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Artificial Intelligence Is Not Human

The Legal Determination of Inventorship and Co-Inventorship, the Intellectual Property of AI Inventions, and the Development of Risk Management Guidelines

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Abstract

The ongoing explosion of artificial intelligence (AI) in a myriad of domains has raised questions on how to reconcile between current patent law and the protection of AI-enabled systems and their creative inventions. U.S. patent law has been challenged on whether it is sufficient to protect AI-enabled systems or whether there is a need to expand or change the law to accommodate inventions resulting from an AI-enabled system. It is our view that current U.S. patent law has statutes and rules capable of addressing both (i) AI-enabled systems as tools to aid humans in their creation of inventions, and (ii) AI generated creative inventions as innovations that can be patented on a case-by-case basis, as long as they meet all the requirements for patentability. In this paper we present arguments in favor of keeping intact current U.S. patent law. The interest by various industries to protect their intellectual property as derived from AI-enabled systems has considerably increased with the exponential growth of resulting inventions and the potential patentability of the subject matter created is debated. We support the United States Patent and Trademark Office (USPTO)'s laws, regulations, policies, procedures and guidance upheld for the processing of patent applications containing AI methods and patentable subject matter, as has been successfully done to support innovation. This context of AI-enabled system proliferation and resulting innovations, however, raises the need to balance the benefits and risks brought on by these systems. Taking a human-centered approach whereby we hu-

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mans remain in control of our built AI-enabled systems and their outputs, we support the further improvement of guidance developed for inventors of AI-enabled systems that specifically delineates the ethical use of AI-enabled inventions, including assessment of potential risks and the measures taken to eliminate or at least mitigate these potential risks. We also strongly favor the inclusion and participation of multiple stakeholders at the global level so that a diversity of perspectives can be considered and uniform best practices implemented to ultimately uphold a regulatory framework for AI-enabled systems and their inventions.

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INTRODUCTION

Artificial Intelligence (AI) today is the most talked about field of study and applicational tool. The improvement of AI-enabled capabilities and their applicability to multiple use cases has led to its rapid integration within every industry (agriculture, oil, fashion, healthcare, finance, food, real estate, manufacturing, transportation, construction, retail, military, media, education, to name a few).[1] The improvements seen resulting from the evolution of compute capacity, data availability and algorithm complexity, however, demonstrate that AI is only a superlative tool at certain tasks (e.g. processing of data, automation, speed, commands). AI algorithms function within the dictates of their human-provided data and depend on such data for training to recognize patterns and thus make predictions or decisions. AI-enabled technology is thus good at following instructions to achieve specified goals. A fundamental distinction that needs to be highlighted here between AI and humans is that AI lacks core features that characterize humans. That is, core features that underpin human intelligence.

[1] *Top 50 Use Cases of Artificial Intelligence in Diverse Sectors*, ANALYTICS INSIGHT (May 27, 2021), https://www.analyticsinsight.net/top-50-use-cases-of-artificial-intelligence-in-diverse-sectors/.

In the context of intellectual property in which creations of the human mind/brain are characterized by innovation, conception, contribution and invention, AI's role can only be that of a tool given its dependency on human necessity and commands. U.S. patent law requires an invention to be patented by a human, to meet novelty, non-obviousness, utility and enablement, and to contain a detailed written description of the invention and its best mode to use. Moreover, the human inventor takes an oath as the inventor of the invention. As our conception of the human mind/brain stands (*i.e.*, a fundamental element endowing the faculties of reasoning, adaptation, emotional understanding, moral judgment, communication and autonomy), as well as that of the U.S. patent law in upholding the very results of said mind/brain, AI systems do not meet any of the core features that characterize humans and therefore the requirements of the U.S. patent law. It is also necessary to highlight that AI, algorithms, and the requisite for data to train systems and improve their performance are not new concepts. AI as a discipline dedicated to the development of human-like intelligence via computational means was born in the 1950s; we have approximately seventy years incrementally improving the various questions, methods, techniques, and metrics in search of building evermore intelligent agents. Based on this history of improvement alone, AI systems are merely tools to assist humans and therefore fail to demonstrate non-obviousness, an important factor for patentability.

Continuing in line with the above argument, it is important to differentiate between the AI systems themselves and the creative inventions generated by such AI systems. This distinction is important to highlight because generated creative inventions could under U.S. patent law potentially be patentable on a case-by-case basis. AI creative inventions are valuable intellectual property. However, we must also recognize that AI-enabled technologies have produced and can further generate adverse social consequences in the absence of substantive AI regulation. AI-enabled systems have raised serious legal issues (*e.g.* bias and discrimination) and the reverberation of such issues across society underscores the need to address the entirety of the AI lifecycle from conceptualization of the system to its monitoring and consequent management in the field. In this contribution, we provide a human-centered and three-tiered approach to addressing the AI and inventorship debate: (i) we discuss how AI-enabled systems and their creative inventions fit within current U.S. patent law, (ii) we highlight the differences between AI-enabled systems and AI-creative inventions with respect to patentability, and (iii) we identify measures that should be taken to mitigate risks associated with AI technology and propose ways to balance innovation and the responsible development of AI-enabled systems.

1.0 THE PATENT SYSTEM AND THE ANTHROPOMORPHIZATION OF AI

Under U.S. law, a patent is a right granted to an inventor of a process, machine, article of manufacture, or composition of matter that is novel, non-obvious and useful. The 'inventor' refers to an individual or set of individuals who invent-

ed or discovered the subject matter of the invention. The terms 'joint inventor' and 'coinventor' refer to any one of the individuals who invented or discovered the subject matter of a joint invention.[2] Patents give the inventor the sole right to exclude others from using and profiting from a patented technology without the consent of the patent-holder for twenty years from the filing date[3]. This period of exclusivity allows inventors to make, use, sell, and import their invention[4]. Since patent law pertains to the protection of inventions by an 'inventor,' *i.e.*, a natural person, an inventor or coinventor is therefore understood to be a human[5]. Furthermore, under 35 U.S.C 115, the inventor must file an oath or declaration stating that the application was made or was authorized to be made by the affiant or declarant, and such individual believes himself or herself to be the original inventor of a claimed invention in the application.[6] Given the requirement that the inventor, coinventor or joint inventor is a human individual, an AI-enabled system cannot be an inventor because the system is not a natural person, is not a legal entity, cannot own property, cannot execute inventor declarations, patent assignments or other legal agreements, and cannot sign the requisite oath. Based on these U.S. patent law requirements, an AI-enabled system should not be granted inventorship or coinventorship status due to its incompatibility with sovereign ownership rights and thus, non-recognizable ownership of intellectual property. Listing a non-human inventor like that of an AI-enabled system will be a violation of the U.S. patent law.

1.1 The Overarching Question

In light of the above observation, we must take several steps back and address the underlying fundamental question at hand:

> "*Should a non-human intelligent system as it stands today with its current characteristics and capabilities have the same or similar rights to humans in the context of ownership or authorship?*"

The answer is straightforward: regardless of an AI-enabled technology's advanced capabilities, it lacks all the core features that characterize humans and the fundamental embodied nature of human intelligence. We humans continuously adapt to new environments by utilizing a combination of different cognitive processes; we source information from various means generating solutions to complex problems with minimal amount of data; and we think, reason, create, and communicate with purpose, curiosity and consciousness.[7] Considering a hu-

[2] Definitions, 35 U.S.C. § 100 (2015), https://www.uspto.gov/web/offices/pac/mpep/mpep-9015-appx-l.html#d0e302338313.

