Q4Z6-ZZKV>]; Anna Gordon, *Why Protestors Around the World Are Demanding a Pause on AI Development*, TIME (May 13, 2024, 7:20 PM EDT), <https://time.com/6977680/ai-protests-international/> [<https://perma.cc/5S5W-W5PX>].

196. See Ko Bragg, *The Writers' Strike Over AI Is Bigger Than Hollywood*, THE MARKUP (July 29, 2023, 8:00 ET), <https://themarkup.org/hello-world/2023/07/29/the-writers-strike-over-ai-is-bigger-than-hollywood> [<https://perma.cc/4QG7-SNWW>] (quoting Drescher: "SAG-AFTRA president Fran Drescher . . . said on the dawn of the strike, 'If we don't stand tall right now, . . . we are all going to be in jeopardy of being replaced by machines.'"); Maham Javaid & Maria Luisa Paul, *Fran Drescher's Speech Recalls 'The Nanny,' Who Never Crossed Picket Lines*, WASH. POST (July 14, 2023), <https://www.washingtonpost.com/nation/2023/07/14/fran-drescher-speech-nanny-sag-actor-strike/> [<https://perma.cc/BN2Z-KWBC>] (quoting Drescher); Kathryn Craft, *Will AI Replace Writers? It Already Is.*, FOXPRINT ED. (May 11, 2023, 10:56 AM), <https://foxprinteditorial.com/2023/05/11/will-ai-replace-writers-it-already-is/> [<https://perma.cc/2TXK-LSXL>] ("Writers feel, not without reason, that they may be an endangered species.").

197. See Henry H. Perritt, Jr., *Robots as Pirates*, 73 CATHOLIC U. L. REV. 57 (2024) (explaining why AI generated material is unlikely to infringe copyrights in works used for machine learning).

Appeals for the Federal Circuit had agreed with the Patent Office that only natural human beings can be inventors.<sup>198</sup>

In its policy statement USPTO considered the relationship between generative AI programs and their human masters in the process of inventing.<sup>199</sup> The statement reiterates the office’s position that only human beings can be inventors, not inanimate computer programs.<sup>200</sup> It then offers guidance on how human inventors working with AI partners can be inventors.<sup>201</sup> But human inventors can be aided by inanimate tools such as power drills, lathes, and milling machines, or, more recently by oscilloscopes, and digital computer simulations.<sup>202</sup> When such tools are involved, the question is a traditional one: does the human being qualify as an inventor—a question receiving much scrutiny over the 235-year life of the patent system? To qualify as an inventor, a person must contribute significantly to the conception behind the invention.<sup>203</sup> Developing an essential building block can qualify, so designing, training, or building a generative AI system backed up by machine learning can qualify one as an inventor.<sup>204</sup>

A natural person who only presents a problem to an AI system may not be a proper inventor or joint inventor of an invention identified from the output of the AI system. However, a significant contribution could be shown by the way the person constructs the prompt in view of a specific problem to elicit a particular solution from the AI system.<sup>205</sup>

On the other hand, “[m]erely recognizing a problem or having a general goal or research plan” is not enough.<sup>206</sup> Neither is reducing a conception

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198. *Thaler v. Vidal*, 43 F.4th 1207, 1210–13 (Fed. Cir. 2022) (holding that statute’s use of the word “individual” excludes AI systems as inventors; affirming summary judgment for USPTO).

199. *Inventorship Guidance for AI-Assisted Inventions*, 89 Fed. Reg. at 10045–46.

200. *Id.*

201. *Id.* at 10048 (“Guiding Principles”).

202. *See id.* (noting that use of AI tools does not negate inventorship).

203. *See* Henry H. Perritt, Jr., *Who Invented It? Streamlining Determination of Patent Inventorship*, 79 U. MIA. L. REV. 91 (2024).

204. *Inventorship Guidance for AI-Assisted Inventions*, 89 Fed. Reg. at 10049 (developing essential building blocks, e.g., designing, training, or building an AI system can qualify).

205. *Id.* at 10048.

206. *Id.*

developed by someone else or something else to practice.<sup>207</sup> And “maintaining intellectual domination” is not enough.<sup>208</sup>

The policy statement has a section specifically focusing on design and plant patent applications,<sup>209</sup> suggesting that the Office thinks those subject areas are most likely to spawn inventions with significant AI contributions and the most human reliance.

The policy statement emphasizes the duty of disclosure imposed on applicants and their coworkers with regard to determination of inventorship.<sup>210</sup>

Several witnesses in Senate Judiciary Committee hearings in 2023 told Congress to amend the patent statute to allow generative AI systems to be inventors, while other witnesses disagreed.<sup>211</sup> Even the witnesses favoring the possibility of inventorship for AI computer systems recommended that a human being be the applicant.<sup>212</sup> That position is a bit schizophrenic, because the typical applicant is a corporation, having been assigned rights by the human inventors. Accountability is focused on the applicant and the patent owner, which already can be—and usually is—an inanimate corporate entity. No one has been terribly clear or persuasive about what is gained by insisting that a natural person be named as an inventor, increasingly a purely symbolic act.

Ryan Abbott, Professor of Law and Health Sciences at the University of Surrey School of Law proposed at a hearing: first, that AI should be defined functionally for purposes of regulatory efforts and regulated in a technologically neutral manner.<sup>213</sup> Second, that the Patent Act should be amended so that AI-generated inventions are patentable, and so that patentability shall not be denied based on how an invention is discovered.<sup>214</sup> Third, that in the case of an AI-generated invention lacking a traditional human inventor, the AI system that has functionally invented should be listed

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207. *Id.* (“Reducing an invention to practice alone is not a significant contribution that rise to the level of inventorship.”).

208. *Id.* at 10049 (maintaining that intellectual domination over an AI system is not enough).

209. *Id.* (“Applicability of This Guidance to Design and Plant Patent Applications and Patents . . .”).

210. *Id.* (reiterating duty of disclosure for inventorship determination).

211. See *Artificial Intelligence and Intellectual Property—Part I: Patents, Innovation, and Competition: Hearing Before the Subcomm. on Intell. Prop. of the S. Comm. on the Judiciary, 118th Cong. (2023)* [hereinafter “*IP Subcomm. Hearing*”].

212. *Id.* at 109–10 (statement of Ryan Abbott, Professor of Law & Health Sciences, University of Surrey).

213. *Id.* at 23.

214. *Id.* at 109.

as the inventor and the AI's owner should be the owner of any intellectual property generated by their system.<sup>215</sup>

One of the difficulties with USPTO's current position, he said, is that the human shepherd of AI systems may not qualify as inventors.<sup>216</sup> Not allowing AI to be an inventor renders an entire class of otherwise patentable subject matter unpatentable. This will get worse as AI continues to improve.<sup>217</sup> Without patentability, owners and users of AI systems will tend to protect their systems with trade secrets rather than patents.<sup>218</sup>

Corey Salsberg, vice president at Novartis,<sup>219</sup> argued that AI is not capable of inventing but that its use may cause examiners to deny inventorship status to human users.<sup>220</sup>

Laura Sheridan, Head of Patent Policy for Google<sup>221</sup> saw no necessity for allowing AI to be named as an inventor, because "in Google's extensive experience using AI as a tool for innovation, humans are involved in a way that makes them inventors for the resulting innovations."<sup>222</sup>

John Villasenor, UCLA Professor of Law and Electrical Engineering<sup>223</sup> testified "that AI inventions should be patentable, and that inventorship should be attributed to the natural persons who use AI as a tool to enhance their ability to innovate."<sup>224</sup> This position, he thought, is fully consistent with the current state of U.S. patent law.<sup>225</sup>

Rama Elluru, Senior Director for Society and Intellectual Property at the Special Competitive Studies Project<sup>226</sup> argued that "[i]t is critical that AI-generated inventions are patentable . . . allowing AI to be named as an inventor

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215. *Id.* at 109–10, 112.

216. *Id.* at 112 (recognizing that human owners or users of generative AI systems may not qualify as inventors).

217. *Id.* at 110.

218. *See id.* at 47–48 (arguing that allowing patents on AI-generated inventions will incentive innovation by making AI output more valuable and will incentive the disclosure of confidential information and trade secrets).

219. *Id.* at 60 (statement by Corey Salsberg, Vice President, Global Head IP Affairs, Novartis).

220. *Id.* at 68–70.

221. *Id.* at 133 (statement of Laura Sheridan, Head of Patent Policy, Google).

222. *Id.*

223. *Id.* at 81 (statement of John Villasenor, Professor of Law & Electrical Engineering, UCLA).

224. *Id.* at 84.

225. *Id.*

226. *Id.* at 114 (statement of Rama Elluru, Senior Director for Society & Intellectual Property, Special Competitive Studies Project). The Special Competitive Studies Project is chaired by Eric Schmidt and has a staff of forty-four. Its CEO is Ylli Bajraktari, former chief of staff to National Security Advisor LTG H. R. McMaster). *Who We Are*, SPECIAL COMPETITIVE STUD. PROJECT, <https://www.scpai/about/who-we-are/#leadership> [https://perma.cc/9B8S-G9MH].



on patent applications might be one way to recognize the patentability of AI-generated inventions.”<sup>227</sup>

It also is not clear that any statutory amendment is necessary to allow AI computer systems to be inventors. Nowhere in the statute is there an explicit requirement for human inventorship.<sup>228</sup> To be sure, throughout the life of U.S. patent statutes, inventors have been natural persons, but the idea that an inanimate business entity can be the applicant is fairly new to U.S. law, and the possibility of computer-generated inventive results meeting subject matter, novelty, and nonobviousness requirements is quite new to U.S. reality.

Consideration of USPTO’s guidance on inventorship and on the testimony spotlights the risks that more powerful generative AI systems used in the invention process may narrow the role of human users to the point that no one qualifies as an inventor under current USPTO guidance. Leaving a growing number of AI influenced inventions as orphans in the patent system would pull the system back from an important area of innovation. Critics of patents in general would be pleased with this, but it is not necessarily good policy.

Sean O’Connor observes that nothing in the Patent Act disables corporate persons from being inventors.<sup>229</sup> He finds no rational reasons why the “product of original . . . thought” aphorism used to mandate individual inventorship does not apply equally to copyrights, where the copyright act expressly allows corporate persons to be “authors.”<sup>230</sup>

He argues that both regimes should leave initial attribution of creation with natural persons, allowing them, however, to transfer control and ownership to corporate entities.<sup>231</sup> He justifies this outcome by his observation that attribution can be equally or more important than economic rights.<sup>232</sup> This is a plausible justification for preferring individual inventorship, but not one strong enough to deny legal accommodation to the reality of robotic invention.

Section 101 analysis would be considerably simplified, if the Patent Office did not care whether a named inventor is a natural human being or inanimate. Matters contained in oaths and declarations can be handled by the

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227. *IP Subcomm. Hearing, supra* note 211, at 114 (concluding that “[h]owever, we must fully explore this approach’s implications and also study alternative approaches”).

228. *See* 35 U.S.C. §§ 111-118.

229. *See* Sean M. O’Connor, *Hired to Invent vs. Work Made for Hire: Resolving the Inconsistency Among Rights of Corporate Personhood, Authorship, and Inventorship*, 35 SEATTLE U. L. REV. 1227, 1227–28, 1238 (2012) (explaining how copyright and patent law are inconsistent in how they treat natural persons and artificial persons in attributing creation and allocating ownership rights).

230. *Id.* at 1238; *see also* 17 U.S.C. § 201(b) (making an employer the author of a work made for hire).

231. O’Connor, *supra* note 229, at 1242–43.

232. *Id.* at 1242; *see also* Perritt, *Who Invented It?*, *supra* note 203, at 121 (exploring reputational interest in inventorship).

applicant or some other natural legal person taking responsibility for the inventive computer. Indeed the disclosure requirements under present law are not limited to natural-person inventors.<sup>233</sup>

Resolving the inventorship question in this way would not bias other aspects of eligibility under section 101. Proponents of easing eligibility for AI-related inventions can continue to make their arguments and continue to be opposed by those defending the status quo or urging further tightening.

The case against AI ownership of patents is weak. To be sure, computer systems running AI software on specialized AI hardware are not typically separate business entities, but they are owned by business entities.<sup>234</sup> Just as a business entity can be an applicant for a patent, so also can it be listed as the inventor. Matters such as oaths and declarations can be handled easily by requiring them to be executed by those business-entity employees most closely connected with the inventive activities of the AI system.

