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## The patentability of ai inventions: Navigating the grey area between human vs computer innovation

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### Abstract

One of the most controversial topics today in the realm of Technology and Intellectual property Law is the patentability or not of inventions wrought by Artificial Intelligence. Significant progress in law has been made in this regard in jurisdictions like the United States and the United Kingdom where the consensus of judicial opinion is that inventions made by Artificial Intelligence, to wit, robots, digital assistants etc. are not eligible to be granted patent. However, there have been growing scholarly exhortations in legal cycles for possible review of this position. This article is a new addition to that increasing scholastic demand for the expansion of the parameters for patentability especially as it relates to Artificial Intelligence. It suggests amongst other things that while the patentability of each case of AI-driven invention ought to be decided on the merits of its own peculiar facts, nonetheless, the relative levels of involvement of the said Artificial Intelligence in the process of making the invention sought to be awarded a patent, and the substantiality or not of its contribution to the project, should also weigh high in the overall consideration of whether the resulting invention should be patented or not.

**Keywords:** Technology; Intellectual Property; Patents; Artificial Intelligence; Innovations

### 1. Introduction

Like the steam engine or electricity, artificial intelligence will result in or has already begun another industrial revolution. While the possibilities that have been unlocked seem mindblowing already, it becomes even more daunting when one considers that we are merely on the precipice of what can be achieved with AI. A deep plunge into an AI-driven world is inevitable and any attempt to exclude the influence of AI in any aspect of human productivity is simply unintelligent. Already AI is revolutionizing the inventive process by replicating human reasoning and automating steps in the 'process' Ning (2017). While this allows for the creation of patentable subject matter that is of immense benefit to society, it challenges traditional notions of patentability which seek to reward the creative effort of human inventors in conceiving new and useful inventions.

Consequently, the patentability of AI-assisted inventions and more critically, AI-generated inventions have been the subject of much debate. This article attempts to address some of these concerns by considering how AI has been applied in the inventive process. Based on this understanding, it examines the concept of inventorship under US patent law from a fundamental perspective to assess whether the national patent system supports this changing paradigm. It then considers various factors within the US patent jurisprudence that collectively serve as a guide for navigating this grey area of patentability of AI inventions.

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## 2. Artificial Intelligence and the Inventive Process

Opinions about the impact of AI are often formed with only an ancillary understanding of the basics of AI, McLaughlin (2018). Most literature discussing the inconsistency of patent systems with AI inventions has been undertaken without adequate technical inquiry into the very source of these concerns - the seemingly 'autonomous' generation of inventions by computers, Kim (2020). While such a deeper inquiry is not the focus of the scope of this paper, some points about the phenomenon must be noted.

First, the concept of machine learning (ML) should be understood. ML has become an indispensable field of AI such that its meaning is often colloquially used in defining AI generally, McLaughlin (2018). ML involves a series of functions ranging from 'data exploration and pattern recognition', which involves the analyses of massive datasets to identify hidden patterns and connections which have the potential to reveal unseen solutions and groundbreaking insights, to 'reinforcement learning' which allows AI systems learn through trial and error, iteratively exploring and refining solutions to complex problems, Hrvoje (2023). Other fields of AI such as 'natural language processing' which allows AI systems to sift through scientific papers, patents, and other texts to discover existing knowledge and draw inspiration for new ideas, Just (2024), as well as 'computer vision' which enables AI to analyze images, videos, and other visual data to identify objects, relationships, and patterns that might inspire innovative solutions; etc have also had a major impact on the inventive process. Behind these functions are artificial neural networks (ANNs) which mimic patterns in the human brain as well as evolutionary algorithms which iteratively test solutions and amplify the best, Yasar (2023)

It is important to understand these functions to better appreciate how they are causing a shift in the inventive process. Prime examples of the application of these technologies can be seen in the pharmaceutical industry. Before now, on average, the process of drug discovery and development costs about \$2.6 billion with the average lab-to-market timeline being 12 years. This is because the process relies heavily on a trial-and-error approach, requiring the examination and testing of large numbers of potential drug compounds, possibly millions, to identify those with the desired properties, Blanco-Gonzalez (2023). But, with the use of AI, researchers can discover new drug candidates and drug targets and even discover new applications for drug repurposing in a fraction of the time (in some cases within months) and the cost, Ning (2023). This is possible as AI systems can sift through mountains of chemical and pharmacological data, medical literature, genomics and patents to discover patterns that may have otherwise taken humans several years to discover.