[3] Contents and term of patent; provisional rights, 35 U.S.C. § 154 (2015), https://www.uspto.gov/web/offices/pac/mpep/mpep-9015-appx-l.html#d0e303482.

[4] Government Interest in Patents, 35 U.S.C. § 267 (2011); Infringement of Patent, 35 U.S.C. § 271 (2010), https://www.uspto.gov/web/offices/pac/mpep/mpep-9015-appx-l.html#top.

[5] David C. Vondle, Megan R. Mahoney, *Federal Circuit Confirms 'Inventor' Must Be Human, Not AI*, AKIN (Aug. 11, 2022), https://www.akingump.com/en/insights/alerts/federal-circuit-confirms-inventor-must-be-human-not-ai.

[6] Inventor's Oath or Declaration, 35 U.S.C. § 115 (2015), https://www.uspto.gov/web/offices/pac/mpep/mpep-9015-appx-l.html#d0e302875912.

[7] Brenden M Lake, Tomer D Ullman, Joshua B Tenenbaum, Samuel J Gershman, *Building machines that learn and think*

man-centered approach whereby human-computer interaction should enhance the human condition further highlights the immature reaction to anthropomorphizing a system simply because it mimics our intelligent behavior on the surface. Today's AI-enabled systems are not genuine human-like systems with authentic beliefs, comprehension of the world, intrinsic and extrinsic emotions, and awareness of self and one's role in society. Crucially, these systems are trained on the many outputs that we as sentient beings have produced and, in the case of AI generated text, for example, are predicting the most probable next words based on what they have learned. Therefore, it is unsurprising that behaviors like engaging in a back-and-forth conversation that moves from informal to literary to poetic and giving a semblance of having understanding, thoughts, sentience, and creativity are exhibited. To give an intuitive example of basic human behavior, take language and communication and consider what they mean to us. It is not so much what we say, machines can generate language instantly and exhibit correct syntax; the what of language, therefore, is a performable capacity. Instead, it is the why behind and the when of what we say, and the what we do with what we say that has a plurality of meaning for us.

Current AI-enabled systems do not have such above capabilities and understanding of the world. As a result, they do not have personhood.[8] They are merely tools that function within the dictates of our human-provided data. On this assertion alone, an AI-enabled system cannot contribute to an invention in the same manner as a human because contribution to an invention entails an understanding of the utility, benefit and overall responsibility as an author of a novel creation. Specifically, being able to explain in detail both the contribution at the input stage as well as at the output stage to show how the invention was conceived of and then reduced to practice necessitates an understanding of the physical world in which one inhabits. Because AI cannot create or invent like a human, an AI-enabled system is at most a tool that assists in an invention, or in the discovery of the subject matter of an invention. Therefore, AI is not an entity that can have rights of ownership or authorship in the conventional sense.

1.2 On The Robustness of U.S. Patent Law

Regarding machine learning (ML) and algorithms, they are AI tools that have been used for more than seven decades to train algorithms and are therefore not novel. For comparison, the generation of a novel output like a molecule, structure and the like could be patentable by a human creator. AI can predict protein folding based on amino acid sequences;[9] AI can predict the structures of nucleoporins (not previously determined) whereby AI generated a near-complete model of the com-

like people, 40 BEHAVIORAL AND BRAIN SCIENCES 253 (2016), https://pubmed.ncbi.nlm.nih.gov/27881212/.

[8] Personhood is a complex concept with a long history of debate within various disciplines and is outside of the scope of this current analysis. Broadly speaking, personhood often refers to the interrelated features of perceptual and cognition abilities and social recognition. As a result, it is noteworthy to highlight the usefulness of utilizing personhood as a criterion for distinguishing humans from AI-enabled systems. Arto Laitinen, *Sorting out aspects of personhood: Capacities, normativity and recognitio*, 14 JOURNAL OF CONSCIOUSNESS STUDIES 248 (2007).

[9] *Timeline of a breakthrough*, ALPHAFOLD, https://web.archive.org/web/20230203225559/https://www.deepmind.com/research/highlighted-research/alphafold/timeline-of-a-breakthrough.

plex's cytoplasmic ring;[10] AI can predict a protein's 3D structure from its amino acid sequence;[11] and AI can simulate complex systems such as the analyses of protein binding sites to predict drug interactions,[12] to name a few. For all these examples, the data and components used by AI to predict structures or interactions are tools in the public domain (*i.e.*, databases) and available for research, making them non-novel.

The problem we have before us is that the rise of AI is not only presented in an aura of hype, but that its anthropomorphization has been strongly asserted despite incomplete and not fully agreed upon operational definitions of human cognitive traits and their underlying mechanisms. For example, it has been claimed that Google's Chatbot generator LAMBDA is sentient,[13] and that a Microsoft AI system is steps closer toward having artificial general intelligence (*i.e.*, a machine that is essentially human-like in its intelligent capacity).[14] In this context, it has been further claimed that traditional patent law "has become outdated, inapplicable and irrelevant"[15] as a result of claiming unproven crucial features of AI systems being "creative; unpredictable; independent and autonomous; rational; evolving; capable of data collection and communication; efficient and accurate; and they freely choose among alternative options."[16] The argument has been further pushed to claim that the United States Patent and Trademark Office (USPTO), in "maintaining the traditional patents system by hunting for a "real" human inventor, policy makers exhibit a misunderstanding of advanced technology and AI systems features."[17] These assertions along with a myriad of crises created from medicine to sociology by the careless use of ML have led to the generation of spurious results.[18]

These irresponsible claims and use of AI tools reveal the lack of understanding of the mathematical assumptions behind AI, ML techniques, AI algorithms, and the processes and complexity of machine systems. The claims are opportunistic, nonsensical, subjective, scientifically unverified, and the result of hyped reasoning. AI is fundamentally a computational system built to problem solve and make predictions similar to how humans recognize patterns and formulate predictions in any given situation. Without mathematics and data there is no AI. As discussed above, a sentient system like a human being is a system that feels, is adaptive, is conscious of its surrounding environment, and has knowledge and understanding of the physical world. These are indisputable features that characterize humans and that AI-enabled systems lack.[19]

[10] *AlphaFold unlocks one of the greatest puzzles in biology*, ALPHAFOLD (July 28, 2022), https://unfolded.deepmind.com/stories/alphafold-unlocks-one-of-the-greatest-puzzles-in-biology.

[11] Mihaly Varadi et. al., *AlphaFold Protein Structure Database: massively expanding the structural coverage of protein-sequence space with high-accuracy models*, 50 NUCLEIC ACIDS RESEARCH 439 (2022).

[12] Ashwin Dhakal, Cole McKay, John J Tanner, Jianlin Cheng, *Artificial intelligence in the prediction of protein– ligand interactions: recent advances and future direction*, 23 BRIEFINGS IN BIOINFORMATICS bbab476 (2022).