The fictional Edison is not going to get a patent on the application it drafted,<sup>235</sup> even if it is not disqualified because it is not human. The language does not come anywhere close to meeting the requirements of section 112,<sup>236</sup> and nothing in the session assessed novelty<sup>237</sup> or obviousness.<sup>238</sup> Generative AI systems are not going to replace human inventors, but some technological contexts exist in which a generative AI will do so much of the work of describing an invention and articulating claims. The law should not require applicants for patents in these contexts to turn cartwheels to emphasize the human contribution and to minimize the machine's.

### B. *As Inventions*

The Patent Office regularly is granting patents on AI inventions and receiving more applications. An October 17, 2024, advanced search in USPTO's ppubs database with the term "artificial intelligence" resulted in 117,057 records, representing issued patents.<sup>239</sup> The same search run against the published applications database resulted in 171,472 records.<sup>240</sup> An

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233. *See* 35 U.S.C. § 101.

234. *See* Amba Kak et al., *Make No Mistake—AI is Owned by Big Tech*, MIT TECH. REV. (Dec. 5, 2023), <https://www.technologyreview.com/2023/12/05/1084393/make-no-mistake-ai-is-owned-by-big-tech> [<https://perma.cc/DS7J-9MPG>].

235. *See infra* Appendix (transcript of patent drafting session with ChatGPT).

236. *See supra* Part II.A (discussing 35 U.S.C. § 112).

237. *See supra* Part II.A (discussing 35 U.S.C. § 102).

238. *See supra* Part II.A (discussing 35 U.S.C. § 103).

239. *Patent Public Search*, U.S. PAT. & TRADEMARK OFF., <https://ppubs.uspto.gov/pubwebapp/> [<https://perma.cc/9DAG-L8ES>] (follow hyperlink; select "USPAT" under "databases" option; then search "artificial intelligence").

240. *Id.* [<https://perma.cc/8KKZ-X5YF>] (follow hyperlink; select "US-PGPUB" under "databases" option; then search "artificial intelligence").

advanced search of the issued patents database with the term “generative AI” produced seventy-eight results, and the same search against the published applications database produced 370 results.<sup>241</sup>

New generative AI inventions qualify for patents if they meet the tests for patentability under section 101,<sup>242</sup> as interpreted in *Alice/Mayo*.<sup>243</sup> AI applications are computer programs, embedded in powerful computing hardware.<sup>244</sup> The complexity of the software and the power (and power consumption) of the hardware is singular and largely unprecedented.<sup>245</sup> But the legal tests for patent eligibility are more than two hundred years old.<sup>246</sup> The generative AI invention must involve a machine, process, item of manufacture or compound; it must be more than a mere algorithm or theory or phenomena of nature.<sup>247</sup> It helps assure patentability when an idea is expressed in detailed pseudocode or actual programming code for computers,<sup>248</sup> and it helps when the invention involves implementation of software on a physical piece of hardware.<sup>249</sup>

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241. *Id.* [<https://perma.cc/7V9Y-XSB5>] (follow hyperlink; select “USPAT” under “databases” option; then search “generative AI”); *id.* [<https://perma.cc/6XD7-EASR>] (follow hyperlink; select “US-PGPUB” under “databases” option; then search “generative AI”); *see also* Datzov, *supra* note 97, at 13 (urging temperance in calls for legislative reform to make AI patents easier to get; reviewing upsurge in patent applications mentioning AI).

242. 35 U.S.C. § 101.

243. *See supra* Part II.A (discussing *Alice/Mayo* test for eligibility of subject matter under 35 U.S.C. § 101).

244. WIRTH, *supra* note 100.

245. But see for example *Modeling + Data Assimilation: Simulating a Complex World*, NCAR, <https://ncar.ucar.edu/what-we-offer/models> [<https://perma.cc/AJ6L-ZZYQ>]; *Advanced Simulation and Computing: Nuclear Weapon Simulation and Computing*, LOS ALAMOS NAT. LAB’Y, <https://mission.lanl.gov/advanced-simulation-and-computing/> [<https://perma.cc/G2A9-B7CH>], discussing the modeling programs for meteorology and nuclear weapons.

246. *See* U.S. PAT. & TRADEMARK OFF., PATENT ELIGIBLE SUBJECT MATTER: REPORT ON VIEWS AND RECOMMENDATIONS FROM THE PUBLIC (2017) (first citing Patent Act of 1790, ch. 7, 1 Stat. 109 (1790); and then citing Patent Act of 1793, ch. 11, § 1, 1 Stat. 318 (1793)).

247. The “more than” is the inventive step. The mere “algorithm or theory or phenomena of nature” are the judicial exceptions. *See supra* notes 34-40 (discussing the inventive step and the judicial exceptions outlined in *Alice/Mayo*).

248. Gene Quinn, *Writing Software Patent Applications*, IPWATCHDOG (Apr. 20, 2013, 9:00 AM), <https://ipwatchdog.com/2013/04/20/writing-software-patent-applications-2/id=39417/> [<https://perma.cc/9K75-4P5V>].

249. David Hopkins, *Can You Patent Your Software?*, COOLEY GO (Mar. 29, 2022), <https://www.cooleygo.com/can-you-patent-software/> [<https://perma.cc/J28G-GVAQ>].

It is clear that prompts for an AI system can satisfy the conception requirement.<sup>250</sup> The Office published examples to be used with its 2019 guidance.<sup>251</sup> Example 39 pertains to an AI invention.<sup>252</sup>

The example contains a claim:

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.<sup>253</sup>

The example concludes that the claim “recites a series of steps and, therefore, is a process,” a statutory category.<sup>254</sup> It concludes that no judicial exception is recited because:

The claim does not recite any mathematical relationships, formulas, or calculations. While some of the limitations may be based on mathematical concepts, the mathematical concepts are not recited in

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250. Inventorship Guidance for AI-Assisted Inventions, 89 Fed. Reg. 10043, 10048 (Feb. 13, 2024) (“[A] significant contribution could be shown by the way the person constructs the prompt in view of a specific problem to elicit a particular solution from the AI system.”).

251. U.S. PAT. & TRADEMARK OFF., SUBJECT MATTER ELIGIBILITY EXAMPLES, *supra* note 44.

252. *Id.* at 8–9.

253. *Id.*

254. *Id.* at 9.

the claims. Further, the claim does not recite a mental process because the steps are not practically performed in the human mind. Finally, the claim does not recite any method of organizing human activity such as a fundamental economic concept or managing interactions between people. Thus, the claim is eligible because it does not recite a judicial exception.<sup>255</sup>

The USPTO example does not offer any help on application of Step II of *Alice*, where most of the recent AI applications have run aground. Jon Grossman, of Blank Rome LLP, offers more guidance on that subject.<sup>256</sup> He reviews Federal Circuit, district court, and PTAB decisions, most of them finding AI inventions ineligible under section 101, and concludes that:

[I]t 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 . . . . 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.<sup>257</sup>

He then makes four concrete suggestions:

- 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.<sup>258</sup>

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255. *Id.*

256. Jon Grossman, *AI Inventions and Subject Matter Eligibility*, INTELL. PROP. & TECH. L.J., Nov.-Dec. 2023, at 1.

257. *Id.* at 2–8.

258. *Id.*

PTAB has considered appeals of rejections of inventions involving assertions of AI in two dozen cases reported since the beginning of 2024.<sup>259</sup> In only one, did the applicant survive section 101 scrutiny. In *Ex parte* Kristin E. McNeil, Robert C. Sizemore, David B. Werts, and Sterling R. Smith,<sup>260</sup> the Board, reversing the examiner, determined that claims were not directed to a judicial exception under Step IIA, Prong Two:

The Examiner’s determination that the testing and determining steps (steps [v] and [vi]) of claim 1 recite mental processes . . . is insufficient to support the rejection. The testing and determining steps (steps [v] and [vi]) of claim 1 only have meaning and *exist in the context of a trained cognitive computing system*, and thus, cannot be performed by human thought alone or by a human using pen and paper. . . . “Such problems only exist if there is a cognitive computing system that is trained through a machine learning process. Thus, the problem only exists in computer technology. Moreover, the solution provided by the invention is an improved computing tool that performs specific computer operations set forth in the claims to not only annotate inputs and outputs of a trained cognitive computing system, *but to perform additional testing of the trained cognitive computing system using a test corpus and test questions and analysis of the results returned to thereby identify the source of the bias in the operation of the cognitive computing system*” . . . Thus, we determine the testing and determining steps (steps [v] and [vi]) of claim 1 are not merely part of the abstract idea; rather, they are additional steps performed *in the context of a trained cognitive computing system* that cannot be performed by human thought alone or by a human using pen and paper.<sup>261</sup>

The other cases involved a judicial exception and nothing more. In *Ex Parte* Corville O. Allen,<sup>262</sup> the board applied Step II, saying:

To do so, we look to whether the claim “appl[ies], rel[ies] on, or use[s] the judicial exception in a manner that imposes a meaningful limit on the judicial exception, such that the claim [is] more than a

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259. *See, e.g., Ex parte* Frandsen, No. 2023-000756, 2024 WL 959418 (P.T.A.B. Mar. 5, 2024) (affirming rejection under section 101; “the elements that Appellant identifies are, in combination, the abstract idea itself; they are not additional elements to be considered in determining whether claim 4 includes an additional element or combination of elements that integrates a recited abstract idea into a practical application”).

260. *Ex parte* McNeil, No. 2023-000011, 2024 WL 197214 (P.T.A.B. Jan. 17, 2024).

261. *Id.* at \*15 (citations omitted) (emphasis in original).

262. *Ex parte* Allen, No. 2022-003311, 2024 WL 339904 (P.T.A.B. Jan. 26, 2024).

drafting effort designed to monopolize the judicial exception,” i.e., “integrates a judicial exception into a practical application.”<sup>263</sup>

It found that:

[T]he claim recites no technical or technological details on how the ingesting is performed such that not re-ingesting is a technical improvement or an improvement to the functioning of the computer. And to the extent the “expenditure of computer resources” is reduced, this reduction is a business improvement in terms of cost and use, and not a technical or technological improvement to the computer elements themselves.<sup>264</sup>

In *Ex Parte* Kevin Lyman, Li Yao, and Anthony Upton,<sup>265</sup> the Board similarly rejected a claim at Step II:

“[t]he claimed invention does not provide a technical improvement as the computing devices are used as a tool to implement the abstract idea.” . . . For example, the presence of additional hardware elements (e.g., “at least one processor,” “memory,” “client device” and “display device”) as well as AI as a training function in the claims are not indicative of “integration into a practical application.” Rather, these generic hardware elements and generic AI (i.e., any “supervised or unsupervised model”) are [sic] simply used as tools to verify billing and improper billing notification in a medical establishment. . . . The claimed generic computer components and generic AI are simply the “automation of the fundamental economic concept.” . . . “[M]erely require[ing] generic computer implementation,” “does not move into [§] 101 eligibility territory.”<sup>266</sup>

In *Ex Parte* Eduardo Cardoso, Alex Ferreira, Leonardo Santos, and Jaqueline Rocha,<sup>267</sup> the Board said more about the flaw in all of these rejected applications:

Taking the claim elements separately, the operation performed by the computer at each step of the process is expressed purely in terms of

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263. *Id.* at \*11 (quoting MPEP § 2106.04(d)).

264. *Id.* at \*13.

265. *Ex parte* Lyman, 2023-000805, 2024 WL 621157 (P.T.A.B. Feb. 12, 2024) (citations omitted) (alterations in original).

266. *Id.* at \*8 (citations and internal quotations omitted) (alterations in original).

267. *Ex parte* Cardoso, 2022-003546, 2023 WL 7647584 (P.T.A.B. Nov. 14, 2023).

results, devoid of implementation details. Steps 1-4 recite generic computer processing expressed in terms of results desired by any and all possible means and so present no more than conceptual advice.

Steps 1-3 recite using an artificial intelligence component, but do not recite any technological implementation details as to how this is done or how the artificial intelligence component is constructed or operates. All recitations are no more than an instruction to apply a black box to labelled data inputs.

