Problems of Patentibility and Inventorship for Inventions Created by Artificial Intelligence

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Abstract—**This study examines the expected interference of artificial intelligence (AI), which challenges the fundamental legal standards used in two principal aspects to protect the patent law: first, if any modification is required to promote the AI innovation under the current patent subject eligibility standard; and, second, if the inventions created by the AI must be patentable are crucial in order to patent issues of imminent disorder and merit discussion. The research also reviews the legal question of whether AI inventions can be properly protected without human intervention under the current patent scheme. To explore the discussion, the research starts with the methodology of "doctrinal" or "black letter law". The study is also based on a comparative method to examine, where appropriate, the patentability and the problems of inventorship on the invention generated by the AI. The feasible recommendation is therefore that the patent system must find ways to help achieve its primary goals. This means that the definition of the individual, inventor and individual specified in patent law needs to be reviewed to ensure a valued identification of patentability and of an inventorship in the rapid development of the technology.**

Index **Terms—Artificial intelligence (AI), patentability, inventorship, human intervention, invention.**

I. INTRODUCTION

The cognitive function of an adapter which is connected with the human mind, features such as language comprehension, problem solving and teaching classifies them as Artificial Intelligence (AI). AI is often defined by its field, for example, logical thinking, knowledge representation, planning and navigation, Natural Language Processing (NLP), perception, or by the number of subjects, such as Machine Learning (ML), deep learning, artificial neural networks, systems, and robotics, which is part of its field of activity [1]. Based on its areas of concern, AI is frequently defined. Due to progress in ML algorithms, exponential growth and enhancement of data supply and lower computing power in these last two decades AI's technological breakdowns are dramatically increasing [2]. In addition to increasing positive, independent and cognitive functions, for instance, learning from experience and making genuinely unrelated choices, the great development

made by AI in technology phrases during the last decade has allowed them to do common human activities. AI revolutionizes the manner human beings live, paintings, examine, analyze and speak, bringing humans on the edge of a time whilst AI robots, bots and androids are increasingly more sophisticated, and might be capable of release a new industrial revolution.

The future of AI technology promises to influence the way people operate with presses that seem to have exceeded human efficiency in areas like medicine. Nevertheless, the discussion continues whether AI can overcome human capacity or whether it is best used as an instrument to help people in their job? In this context, the consequences on patents and intellectual property for the increase of AI are also under discussion. It has been planned that 38% of the AI in organizations and 62% were projected in 2018. In the same vein, AI led the world's leading companies to a patent competition and intellectual property (IP) rights that are growing dramatically through a wide range of AI patent application programs [3].

II. THEORETICAL BACKGROUND

Increasing media coverage has been the consequence of continuous advancement in increasing its capacity. AI is a technology with a deep growth in attention over the years. Recent successes have found that AI now can learn how to perform complex tasks in conjunction with music compose independently, disclose mathematical theorems and participate in inventive steps. AI develops computers into thinking machines that are able to fulfill innovative and ingenious obligations through the use of evolutionary understanding technology, molecular biology, neurology and cognitive human techniques [4].

The Creativity Machine, which was developed by Stephen Thaler in 1994 as an AI pioneer, has already become capable of generating new thoughts by means of neural artificial networks which can be collections of on / off switches which automatically connect to a software program without human intervention. The creative machine can generate virtually new, creative ideas by combining an artificial neuronal network that generates output through self-stimulation of network-output relationships. It was also considered that, on 15 May 1998, an invention was created which finally became the first patent to be granted for an invention manufactured using an AI on the behalf of the United States Patent No. 5,852,815. Thaler nevertheless recognized himself as the sole inventor, not discovering the involvement of the Creativity Machine in the US Patent and Trademark Office (USPTO) [5].

The computers' invention machine John Koza is another notable example. It is a model of the process of bio-development for the genetic programming inventory machine. The invention was also produced by an invention machine culminating, on 25 January 2005, in the American patent number 6,847,851. But as inventors, Koza and two others, such as the patent for the invention granted by the Creativity Machine, were included; the involvement of the invention machine was not disclosed to USPTO during the proceedings or the application procedure [6]. It is very wonderful for age reasons that AI innovations were already awarded patents, but it increases also concern since it offers patentability inventions and inventorship with unexplored problems of patent regulation.