[13] Nitasha Tiku, *The Google Engineer who thinks the company's AI has come to life*, THE WASHINGTON POST (June 11, 2022), https://www.washingtonpost.com/technology/2022/06/11/google-ai-lamda-blake-lemoine/.

[14] Cade Metz, *Microsoft Says New AI Shows Signs of Human Reasoning*, THE NEW YORK TIMES (May 16, 2023), https://www.nytimes.com/2023/05/16/technology/microsoft-ai-human-reasoning.html.

[15] Shlomit Yanisky Ravid & Xiaoqiong (Jackie) Liu, *When Artificial Intelligence Systems Produce Inventions: The 3A Era and An Alternative Model for Patent Law*. 39 CARDOZO L. REV. 2215 (2018), https://cardozolawreview.com/wp-content/uploads/2018/08/RAVID.LIU.39.6.5-1.pdf.

[16] *Id.*

[17] *Id.*

[18] Will Knight, *The AI Database. 2023. Sloppy use of machine learning is causing a 'Reproducibility Crisis' in science*, WIRED (Aug. 10, 2022), https://www.wired.com/story/machine-learning-reproducibility-crisis/.

[19] Josh Tenenbaum, Building machines that learn and think like people (July 10, 2018) *in* PROCEEDINGS OF THE 17TH INTERNATIONAL CONFERENCE ON AUTONOMOUS AGENTS AND MULTIAGENT SYSTEMS, July 2018.

To further emphasize why U.S. patent law does not necessitate changes, consider some of its relevant features. 35 U.S.C. 101 states "*whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent . . .*" Using the pronoun "whoever" indicates that the inventor(s) should be a natural person and not a machine. The threshold question in determining inventorship is *who* conceived of the invention, not *what* conceived of the invention. Here, 'conception' is the formation in the mind of the inventor, of a definite and permanent idea of the complete and operative invention.[20] Section 101 also specifies "*who may obtain a patent*." This is interpreted to mean that only a natural person or a human individual can obtain a patent. Further breakdown of sections highlights this requirement:

> 35 U.S.C. 115 states: "*Except as otherwise provided in this section, each individual who is the inventor or a joint inventor of a claimed invention in an application for patent shall execute an oath or declaration in connection with the application.*"[21] Since AI-enabled systems are not individual humans, they cannot execute an oath declaration.

In both 35 U.S.C. 101 and 115, the inventor knows about the invention, can meet the requirements of novelty, non-obviousness, utility, enablement, detailed written description of the invention and best mode to use the invention, and sign an oath declaration to obtain a patent. There are a set of criteria and socially accepted frameworks by which we humans communicate how we arrived at a decision, and cognitive psychology as a field of study that investigates the structure and function of the human mind/brain has years developing robust approaches to explain the inner workings of our own black box.[22] In the case of AI, the processes that an AI system uses to generate outputs from input datasets are at best incomplete and generally unknown (*i.e.*, gray or black box models). The reasoning behind algorithmic prediction and decision-making cannot be plainly, safely, and fairly described because of the high complexity of the computing process and the multiple tools, techniques and algorithms underlying thereof.[23]22 For inventors, this difficulty is further underscored by the fact that they do not have complete access to the internal processes of the AI system. As a result, an AI system cannot be listed as an inventor but can certainly be used as a tool to generate a predicted outcome which could be a potentially patentable creative innovation.

> 35 U.S.C. 116 states: "*Inventors may apply for a patent jointly even if they did not physically work together, each did not make the same type or amount of contri-*

[20] Fiers v. Revel, 984 F.2d 1164, 1168 (Fed. Cir. 1993); *see also* Burroughs Wellcome Co. v. Barr Lab'ys, Inc., 40 F.3d 1223, 1227–28 (Fed. Cir. 1994).

[21] Inventor's Oath or Declaration, 35 U.S.C. § 115 (2012), https://www.uspto.gov/web/offices/pac/mpep/mpep-9015-appx-l.html#d0e302875912.

[22] J. Eric Taylor & Graham Taylor, *Artificial cognition: How experimental psychology can help generate explainable artificial intelligence*. 28 PSYCHONOMIC BULLETIN & REVIEW, 454 (2021).

[23] Alejandro Barredo Arrieta, Natalia Díaz-Rodríguez, Javier Del Ser, Adrien Bennetot, Siham Tabik, Alberto Barbado, Salvador Garcia, Sergio Gil-Lopez, Daniel Molina, Richard Benjamins, Raja Chatila, Francisco Herrera. *Explainable Artificial Intelligence (XAI): Concepts, taxonomies, opportunities and challenges toward responsible AI*, 58 INFORMATION FUSION 82 (2020).

bution, or each did not contribute to every claim in the patent."[24] This assumes that each inventor, or human, is presumed to be a joint owner in the patent, having an "*undivided equal partial interest in the invention as a whole*."[25]

37 CFR 1.41 states: "A*n application must include, or be amended to include, the 'name' of the 'inventor' for any invention claimed in the application*."[26] Rule 1.45 states "j*oint inventors must apply for a patent jointly, and each must make an inventor's oath or declaration*."[27] In both rules the name of the 'inventor' or joint inventors are natural persons as stated by rules 35 U.S.C. 101, 115, and 116.

These relevant statutes and rules confirm that U.S. patent law, as written, cannot be applied to AI-enabled systems. It is therefore not permissible to change the patent statutes and rules just for the sake of including inanimate AI-enabled systems as inventors or co-inventors. As such, patent statutes and rules should be kept intact. As stated previously, AI-enabled systems are like other technological tools, to help humans. In fact, there is no difference between the inventions generated with the use of an AI tool compared to that generated by other tools. All of the above underscores the fact that we humans maintain control over the development of AI-enabled systems, and we humans create such tools to successfully adapt to our changing environment.

2.0 THE RACE TO PROTECT INTELLECTUAL PROPERTY BY PRIVATE INDUSTRY

As AI has become one of the most important technologies of this century and continues to advance and demonstrate considerable potential for all industries and society, it has also disrupted aspects of U.S. patent law and other legal frameworks. Intense and heated discussions surround issues regarding inventorship, ownership, authorship, and co-authorship, and whether AI-enabled systems can be patented. One argument states that recognizing AI systems as inventors could stifle innovation by allowing companies to monopolize the rights of inventions created by their AI systems.[28] Another argument claims that not allowing AI-creative innovations to be patented also stifles innovation.[29] The lack of consensus on whether AI systems and their innovations can be patented has further brought some to argue that AI is breaking U.S. patent law.[30]

[24] Inventors, 35 U.S.C. § 116 (2012), https://www.uspto.gov/web/offices/pac/mpep/mpep-9015-appx-l.html#d0e302886912.

[25] Ethicon v. U.S. Surgical Corp., 135 F.3d 1456, 1465–66 (Fed. Cir. 1998).

[26] Inventorship, C.F.R. § 1.41 (2023), https://www.ecfr.gov/current/title-37/chapter-I/subchapter-A/part-1/subpart-B/subject-group-ECFR54730050aee7ae0/section-1.41.