Limitation 5 recites that the artificial intelligence component is trained using historical employee off-boarding data to create a specialized machine learning model that determines the employee retention insights and the action steps for respective employers for particular employee types. This again simply recites applying some labelled data as input to a black box with no technological implementation details. The recitation of a specialized machine learning model that determines the employee retention insights and the action steps for respective employers for particular employee types is a conclusory description as a “specialized learning model” with no recitation of how it is so specialized or how the model is constructed or operates, followed by the aspirational objective for the model with no recitation as to how that objective is achieved.

Limitation 6 recites that the specialized machine learning model increases performance and accuracy regarding analytical and predictive capabilities of the artificial intelligence component thereby increasing performance of the computer, itself. This is likewise a conclusory recitation with no recitation of how the performance and accuracy are improved or how computer performance is improved.

All purported inventive aspects reside in how the data are interpreted and the results desired, and not in how the process physically enforces such a data interpretation or in how the processing technologically achieves those results.<sup>268</sup>

At least one of the PTAB cases rejected the application, not only under section 101, but also under section 112.<sup>269</sup> This shows how section 112 can properly be applied when a patent applicant makes a generic claim to artificial

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268. *Id.* at \*7–8.

269. *See Ex parte Gustafson*, 2020-000900, 2020 WL 4673713, at \*7 (P.T.A.B. Aug. 3, 2020).



intelligence or to machine learning, especially since neither term is well defined in the art, let alone in popular understanding. It is impossible for anyone to know the scope of the claim. It is also impossible for someone skilled in the art to make and use the invention with no more than the specification in front of him, because he would have to invent artificial intelligence and machine learning, respectively. Moreover, black box limitations raise questions about whether the applicant had reduced the invention to practice—whether he “possessed” it. In *Ex parte* David Gustafson, Christopher Danson, Tomasz Stadnik, Jessica Leigh Hempel, Rachel Jean Stark, and Alain Stephan,<sup>270</sup> the Board explained that a “black box” limitation in a specification pertaining to machine learning does not satisfy the requirements of section 112 because it does not show that the inventors possessed the invention.<sup>271</sup>

The relationship between section 101 eligibility analysis and section 112 definiteness analysis has been controversial. In *Berkheimer v. HP Inc.*,<sup>272</sup> the Federal Circuit explained that “[t]he second step of the *Alice* test is satisfied when the claim limitations involve more than performance of well-understood, routine, [and] conventional activities previously known to the industry.”<sup>273</sup> It explained the application of that test by analogy to application of section 112.<sup>274</sup>

In April 2019, the Patent Office issued a memorandum explaining how the Office will apply *Berkheimer*.<sup>275</sup> It said that the analysis of whether an element is widely prevalent or in common use for purposes of applying *Alice/Mayo* Step II is the same as the analysis under section 112(a) as to whether “whether an element is so well-known that it need not be described in detail in the patent specification.”<sup>276</sup>

As Part III.C explains, Lee and Kayden have a lot of work ahead of them to refine the patent application drafted by Edison. If they do a good job of that, they may be able to get a patent on the CherryBot. Eligibility of the subject matter under section 101 depends on application of the same rules applied to any other computer system, as explained in Part II.A. Likewise, application of

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270. *Id.*

271. *Id.* at \*3 (“[T]he specification itself must explain how the claimed function is achieved to demonstrate that the applicant had possession of it.”).

272. 881 F.3d 1360 (Fed. Cir. 2018) (vacating invalidation of certain claims as ineligible under section 101).

273. *Id.* at 1367 (citations omitted).

274. *See id.* at 1368.

275. *See* Memorandum from Robert W. Bahr, Deputy Comm’r for Patent Examination Policy, to Patent Examining Corps, Changes in Examination Procedure Pertaining to Subject Matter Eligibility, Recent Subject Matter Eligibility Decision (*Berkheimer v. HP, Inc.*) (Apr. 19, 2018), <https://www.uspto.gov/sites/default/files/documents/memo-berkheimer-20180419.PDF> [<https://perma.cc/9JPV-2AP8>].

276. *Id.* at 3.

section 102's novelty requirement and section 103's nonobvious requirement will be straightforward, with patentability turning on their ability to show how the CherryBot is different from the prior art in ways that would not have been obvious to a PHOSITA.

How they apply section 112 is going to be the heavy lifting. The cases reviewed earlier in this section make it clear that Lee and Kayden are not going to be able to get a patent on Edison as a black box, and they will not help their cause by simply scattering buzzwords like "artificial intelligence," "machine learning," and "transformers" throughout their application. Edison could do that. They must explain how Edison works. That does not mean that they cannot adopt some off-the-shelf natural language engines and models, but they must explain how their use of those models differs from what has gone before in nonobvious ways, and they must do it with enough definiteness that a PHOSITA could follow the instructions represented by their specification and build their own Edison.<sup>277</sup>

### C. *To Write Applications and to Prosecute*<sup>278</sup>

Patent search and drafting of patent applications are good uses for generative AI. The subject matter is well defined, and the publicly available database of patents and patent applications is enormous, facilitating good machine learning with large language models used by Chat GPT and its competitors.

Google Patents offers full text search of prior art from around the world from one source. It provides pdfs of complete documents, images, citations and translations.<sup>279</sup> Its database includes more than 120 million patent publications from more than 100 patent offices around the world. It also offers

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277. *See* Dyfan, LLC v. Target Corp., 28 F.4th 1360, 1369 (Fed. Cir. 2022) (rejecting means-plus-function treatment because limitations referring to off-the-shelf components would communicate sufficiently definite structure to POSITA); *see also* Uniloc USA, Inc. v. ADP, LLC, 772 F. App'x. 890, 897–98 (Fed. Cir. 2019) (explaining that the use of off-the-shelf components does not negate patentability if the way in which those components are used satisfies requirements of statute; claims recite more than abstract idea); E-Numerate Sols. v. United States, 170 Fed. Cl. 147, 191 (Fed. Cl. 2024) (holding that a patent was sufficiently definite because it claimed definite structure for using off-the-shelf components).

278. The results reported in this section are from the author's own experiences in using the various AI-enabled tools.

279. *About Google Patents: Overview*, GOOGLE HELP, <https://support.google.com/faqs/answer/6390996?hl=en> [<https://perma.cc/JU6C-JC3C>].

access to technical documents and books indexed in Google Scholar and Google Books.<sup>280</sup> It offers instructions on use.<sup>281</sup>

Its natural language models are as powerful and flexible as Google Internet search as Westlaw and Lexis. Google Patents is more complete than USPTO PatSearch, and easier to use, as well. It is free.<sup>282</sup> It is a mainstay of prior art searching for both patent practitioners and patent examiners.

A half-dozen vendors are deploying generative AI for patent prosecution: Dolcera's IP Author,<sup>283</sup> Rowan Patents,<sup>284</sup> Qatent,<sup>285</sup> DorothyAI,<sup>286</sup> davinci,<sup>287</sup> and XLScout.ai.<sup>288</sup> Of these, Rowan Patents and IP Author are the most useful. ChatGPT itself can play a useful role. Davinci requested that it be excluded from this review.

IP Author and Rowan Patents are ready for serious pilot projects in patent practices, and they have quite different strengths and weaknesses. IP Author's integration with prior-art search capability is a considerable advantage, and it generates useful first drafts of all the elements of a patent application. Rowan Patents is a productive partner throughout the process of writing a patent application and offers assistance with prior art search.

Neither product can understand an invention; no AI technology can do that. Both can, however, tag phrases as concepts, and thereby relate them to other parts of the application.<sup>289</sup> Nothing within the foreseeable future will

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280. *About Google Patents: Coverage*, GOOGLE HELP, [https://support.google.com/faqs/answer/7049585?hl=en&ref\\_topic=6390989&sjid=2274870518518533530-NA](https://support.google.com/faqs/answer/7049585?hl=en&ref_topic=6390989&sjid=2274870518518533530-NA) [<https://perma.cc/UN4J-J88K>].

281. *About Google Patents: Searching*, GOOGLE HELP, [https://support.google.com/faqs/answer/7049475?hl=en&ref\\_topic=6390989&sjid=2274870518518533530-NA](https://support.google.com/faqs/answer/7049475?hl=en&ref_topic=6390989&sjid=2274870518518533530-NA) [<https://perma.cc/DPN8-PN8H>].

282. Joseph Hadzima, *What is the Best Website for Patent Research?*, IPVISION: IPVISION BLOG, <https://info.ipvisioninc.com/blog/what-is-the-best-website-for-patent-research> [<https://perma.cc/9QFL-SKMX>].

283. *About Us*, IP AUTHOR, <https://ipauthor.com/about-us/> [<https://perma.cc/43ET-DVHR>].

284. *Patent Prosecution*, ROWAN PATS., <https://rowanpatents.com/prosecution/> [<https://perma.cc/V3VB-M9VN>].

285. *Features*, QATENT, <https://qatent.com/features> [<https://perma.cc/356T-TLRJ>].

286. *Products*, DOROTHYAI, <https://dorothyai.com/products/> [<https://perma.cc/9B67-JX24>] (designed to assist applicants with managing Information Disclosure Statements).

287. *See Reply to Office Actions Faster*, DEEPIP, <https://www.deepip.ai/products/patent-prosecution> [<https://perma.cc/CET3-VJFL>] (assisting with application preparation and office action responses).

288. Evenpreet Singh, *The Role of Prior Arts in Patent Prosecution*, XLSCOUT, <https://xlscout.ai/the-role-of-prior-arts-in-patent-prosecution> [<https://perma.cc/5S5L-K5MA>] (Jul. 18, 2024).

289. *See Rowan Patents*, ML4PATENTS.COM, <https://www.ml4patents.com/vendors/rowan-patents> [<https://perma.cc/6RE6-YV54>]; Manikandan B, *Best Practices for Drafting Non-Provisional Patent Applications More Effectively*, IPAUTHOR (Mar. 28, 2024), <https://ipaut>

allow a computer program to examine a model or watch a demonstration and describe what's inventive about it. So it always will be essential, as it is with all these products, for a user—inventor or patent lawyer—to provide some kind of starting point describing the invention—a brief disclosure, draft claims, or drawings.

IP Author can generate draft claims; indeed vanilla GPT4 can do that if supplied with a simple description. Rowan Patents is much more interactive than IP Author. IP Author is more of a black box. With any of the products, a skilled patent lawyer will have to pay close attention to claims language.

An ideal implementation would use IP Author to come up with an initial draft and then input that draft into Rowan Patents for managing drawings and the editing process.

Qatent is worth following, but it is not ready for any serious implementation. The publicly available version of ChatGPT does a good job of drafting “Field of the Invention” and “Background of the Invention” sections when given a relatively simple Abstract section as a prompt.

Both IP Author and Rowan Patents understand the structure of a patent application and organize pre-written material appropriately. IP Author concentrates on generating draft language through generative AI; Rowan Patents concentrates on managing terms and references according to MPEP standards. Provided with a brief description, IP Author drafted two independent claims and eighteen dependent claims in approximately 120 seconds. The user could edit the claims directly in a window to modify the invention, or to save the claims to draft a complete patent application. The software generated figures including a fairly detailed but primitive flowchart and a drafted a detailed description of the figures. The twenty-two page draft of the complete application could be downloaded in Microsoft Word.docx format.<sup>290</sup>

Working from the same brief description, IP Author displayed prior art search results. Each item of prior art had a graph rating similarity, along with brief paragraphs summarizing points of similarity and difference. IP Author prior art searches present search results in the form of a matrix, listing prior art references from the most similar to the least similar, and providing summary tables for each reference identifying the main similarities and main differences between the reference and the invention description used to prompt the search. The prior art identification and summary easily was downloadable in .docx format.

Dolcera's IP Author's work product was not perfect. It got the sequence of steps wrong in the flowchart. In another run, providing claims language

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hor.com/blog/draft-nonprovisional-patent-applications-effectively/ [https://perma.cc/PYL4-V8UW].

290. These results arise from the author's own use of the tools.

along with a brief description confused it, triggering an endless loop. It produced claims language that interspersed system claims with method claims, repeated limitations in the independent claims, and expressed dependent claims in terms of the wrong independent claim. At one point, it hallucinated and produced drawings and associated detailed descriptions for an entirely different invention in a completely different field. Restarting the software fixed the problem.

Rowan Patents accepts claims, drawings, or brief descriptions as starting points. A user can begin by importing a Word file, in which case the system parses it and inserts portions into the appropriate sections of the Rowan patent. AI is just one small component of the software suite, which has been in use by the patent bar for a number of years. The program concentrates on defined data objects, such as claim terms, definitions, part numbers, and figure references. Once terms have been tagged, the system flags every instance of each term and provides a red warning for each term in the claims that does not also appear in the specification and in a drawing.