The discussions about AI's growth of the invention, including the Creativity Machine and Invention Machine, and modern patent drafting technology predict a global process in which AI can autonomously complete the whole inventiveness and patents process. It begins with an AI that produces inventory ideas that usually develop patent applications to protect such ideas without any human insight. By accessing the historically required areas of human naivety, the number of key legal and policy issues to tackle will be increased. For example, if so, to what extent should the innovation generated by AI be covered? And if the patented synthetic intelligence collision is legalized in patenting AI inventions, should AI be inventorship?

III. THE STANDARD FOR AI PATENT ELIGIBILITY

In many countries such as Japan, the United Kingdom, and the USA, a growing number of AI patents have been issued, but the present legal framework for patentable subject matter has been stepped up for 2014, with access for AI patents increasingly challenging for patent applicants [7]. The European Patent Convention (EPC) excluded AI as a method of patentability. The technical feature and patentability of this subject-matter, for this reason, shall not be excluded if the object of the claim as a whole is addressed by technical means to a process (for example, a machine). An important factor in EU algorithms was AI. The claim "as such" was excluded from patentability, as it was similar to mathematical methods. However, if the claim relates to a method by using technical means or devices (e.g. computer), the subject-matter as a whole has a technical character and the barrier to eligibility has therefore been crossed and patentability not ruled out [8].

There was no patentability in the United States of the abstract ideas which made eligibility difficult. There is currently, however, little information on how to define the term abstract. In addition, simply using a computer to create an abstract idea was not enough to remove the hindrance to eligibility in the US. Therefore, in the United States, eligibility was more a matter for AI applications than in Europe. In the light of the many similarities between the legal patenting frameworks in the USA and Europe, many AI-related inventions are probably subject to the same patent allowance odds under both regimes. A possible difference between AI patents in Europe and those in USA is the possible impact of restricting mathematical recitation to a specific technical purpose or application [9].

In Japan, claims for AI inventions had to be prepared in a single format to meet the criteria of patentability. In order to implement, find and provide sufficient proof, it was not necessarily evident that the contravening product or method was worked out. The Courts could, therefore, issue documents production orders for the systems behind it. Examples of correlations with the AI-related invention in Japan should therefore be revealed when filing AI patent applications [10]. Some AI inventions should also include test results or validation of the AI model. In addition, new input and output data may be sufficient to establish a patentable inventive step in Japan. It remains to be seen whether there are similarly other patent offices dealing with inventions related to AI.

In the United States, there are also other issues that may need to be addressed first, namely the present chaotic state of the patentability law and that artificial intelligence inventions are correct and consistent. There was a major problem for all US applicants with the uncertainty about the application and therefore the eligibility criteria of Patent protection of Section 101 of the US Patent Law. The new Patent Commissioner has announced that he will focus his attention on a sustainable solution. The second point was the decision on the validity of patents made by the Trial and Patent Appeal Board. However, its decisions have become more patentable over the last three months [11].

Many recently argued that providing software can encourage software-specific research investment and foster innovation by providing incentives to innovate inventively, invest and innovate. This argument would also apply to AI, however, because of the higher AI potential over software the case for innovation could be stronger. Others argued that software patents constitute an impediment to innovation. Some suggested that software should not be granted patents, and others suggested that short-term patents should be granted. Moreover, courts often claim, for imitation or reproduction of patent claims for human activities, that there is no "inventive concept". These various perspectives must be taken into sufficient account to see whether AI patents actually promote innovation or are more effectively protected by other means [12].

Contrary to more general software considerations, it should be discussed also whether the economic, social and ethical implications of the AI patent stimulation may differ or exceed that of the software stimulus in general. Others think that AI is not going to be very different in its overall economic impact from previous technological developments. But this is still difficult for some, even if it did, because they believe that the new technological changes have led to greater inequality and the reduction in workforce participation. Some still support the development of AI to facilitate innovative discovery to boost productivity growth and improve people's life worldwide by overcoming all adverse employment and inequality effects of AI.