Such inventions, which still involve a fair amount of human input are considered 'AI-assisted inventions'. However, some AI systems have assumed significant human inventive capacities and can independently generate solutions without detailed problem statements or defined parameters of output. One such example, which has sparked debates worldwide on the principle of inventorship, is DABUS (Device for the Autonomous Bootstrapping of Unified Sentience). Between 2018 and 2019, the creator of DABUS, Stephen Thaler, filed across the US, UK, European and Australian patent offices, patent claims for a food container constructed using fractal geometry, which enables rapid reheating, and a flashing beacon for attracting attention in an emergency, Weber (2023). While not asserting that the inventions did not meet the standard patentability requirements of novelty, usefulness, and non-obviousness, the USPTO rejected the application as Thaler listed DABUS, an AI system, on the datasheet and the oath as the inventor and not himself, Schwartz (2022) Notwithstanding that before then, some AI-generated inventions had been patented without the 'inventors' disclosing an AI system was the 'inventor-in-fact' While Thaler's actions and arguments showed integrity, the USPTO was resolute in its rejection on the basis that US patent law requires an 'inventor-in-law' to be a natural person, Ning (2023). A court of the Federal Circuit in an appeal by Thaler affirmed the decision of the USPTO, holding that an inventor must be human. While the Court did not pronounce expressly on the patentability of AI-assisted inventions, the ruling revealed gaping holes in the patent system concerning the protection of AI inventions. Considering that we are in the dawn of an AI-driven age, the place of AI in the determination of inventorship must be determined sooner rather than later.

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## 3. The Inventorship Requirement

The patent system is built on the fundamental principle that there must be a substantial contribution to the inventive process for one to be entitled to the status of inventor, Kim (2020). This process essentially involves "...identifying a problem to be solved, creating a solution to solve the problem, and applying the technical teachings of that solution to the problem." Ramalho (2018) The challenge that AI poses to this process and the patent system is that the most essential component of this process, the 'conception' of solutions, which has traditionally been considered to be within the exclusive domain of human cognition, is now being replicated by computers, Odeh (2020). This phenomenon raises

some vital questions: Should humans be entitled to inventorship for inventions generated with AI? What level of contribution to an AI invention entitles a human to claim inventorship? Can AI systems be recognised as inventors?

The answer to these questions would be simpler if the ratio of human to AI contribution in an AI invention could be reduced to numbers such that it can be determined with mathematical exactitude whether an invention is AI-generated and therefore not patentable or AI-assisted and possibly patentable. But being that these factors are indeterminate, it should be acknowledged that AI involvement in the inventive process occurs on a spectrum. At one end of the spectrum are AI-generated inventions with the most negligible human contribution and on the other are AI-assisted inventions with the most negligible AI contribution. The challenge with ascribing patentability lies with inventions that fall anywhere in between these ends.

If it is accepted that this phenomenon can be examined on a spectrum, the normative criteria for each measure on the spectrum cannot explicitly be found in existing patent law. If they were, perhaps it would have allowed for a more detailed justification of the rejection of the DABUS' inventions and other AI inventions which have been rejected by the USPTO and the courts. Regardless, it would be necessary to undertake a re-evaluation of the principle of inventorship from a fundamental perspective to determine if any underlying principles support this changing paradigm.

### 3.1. The Legal Scope of Inventorship

The legal scope of inventorship takes its roots in the Constitution which grants powers to Congress to make legislations that "Promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries." (United States Constitution). The Patent Act, which was created in light of this clause, the Intellectual Property Clause, defines an inventor as "the individual or, if a joint invention, the individuals collectively who invented or discovered the subject matter of the invention." (The provisions of this legislation have been expanded by subsequent judicial activity. For instance, the courts have held that to qualify as an inventor in a situation of joint inventorship, one must "...contribute in some significant manner to the conception or reduction to practice of the invention [and] make a contribution to the claimed invention that is not insignificant in quality, when that contribution is measured against the dimension of the full invention." See *Nartron Corpo v. Schukra, USA., Inc* 558 F. 3d 135 6-57 (Fed. Cir. 2006). Based on the above, the following may be deduced: that an inventor must be a natural person and that invention must not be a product of his singular effort. This provides a basis for the patentability of AI-assisted inventions. The question then becomes the amount of contribution that must be made to be entitled to be an inventor.