A user can enter text into defined windows, create drawings with provided tools, or import an existing .docx file by opening the entire file or by dragging and dropping components of it into the appropriate windows. A user can download a published patent or patent application, convert it to a .docx or to an .rp file, and cut and paste portions, editing them into a Rowan application.

One then can define new terms and parts by highlighting them and thereafter edit them. Edits propagate throughout the file. One can import an image, such as a drawing created by a commercial artist and apply numbers to it. One can import particular .pdf pages from a patent publication, crop them, and cover up existing elements such as numbers with new ones.

Rowan has a complete suite of drawing tools, including flow chart tools. It allows auto numbering using defined terms with point and click. It can auto generate flow charts and other figures. Using these tools, a user can generate a set of drawings more than adequate for initial submission to the Patent Office.

Initial implementation includes the ability to designate specific text in the draft patent application and then select from options of pre-built prompts for actions on that selected text. For example, selecting specific terminology provides options to define or describe that term. Selecting an entire paragraph (e.g., a claim) provides options to summarize that content. An optional bioscience module can keep track of DNA sequences.<sup>291</sup>

The product has limited prior art search features through its “launch analytics” feature. This feature breaks a completed patent application into

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291. See Dave Billmaier, *Rowan Patents Release Notes*, ROWAN PATS. (Aug. 15, 2024), <https://intercom.help/rowanpatents/en/articles/4454732-rowan-patents-release-notes> [https://perma.cc/TAH9-3ENS].

pieces and sends the pieces back to Rowan servers. Then the product gives the user an option whether the user wants to see search results and flags items of prior art that might present 102, 101, 103, or 112 difficulties. It does not, unlike IP Author, summarize similarities and differences. Rowan does not keep copies of an application submitted for its analytics module.

Rowant Patents is harder to use than IP Author because navigating around the different Rowan modules is not intuitive and the choices in each module are confusing. Two very detailed instruction manuals are available, however, which help when a new user gets stuck. As with any full-featured software product, use would become intuitive after a few hours' experience.

Qatent generated reference list of thirty-one nouns and gerunds from submitted description and claims. The figures it generated were garbled and the flow chart was generic. The brief description of drawings was generic with things like "Figure 4 shows Block Chart 2." The claims were repeated almost verbatim in the specification's detailed description. Grammar and style were atrocious, with meaningless terms like *triplication*, *performant*, *conductive*, *operative*, and *performative* scattered throughout the description.

DorothyAI is only a search engine, with no drafting capability advertised. It is advertised as "directly compar[ing] the text of any document, such as inventions disclosures, patent claims, abstracts, product data sheets."<sup>292</sup>

IP Author and Rowan Patents take secrecy and security seriously. Neither puts user provided information or software generated drafts into the Cloud, and every external exchange is encrypted.

Both the Dolcera and the Rowan products are ready for deployment as production elements in patent prosecution workflow—Dolcera's IP Author at the threshold of a new application, Rowan Patents as a wingman throughout the application drafting process.

Generative AI technology is still trying to find a productive place in the legal world. Identifying useful work cases requires experienced practitioners to work with the technology developers and vendors to refine application concepts and product features.

The second USPTO policy statement addressed how AI technology can be used to assist inventors and their lawyers in writing and prosecuting patent applications.<sup>293</sup>

It began by noting the longstanding and ubiquitous use of computer tools in document drafting, including word processing software with spellcheck and grammar check.<sup>294</sup> More recently, the notice observes, word processing and

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292. *DorothyAI*: "About," LINKEDIN, <https://www.linkedin.com/company/dorothyai/about/> [<https://perma.cc/XK24-RAXR>].

293. Guidance on Use of Artificial Intelligence-Based Tools in Practice Before the United States Patent and Trademark Office, 89 Fed. Reg. 25609, 25610 (Apr. 11, 2024).

294. *Id.* at 25614.

other office-productivity software has adopted generative AI features that can develop a written document with much less human involvement.

For example, recent tools directed to the IP industry include the ability to draft technical specifications, generate responses to Office actions, write and respond to briefs, and even draft patent claims. The capabilities of these tools continue to grow, and there is no prohibition against using these computer tools in drafting documents for submission to the USPTO. Nor is there a general obligation to disclose.<sup>295</sup>

It then proceeded to identify a number of risks that practitioners must guard against when using intelligent computer tools. Practitioners must “take extra care” to verify the technical accuracy of specifications and drawings drafted by using AI tools and their compliance with the description and enablement requirements of section 112.<sup>296</sup>

Practitioners must ensure that readers can differentiate prophetic examples created or drafted by AI tools from actual working examples.<sup>297</sup> Practitioners are not relieved from ensuring that AI-written summaries of evidence, affidavits, petitions, and responses to Office actions, are accurate, both technically and legally. Such documents must “not introduce inaccurate statements and evidence into the record . . . .”<sup>298</sup> “[T]he signature requirement and corresponding certifications ensure that documents drafted with the assistance of AI systems have been reviewed by a person and that person believes everything in the document is true and not submitted for an improper purpose.”<sup>299</sup>

AI-conducted prior art searches must not “burden the Office with large numbers of cumulative and irrelevant submissions.”<sup>300</sup> Natural persons must sign Information Disclosure Statements (“IDS”s) certifying that they have “performed a reasonable inquiry—including not just reviewing the IDS form but reviewing each piece of prior art listed on the form—and determined the paper is compliant with 37 CFR 11.18(b).”<sup>301</sup> After review, irrelevant and marginally pertinent cumulative information must be removed.<sup>302</sup>

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295. *Id.*

296. 35 U.S.C. § 112; Guidance on Use of Artificial Intelligence-Based Tools in Practice Before the United States Patent and Trademark Office, 89 Fed. Reg. at 25615.

297. Guidance on Use of Artificial Intelligence-Based Tools in Practice Before the United States Patent and Trademark Office, 89 Fed. Reg. at 25615.

298. *Id.*

299. *Id.* at 25612.

300. *See id.* at 25615–16.

301. *Id.* at 25616.

302. *Id.* (imposing these requirements to avoid violating 37 C.F.R. § 11.18 (2021)).

It notes confidentiality risks arising from use of AI systems. “Use of AI systems to perform prior art searches, application drafting, etc. may result in the inadvertent disclosure of client-sensitive or confidential information to third parties through the owners of these systems, causing harms to the client.”<sup>303</sup> When AI systems perform prior art searches or generate drafts of specification, claims, or responses to Office actions, they may retain the information on aspects of an invention. This information may be used to train AI models further or the data may be released to “third parties in breach of practitioners’ confidentiality obligations to their clients.”<sup>304</sup>

If Kayden submits the application for the CherryBot just as it was drafted by Edison, he will violate his duties to review the application and determine that it is factually correct and advances meritorious arguments. Hopefully he already knows that, but USPTO’s April 2024 guidance can serve as a reminder. Lee, if he signs an oath and declaration in support of the Edison-drafted application, will violate his duty as well. Lee risks having the patent subsequently found to be invalid because of his inequitable conduct in signing a false oath or declaration.<sup>305</sup> Kayden not only risks that; he risks disciplinary penalties under Patent Office rules of practice.<sup>306</sup>

Neither Kayden nor Lee has a duty to conduct a search for prior art.<sup>307</sup> But if they do, they must disclose anything they find that may be material to patentability.<sup>308</sup> An Information Disclosure Statement is the Patent Office’s preferred way to make that disclosure.<sup>309</sup>

They will do a search because they do not want to waste time and money on an application for an invention that is anticipated or obvious. They can get most of what they need through a combination of USPTO’s free Patent Public Search facility,<sup>310</sup> supplemented by a Google Patents<sup>311</sup> search. Google

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303. *Id.* at 25612.

304. *Id.* at 25617.

305. *See id.* at 25611 (discussing duties of candor and good faith under 37 C.F.R. § 1.56, which are applicable to everyone associated with filing and prosecution); 37 C.F.R. § 11.303 (2013) (outlining candor to the tribunal requirements applicable to practitioners); 37 C.F.R. § 11.18(b) (2021) (outlining the duty of reasonable inquiry imposed on practitioners).

306. *See* § 11.18(b) (signing imposes a duty of reasonable inquiry, including that the legal contentions are warranted by law, the allegations and other factual contentions have evidentiary support, and the denials of the factual contentions are warranted on the evidence); *see also* 37 C.F.R. § 11.19(b)(1)(iv) (2023) (identifying violation of any USPTO Rule of Professional Conduct as grounds for discipline).

307. *See* 37 C.F.R. § 1.97(g) (2015) (there is no requirement that an applicant for a patent make a patentability search).

308. *See* 37 C.F.R. § 1.56(a) (2012).

309. *See* § 1.97.

310. *Patent Public Search*, U.S. PAT. & TRADEMARK OFF., <https://ppubs.uspto.gov/pubw ebapp/static/pages/landing.html?MURL=PatentPublicSearch> [https://perma.cc/EG72-FJVX] (utilizing the basic or advanced search functions to conduct searches for prior art).

311. *GOOGLE PATS.*, *supra* note 117.



Patents has the advantage of including more material—foreign material, nonpatent publications—as well as providing instant translation of almost everything.<sup>312</sup>

If Kayden has access to Dolcera’s IP Author—surely Milligan, Anderson does—he and Lee will use its search engine<sup>313</sup> as well because of the good assessment of similarities and differences between the CherryBot and each prior art reference revealed by the search.

#### D. To Aid Examiners

One former examiner and present patent agent described the tools available to examiners in 2020:<sup>314</sup>

The main patent search tool (EAST) is keyword-based and requires the Examiner to create a keyword description of the invention to search. Google Patents<sup>315</sup> and Google Scholar are included in many examiners’ favorite search tool set, especially for non-patent literature (NPL). The other artificial intelligence (AI) based search tools (e.g., ip.com) I used at the USPTO did not provide meaningful results when pasting in an entire claim the majority of time (maybe ~5% of time was accurate) but when they were right, they were very accurate. When I narrowed the search down to a handcrafted search string, I saw significant improvement in the AI based search tools.<sup>316</sup>

In February 2024, the Patent Office announced a five-year, \$70 million, sole-source contract with Accenture to modernize internal patent office search tools.<sup>317</sup> The project emphasizes the use of AI and machine learning

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312. *What is Google Patents Search Guide*, GHB INTELLECT, [https://ghbintellect.com/what-is-google-patents-search-guide/?gad\\_source=1&gclid=CjwKCAjw9eO3BhBNEiwAoc0-jdncWPHUAeyRAX8G4JRdm3VYGHWM6ULi33MZd6BHp0jWkUsUsBRZaBoC8tsQAvD\\_BwE](https://ghbintellect.com/what-is-google-patents-search-guide/?gad_source=1&gclid=CjwKCAjw9eO3BhBNEiwAoc0-jdncWPHUAeyRAX8G4JRdm3VYGHWM6ULi33MZd6BHp0jWkUsUsBRZaBoC8tsQAvD_BwE) [https://perma.cc/2BYG-PB6R].

313. See Manikandan B, *How Does AI Improve Prior Art Search*, IPAUTHOR (Apr. 24, 2024), <https://ipauthor.com/blog/how-ai-improves-prior-art-searches/> [https://perma.cc/46K7-GJMV].

314. See Brian Downing, *From Agent to Examiner and Back Again: Practical Lessons Learned from Inside the USPTO*, IPWATCHDOG (Jan. 16, 2021, 12:15 PM), <https://ipwatchdog.com/2021/01/16/agent-examiner-back-practical-lessons-learned-inside-uspto/id=128986/> [https://perma.cc/46K7-GJMV] (covering a patent agent and former USPTO examiner sharing his unique experience interpreting claim applications and prior art analysis).