In the extent necessary in any patent law adjustments, it should also be considered how to implement legal changes to maximize the social and ethical benefits of AI. Reducing the patentability standard of AI inventions in areas considered to be more socially advantageous such as healthcare, the environment, criminal law and education could serve as one way to help balance innovation with ethic mitigation. These issues must be closely considered by all relevant actors to ensure the Patent Law develops and achieves an optimal balance between the different opposing goals.

IV. PATENTIBILITY AND INVENTORSHIP ISSUES ON AI-GENERATED INVENTIONS

In order to determine whether AI patents for inventions produced would further the main objectives of the patent system it must also examine the question of patent eligibility for inventions generated by AI. Some people have argued that granting patent rights to inventions generated by AI will accelerate innovation or even enable progress which cannot by human genius be achieved. In this regard, new inventions created by AI will increase social costs, monopolies and prevent the creation of new businesses, hampering innovation. Others have argued that patent rights do not promote innovation, that individuals or AIs have produced inventions. In this view, further patents resulting from AI-generated inventions increase social costs and monopolies and impede the entry of new enterprises and thus hinder innovation [13]. Some point out that although patents on inventions generated by AI finally promote innovation, those patents might adversely impact future human innovation, because an atrophy of human intelligence might result from the invention's replacement by independent algorithms. They believe that alternative means of preventing infringements of the patent rights, such as advantages for an initial mover and recognition of the social identity of AIs, and alternative technology, lead to innovations and public communication of the invention [14]. In order to take into account these contrary opinions, it is important to examine closely the net impact on innovation arising from patent rights for inventions created by the AI. For example, whether patents for the inventions generated by the AI encourage dissemination of information or encourage the right of beings to create inventions that operate the system needs special attention.

Moreover, if patent rights are granted to inventions generated entirely by AI, then the next question to be asked is who should be listed. Certain people argue that if AI is indeed inventive, it would then be in accordance with the Constitutional rationale for patent protection to treat computer inventions as being patentable and recognize AI as an inventor. However, in order to do this, AI needs to be recognized as a legal entity or person who is unavailable under current EU and US patent laws.

Although the definition of inventories is not explicitly laid down in the European Patent Convention (EPC), it is commonly understood that inventors should be natural persons. (Paragraph 60(1) EPC). The inventor is the creator of the invention. The invention is the intellectual creative action of the inventor. Thus, a person may not be regarded as a (co-)inventor simply following another person's instructions. This also applies to corporate. The concept of inventorship in European patent law builds on a notion of a natural person's act of intellectual creation. The system used to produce an invention is "intelligent" and could possibly even have the ability of a human inventor. However, a non-human entity contributing to the act of creation cannot be chosen as inventor under current European patent law. There cannot be an invention without a human inventor.

The European Patent Convention (EPC) does not allow software "as such" to be patented. However, Europe will allow claims for "computer-implemented inventions" (Art. 52(c) of Convention on the Grant of European Patents), i.e. inventions involving a software component and another thing. The "something else" (Case T-1173/97, Comput. Program Prod./IBM), 1999 O.J. E.P.O. 609), must produce a "further technical effect, for instance, it must communicate in some ways with the actual globe. Almost every AI invention has this interaction, or otherwise why was it invented? AIs that optimize transport patterns to decrease energy demand can provide an additional technical impact, for instance, AIs that handle network transfers and compress information in order to decrease bandwidth use and AIs that read sensors or drive actuators.

Likewise, in order to encourage the people to pursue ideas that might prove beneficial, a person who traces the origins of US patent law should be allowed a right in the interest of its invention for some time. Under American patent law, the invention requires a definitive and permanent idea of the whole and operational invention, in which "the inventor" refers to an "individual", to be conceived which is in the mind of the inventor [15]. The use of AI, especially the deep-seated machine learning or the development and encoding of AI, raises questions as to who (or what) conceived of the invention and, therefore, should be appointed as an inventor. The design is determined by design or by a creation in the mind of the inventor of a definite and permanent concept of an overall or operative creation. As AI moves forward, the USPTO receives more patent requests, wherein AI may be regarded as an inventor or a co-inventor at least. It is up to the USPTO and the judiciary to decide whether computer inventors are included in the present Patent Act. Some have already called for computers to be a legal inventor [16]. Some have asserted that AI will displace people entirely from the inventive step quickly and that patent protection would not therefore be provided unless a person contributes materially to designing an invention.