[27] Application for patent by join inventors, C.F.R. § 1.45 (2023), https://www.ecfr.gov/current/title-37/chapter-I/subchapter-A/part-1/subpart-B/subject-group-ECFR54730050aee7ae0/section-1.45.

[28] Emmaline Fisher, *Patents and AI-generated works: should AI be designated as inventors?*, 91 U. CIN. L. REV. (2022), https://uclawreview.org/2022/12/28/should-ai-be-designated-as-inventors/.

[29] Rahul Rao, *Generative AI's Intellectual Property Problem Heats Up*, IEEE SPECTRUM (Jun. 13, 2023), https://spectrum.ieee.org/generative-ai-ip-problem.

[30] Alexandra George, Toby Walsh, *Artificial intelligence is breaking patent law*, 605 NATURE 615 (2022), https://www.

2.1 In Pursuit of Innovation

Unfortunately, the phrase "*stifle innovation*" has been used by many industries and has inspired a variety of similar popular phrases like *"high interest rates stifle innovation," "regulation stifles innovation," "limited government funding stifles innovation," and "safety standards stifle innovation,"* to name a few. The invocation of such phrases reveals an unawareness of how science as a process of discovery unfolds. Moreover, such phrases underscore contexts and intentions outside of the work of science like political leanings, hyperbolic rhetoric, and financial greed. The reality is, however, that the lack of regulation has had a prominent role, for example, in the tragic loss of life[31] and in the development of a financial crisis.[32] In regards to inventions and USPTO patenting, innovation has not been stifled. A myriad of patents issued by the USPTO use a variety of AI tools to describe the apparatus and methods, ML systems, computational methods, and system methods. All these patents support the validity and usefulness of AI-driven systems' tools and methods to generate useful outputs and meet the requirements of patentability. In fact, the record of patents containing AI-innovations issued by the USPTO is staggering. Thousands of inventions directed to AI subject matters have been examined at the USPTO and a large amount of patents have already been issued for many years. For these patents, AI is the main tool in the inventions using algorithms, ML and deep learning (DL) methods in their processes and computer programs. For example, the number of U.S. patent applications for AI-based chemical inventions have considerably increased from 2009 to 2019,[33] and U.S. patents issued in the same subject area more than tripled during the same time period. AI-related inventions also include many advances in the architecture, computational techniques, hardware/material components, and specific uses of AI.

Regarding AI technology, ML is the dominant AI technique. It is found in 40% of all AI-related patents and has grown at a rate of about 28% for every year between 2013 and 2016. Within ML, DL and neural networks (NN) are instrumental in transforming automated translation. As a result, DL grew annually at the rate of 175% between 2013 to 2016 in patent filings and over the same period NN also grew at the rate of 46%. In terms of applications, computer vision is the most used functional application in all AI-related patents with an annual growth rate of about 24% between 2013 to 2016; natural language processing and speech processing have followed with growth rates of 14% and 13%, respectively, during the same period. Robotics and control methods-related patents are also growing, as well as in other fields in which AI technologies are being employed including tele-

nature.com/articles/d41586-022-01391-x.

[31] Rebecca Morelle, Alison Francis & Gareth Evans, *Titan sub CEO dismissed safety warnings as 'baseless cries', emails show*, BBC (23 June 2023, 11:59 EDT), https://www.bbc.com/news/world-us-canada-65998914; Steve Gorman and Joseph Ax, *Canadian safety regulators open probe into fatal loss of Titan submersible*, REUTERS (June 25, 2023, 3:46 AM EDT), https://www.reuters.com/world/relatives-mourn-titanic-sub-deaths-after-catastrophic-implosion-2023-06-23/; *Nearly 400 car crashes in 11 months involved automated tech, companies tell regulators*, NPR (June 15, 2022), https://www.npr.org/2022/06/15/1105252793/nearly-400-car-crashes-in-11-months-involved-automated-tech-companies-tell-regul.

[32] Isaac Chotiner, *The Regulatory Breakdown Behind the Collapse of Silicon Valley Bank*, THE NEW YORKER (Mar. 19,. 2023), https://www.newyorker.com/news/q-and-a/the-regulatory-breakdown-behind-the-collapse-of-silicon-valley-bank.

[33] Michael Sartori and Matthew Avery, *Industry Insights To Navigate AI Chemical Invention Patents*. LAW360 (Mar. 2, 2022), https://www.law360.com/articles/1469893/industry-insights-to-navigate-ai-chemical-invention-patents.

communications, transportation and the life and medical sciences.[34] AI in U.S. patents has risen more than 100% since 2002 and doubled between 2002 to 2018 (*i.e.*, 30,000 patents in 2002 and more than 60,000 patents in 2018).[35] Companies leading the patenting race include Google, Samsung Group, Microsoft, Intel, Nokia and Northrup Grumman, with IBM, Microsoft and Google holding the top spot for specific patents.[36]

Such growth led the USPTO and the Office of the Chief Economist (OCE) to release the Artificial Intelligence Patent Dataset (AIPD) in 2021 to assist researchers and policymakers focusing on the determinants and impact of AI. The AIPD helps identify from more than 13 million U.S. patents and pre-grant publications which ones include AI.[37] The USPTO has done robust work in this area, supporting patent rights as a means to encourage innovation, spread knowledge and provide incentives to create new works and generate useful inventions. The use of many AI techniques like ML, DL, NN and algorithms provides clear evidence of their utility as tools to support human creativity and innovation, and they stand as evidence that AI systems are tools that cannot be patented.

2.2 AI's Long History

A brief step back in history to understand why AI systems, which are tools and techniques, are not novel is imperative. Born between 1952 and 1956,[38], the term "Artificial Intelligence" was coined in 1956 in Dartmouth College[39] and the term "Machine Learning" in 1959. AI uses data and algorithms to mimic the way humans learn[40] and they have been widely used since 1963, including in the testing of system robustness.[41] AI gained popularity between 1957 to 1974 as computers became faster, cheaper and more accessible and were able to store more information.[42] Chatbots, vastly simpler versions of today's ChatGPT, were initially created between 1964 to 1966. The most notorious example being ELIZA, a natural language processing computer program created to explore back-and-forth com-

[34] *WIPO Technology Trends 2019: Artificial Intelligence*, WIPO, 19, https://www.wipo.int/edocs/pubdocs/en/wipo_pub_1055.pdf (last accessed 12 Jan. 2024).

[35] *New Benchmark USPTO study finds artificial intelligence in US patents rose by more than 100% since 2002*, USPTO (October 27, 2020), https://www.uspto.gov/about-us/news-updates/new-benchmark-uspto-study-finds-artificial-intelligence-us-patents-rose-more.

[36] Andrew Rapacke, *The AI Patent Boom: Why companies are racing to protect their artificial intelligence IP*, RAPACKE LAW GROUP (Jan. 20, 2023), https://arapackelaw.com/patents/the-ai-patent-boom/.

[37] *Artificial Intelligence Patent Dataset*, USPTO, https://www.uspto.gov/ip-policy/economic-research/research-datasets/artificial-intelligence-patent-dataset (last accessed 12 Jan. 2024).

[38] Mandar Karhade, *History of AI: The Birth of AI (1952-1956)*, MEDIUM (Apr. 10, 2023), https://pub.towardsai.net/history-of-ai-the-birth-of- artificial-intelligence-1952-1956-f5fbdbfff08f.