315. See *supra* Part III.C (describing Google Patents).

316. Downing, *supra* note 314.

317. Carolina Nihill, *U.S. Patent and Trademark Office Announces \$70 Million Contract for AI Patent Search Tool*, FEDSCOOP (Feb. 15, 2024), <https://fedscoop.com/u-s-patent-and-trademark-office-announces-70-million-contract-for-ai-patent-search-tool/> [https://perma.cc/XQ46-3Q47].

technologies “to expand, rank, and sort the results of existing patent search systems so the prior art that might otherwise not have been present in or near the top of a list of search results would not be readily available to examiners.”<sup>318</sup>

Nothing in the announcement or in the request for proposals or information statements that preceded the announcement suggests that the office is deploying AI beyond the search function. Nevertheless, the capabilities of existing private sector search tools like IP Author show that search results can provide a considerable measure of analysis of similarity and differences between a patent application and a prior art reference, providing a significant starting point for novelty and obviousness analysis.<sup>319</sup>

As it does so it should disclose the resulting algorithms so they can be tested against long-decided interpretations of statutory requirements.

If the Office does not take the initiative to do this unilaterally, it should be subject to orders to make the disclosures under the Freedom of Information Act.

The procurement followed a Request for Information and Notice of Vendor Engagement published in August 2023, which provided details in a series of attachments.<sup>320</sup> The heart of the new system is a “More Like This Document” (“MLTD”) function which can take the full text of a patent application and identify other published U.S. patent documents, unpublished U.S. applications, and foreign patents from sixty-four countries.<sup>321</sup> MLTD “uses machine learning models and pre-computed measures of similarity.”<sup>322</sup> SimSearch sorts documents by degree of similarity. Users can “emphasize text or Cooperative Patent Classification (CPC) symbols within the patent application to tune the results from the model.”<sup>323</sup>

SimSearch includes the capability to suggest synonyms for an examiner to consider adding into a query. An examiner can select a single term, phrase, group of terms and phrases and receive

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318. Alder, *supra* note 185.

319. *See supra* Part III.C (describing IP Author capabilities).

320. *See* U.S. Pat. & Trademark Off., *Patent-End-to-End Search Artificial Intelligence Capability, RFI-PTAG*, HIGHERGOV (Aug. 25, 2023, 10:31 AM EDT), <https://www.uspto.gov/sites/default/files/documents/ai-sim-search.pdf> [<https://perma.cc/9VNB-F9UA>] (listing attachments including the RFI Response Template, PSAI Draft, Question and Answer Sheet, Current Process Flow & High-Level Architecture, and PSAI Overview).

321. U.S. Pat. & Trademark Off., *RFI Attachment 5 - PSAI Overview*, HIGHERGOV, 2–3 (Aug. 25, 2023, 10:31 AM), <https://www.highergov.com/document/rfi-attachment-5-psai-overview-pdf-fa3fc7/> [<https://perma.cc/Q5BH-RYNJ>].

322. U.S. Pat. & Trademark Off., *RFI Attachment 2 – PSAI Draft SOO Final Draft*, HIGHERGOV, 4 (Aug. 25, 2023, 10:31 AM), <https://www.highergov.com/document/rfi-attachment-2-psai-draft-soo-final-draft-pdf-b72f54/#preview> [<https://perma.cc/C4HC-DCD6>].

323. *Id.*

contextualized groups of technical and general synonyms most similar to the examiner's selection. The suggested synonyms are ranked by similarity to the examiner selection. Additionally, in order to make the results explainable, each of the returned synonyms shall include the specific word or phrase from within the examiner's selection that identifies the strongest related synonym.

SimSearch includes the capability to suggest CPC symbols for an examiner to consider adding into a query. An examiner can select a single symbol, group of symbols, term, phrase, group of terms and phrases and receive CPC symbols most similar to the examiner's selection. The suggested CPC symbols are ranked by similarity to the examiner selection. Additionally, in order to make the results explainable, each of the returned CPC symbols shall include the symbol, word, or phrase from within the examiner's selection that identifies the strongest related CPC symbol.<sup>324</sup>

The Request identifies future enhancements, which could include capabilities that:

Leverage the Boolean queries based on keywords, patent classifications, and proximity operators as an "anchor" to retrieve and rank documents through AI models.

Direct image-to-image search by using examiner selected images from US or foreign patent documents or US patent applications as an "anchor" image to retrieve and rank documents through AI models.

Direct text-to-image search by using examiner Boolean queries or free text as an "anchor" to retrieve and rank documents through AI models.

Conduct chemical-based search by using chemical structures/formulas or chemical names as an "anchor" to retrieve and rank chemical structure, formula and chemical names and their corresponding documents through AI models.

Provide visualizations and indicators that provide users deeper insights into AI model reasoning, show users document similarity clusters and potential fields of search, and provides users with

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324. *Id.* at 8.

feedback about query effectiveness in yielding cited prior art references and documents tagged or dwelled upon.

Use free text and plain language (such as a description by the examiner of an invention or a technical concept) as a query mechanism for retrieval of documents in patent search.

Provide examiner access to an expansive Non-Patent Literature (NPL) corpus. In addition to the AI models that support a corpus of patent documents identified above, the USPTO seeks solutions with the ability for the AI models to support the incorporation of broad NPL sources. Solutions that can use examiner Boolean based queries, US or foreign patent documents, and/or US patent applications to crawl broad NPL libraries and publication sources, including behind paywalls, on the internet and return NPL citations or digital object identifiers in combination with snippets of publicly available content (such as abstracts or portions of documents freely accessible) for examiner review are preferred so that the examiner can leverage the Search tool to execute the search and USPTO paid subscriptions, document purchases, and/or databases of non-patent literature to obtain access to full copies. The ability for these NPL returns to be effectively scored by similarity in a manner that can be interleaved together with similarity rankings of patent documents are preferred.<sup>325</sup>

Experience with commercial prior art search products and USPTO's request for similarity ranking shows that noise is an important factor limiting aggressive use of search engines. Being buried in prior art references is worse than having an incomplete set. With an incomplete set, one can begin section 102 and section 103 analysis. With a haystack of search results, one may not have time to find the needle.

The USPTO RFI does not suggest that the Office aspires to use machine learning to conduct anticipation or obvious analysis.<sup>326</sup> Anticipation analysis should be within reach because it involves little more than matching elements one-for-one.<sup>327</sup> A mechanical approach to first step in obviousness analysis—

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325. *Id.* at 13–14.

326. *See id.* at 2.

327. *See* MPEP, *supra* note 34, §§ 2131, 2131.01 (“To reject a claim as anticipated by a reference, the disclosure must teach every element required by the claim under its broadest reasonable interpretation . . . . Normally only one reference should be used in making a section 102 rejection.”).

identifying references with some of the elements in the application<sup>328</sup>—is feasible now, but USPTO understands that a more nuanced, subjective, and holistic standard is required to assess motivation and expectation of success.<sup>329</sup> Such analysis is not within the current AI state of the art.

The patent bar can expect, indeed it should hope, that USPTO will continue to embrace new technologies for managing its enormous information load. As it does so, it should continue its policy of transparency on the tools it uses and the criteria those tools apply.<sup>330</sup> It is not unreasonable to suppose that the Office will use machine learning to develop algorithms to apply anticipation concepts under section 102's novelty requirement, to apply the touchstones of obviousness under section 103's nonobviousness requirement, and the test for adequate disclosure and enablement under section 112.

In mid-2024 USPTO solicited input on the impact of generative AI on prior art under the patent statutes. The Office published a request for information on April 30, 2024,<sup>331</sup> and held a public listening session on July 19, 2024.<sup>332</sup> The office posed a number of questions. The questions are surely relevant to the impact of generative AI on patent prosecution, but their expression and tone suggests an unwarranted defensiveness and reserve about a technology that has the potential greatly to improve patent office function. Responsive comments point out the advantages that new AI technology offer for patent prosecution and examination.<sup>333</sup>

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328. See § 2143.02 (“A rationale to support a conclusion that a claim would have been obvious is that all the claimed elements were known in the prior art and one skilled in the art could have combined the elements as claimed by known methods with no change in their respective functions, and the combination would have yielded nothing more than predictable results to one of ordinary skill in the art.”).

329. See § 2141 (interpreting KSR as embracing a holistic test, “[t]he combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results”).

330. See generally e.g., U.S. PAT. & TRADEMARK OFF., MANUAL OF PATENT EXAMINING PROCEDURE (9th ed. July 2022), <https://www.uspto.gov/web/offices/pac/mpep/index.html> [<https://perma.cc/N7F2-8BC5>] (providing a good example of detailed transparency in this regard).

331. USPTO, *Impact of the Proliferation of AI on Prior Art and PHOSITA*, 89 Fed. Reg. 34217 (Apr. 30, 2024).

332. USPTO, *Impact of the Proliferation of AI on Prior Art and PHOSITA: Public Listening Session*, 89 Fed. Reg. 55588 (July 5, 2024) (announcing public listening session July 19, 2024).

333. See Henry H. Perritt, Jr., *Willful Ignorance or Embracing AI to Find Prior Art? USPTO Misses the Mark*, SMU SCI & TECH. L. REV. (2024) (reviewing USPTO request for comments and comments on concerns that AI will proliferate prior art).

*E. To Aid Pro Se Applicants*

Representation by a patent lawyer in patent prosecution is expensive. Some lawyers advertise bargain rates, but it is reasonable to expect that prosecuting a relatively routine application will cost upwards of \$15,000, and if additional effort is required to overcome Patent Office resistance, the cost easily can climb towards \$100,000.<sup>334</sup> Many inventors do not have the resources to pay those kinds of fees and therefore prosecute their patent applications pro se. They do not necessarily do an inferior job of it. Many of them have engineering or science credentials as strong as those required of patent agents, who are not required to be lawyers, but lack the same level of detailed knowledge about Patent Office procedures. Registered patent agents have passed the patent bar exam.<sup>335</sup> The typical inventor has not.<sup>336</sup> But now, AI software available at prices readily affordable by small inventors has much of the necessary knowledge about Patent Office procedure built in.

One study shows that pro-se applications were abandoned at a 76% rate compared with 35% of represented applications, because of pro-se applicants' failure to understand USPTO requirements, because of unjustified early surrender, and because desired claims do not meet patent requirements and cost.<sup>337</sup> The data manipulations necessary to identify pro se applicants in the study suggest that USPTO does not identify applications filed pro se.<sup>338</sup> So time series data on pro-se applications necessary to know trends is not available.

It's likely that the availability of patent prosecution software like that described in Part III.C will lead to an upsurge in pro se applications. At the margin, this may lead to a decline in business for its patent lawyers, although to some extent it will simply result in applications being filed that never would have come to a lawyer.

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334. See *How Much Does a Patent Cost*, LEAVITT & ELDREDGE L. FIRM, <https://uslawpros.com/how-much-does-a-patent-cost/> [<https://perma.cc/XUY8-UHCP>] (estimating overall cost as ranging from \$5,000 to \$100,000; \$5,000 to \$14,000 for non-provisional utility application).

335. See 37 C.F.R. § 11.7(b)(1)(ii) (2023).

336. See Jeff Williams, *Differences Between Patent Engineers, Patent Agents, and Patent Attorneys*, L. OFF. OF JEFF WILLIAMS PLLC, <https://www.txpatentattorney.com/blog/differences-between-patent-engineers-patent-agents-and-patent-attorneys/> [<https://perma.cc/N76L-HF7C>].

337. Kate S. Gaudry, *The Lone Inventor: Low Success Rates and Common Errors Associated with Pro-Se Patent Applications*, PLOS ONE, Mar. 21, 2012, at 3, 8–9.

338. See *id.* at 2 (explaining the methodology for identifying pro-se applicants by requesting applications with no attorney-docket number from the USPTO and individually verifying each file as being pro-se applications through the PAIR system).

This possibility intensifies the challenge to law firms, which have been rethinking the viability of hourly billing for decades.<sup>339</sup> Law firms can respond by understanding their cost structures better so they can offer flat fee arrangements more frequently,<sup>340</sup> by using at least the same tools that are available to pro se applicants, using them more efficiently because they collectively understand better than the ordinary inventor how the new tools fit with Patent Office procedure, and, of course, because they have additional skills rooted in their knowledge of the law.

#### F. To Support Infringement Litigation

Generative AI will not result in particularly dramatic changes in the ways that trial lawyers use computer processing in patent infringement lawsuits. They already use sophisticated search tools to search the Patent Office database, Google patents, Google itself, and other search engines to detect instances of possible infringement.<sup>341</sup> They already use electronic discovery tools to process large quantities of emails and other documents in electronic form made available in civil discovery.<sup>342</sup> The advances in generative AI will improve both these types of tools but not result in any transformation of how they work or how they are used; artificial intelligence has been a core part of these tools for ten or fifteen years. Indeed, natural language processing was one of the original features that drew lawyers to Lexis and Westlaw in the

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339. See *Billing Best Practices: Is it Time for Hourly Billing to Die*, APPARA (Nov. 3, 2021), <https://appara.ai/news-and-insights/billing-best-practices-is-it-time-for-hourly-billing-to-die> [<https://perma.cc/KG29-S32G>].