Furthermore, it may also be deduced that a person cannot claim inventorship where he did not make a significant contribution to the conception and reduction to practice of the invention. This seems to preclude a claim of inventorship for AI-generated inventions. Contemporaneous comments from the framers of the Act seem also not to support such a conclusion as patentable subject matter has been popularly defined as "anything under the sun made by man" (Senate Report No.1979, 1952). Even in a situation where an applicant has a proprietary interest in the author of the invention, if there is no significant contribution on his part, he cannot claim inventorship. Historically, this is illustrated in the dark days of slavery in the US during which neither the slave owner nor the slave could patent the machine invented by a slave, McLaughlin (2018). The rationale for this was that the slave owner could not swear an oath of inventorship needed for patent registration and that the slave could not swear at all. Summarily, an inventor has been considered to refer to "...a human individual who is capable of contributing to the invention through conception or reduction to practice." McLaughlin (2018).

Perhaps a deeper inquiry could be made by evaluating the provisions of the Constitution. Does the text of the Intellectual Property clause preclude any claim for inventorship in the absence of significant contribution? The operational words in the clause, as it concerns patent law, are 'inventors' and 'discoveries'. Authors in deciphering the meaning to be ascribed to 'inventor' within the relevant time-period, 1787, often have recourse to Samuel Johnson's Revolutionary-era Dictionary which, in its 1785 edition, defined inventor as "[o]ne who produces something new; a deviser of something not known before." Schwartz et al (2022). This requirement of not being known before naturally raises the question: Not known where? Does this suggest that an invention not known within a particular jurisdiction may yet be claimed as an invention in another jurisdiction where that invention was not known before? This leans on patents of importation which although not expressly permitted under US patent law was permitted under English patent law from which US patent law drew heavily. Thus, under English law, one could be an inventor "...merely by providing the public the benefit of introducing an invention "not known or used" in the realm." Schwartz et al (2022) The requirement of significant contribution that would justify entitlement has been argued to be the effort and labour it took to travel to Europe and other parts of the world to bring new inventions back to the United States, Evans (2010) If this is agreeable,

it would hardly be a stretch to argue that a person should be entitled to inventorship for introducing an invention generated by AI, particularly where he has taken pains and expended resources to develop said AI system.

History shows that the first draft of the Patent Act of 1790, a precursor of the extant law, clearly accommodated patents of importation, Waltersheid (2009) Although the position was changed in the final draft, it has been noted that a number of framers and other founding fathers such as George Washington preferred the incorporation of patents of importation, Schwartz et al (2022). Although patents of importation were rejected at that time and have been maintained till today, what is clear is that Congress has the power to permit patents of importation under the Intellectual Property clause. If so, based on the above inference, the patentability of AI-generated inventions may yet be made possible by Congress without the need for a constitutional review. But until such a time, our attention should be focused on the patentability of AI-assisted inventions which may be patented under the extant law.

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#### 4. Criteria for Patentability of AI-Assisted Inventions

As we previously noted, the ratio of human to artificial intelligence involvement that can be seen in an AI invention lies on a spectrum. What are the criteria for determining the position of such an invention on this spectrum? What factors are the courts or lawmakers likely to consider if they are to decide on the patentability of AI-assisted inventions?

One factor that would generally be agreed upon is the amount of contribution to the inventive process. Judicial pronouncements, Schwartz et al (2022), and legislative provisions are in accord on this point. Section 116 of the Patent Act which qualifies who can claim inventorship in a situation of joint inventorship indicates that the operational factor is the amount of contribution to the inventive process. Although different patentable subject matter may follow different steps in their invention, the inventive process is generally considered to include the following: the definition of a problem, conception of a solution, development of the solution, reduction to practice and documentation, Abbot (2016). The more the contribution of a human to these steps, the stronger the argument for patentability. To illustrate this, we refer back to the pharmaceutical industry. An example of a patentable AI-assisted invention could be software designed for personalized medication dosing. Let's say an inventor who has been studying how the problem of variability of individual responses to medication dosages conceives a solution: an AI algorithm that analyzes patient data (genetics, medical history, etc.) to predict optimal medication dosage for each individual. This invention would, inter alia, be built on predictive models, Ghassemi (2018). If he uses an existing AI system to build and refine the predictive models that estimate the dosages or uses a system that generates and tests different combinations of features (patient variables) to determine the most influential ones for dosage prediction, provided he contributed to other steps in the inventive process such as performing human clinical trials, his contribution to the development of this invention may yet be considered substantial. If in this scenario, other factors remain the same and he did not conceive the algorithm as a solution, there would be a weaker argument for its patentability.