It can also be a factor to predict the inventive principle. The programmer would probably have had the inventive concept with the AI as an instrument to decrease the idea to practice if the programmer develops an AI with a particular purpose in view and it is expected that the AI would produce the outcome. If the result is not predictable, it remains a question if it is sufficient for an inventor to recognize the importance and patentability of the result.

That is no longer the case: Stephen Thaler's creativity machine, referred to above, produced an invention that was later transformed into a US patent. John Koza's Invention Machine was also known for producing an idea leading to a US patent. The involvement of AI technologies, however, was neither revealed nor listed as inventors by the US Patent and Trademark Office.

Nevertheless, as long as the inventor's role is legally binding, the general definition of a legal person which is an area of legal rights and obligations is likely to be sufficiently broad as possible to cover AI. Theoretically, AI can therefore have legal status and inventor status if the legislature is prepared to grant them. However, it is important to evaluate whether inventorship would be beneficial for the patent system [17].

Reviewing the definition to cover the use of AI by a person would in particular significantly increase the non-obviousness bar. Too high a standard could prevent valuable inventions from being patented and prevent innovation. An excessively low barrier, on the other hand, may cause a flood of junk patents, which can prevent

companies from developing and also increase the patent level against genuine innovative companies.

With this in mind, human participation might be limited to switching on the system and/or reading the results. Thus, as the human contribution decreases, the concept of inventorship becomes more and more disputable. If the human contribution is simply that the AI system is activated and/or the results are read, it can be argued that its purpose is no longer achieved.

In order to be eligible for patent protection, the patent applicant shall, in addition, clarify the technical purposes of the invention, ensure that the technical solutions provided by the invention are detailed in the specification, but note that these descriptions must be sufficiently compatible with the language claimed. The Patent Office should, of course, update any forthcoming guidelines concerning the patenting of the inventions relating to the AI, for example by specifying in the guiding principle that the patent applicant should prevent excessive dependence on commonly used AI mock words like neural net, reasoning engine and vector-supporting machine.

The final related question is whether AI content should become a state of the art. If so, the burden on the ability of the patent office to examine its prior art may be increased by reducing the chance to effectively identify the best prior art. Similarly, if content generated by AI has been qualified as a prior art, it may be even more difficult to meet the current requirement for patent applicants to communicate to the patent office all information which they know to be patentable material, considering the imposition of certain regulations for the treatment as a state of the art of AI-generated contents.

V. Conclusion

The anticipated disintegration of AI will be much more prevalent than prior technological changes, challenging the core legal standards which serve as the protection of patent legislation. The problem solutions provided by AI therefore have relevance both to the patenting and inventorships of computer-implemented inventions. Furthermore, aided by the AI examination, the patent applications could generally have been more thoroughly examined. Inadequate preparation could lead to an outdated patent system that cannot fulfill its intended functions anymore.

The increasing and sophisticated application of AI in the digital economy will mean that legal professionals and the courts will have to answer the questions of patentability and inventory for AI. The most pressing issue to be resolved is that of the eligibility of subjects, so that novelty is stifled in this booming field. Many instances of patenting "revolutionary" diagnostic technology in the United States and Europe have already been prevented; patent draftsmen have to ensure that the same is avoided with inventions made with AI until this issue is answered. The definitions of the person, of the inventor and of the individual must be revised from there to allow our understanding of inventory and ownership to develop in a rapid advancement of technology. The early recognition and resolution of these problems will allow the patent law to keep pace with the new machine increase.

Moreover, it could help to distinguish only obvious machines and to create human beings from those truly innovative by replacing the 'skilled person' in the artist with 'skilled computers'. In contrast, because of the increased "obvious" knowledge, this process is likely to lead to the refusal to accept inventiveness for inventions that today seems extraordinary. However, the technology certainly changes and gets nearer to the realization of AI innovation, so that patents must be adjusted accordingly. Therefore, while the patent drafters are working on the invention claims, a healthy drafting process should be used. The wording should be articulately selected to focus on the function of the scheme and to incorporate the functioning principle / algorithm of the AI scheme.