340. For example, firms should do time-and-motion studies focused on personnel involved in patent prosecution, breaking down the type of labor and the hours spent on each subtask. Only then are they in a position to make rational decisions about automation, including the use of AI.

341. See, e.g., John Wiora, *Understanding Patent Infringement: A Guide for Lawyers and Law Firms*, ktMINE (May 25, 2023), <https://www.ktmine.com/patent-infringement/> [<https://perma.cc/3KSJ-DJPB>] (discussing ktMINE, a sophisticated search tool used by many patent attorneys that searches patent application databases and other sources to identify possibilities of infringement); *Patent Analytics Software for IP Law Firms*, ANAQUA ACCLAIM IP, <https://www.acclaimip.com/law-firms/> [<https://perma.cc/G9A3-RBHK>] (discussing AcclaimIP, a search tool used by patent attorneys that offers analytics, alerts, and visualizations to help IP law firms identify potential infringement).

342. Julie Clements, *How Do eDiscovery Services Handle Large Volumes of Electronic Data in Litigation Cases?*, MANAGED OUTSOURCE SOLS. (Apr. 8, 2024), <https://www.managedoutsources.com/blog/ediscovery-services-handle-large-volumes-electronic-data-litigation-cases/> [<https://perma.cc/7BCN-MT4Q>].

early 1990s,<sup>343</sup> and it likewise was an original feature of Google and other Internet search engines in 1999.<sup>344</sup>

#### IV. DOES IT MATTER?

Based on the analysis in the preceding sections, Kayden will advise Lee that Edison will have difficulty getting named as an inventor, but that, under USPTO's 2024 statement on inventorship, Lee should qualify as an inventor of the CherryBot, based on his prompts to Edison. He will tell Lee that they may be able to obtain a patent on Edison, if they claim the details about how Edison works and uses generative AI technology in the particular context of agricultural robotics. He will explain that both of them have legal obligations to review Edison's draft patent application carefully and to revise it to comport with USPTO requirements for applications and to express what Lee believes is different from the prior art.

They will amuse themselves by speculating about the possibility of a robotic patent system, in which human inventors and their lawyers struggle to get human attention.

Beyond their (hypothetical) situation, the new generative AI technologies will produce two phenomena: a more robotic prosecution system and more pro-se applications and prosecutions. Observers who are concerned about these developments must marshal evidence and arguments about why they matter in a patent system that is falling so far short of meeting the needs of inventors that most of them prefer to rely on trade secrets or nimble entrepreneurship rather than patents.

Generative AI will intensify the trend for patent prosecution to involve the interaction of robots rather than of patent examiners and patent lawyers exercising discretion as to their positions and the expression and defense of them. Patent Center screening algorithms already check for format compliance and inclusion of all parts of an application. A relatively modest modification in the software would permit the same or similar software to assist in the examination process by performing an "every noun" check to

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343. See *LexisNexis Launches Lexis Answers, Infusing New Artificial Intelligence Capabilities into the Company's Flagship Legal Research Platform*, *Lexis Advance*, LEXISNEXIS (June 26, 2017), [https://www.lexisnexis.com/community/pressroom/b/news/posts/lexisnexis-launches-lexis-answers-infusing-new-artificial-intelligence-capabilities-into-the-company-s-flagship-legal-research-platform-lexis-advance?srltid=AfmBOopz2vKXD4-no\\_PATrQPQIHynd8MGzVM2sLRpGEijJQPmt4YggJF](https://www.lexisnexis.com/community/pressroom/b/news/posts/lexisnexis-launches-lexis-answers-infusing-new-artificial-intelligence-capabilities-into-the-company-s-flagship-legal-research-platform-lexis-advance?srltid=AfmBOopz2vKXD4-no_PATrQPQIHynd8MGzVM2sLRpGEijJQPmt4YggJF) [https://perma.cc/S27P-CCMA]; *Ready or Not: Artificial Intelligence and Corporate Legal Departments*, THOMSON REUTERS, <https://legal.thomsonreuters.com/en/insights/articles/artificial-intelligence-ai-report> [https://perma.cc/X66D-5L2M].

344. Kurt Cagle, *What is Natural Language Search?*, COVEO SOLS. (Oct. 26, 2023), <https://www.coveo.com/blog/what-is-natural-language-search/> [https://perma.cc/PKP3-S468].



ensure antecedent bases for all of the material elements in claims, as Rowan Patent does. Similarly, it is not difficult to catalog every limitation in the set of claims, as Rohan Patent does, for its compliance checking, and use the terms in that catalog as search terms in prior art searches aimed at identifying the main candidates for anticipation under section 102 novelty analysis.

Automating the obviousness analysis is harder. The author's experiments with ChatGPT did not produce useful results. The robot just reiterated the legal requirements for nonobviousness without providing any concrete guidance as to whether a sample invention description was or was not obvious, as the following result shows:

Regarding your question about whether the described autonomous herding system is obvious under Section 103 of the United States patent law, this requires a legal analysis that involves the consideration of the state of prior art at the time the invention was made, whether there are any prior art references that are pertinent to the claims of the invention, and whether the differences between the prior art and the claims would have been obvious to a person having ordinary skill in the art (PHOSITA).

The autonomous herding system you described integrates advanced navigation, propulsion, sensory technology, optical-LiDAR sensors, global navigation satellite systems, and machine learning. This suggests a complex interplay of technologies tailored for a specific application—managing and retrieving stray animals—which could be argued to be non-obvious if each of these integrations provides a novel and unexpected benefit. The non-obviousness argument can be strengthened if this combination achieves more than the sum of its parts or solves a problem that prior systems could not solve.

In practice, a patent examiner would review relevant prior art, including existing patents, patent applications, and other published materials, to determine if the invention is non-obvious. He would consider whether the claimed invention is a predictable use of prior art technologies, or whether it reflects an inventive step that would not be obvious.

A patent attorney or agent would be better positioned to conduct this analysis and provide a legal opinion on the matter, as this would require a detailed investigation of the current state of technology, patent databases, and

potential analogous fields. If you're considering patenting this system, consulting with a patent professional would be a necessary step.<sup>345</sup>

Automating the section 112 analysis is even more challenging, but further experimentation with appropriate generative AI engines would be useful in quantifying the probabilities that this can be useful.

As generative AI technology improves, the resources available to the patent system will increasingly be diverted to computer resources and away from human resources. The result will be a system in which applicants and their lawyers interact with computers and have trouble obtaining real involvement by a human being with any kind of discretion to deal with exceptional cases. Some patent examiners already frustrate applicants in this way by pumping out standard forms and not seeming to pay any attention to applicant arguments.

This problem is already familiar to anyone who engages in e-commerce and interacts with call centers. Vendors make it increasingly difficult to escape customer support corrals on websites and get to human beings. When a human being is available, he or she all too often is completely straitjacketed by what he or she sees on a computer screen.

The second phenomenon likely to result from the spread of generative AI technology in the patent system is that the technology will reduce transaction costs significantly, and that will result in more patent applications and may result in a higher proportion of applications being turned into patents. Even if the acceptance rate does not increase, the number of patents is linearly related to the number of applications.

Part of this will be an upsurge in pro se patent applications, which are also being encouraged by well-funded patent office initiatives to educate and assist pro se applicants. These initiatives are mandated statutorily in the interest of increasing racial, gender, ethnic, and wealth diversity in the patent system.

Regardless of how interesting these phenomena are, a serious student of law and public policy should ask "Who cares?" Most patents never are commercialized; let alone do they become subjects of infringement controversy. Many more pro-se applicants are abandoned than represented applications.<sup>346</sup> A significant increase in the number of patents will almost inevitably result not only in a greater number but also a greater proportion of patents that don't make any real difference to commercial reality. This result would not necessarily be harmful, except that it will trivialize patent law and the significance of owning a patent. Trivialization generally is not a good thing for the legitimacy of law.

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345. Assisted by ChatGPT, OpenAI, author interacted on Apr. 28, 2024 (prompt: "Is this invention obvious under section 103?" followed by a 106-word description of a patent application currently pending before USPTO).

346. See *supra* note 337 and accompanying text.

Fifty years, or so, ago Quaker Oats, as a marketing ploy, purported to give fee simple interests in one square inch parcels of land in Alaska.<sup>347</sup> It is not clear how legally effective these promises were, but some commentators have thought about its impact on Alaska, on the owners (which include the author, he thinks), and on property law, and have concluded that the overall effect was insignificant.<sup>348</sup> The data is clear: most patents are never commercialized.<sup>349</sup>

Moreover, “[m]any valuable inventions that are commercialized are not patented. Companies choose a variety of strategies to protect their inventions and intellectual property. For example, U.S. companies rate trade secrets higher than patents in their importance for protecting intellectual property[.]”<sup>350</sup>

[P]atent protection may be sought for reasons other than intended commercialization. Privately owned patents may be obtained to block rivals and negotiate with competitors, to use in lawsuits, or to build “thickets” of patents to impede or raise others’ costs of R&D and innovation . . . . New and emerging firms may seek patent protection to help obtain financing because investors perceive patents as potentially valuable for a firm’s assets and future profitability.<sup>351</sup>

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347. Michael A. Heller, *The Tragedy of the Anticommons: Property in the Transition from Marx to Markets*, 111 HARV. L. REV. 621, 682–84 (1998) (describing the “Quaker Oats Big Inch Land Giveaway” resulting in twenty-one million deeds, which escheated to the Canadian government for failure to register the deeds and to pay taxes).

348. See, e.g., Les McLaughlin, *The Big Inch Company*, YUKON NUGGETS, <https://yukonnuggets.com/stories/the-big-inch-company> [<https://perma.cc/A7CA-Q7JW>] (“Alas, none of the land was ever developed. Years later, Quaker Oats let the land lapse for back taxes. It was listed for sale for 37 dollars in back taxes. I don’t know if anyone picked up the option. Maybe Erik Nielsen knows. You see, he was the lawyer retained by Quaker Oats to buy the land for the Klondike Big Inch Company. If you happen to have a deed to the land, it’s worth about \$45 to a collector.”).

349. NAT’L SCI. FOUND., INVENTION: UNITED STATES AND COMPARATIVE GLOBAL TRENDS (2018), <https://nces.nsf.gov/pubs/nsb20204/invention-u-s-and-comparative-global-trends> [<https://perma.cc/Y7BC-BA7N>] (“Most patented inventions are never commercialized . . .”).

350. *Id.* (showing in figure 8-1 about 12% of high R&D companies rated trade secrets as important, while only 5% rated utility patents as important).

351. *Id.* See also generally Gerson S. Panitch, *The One Secret Everyone Needs to Know About Patents*, FINNEGAN (June 24, 2020), <https://www.finnegan.com/en/insights/articles/the-one-secret-everyone-needs-to-know-about-patents.html> [<https://perma.cc/56KV-TLXV>] (reporting that 95% of patents are worthless; arguing in favor of “strong,” “conceptual” patents as defenses against competitors); Henry H. Perritt, Jr., *Drowning in the Patent Pool: Is Statutory Invention Registration a Lifeguard*, 127 W. VA. L. REV. \_\_\_\_ (forthcoming 2025) (discussing that patent thickets make it impossible to create and market innovative products without infringing hundreds of patents, and how SIR could solve the problem).

More than half of issued patents are allowed to lapse before running their full twenty-year term.<sup>352</sup> In 2020, 62% of patent applications were abandoned.<sup>353</sup>

Not only may the impact of generative AI be uninteresting, though significant on the system, a number of barriers exist to wider utilization of generative AI, even in the patent arena, where its strengths seem particularly well matched to the needs. One constraint is the huge cost of the semiconductor chips necessary to do machine learning and operate large-language and other generative AI models.<sup>354</sup> The proponents of the technology have creatively and quite successfully sought to draw people into using their products, but they have done so with a considerable subsidy by making it free or almost free to everyone. At some point, they will have to increase prices in order to cover their costs and provide a return on investment. The price elasticity of demand for generative AI is yet to be tested.