Deriving from the above factor of human to AI involvement, another factor that should also be considered is whether the AI system employed in the process was itself the creation of the human inventor. That is, whether there is a mutuality of inventorship between the AI and the invention, Ning (2023) If the AI was a product of the inventor's innovation, even if it was used to generate patentable inventions, such further inventions should be patentable. This would be justified as the spirit and purpose of the US patent system is to "...provide an incentive to invent, [and] promote the full disclosure of inventions...." *Pactiv Corp. v. Perk-Up, Inc.*, Civil Action No. 08-05072 (DMC), 2009 WL 2568105 Thus, embracing this factor would promote the development of more AI systems as well as full disclosure in patent applications. Consequently, in our above example on the personalized medicine dosage software, if our inventor was the one who developed the AI he used and it was that AI that generated the solution of using an algorithm to predict optimal medicine dosage, he should yet be considered the inventor and patentee of the software.

Another factor would be the necessity of the AI's involvement. This would essentially ask: but for the AI's involvement, would the invention have been discovered? Ning (2023). This factor aligns with the purpose of patent law to promote the progress of art and science. Again, the pharmaceutical industry offers an apt illustration. While drug discovery has before now been successfully carried out, the emergence of new and complex medical conditions and diseases like the coronavirus disease, have added to the complexity and exigency of drug discovery and development thereby making the use of AI critical in some circumstances. For instance, AI algorithms were used to predict the 3D structure of the SARS-CoV-2 spike protein, a crucial target for vaccine development. This assisted scientists in identifying potential vaccine candidates for further testing. Also, AI helped screen enormous libraries of molecules, identifying those with promising properties for use in vaccines or antiviral drugs. See Ashwani Sharma and others, 'Artificial Intelligence-Based Data-Driven Strategy to Accelerate Research, Development, and Clinical Trials of COVID Vaccine' BioMed Research International (2022).

It has also been suggested that the legal implications of granting a patent to such an invention should be considered. These would include matters of public policy, particularly issues of unfair competition. This is based on the argument that “...private parties with greater access to AI resources are at a natural competitive advantage over those with less AI accessibility: an imbalance that commentators believe will reshape U.S. patent law.” Thus, if the purpose or output of the invention in controversy is anti-competitive, then there is a strong argument against patentability. An example of anti-competitive purpose or output can be seen in the evergreen patenting practices of pharmaceutical companies.

It is suggested that these factors be applied collectively along the spectrum. That is, if an invention in controversy is placed at the middle of the spectrum, with purely AI-generated on the right and purely AI-assisted on the left, the invention should be examined against each of the above factors. With each factor that is attributed to either human intelligence or artificial intelligence, the position of the invention would move either towards the right or the left such that at the end of the evaluation, an objective assessment of its patentability would be achieved. Admittedly, this is simplistic and maybe with prejudice to the intricacies that may be involved in deciding even on a single factor. However, it presents a starting point and to an extent, reduces the subjectivity that may otherwise be exhibited in deciding without set parameters.

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## 5. Conclusion

Without a doubt, the advancement of AI and its disruptive effects in all facets of human activity cannot be slowed down, let alone stopped. As the years go by, AI will continue to be used in the inventive process in far deeper capacities than they currently are. While this may offend some traditional notions of patentability, it should also be acknowledged that these advancements are to the benefit of society. It should also be understood that while an attempt to exclude AI inventions as patentable subject matter may seem to protect some of these traditional notions of patent law such as human inventorship, it needs to be balanced with the need to promote the progress of art and science which is rapidly becoming AI-driven. Such development of the law must however be undertaken with caution so as not to allow for overbroad patenting and at the same time unjustified rejection of patent-worthy inventions based on AI involvement. To properly navigate in this emerging paradigm, the law must develop a guide to determine with as much objectivity as possible, the patentability of AI inventions. While some criteria have been offered in this work for consideration, they are by no means exhaustive. And while this guide may be skewed at this time to favour the patentability of inventions with lesser AI involvement, as AI infiltrates further into the inventive process, legislative amendments may have to be made to embrace the patentability of AI with lesser proportions of human involvement.