References

[1] D. G. Harkut and K. Kasat. (March 2019). *Introductory Chapter: Artificial Intelligence - Challenges and Applications*. [Online]. Available: https://www.intechopen.com/books/artificial-intelligence-scope-and-limitations/introductory-chapter-artificial-intelligence-challenges-and-applications

[2] B. Tomasik. (January 2019). *Artificial Intelligence and Its Implications for Future Suffering*. [Online]. Available: https://foundational-research.org/artificial-intelligence-and-its-implications-for-future-suffering

[3] World Economic Forum, Center for the Fourth Industrial Revolution. (April 2018). *Artificial Intelligence Collides with Patent Law*. [Online]. Available: http://www3.weforum.org/docs/WEF_48540_WP_End_of_Innovation_Protecting_Patent_Law.pdf

[4] J. Bac, *Artificial Intelligence: A Dependent Legal Person: An Evolutionary Step for the United States Patent Law*, Washington, D.C.: Academica Press, 2018, pp. 72-73.

[5] J. Turner, *Robot Rules: Regulating Artificial Intelligence*, London, U.K.: Springer, 2018, pp. 319-320.

[6] *World Intellectual Property Organization, WIPO Technology Trends 2019 – Artificial Intelligence Neural Networks for Optimization and Signal Processing*, Geneva, Switzerland: WIPO, 2019, p. 127.

[7] World Intellectual Property Organization (WIPO). (2019). WIPO Technology Trends 2019: Artificial Intelligence. [Online]. Available: https://www.wipo.int/edocs/pubdocs/en/wipo_pub_1055.pdf

[8] S. Luginbuehl, *European Patent Law: Towards a Uniform Interpretation: CIER Series*, Northamham, USA: Edward Elgar Publishing, 2011, p. 262.

[9] W. Barfield and U. Pagallo, *Research Handbook on the Law of Artificial Intelligence*, Cheltenham, U.K.: Edward Elgar Publishing, 2018, pp. 2-3.

[10] The European Patent Office (EPO), and the Japan Patent Office (JPO). (2018). *Comparative Study on Computer Implemented Inventions/Software Related Inventions*. [Online]. Available: https://www.jpo.go.jp/news/kokusai/epo/document/software_201903/01_en.pdf

[11] *World Intellectual Property Organization, WIPO Technology Trends 2019 – Artificial Intelligence Neural Networks for Optimization and Signal Processing*, Geneva, Switzerland: WIPO, 2019, p. 39.

[12] G. Discher, S. Utku, and R. Paul. (December 2018). *AI Update: Considerations for Patenting Artificial Intelligence in Europe and the United States*. [Online]. Available: https://www.insidetechmedia.

com/2018/12/03/ai-update-considerations-for-patenting-artificial-intelligence-in-europe-and-the-united-states/

[13] W. Barfield and U. Pagallo, *Research Handbook on the Law of Artificial Intelligence, Cheltenham,* U.K.: Edward Elgar Publishing, 2018, pp. 411-413.

[14] J. M. Rogitz. (February 2019). *Japan Patent Office Case Examples on Artificial Intelligence Offer Guidance for Other Offices on Treating AI Inventions.* [Online]. Available: https://www.ipwatchdog.com/2019/02/28/jpo-examples-on-artificial-intelligence-offer-guidance-for-other-offices/id=106835/

[15] World Economic Forum, Center for the Fourth Industrial Revolution. (April 2018). *Artificial Intelligence Collides with Patent Law.* [Online]. Available: http://www3.weforum.org/docs/WEF_48540_WP_End_of_Innovation_Protecting_Patent_Law.pdf

[16] K. Gaudry and S. Hayim. (November 2018). *Artificial Intelligence Technologies Facing Heavy Scrutiny at the USPTO.* [Online]. Available: https://www.ipwatchdog.com/2018/11/28/artificial-intelligence-technologies-facing-heavy-scrutiny-uspto/id=103762/

[17] W. Barfield and U. Pagallo, *Research Handbook on the Law of Artificial Intelligence, Cheltenham,* U.K.: Edward Elgar Publishing, 2018, pp. 55-56.

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