[39] McCarthy, J. et al. 1956. *Artificial Intelligence Coined at Dartmouth*, DARTMOUTH, https://home.dartmouth.edu/about/artificial-intelligence-ai-coined-dartmouth#:~:text=The Dartmouth Summer Research Project of this field of research (last accessed 12 Jan. 2024).

[40] Mariette Awad & Rahul Khanna, *Machine Learning*, *in* EFFICIENT LEARNING MACHINES 1 (2015), https://link.springer.com/chapter/10.1007/978-1-4302-5990-9_1.

[41] Glenn W. Milligan, Danny S. Wong, and Paul A. Thompson, *An Algorithm for testing robustness properties of two-way nonorthogonal analysis of variance*, 45 EDUCATIONAL AND PSYCHOLOGICAL MEASUREMENT 607 (1985), https://journals.sagepub.com/doi/abs/10.1177/001316448504500316.

[42] *Artificial Intelligence: Will machine be smarter than us in the future?*, EDUBIRDIE, https://edubirdie.com/examples/artificial-intelligence-will-machine-be-smarter-than-us-in-the-future (last accessed 12 Jan. 2024).

munication between humans and machines.[43] After a period of unachieved goals and decreased funding, known as the AI Winter, optimism about AI returned from 1993 to 2011 as new successes in task-specific models were propelled by an increase in computational power and data-driven models. In 1997 IBM's DeepBlue beat world champion Kasparov at chess. In 2002 Amazon used automated systems to provide recommendations. In 2011 Apple released Siri and IBM Watson beat two human champions at the TV quiz Jeopardy. In 2012 Google's driverless cars began to navigate autonomously and in 2016 Google's AlphaGo beat a world champion at the board game Go.[44]

As this broad timeline demonstrates, AI technologies and systems have been in existence for more than seventy years, and as such, accumulating large amounts of prior art. From the point of view of U.S. patent law, AI systems and techniques are old, not novel, and fail to demonstrate non-obviousness, an important feature for patentability. Since an AI-enabled system is not beyond or above the state of the art and can only be considered as a useful tool or technique to help humans carry out expected tasks or produce specific outcomes, it is not patentable and is not an inventor. Arguing that the contrary is what is needed to promote and incentivize innovation is absurd because AI cannot 'invent' like humans invent. AI algorithms learn (not thinking or transforming) from thousands of publicly available data sets (i.e., prior art) that are fed by a human. Once the AI system learns, it uses a mathematical function and probabilities to identify patterns and relationships in data and then uses those patterns to generate an output (*e.g.*, prediction, decision, product). The difference between today and the past is the speed of AI due to the availability of greater computer processing power, advanced chips[45] and storage capabilities. The inventor is the human that built the AI-enabled system. An example is the creation of a system and method for machine learning.[46] The USPTO has already issued millions of patents that use AI-enabled systems and algorithms as tools and techniques.

Let us now consider AI-creative innovations instead of AI-enabled systems. The USPTO determines whether the patent claim is directed to patent-eligible subject matter. Areas such as abstract ideas, laws of nature, and natural phenomena are not patentable.[47] If a patent claim is directed to one of these concepts the USPTO will reject the application. A claim may still be patentable as long as it is significantly beyond un-patentable concepts. In this case, the claim may still be patent-eligible. Autonomous systems like robots or machines, for example, that aim to control real objects such as heavy tools, packages or construction materials are generally patentable.[48] The subject matter is patent-eligible because it is not abstract, it produces a

[43] Josph Weizenbaum, *ELIZA - A computer program for the study of natural language communication between man and machine*, 9 COMPUTATIONAL LINGUISTICS 36 (1966), https://dl.acm.org/doi/10.1145/365153.365168.

[44] *WIPO Technology Trends 2019: Artificial Intelligence*, WIPO, 19, https://www.wipo.int/edocs/pubdocs/en/wipo_pub_1055.pdf (last accessed 12 Jan. 2024).

[45] Saif M. Khan, *AI Chips: What They Are and Why They Matter*, GEORGETOWN CENTER FOR SECURITY AND EMERGING TECHNOLOGY (Apr. 2020), https://cset.georgetown.edu/publication/ai-chips-what-they-are-and-why-they-matter (last accessed 12 Jan. 2024).

[46] System and method for machine learning and augmented reality based user application, U.S. Patent No. 11,625,761 (filed May 26, 2020).

[47] *Section 101 Index*, BITLAW, https://www.bitlaw.com/patent/section-101-index.html (last accessed 12 Jan. 2024).

[48] Wayne Grayson, *Komatsu brings artificial intelligence to heavy equipment with NVIDIA-powered cameras*, EQUIPMENT WORLD (Dec 13, 2017, updated Dec 15, 2017), https://www.equipmentworld.com/technology/article/14968631/

tangible result, and meets patentability requirements. Thus, patentable inventions are a combination of known elements combined in a novel and non-obvious manner. If one skilled in the art would have combined AI elements (*i.e.*, tools and methods) in such a manner, the generation of an AI-creative invention will be non-obvious. This will meet the requirement that a non-obvious conception of a novel and useful machine, process, or article of manufacture is usually the conception of a combination of known items in a non-obvious and new manner to solve a problem, thereby having utility and patentable subject matter. As AI technology advances, the amount of different types of AI-creative inventions will continue to grow exponentially across fields and increase the number of AI-creative inventions that could be potentially patented on a case-by-case basis; they include inventions in art, music, fashion, language processing, accounting, banking, corporate finance, architecture, construction, medical devices, robots, weapons, law, and the life sciences, to name a few. In the life sciences, AI creative inventions include drug discovery,[49] medical device design,[50] drug discovery and development,[51] biomarker identification,[52] protein interactions,[53] protein structure,[54] and virtual assistants,[55] among others.

If the AI-creative invention meets all the patentability requirements such as novelty, non-obviousness, utility, enablement, best mode to use the invention, and a detailed description of the mathematical functions used, the type of algorithms created and the selected data used to train algorithms, then it is patentable. There are already many patent applications with AI derived products. For example, an application providing an AI protein structure prediction method was submitted to the USPTO[56] and is currently pending. There are also many issued U.S. patents on AI applied to life sciences. Examples include medical devices,[57] protein engineering,[58] and biomarkers. These examples support the validity and usefulness of AI as a tool to generate an AI-useful invention and further demonstrates that there is

komatsu-brings- artificial-intelligence-to-heavy-equipment-with-nvidia-powered-cameras.

[49] Jianyuan Deng, Zhibo Yang, Iwao Ojima, Dimitris Samaras, Fusheng Wang, *Artificial intelligence in drug discovery: applications and techniques*, 23 BRIEFINGS IN BIOINFORMATICS bbab430 (2022), https://academic.oup.com/bib/article-abstract/23/1/bbab430/6420092.

[50] *HARNESS THE POWER OF ARTIFICIAL INTELLIGENCE IN MEDICAL DEVICES*, TÜV SÜD, https://www.tuvsud.com/en-in/industries/healthcare-and-medical-devices/artificial-intelligence-in-medical-devices#:~:text=Artificial%20intelligence%20in%20medical%20devices%20is%20employed%20to%20fulfil%20human,and%20analysis%20for%20disease%20outbreak (last accessed 12 Jan. 2024).