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## Compliance with ethical standards

### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

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## References

- [1] Abbott R, 'I Think, Therefore I Invent: Creative Computers and the Future of Patent Law' (2016) 57 Boston College Law Review <[https://heinonline.org/HOL/Page?handle=hein.journals/bclr57&div=35&g\\_sent=1&casa\\_token=&collection=journals](https://heinonline.org/HOL/Page?handle=hein.journals/bclr57&div=35&g_sent=1&casa_token=&collection=journals)> accessed 11 January 2024
- [2] Blanco-González A, 'The Role of AI in Drug Discovery: Challenges, Opportunities, and Strategies' (2023) 16 (6) Pharmaceuticals (Basel) <doi: 10.3390/ph16060891> accessed 10 January 2024.
- [3] Evans O, *Exposition of Part of the Patent Law by a Native-Born Citizen of the United States; To Which Is Added, Reflections on the Patent Law* (Gale, Making of Modern Law, 2010)
- [4] Ghassemi MM and others, 'Personalized Medication Dosing Using Volatile Data Streams' (Thirty-Second AAAI Conference on Artificial Intelligence, New Orleans, February 2018)
- [5] Just J, 'Natural language processing for innovation search – Reviewing an emerging non-human innovation intermediary' (2024) 129 Technovation <<https://doi.org/10.1016/j.technovation.2023.102883>> accessed 11 January 2024.
- [6] Kim D, 'AI-Generated Inventions': Time to Get the Record Straight?' (2020) 69 (5) GRUR International <doi: 10.1093/grurint/ikaa061> accessed 10 January 2024

- [7] McLaughlin M, Computer-Generated Inventions (2018) American University Washington College of Law Legal Studies Research Paper Series <<http://dx.doi.org/10.2139/ssrn.3097822>> accessed 8 January 2024
- [8] Ning H, 'Is It Fair? Is It Competitive? Is It Human?: Artificial Intelligence and the Extent to Which We Can Patent AI-Assisted Inventions' (2023) 49 Journal of Legislation 429
- [9] Odeh M.K, 'Patenting Inventions Generated by Artificial Intelligence: The Way Forward' (2020) 11 (2) The Gravitas Review of Business and Property Law <<http://dx.doi.org/10.2139/ssrn.3910124>> accessed 10 January 2024
- [10] Ramalho A, 'Patentability of AI-generated inventions: is a Reform of the Patent System Needed?' (SSRN, 5 February 2018) <<http://dx.doi.org/10.2139/ssrn.3168703>> accessed 10 January 2023.
- [11] Schwartz D.L & Rogers M, "'Inventorless" Inventions? The Constitutional Conundrum of AI-Produced Inventions' (2022) 35 (2) Harvard Journal of Law and Technology <<https://jolt.law.harvard.edu/assets/articlePDFs/v35/3-Schwartz-Rogers-Inventorless-Inventions.pdf>> accessed 11 January 2024
- [12] Sharma A and Others, 'Artificial Intelligence-Based Data-Driven Strategy to Accelerate Research, Development, and Clinical Trials of COVID Vaccine' (2022) BioMed Research International <doi: 10.1155/2022/7205241> accessed 11 January 2024
- [13] Smolic H, 'A Beginner's Guide to Machine Learning: Understanding the Basics and Getting Started' (Graphite, 22 October 2023) <<https://graphite-note.com/a-beginners-guide-to-machine-learning-understanding-the-basics-and-getting-started>> accessed 11 January 2024.
- [14] Walterscheid E C, 'Within the Limits of the Constitutional Grant": Constitutional Limitations on the Patent Power' (2002) 9 Journal of Intellectual Property Law <<https://digitalcommons.law.uga.edu/jipl/vol9/iss2/3>> accessed 10 January 2024.
- [15] Weber T, 'The Inventor who fell in love with his AI' (The Economist, 2023) <<https://www.economist.com/1843/2023/04/04/the-inventor-who-fell-in-love-with-his-ai>> accessed 11 January 2023.
- [16] Yasar K, 'Neural Network' (TechTarget, August 2023) <<https://www.techtarget.com/searchenterpriseai/definition/neural-network>> accessed 11 January 2024.
- [17] Yasunari, M and Yashiro R, 'AI-Based Computer Vision Techniques and Expert Systems' (2023) 4 (1) AI <<https://doi.org/10.3390/ai4010013>> accessed 11 January 2024

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## 6. Appendix

- **Table of cases**

- Nartron Corp. v. Schukra U.S.A., Inc., 558 F.3d 1352, 1356-57 (Fed. Cir. 2006)
- Pactiv Corp. v. Perk-Up, Inc., Civil Action No. 08-05072 (DMC), 2009 WL 2568105
- Pannu v. Iolab Corp., 155 F.3d 1344, 1351 (Fed. Cir. 1998)
- Thaler v. Vidal, 43 F.4th 1207 (Fed. Cir. 2022)

- **Table of statutes**

- Constitution of the United States art. I, § 8, cl. 8.
- Patent Act 35 U.S.C. § 100(f) (2012)