A second barrier is the enormous amounts of electricity required to operate computers engaged in machine learning and employing the results.<sup>355</sup> Already, NIMBY<sup>356</sup> activists are using energy consumption as a basis for opposing large data centers, which are being expanded in anticipation of a continued generative AI boom.<sup>357</sup>

The final constraint is the likelihood that the open range represented by Google and its search engine competitors will be fenced off, eradicating the business model that enables the machine learning for ChatGPT, in much the

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352. See Dennis Crouch, *Maintenance Fees 2015*, PATENTLY-O (July 21, 2015), <https://patentlyo.com/patent/2015/07/maintenance-fees-2015.html> [https://perma.cc/3VS6-ZJ8D] (showing the percentage of patents paying first, second, and third maintenance fees in a table).

353. Michael Gzybowski, *It's Not Just COVID: Understanding the Drop in U.S. Patent Application Filings*, IPWATCHDOG (Feb. 9, 2022, 7:15 AM), <https://ipwatchdog.com/2022/02/09/its-not-just-covid-understanding-the-drop-in-u-s-patent-application-filings/id=145491> [https://perma.cc/YQ5L-WY92].

354. See *Can Wafer Shortage Put a Stop to Generative AI*, WAFER WORLD INC. (June 21, 2024), <https://www.waferworld.com/post/can-wafer-shortage-put-a-stop-to-generative-ai> [https://perma.cc/DWY4-TH5R].

355. Cox, *supra* note 192 (“Generative AI systems . . . require vast amounts of data and computational power. The training process for these models is incredibly energy-intensive, often running on thousands of high-performance GPUs for weeks or even months.”).

356. Not In My Back Yard—a pejorative description of citizens who oppose any development near where they live.

357. See Christopher Tozzi, *Why Communities Are Protesting Data Centers – And How the Industry Can Respond*, DATACENTER KNOWLEDGE (June 13, 2024), <https://www.datacenterknowledge.com/data-center-construction/why-communities-are-protesting-data-centers-and-how-the-industry-can-respond> [https://perma.cc/S3EA-GCVV].

same way that long cattle drives were eradicated by barbed wire enclosures on the Plains one hundred fifty years ago.<sup>358</sup>

Most of the copyright claims by rights holders whose works have been included in Google like searches to feed machine learning have only frivolous claims of copyright infringement.<sup>359</sup> But the merit of their claims does not matter. Rent seeking of this sort is neither immoral nor, in this context, illegal. A new stream of revenue has sprung up originating in some general sense with the content the copyright owners have made available, and they want to share in the stream. That desire will continue regardless of whether they can succeed in any legal theory to compel sharing. Already, the owners of significant content that heretofore has been freely available on the Web are erecting pay walls around it—the twenty-first century equivalent of barbed wire.

But the patent arena is shielded from much of this controversy. Patents are public, as are published applications. A patentee has no claim of misappropriation or infringement against an AI machine learning system that learns from his patent.

The questions about how far AI will revolutionize invention, patent prosecution, and patent enforcement have more to do with economics than with policy and technology. AI's penetration into the system already is substantial and is likely to increase.

Whether a computer program can be an inventor is largely a distraction.

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358. See Henry H. Perritt, Jr., *Rise and Fall of the Cowboy: Technology, Law, and Creative Destruction in the Industrialization of the Food Industry*, 94 N.D. L. REV. 361, 392–95 (2019) (explaining how the steel plow, barbed wire, and windmills brought an end to long cattle drives on the open range).

359. See Perritt, *Robots as Pirates*, *supra* note 197, at 119–20 (analyzing elements of copyright infringement and showing that claimants have difficulty satisfying them, given how machine learning works).

## V. APPENDIX

The Article assumes that the content of this Appendix represents the transcript of the session between the fictional Lee and the fictional AI robot Edison.<sup>360</sup>

**[Henry Perritt]:** what areas in robotics are most in need of new inventions

**ChatGPT:** Robotics is an evolving field that intersects with many areas of technology and human endeavor. As of my last update, here are some areas within robotics that are ripe for innovation:

1. **Human-Robot Interaction (HRI):** As robots become more prevalent in everyday settings, improving how humans and robots communicate and work together is crucial. This includes advancements in natural language processing, emotion recognition, and non-verbal communication cues.
2. **Robotic Dexterity and Manipulation:** Enabling robots to handle objects with the same dexterity as humans, especially in unstructured environments, is a significant challenge. This includes the development of advanced grippers and hands, as well as the algorithms that control them.
3. **Autonomous Navigation:** While significant strides have been made in this area, there's still room for improvement in GPS-denied environments, uneven terrain, and dynamic, unstructured settings.
4. **Power and Energy Efficiency:** Longevity and energy efficiency in robots, especially for those that are mobile, are critical. This could include new battery technologies, energy harvesting, or more efficient motors and actuators.
5. **Robot Ethics and Safety:** As robots become more autonomous, ensuring they make decisions that are ethical and safe for all involved is increasingly important. This includes both the programming of ethical guidelines and the creation of safety measures to prevent accidents.
6. **Swarm Robotics:** Coordinating multiple robots to work together seamlessly can vastly improve efficiency in various tasks. Invention

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<sup>360</sup>. ChatGPT invented CherryBot (transcript of author session with ChatGPT, 1150, Apr. 29, 2024).

in this area would likely focus on communication methods and collective AI algorithms.

7. **Soft Robotics:** Robots that can change their stiffness and shape on demand could be incredibly useful in delicate environments or in situations where traditional robots would be too rigid or dangerous.
8. **Biomimetic Robots:** Robots that mimic the functions and movements of living organisms offer numerous potential applications, from new forms of locomotion to robots that can better adapt to natural environments.
9. **Robotic Fabrication and Construction:** Advancements in robots that can build or fabricate structures, especially in remote or hazardous environments, could change the landscape of construction and manufacturing.
10. **Healthcare Robotics:** There's a continuous need for inventions in robotic surgery, rehabilitation robots, assistive devices for the elderly or disabled, and robotic prosthetics.
11. **Robotic Materials:** Materials that can self-heal, change properties in response to stimuli, or offer new ways to interface with electronics are needed to advance robot capabilities.
12. **Environmental Monitoring and Clean-up:** Robots that can monitor environmental health or clean up pollutants in areas where it's unsafe or impractical for humans to do so.
13. **Rescue Robots:** Robots capable of navigating disaster sites to locate and rescue victims or deliver essential supplies can be vital during emergencies.
14. **Space Robotics:** The extreme conditions of space require robots that can operate with high reliability over long periods without maintenance, handling tasks like repair, construction, and exploration.
15. **Agricultural Robotics:** Inventions that could automate tasks like picking, weeding, or harvesting in ways that are gentle on the crops and efficient in varied farm conditions are in demand.

Each of these areas offers substantial opportunities for impactful inventions, driven by the need to solve complex problems and improve the capabilities and integration of robots in our lives. Collaboration between different scientific and engineering disciplines is often necessary to push the boundaries in these areas.

**[Henry Perritt]:** invent an automatic cherry picking robot

**ChatGPT:** Designing an automatic cherry picking robot involves considering various technical aspects to ensure the robot is efficient, gentle with the fruit, and adaptable to different cherry tree configurations. Here's an outline for such an invention:

1. Automatic Cherry Picking Robot "CherryBot"

*a) Design Overview*

- **Structure:** Lightweight, with a central processing unit mounted on an all-terrain, stabilized platform suitable for navigating orchard rows.
- **Mobility:** Autonomous guided vehicle (AGV) system with electric-powered wheels, GPS navigation for orchard layout mapping, and obstacle detection sensors to navigate around trees and terrain.
- **Power:** Solar panels with backup batteries, allowing for extended periods of work with minimal environmental impact.
- **Manipulator Arms:** Multiple articulated arms equipped with soft, adaptive grippers that can gently pick cherries without bruising them.
- **Sensors:** A combination of visual, LiDAR, and infrared sensors to detect ripe cherries and assess the 3D structure of the trees for optimal picking paths.

*b) Functional Modules*

- **Detection Module:** Utilizes machine learning algorithms trained on a dataset of ripe cherries to accurately identify the target fruit. It adjusts picking strategy based on size, ripeness, and cluster density.
- **Navigation Module:** Processes input from GPS and onboard sensors to move the robot around the orchard and position it correctly in front of each cherry tree.
- **Manipulation Module:** Employs advanced control algorithms to guide the manipulator arms and grippers, ensuring precise and gentle picking of the cherries.
- **Storage Module:** Features a cushioned collection bin that minimizes impact and damage to cherries as they are gathered.
- **Decision-making AI:** Integrates sensor data and controls all systems to optimize the path of the robot and the picking process, learning from each interaction to improve efficiency.



*c) Unique Features*

- **Noise and Vibration Control:** Operates quietly to not disturb local wildlife or residents, with vibration-damping materials and technology to avoid shaking the trees excessively.
- **Weatherproofing:** Built to withstand various weather conditions with waterproof and temperature-resistant materials.
- **Real-Time Monitoring:** Equipped with a communication system that allows remote monitoring and control if manual intervention is required.
- **Selective Harvesting:** Capable of selectively picking fruit to meet specific quality or ripeness criteria, which can be adjusted via the operator interface.
- **Collaborative Operation:** Can work in tandem with other robots and human workers, coordinating activities to maximize efficiency.

*d) Potential Development Stages*

1. **Prototype Development:** Build a scaled-down version of the robot to test the picking mechanism and basic navigation.
2. **Field Testing:** Deploy the prototype in an actual orchard to gather data and refine the machine learning models and control systems.
3. **Commercial Model Fabrication:** With data and feedback from field testing, develop a full-scale, commercial-ready model.
4. **Market Integration:** Introduce the robot to the market with on-site demonstrations and pilot programs with early adopters.
5. **Iterative Improvement:** Continuously improve the design based on real-world performance data and customer feedback.

This automatic cherry picking robot could significantly increase harvesting efficiency and reduce labor costs, while also being gentle on the fruit and the environment. The technology used could potentially be adapted for other types of fruit-picking tasks as well, making it a versatile tool in the agricultural robot sector.

**[Henry Perritt]:** write a patent application for this invention

**ChatGPT:** Writing a complete patent application is a complex and detailed process usually undertaken by a patent attorney or agent, but I can give you an outline of what such an application might look like for the automatic cherry picking robot “CherryBot”.

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**Title of Invention:** Autonomous Cherry Harvesting Robotic System (CherryBot)

**Background of the Invention:** The invention relates to agricultural robots, and more specifically to a robot capable of autonomously detecting, picking, and collecting cherries.

**Field of the Invention:** The invention falls within the field of robotics, particularly applied to precision agriculture and automated harvesting systems.

**Summary of the Invention:** This invention provides an automatic cherry picking robot designed to operate autonomously within cherry orchards. The robot is equipped with advanced navigation, sensory, and manipulation technologies to detect and harvest cherries.

**Brief Description of the Drawings:**

- Fig. 1: A side view of the CherryBot, illustrating the solar panels and the articulated manipulator arms.
- Fig. 2: A top-down layout of an orchard with the robot's navigation path.
- Fig. 3: A close-up of the adaptive gripper handling a cherry.
- Fig. 4: Block diagram of the robot's decision-making AI and control system.

**Detailed Description:** The CherryBot consists of several components that work synergistically to achieve efficient cherry picking.

1. **Autonomous Navigation System:** Description of the GPS and sensor-based navigation system.
2. **Sensory Module:** Details of the visual, LiDAR, and infrared sensors used to identify ripe cherries.
3. **Manipulator Arms and Grippers:** Explanation of the robotic arms, their range of motion, and the soft grippers designed to handle cherries without causing damage.
4. **Machine Learning Detection System:** A description of the algorithms used to identify cherries and determine the optimal picking strategy.
5. **Collection and Storage System:** Description of the mechanism that collects and stores cherries during operation.

6. **AI and Control System:** In-depth information about the AI that integrates sensor data, controls the robotic systems, and optimizes picking paths.

**Claims:** A series of numbered claims that define the scope of the invention, starting from broad to increasingly specific. For instance:

1. An automated cherry picking robot comprising:
  - an autonomous guided vehicle chassis;
  - a solar panel energy system;
  - a plurality of articulated manipulator arms with adaptive grippers;
  - a multi-sensor detection system integrating visual, LiDAR, and infrared sensors;
  - a machine-learning algorithm trained to identify ripe cherries;
  - an autonomous navigation system utilizing GPS;
  - a collection bin for harvested cherries.