[51] Debleena Paul et al., *Artificial intelligence in drug discovery and development*, 26 DRUG DISCOV. TODAY 80 (2021), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7577280/.

[52] Jaishree Meena, Yasha Hasija, *Application of explainable artificial intelligence in the identification of Squamous Cell Carcinoma biomarkers*, 146 COMPUTERS IN BIOLOGY AND MEDICINE 105505 (2022), https://www.sciencedirect.com/science/article/pii/S0010482522002979.

[53] Artificial intelligence successfully predicts protein interactions, UNIVERSITY OF TEXAS SOUTHWESTERN MEDICAL CENTER (Nov. 16, 2021), https://www.utsouthwestern.edu/newsroom/articles/year-2021/artificial-intelligence-successfully-predicts-protein-interactions.html.

[54] Andy Hsien-Wei Yeh et al., *De novo design of luciferases using deep learning*, 614 NATURE 774 (2023), https://www.nature.com/articles/s41586-023-05696-3.

[55] Anthony Perez-Pino et al., *The accuracy of artificial intelligence–based virtual assistants in responding to routinely asked questions about orthodontics*, 93 ANGLE ORTHOD 427 (2023), https://doi.org/10.2319/100922-691.1.

[56] Protein Structure Information Prediction Method and Apparatus, Device, and Storage Medium, U.S. Pre-Grant Pub'l. No. 2022/0093213 A1 (published Mar. 24, 2022).

[57] Facilitating artificial intelligence integration into systems using a distributed learning platform, U.S. Patent No. 10957442 (issued Mar. 23, 2021); System, method, and device for personal medical care, intelligent analysis, and diagnosis, U.S. Pre-Grant Pub'l. No. 2019/0392931A1 (published Dec. 26, 2019).

[58] Artificial intelligence platform for protein engineering, U.S. Pre-Grant Pub'l. No. 2019/0259470 A1 (published Aug. 22, 2019).

no objection by the USPTO to reviewing and processing patent applications with AI-creative inventions as long as they meet all patentability requirements. In fact, AI inventions, including inventions developed with AI as a tool and inventions directed to AI subject matters, are patentable according to a recent USPTO report.[59] A consensus by academics and patent law practitioners generally agree that AI can represent a subset of computer-implemented technology that can be the subject matter of an invention or used to assist with other inventions. Policymakers also agree that U.S. patent laws are well positioned to address and handle both AI inventions and AI-assisted inventions on a fact-specific, case-by-case basis.

It is paramount to underscore that an AI-enabled system's work is driven by a human researcher/inventor regardless of whether an AI system is used as a tool to develop an invention. Thus, activities by a natural person that would ordinarily qualify as conception of the invention should be unaffected by such use. AI algorithms, for example, handle complex and diverse datasets to improve performance, efficiency, and accuracy and save time based on feedback. This can be illustrated by generating the 3D structure of a known protein which can be currently predicted from scratch using AI.[60] In contrast, standard technical tools are costly, complex and time consuming and due to the advent of AI tools, old scientific tools are waning in popularity due to their use requirements of multiple steps and complex instrumentation. For example, the structure-function information of a protein is usually determined via mass spectrometry and cryo-electron microscopy;[61] other traditional tools include nuclear magnetic resonance and X-ray crystallography.[62] It is possible to now use AI tools to predict protein folding,[63] although not necessarily replacing key scientific tools that are still amply used.

As supported by multiple historical and current examples, there is no need to have comprehensible law reform to respond to issues of AI inventorship. There is also no need to change U.S. patent law, or create new categories of intellectual property with distinct doctrine, or create a new set of regulations that would be distinct from traditional patents. For cases in which AI has been anthropomorphized, it is simply not possible to force the inclusion of AI-enabled systems as persons because AI-enabled systems are tools and techniques to aid humans and no more. AI-creative inventions fall within the category of subject matter and can be treated as such. As long as the inventor is a natural person, *i.e*. defined as a human and has a name,[64] the concept of inventor should remain a requirement for a U.S. patent. In the unknown and unpredictable situation in which AI-enabled

[59] *Public Views on Artificial Intelligence and Intellectual Property Policy*, USPTO (Oct. 2022), https://www.uspto.gov/about-us/news-updates/uspto-releases-report-artificial-intelligence-and-intellectual-property (last accessed 12 Jan. 2024).

[60] John Jumper et al., *Highly accurate protein structure prediction with AlphaFold*, 596 NATURE 583 (2021).

[61] Aneek Banerjee et al., Integrative approaches in cryogenic electron microscopy: Recent advances in structural biology and future perspectives, 24 iSCIENCE 1, 1–10 (2021), https://www.sciencedirect.com/science/article/pii/S2589004221000122.

[62] Andrea Ilari & Carmelinda Savino, *Protein Structure Determination by X-ray Crystallography*, 452 METHODS IN MOLECULAR BIOLOGY 63, 63–87 (2008).

[63] Jeff SoRelle, *AI vs. Crystallography: Predicting pathogenic variants*, LABLOGATORY (Feb. 16, 2021), https://labmedicineblog.com/2021/02/16/ai-vs-crystallography-predicting-pathogenic-variants; Andrew W Senior, Richard Evans, John Jumper et al., *Improved protein structure prediction using potentials from deep learning*, 577 NATURE 706, 706–710 (2020), https://doi.org/10.1038/s41586-019-1923-7.

[64] Applicant for Patent, 37 C.F.R. § 1.42 (2012), https://www.uspto.gov/web/offices/pac/mpep/s605.html.

systems develop human-like intelligent capacities and beyond (*i.e.*, artificial general intelligence (AGI) and artificial superintelligence (ASI)) and we humans lose control of such systems as a result, the argument on authorship and patentability will require a significant shift away from current protocol. By this stage, AGI and ASI will presumably have their own moral judgement capacity and thus be able to dictate how they should be (legally) governed.

3.0 BALANCING THE BENEFITS AND RISKS OF ADOPTING AI INVENTIONS BY SOCIETY

The USPTO should consider not only the technical aspects of AI creative inventions for patenting purposes but also the potential risks and harms[65] they can incur to individuals and society more broadly. Serious legal issues that have already arisen with AI-enabled automated systems include biases against protected characteristics (*e.g.* age, disability, race), as well as other issues relating to data privacy and intrusion, surveillance, and mind influencing. The consequences of not dealing with unethical and biased algorithms are now a new source of law suits[66] and class action suits.[67] Fortunately, mitigation strategies are being proposed to deal with these and other ethical problems.[68] There is no specific guidance on disclosing risk and its minimization in patent applications in the Manual of Patent Examining Procedure (MPEP). Instead, the USPTO provides an AI-related examination guidance where AI-related inventions can be viewed as a subset of computer-implemented inventions.[69]

To facilitate and promote the examination of risks in patent applications containing AI systems, we provide the following suggestions on what to disclose and describe:

(i) The patent claims should be drafted to cover the AI invention in a way that captures its novel and non-obvious aspects while also addressing risk mitigation strategies.
   a. Claims should also clearly define the scope of protection sought for the invention, including any specific features or limitations that contribute to risk reduction.
   b. Any potential risks associated with the invention, such as safety concerns or any other potential negative consequences of the invention's use, should be thoroughly disclosed and written in detail in the description of the invention.

[65] *Negative Effects of Artificial Intelligence*, MASAAR TECHNOLOGY AND LAW COMMUNITY (Oct. 3, 2022), https://masaar.net/en/negative-effects-of-artificial-intelligence/#:~:text=AI. Systems learn from training, based on their own biases.

[66] Kyle Wiggers, *The current legal cases against generative AI are just the beginning*, TECH CRUNCH (Jan. 27, 2023, 11:30 AM EST), https://techcrunch.com/2023/01/27/the-current-legal-cases-against-generative-ai-are-just-the-beginning/.

[67] Julia Musto, *OpenAI, Microsoft face class-action suit over internet data use for AI models*, FOX 2 KTVU (Jun. 29, 2023), https://www.ktvu.com/news/openai-microsoft-class-action-lawsuit-data-use.

[68] Emilio Ferrara, *Fairness and Bias in Artificial Intelligence: A Brief Survey of Sources, Impacts, And Mitigation Strategies*, ARXIV (7 Dec. 2023), https://doi.org/10.48550/arXiv.2304.07683.

[69] AI-Related Patent Resources, USPTO, https://www.uspto.gov/initiatives/artificial-intelligence/artificial-intelligence-resources (last accessed 20 Jan. 2024).

(ii) The description of background and prior art should disclose both (a) prior AI inventions, technologies, or publications that may affect the novelty or non-obviousness of the AI invention, and (b) risk mitigation strategies associated with existing technologies, methods, or products, highlighting how the AI invention overcomes or minimizes those identified risks.
(iii) For enablement and best mode, sufficient detail should be provided such that a person skilled in the art can practice the invention without undue experimentation. This includes disclosing any known risks associated with the AI invention and writing in detail strategies for minimizing those risks.
(iv) For experimental data used, evidence of risk minimization strategies employed should be included.

3.1 The Need To Start with Algorithmic Fairness

Since humans build algorithms and utilize data generated by other humans, bias is inevitably encoded into these systems[70] and replicated in the inventions created. The goal should be to ensure algorithmic fairness from the onset. As such, the USPTO should develop specific guidance that addresses the risks of embedded bias in AI-enabled systems and their creative inventions. For example, algorithms that discriminate against racial groups, skin color, or populations based on demographic information have clear legal consequences and should be preempted.[71] In these cases, the mathematical assumptions and the data used to train AI algorithms either via ML, NN or DL must be evaluated. Bias in AI systems comes from the data sets on which models are trained and from the design of the models themselves.[72] An algorithm can generate systematically prejudiced results due to assumptions in the ML process.[73] In the judicial system, for example, biases in the data, which are used to make predictions, affect who gets charged and sentenced for a crime.[74] The potential for discrimination bias in AI decision-making models underscores the need to carry out a thorough bias impact risk assessment to raise awareness of bias.[75]

Some guidelines and risk management strategies are available to deal with biases in AI algorithms. In the U.S., protected classes include age, race, gender, religion, color, national origin, disability and ethnicity, among others.[76] The Algo-

[70] Ayanna Howard and Jason Borenstein, *The Ugly Truth About Ourselves and Our Robot Creations: The Problem of Bias and Social Inequity*, 24 SCI. ENG. ETHICS 1521, 1521–1536 (2018), https://doi.org/10.1007/s11948-017-9975-2.

[71] Crystal Grant, *Algorithms are making decisions about health care, which may only worsen medical racism*, AMERICAN CIVIL LIBERTIES UNION (Oct. 3, 2022), https://www.aclu.org/news/privacy-technology/algorithms-in-health-care-may-worsen-medical-racism#:~:text=Bias in Medical and Public, recommended for the same care

[72] Greg Satell and Josh Sutton, *We Need AI That Is Explainable, Auditable, and Transparent*, HARVARD BUSINESS REVIEW (Oct. 28, 2019), https://hbr.org/2019/10/we-need-ai-that-is-explainable-auditable-and-transparent.

[73] Alexander S. Gillis, Mary K. Pratt, *machine learning bias (AI bias)*, TECHTARGET (BLOG) (June 2023), https://searchenterpriseai.techtarget.com/definition/machine-learning-bias-algorithm-bias-or-AI-bias (last accessed 20 Jan. 2024).

[74] Abdul Malek, *Criminal court's artificial intelligence: the way it reinforces bias discrimination*, 2 AI AND ETHICS 233, 233–245, https://link.springer.com/article/10.1007/s43681-022-00137-9.

[75] Lorenzo Belenguer, *AI Bias: Exploring discriminatory algorithmic decision-making models and the application of possible machine-centric solutions adapted from the pharmaceutical industry*, 2 AI AND ETHICS 771, 771–787 (2022), https://doi.org/10.1007/s43681-022-00138-8.

[76] *Laws Enforced by EEOC*, U.S. EQUAL EMPLOYMENT OPPORTUNITY COMMISSION, https://www.eeoc.gov/statutes/laws-

rithmic Accountability Act of 2019 would require large companies to audit their algorithms for potential bias and discrimination and to submit impact assessments to Federal Trade Commission (FTC) officials. The reports would address the accuracy, fairness, bias, discrimination, privacy and security issues of any high-risk system being used, as well as advise the FTC on the data used and how the system was developed.[77] Auditing AI, ML, and associated algorithms are increasingly being adopted by companies and organizations to ensure that risks are adequately managed.[78] This is paramount to preventing financial losses, reputation damage to companies, and negative effects to individuals and society. The New York City Council enacted Local Law 144 in November of 2021 to come in effect July 5, 2023. The law mandates bias audits of Automated Employment Decision Tools (AEDTs),[79] for which auditing platforms exist to help companies comply with the law.[80]

3.2 Including Audits in The Description of The Invention

In the case where an AI system and its invention falls within a regulation that already exists, inventors should disclose how such regulation affects their invention and how it was implemented to minimize any existing risks. The USPTO should require this disclosure, including an audit of the AI technology, in the description of the invention. The goal here is to determine the level of harm and the legal implications of certain algorithms so that reasonable steps can be taken to mitigate any biases that could become financially devastating for companies and individuals. Dealing with Algorithmic bias is an important ethical issue to recognize because any amount of bias in the data used to train the AI algorithm can cause undesirable effects. In recognition of this ethical problem, the American Bar Association issued a resolution urging courts and lawyers to address the emerging ethical and legal issues related to the use of AI.[81]

Although the USPTO's primary focus is on the technical aspects of patent applications, this does not preclude that the USPTO should examine ethical issues in patent applications containing AI-enabled systems. We propose that ethical issues should be part of the detailed descriptions of patent applications and should be a requirement enforced by the USPTO. This is important because ethical considerations may indirectly impact the patent examination process in certain cases.

enforced-eeoc (last accessed 20 Jan. 2024).