Further claims would break down these components into more specific elements and may claim the methods by which the robot picks cherries or navigates the orchard.

**Abstract:** A summary of the invention, highlighting the autonomous cherry picking robot with its advanced detection, navigation, and harvesting capabilities designed to work in orchard environments.

**Conclusion, Ramifications, and Scope of Invention:** A closing statement summarizing the innovation, potential variations, and the breadth of the invention's applicability.

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Please note, an actual patent application must also include professional drawings, a detailed description of each component and process, formal claims that precisely define the invention's scope, and an abstract. The application would have to comply with all requirements of the patent office in which it is being filed. It is recommended to work with a patent attorney to ensure that the application meets all legal standards and to navigate the complex process of patent prosecution.

**[Henry Perritt]:** How long should the manipulator arms be?

**ChatGPT:** The length of the manipulator arms for an autonomous cherry picking robot like the CherryBot would need to be carefully considered based on several factors:

1. **Tree Size:** Typical cherry trees can vary in height and width. Dwarf varieties might be as short as 8-10 feet, while standard trees can reach heights of 35 feet or more. The robot arms should be long enough to reach at least halfway across the average tree canopy to minimize the need to reposition the robot.
2. **Reach and Coverage:** The arm length should be optimized for the maximum reach while ensuring stability and precision. It should allow the robot to cover a significant portion of the tree without moving too often, increasing efficiency.
3. **Weight and Balance:** Longer arms will be heavier and could affect the robot's balance and power consumption. The design should ensure that the robot remains stable, even when the arms are fully extended.
4. **Mobility Constraints:** The arms should be able to retract or fold to allow the robot to navigate between rows of trees without damage to the trees or the robot.
5. **Working Envelope:** The concept of a working envelope in robotics refers to the range within which a robot arm can operate. The arms should have a working envelope that covers the necessary spatial area for effective cherry picking.
6. **Safety and Practicality:** The arms should not be so long that they pose a safety risk to humans or create practical issues with transport or navigation.

As an initial design consideration, if we assume the average mid-sized cherry tree is about 15-20 feet wide and the robot is positioned close to the trunk, manipulator arms of about 8-10 feet might be sufficient to access much of the tree. However, for larger trees or to minimize repositioning, arms may need to be longer. It's also possible that a telescopic design could be implemented to provide variable length for different scenarios, adding to the complexity but also to the versatility of the CherryBot.

Final specifications should be determined after a thorough analysis of the target environment, engineering constraints, and after iterative testing and prototyping.

**[Henry Perritt]:** What algorithms can CherryBot use to identify cherries and determine the optimal picking strategy.

**ChatGPT:** To effectively identify cherries and determine the optimal picking strategy, CherryBot could utilize a combination of algorithms focused on image processing, machine learning, and path planning:

1. **Image Processing Algorithms:**

- **Color Thresholding:** To identify cherries based on their distinct red color against the green leaves.
- **Edge Detection:** To outline the boundaries of cherries and differentiate them from the background.
- **Blob Detection:** To locate the individual cherries or clusters of cherries as single entities.

2. **Machine Learning Algorithms:**

- **Convolutional Neural Networks (CNNs):** Trained on labeled datasets of cherry images to recognize the fruit in various stages of ripeness and under different lighting conditions.
- **Object Detection Models:** Such as YOLO (You Only Look Once) or SSD (Single Shot Multibox Detector), which can identify and locate cherries in real-time.
- **Semantic Segmentation:** To precisely segment the image into regions that represent different objects, separating cherries from leaves and branches.

3. **Pattern Recognition:**

- **Shape Matching:** To distinguish cherries based on their characteristic shape, especially useful in detecting partially obscured cherries.

4. **Deep Learning for Ripeness Assessment:**

- **Reinforcement Learning:** To continually improve the selection criteria based on the feedback from the actual ripeness of picked cherries versus the predicted ripeness.

5. **Path Planning Algorithms:**

- **Greedy Algorithms:** For initial implementations, to simply choose the closest ripe cherry next.

- **Travelling Salesman Problem (TSP) Solvers:** To find an efficient route that allows the robot to pick all identified ripe cherries with minimal movement.
  - **Dynamic Programming:** To solve complex decision-making problems where the optimal solution involves solving smaller sub-problems.
6. **Optimal Control Algorithms:**
    - **Model Predictive Control (MPC):** To control the manipulator arms by predicting the future state of the system and correcting the path in a controlled manner.
  7. **Safety and Collision Avoidance:**
    - **Motion Planning Algorithms:** Like Rapidly-exploring Random Trees (RRT) for planning the arm movements without colliding with the tree or other cherries.
  8. **Multi-Agent Coordination** (if multiple robots are used):
    - **Swarm Intelligence Algorithms:** To allow multiple robots to work together efficiently without interfering with each other.
  9. **Harvest Optimization:**
    - **Genetic Algorithms:** To optimize the picking schedule and pattern based on past performance and continuously evolving environmental variables.

All these algorithms would be part of a larger integrated system where the output of the image processing and machine learning algorithms informs the path planning and manipulation control systems to perform the actual picking of cherries. The system would be trained and tested using a variety of data from real-world scenarios to ensure robust performance under different conditions and to handle anomalies effectively. The combination of these algorithms would allow CherryBot to adaptively and intelligently harvest cherries, maximizing yield and efficiency while minimizing damage to the fruit.

**[Henry Perritt]:** What are the details of the CherryBot's visual, LiDAR, and infrared sensors used to identify ripe cherries.

**ChatGPT:** For the CherryBot to efficiently identify ripe cherries, it would be outfitted with a suite of advanced sensors, each contributing unique capabilities to the overall system. Here are the details for each type of sensor:

## 2. Visual Sensors (Cameras)

### 1. High-Resolution Cameras:

- **Purpose:** Capture detailed images of the cherry trees, allowing for the identification of cherries based on color, shape, and size.
- **Specifications:** Multispectral imaging capabilities to distinguish ripe cherries from unripe ones and foliage.
- **Integration:** Real-time image processing with onboard GPUs for quick analysis.

### 2. Stereo Vision:

- **Purpose:** Provide depth perception to assess the distance and spatial arrangement of cherries.
- **Specifications:** A pair of cameras mimicking human binocular vision, calibrated for depth estimation.
- **Integration:** Coupled with computer vision algorithms to generate 3D models of the picking environment.

## 3. LiDAR Sensors

### 1. 3D LiDAR Scanners:

- **Purpose:** Generate detailed 3D maps of the orchard environment, including the structure of trees, branches, and the position of cherries.
- **Specifications:** High scan rate for rapid point cloud generation, capable of operating in bright sunlight and varying light conditions.
- **Integration:** Data fusion with visual sensors to enhance detection accuracy and to guide the manipulator arms precisely.

### 2. Miniaturized LiDAR:

- **Purpose:** Serve as a proximity sensor for the manipulator arms, avoiding collisions and fine-tuning the picking process.
- **Specifications:** Small form factor LiDARs placed on the robot's arms to provide immediate spatial feedback.

- **Integration:** Real-time obstacle detection and avoidance during arm movement.
4. Infrared Sensors
    1. **Thermal Imaging Cameras:**
      - **Purpose:** Detect the temperature variations that can indicate ripeness and differentiate fruit from leaves.
      - **Specifications:** Infrared cameras sensitive to the specific thermal signature of ripe cherries.
      - **Integration:** Combined with visual data to improve detection accuracy, especially in low visibility conditions.
    2. **Near-Infrared (NIR) Spectroscopy:**
      - **Purpose:** Analyze the chemical composition of cherries to determine sugar content and ripeness.
      - **Specifications:** Sensors capable of capturing NIR spectra that are indicative of different ripeness stages.
      - **Integration:** Cross-referencing spectral data with visual and 3D LiDAR data for comprehensive ripeness analysis.
  5. Combined Sensor System
    - **Sensor Fusion:** All sensor data is integrated through sensor fusion algorithms, providing a comprehensive dataset that includes visual appearance, 3D structure, and thermal and chemical properties.
    - **Calibration System:** Ensures that all sensors are calibrated to work in unison, providing accurate and consistent data.
    - **Data Processing:** Utilizes edge computing with a combination of onboard processors and AI accelerators to process sensor data in real-time.
    - **Environmental Adaptation:** Algorithms capable of adjusting sensor parameters based on environmental conditions, such as sunlight intensity, to maintain sensor performance.
    - **Feedback Loops:** The sensors provide feedback to the control system, allowing for continuous adjustment and improvement of the picking process.



The details of these sensors represent a sophisticated system that, when combined with advanced algorithms, enables the CherryBot to navigate the orchard environment, identify ripe cherries, and execute the picking process with high precision and efficiency.

**[Henry Perritt]:** Please rewrite the patent application using these answers

**ChatGPT:**

**Title of Invention:** Autonomous Cherry Harvesting Robotic System (CherryBot)

**Background of the Invention:** The present invention pertains to agricultural robotics, specifically an autonomous robotic system designed for the harvesting of cherries. The invention seeks to address the need for increased efficiency and reduced labor costs in cherry picking through automation.

**Field of the Invention:** The invention applies to the field of agricultural robotics, with a focus on the automation of fruit harvesting processes.

**Summary of the Invention:** This invention relates to CherryBot, an automated cherry picking robot that employs a sophisticated array of sensors and algorithms to navigate orchard environments, identify ripe cherries, and determine optimal picking strategies. The system is designed to work autonomously, with minimal human intervention.

**Brief Description of the Drawings:**

- Fig. 1: A side view of CherryBot showcasing the solar panels and manipulator arms.
- Fig. 2: An overhead view of the robot navigating an orchard path.
- Fig. 3: A detailed view of the adaptive gripper engaging a cherry.
- Fig. 4: A diagram of the AI decision-making and control system.
- Fig. 5: An illustrative depiction of the sensor fusion process integrating visual, LiDAR, and infrared data.

**Detailed Description:** The CherryBot is an innovative robotic system comprising several components that function together for effective cherry harvesting:

1. **Autonomous Navigation System:** A GPS and sensor-based navigation platform enabling the robot to maneuver through various terrains within cherry orchards.

2. **Visual, LiDAR, and Infrared Sensor Suite:** This suite includes high-resolution and stereo vision cameras, 3D LiDAR scanners, miniaturized LiDAR for manipulator arm guidance, thermal imaging, and NIR spectroscopy sensors, all integrated through sensor fusion algorithms to accurately identify ripe cherries and their spatial location.
3. **Manipulator Arms with Adaptive Grippers:** Articulated arms equipped with grippers designed to pick cherries without causing bruising, featuring proximity sensors for collision avoidance.
4. **Machine Learning and Image Processing Algorithms:** A combination of CNNs, object detection models, and semantic segmentation for cherry detection, alongside path planning algorithms like TSP solvers and dynamic programming for movement efficiency.
5. **Control System and AI:** A sophisticated AI system that integrates sensor data and controls robotic operations, including a calibration system for maintaining sensor accuracy and a feedback loop for continuous performance improvement.

**Claims:**

1. A robotic system for harvesting cherries, comprising:
  - an autonomous vehicle platform with stabilization features;
  - an energy system incorporating solar panels;
  - a suite of visual, LiDAR, and infrared sensors for detection and analysis of cherries;
  - a plurality of robotic arms with adaptive grippers for picking cherries;
  - a machine-learning based detection system trained to identify ripe cherries;
  - a navigation system guided by GPS and integrated sensors;
  - a collection mechanism for storing harvested cherries.

Additional claims would further specify the configurations and operations of each system component.

**Abstract:** The CherryBot is a cutting-edge autonomous robot designed to harvest cherries. It uses a combination of visual, LiDAR, and infrared sensors to identify ripe cherries and employs machine learning algorithms for optimal

picking strategy determination. This system promises to revolutionize cherry harvesting by improving efficiency and safety while reducing labor costs.

**Conclusion, Ramifications, and Scope of Invention:** This invention presents a novel solution to cherry harvesting with the potential for adaptation to other fruit-picking applications. Variations in design and method are contemplated, all within the scope of the invention as claimed.

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This revised outline includes specific technical details and is crafted to align with patent application requirements. It is essential, however, to consult with a patent attorney to prepare and file an actual application, as the attorney can ensure that the application meets all legal criteria and has the best chance of being granted.