[77] Algorithmic Accountability Act of 2019, H.R.2231, 116th Cong. (2019), https://www.congress.gov/bill/116th-congress/house-bill/2231/text.

[78] Adriano Koshiyama; Emre Kazim; Philip Treleaven, *Algorithm Auditing: Managing the Legal, Ethical, and Technological Risks of Artificial Intelligence, Machine Learning, and Associated Algorithms*, 55 COMPUTER 40, 40–50 (2022), https://ieeexplore.ieee.org/document/9755237/; Emre Kazim, Adriano Soares Koshiyama, Airlie Hilliard, Roseline Polle, *Systematizing audit in algorithmic recruitment*, 9 J. INTELL. 46, https://doi.org/10.3390/jintelligence9030046.

[79] Automated Employment Decision Tools, 2021 New York City Local Law No. 144, N.Y.C. Admin. Code § 20-871, https://legistar.council.nyc.gov/LegislationDetail.aspx?ID=4344524&GUID=B051915D-A9AC-451E-81F8-6596032FA3F9&Options=Advanced&Search.

[80] Giulio Filippi, Sara Zannone, Airlie Hilliard, Adriano Koshiyama, *Local Law 144: A Critical Analysis of Regression Metrics*, ARXIV (8 Feb. 2023), https://arxiv.org/abs/2302.04119.

[81] Bon Ambrogi, *ABA Votes To Urge Legal Profession To Address Emerging Legal and Ethical Issues of AI*, LawSites (Aug. 14, 2019), https://www.lawnext.com/2019/08/aba-votes-to-urge-legal-profession-to-address-emerging-legal-and-ethical-issues-of-ai.html.

For example, the utility requirement must demonstrate that the invention has a useful purpose. If the AI invention raises ethical concerns, it will be contrary to its useful purpose and thus render the AI invention not useful, further impacting its patentability. Also, if the AI invention raises ethical considerations that make the invention obvious or readily apparent, it may impact the determination of non-obviousness. Furthermore, if prior art references highlight ethical concerns related to similar AI-enabled systems, such may be taken into account during the examination process. Additionally, during patent prosecution, the inventor, inventors or assignee may raise ethical considerations as arguments to support or challenge the patentability of an invention. These arguments may be considered by the USPTO to the extent that they pertain to the technical aspects of the invention.

3.3 Guidance on Ethics Disclosure

We further suggest that the risk of AI technologies should be placed across high, medium and low risk categories. AI systems categorized as high risk are those that directly impact humans (*e.g.*, face recognition), and therefore, should have built-in ethical considerations to prevent or reduce the risk of harmful outcomes. The USPTO should develop a guidance for ethical issues in AI-enabled systems and their inventions to ensure responsible and ethical development, deployment, and managing of AI technologies. The guidance should be included in the MPEP, perhaps with a section on ethical issues, and mandate disclosure in the description of the invention how biases in the AI system and its creation have been managed and mitigated.

The justification for the need to provide detailed and comprehensive descriptions of the AI-enabled system and its invention is based on the fact that for AI-enabled systems the underlying AI algorithms, ML models, DL architectures, training process, data input, and optimization techniques used are the essential parts to obtaining the desired output (*i.e.*, novel invention). Since AI systems rely on training data to learn patterns and make predictions, we suggest that inventors must disclose the source of data, including the data collection process, data pre-processing techniques, data augmentation methods, and potential biases associated with the training data. Disclosure of the data training process and the model architecture becomes paramount if the AI system involves complex neural network including the layers, connections, activation functions, and other components that comprise the AI system. The detailed description should also include the method used for performance evaluation, the learning capability of the algorithm, and how the AI system handles data processing and decision-making to generate outputs. It is worthy of mention that the detailed description, however, will depend on the type of AI-enabled system developed and its output. AI systems that involve DL methods consist of multiple layers of interconnected nodes and as a result are notoriously difficult to interpret and understand, leaving the internal processing of the system opaque and effectively a black box problem. An issue that has also been debated is that some black box inputs and operations are related to intellectual property whereby companies and developers may choose to

protect their algorithms and methods as trade secrets, restricting access to detailed information about the internal workings of their AI systems. Except for the complexity of internal computing processes, a detailed description of the invention of the AI-enabled system is possible because key information regarding the data used, their source and selection to train the algorithm, and the methods and techniques used for the process and the expected outcome are known to the inventor.

Algorithmic transparency or explainable AI (XAI) is as a result a topic of considerable discussion. The U.S. Department of Defense (DoD) has referred to XAI as "traceable AI" and included ethical principles for the design, development, deployment, and use of Al capabilities. On February 2020, the DoD reaffirmed the implementation of responsible AI with five key principles (i.e., responsible, equitable, traceable, reliable, and governable).[82] As U.S. government agencies adopt ethics rules and responsible AI, it is advisable that the USPTO adhere to the same principles by making mandatory for inventors submitting AI inventions the disclosure and descriptions of the methods used that address ethical issues, and the auditing methods used to mitigate potential impact on individuals. This could be disclosed in the detailed description of the invention under, for example, a section of ethical disclosures.

Regarding monitoring, auditing, regulation and oversight of AI-enabled systems and their products, the USPTO does not require the description of how these issues are addressed in patent applications. As auditing processes and regulations become more developed, however, AI systems and their products will need to be audited and eventually regulated. Education and public awareness on how patented AI inventions deal with these issues will become paramount. All these best practices will help the USPTO patent system to achieve its main objectives and avoid negative economic and social effects. It should also be a priority for the USPTO to continue outreach and genuinely involve a diversity of stakeholders from a variety of fields that come from industry (large and small and medium sized enterprises), academia (private and public universities), civil society (from small and local to large and international organizations), government (across the various agencies here in the U.S. and international entities), and the general public. This will ensure that the USPTO's practices, guidances and policies are harmonized with the global need for AI tools and patented AI inventions that are safe and for the benefit of society.

CONCLUSION

The US patent law system is well positioned to deal with all types of AI-enabled systems and creative inventions. Since such systems and inventions are not capable of reasoning, understanding and communicating about their environment and as such lack the basic characteristics of personhood, it is not permissible to change the U.S. patent statutes and rules to anthropomorphize them and grant

[82] *Implementing Responsible AI in the Department of Defense*, Memorandum from Deputy Secretary of Defense Kathleen H. Hicks to Senior Pentagon Leadership, Commanders of the Combatant Commands, and Defense Agency and DOD Field Activity Directors (May 26, 2021), https://media.defense.gov/2021/May/27/2002730593/-1/-1/0/IMPLEMENTING-RESPONSIBLE-ARTIFICIAL-INTELLIGENCE-IN-THE-DEPARTMENT-OF-DEFENSE.PDF.

them authorship rights. As AI-enabled systems continue to advance, the patenting of AI-creative inventions is important as long as they meet all the requirements for patentability. The fact that many patents containing modern AI tools, methods and creative inventions already exist demonstrates that U.S. patent law favors promoting innovation via the protection of intellectual property. AI technology, however, is not without its risks. We argue therefore that the USPTO should develop specific ethical and risk mitigation guidelines in patent applications for both AI-enabled systems and their inventions. Given the international reach of AI technology, such guidelines necessitate interdisciplinary and global collaboration to develop and standardize.