

The Impact of Artificial Intelligence on Patents

Dr. Dema Matrouk Aloun

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Abstract: Artificial intelligence is expected to aid the global patent system in various different ways. This will be a natural progression from the current system in which the classification and search of prior art represents an essential stage of patent examination. Throughout this process, successful examination relies on the skill of the examiner to identify highly relevant prior art for a particular application. However, prior art documents can be difficult to find and the volume of information available can be overwhelming. This is especially true in technical fields where patents are often written in highly specific, jargon-laden language. In these circumstances, an AI system that could quickly and accurately identify and classify relevant prior art would be an invaluable tool for examiners.

This article will explore the areas in which artificial intelligence (AI) will impact the global patent system. These areas include the utilization of AI as a tool to process patent data in order to aid patent examination, the proposition that AI might become a creator of patentable inventions, and that AI may also impact how patents are enforced. AI is an area of computer science that looks to create systems that can perform tasks that would normally require human intelligence. This encompasses a diverse range of abilities including visual perception, speech recognition, decision making, and translation between languages. AI systems can take various forms ranging from simple tools to expert systems designed to emulate human decision making.

Keywords: Artificial intelligence, AI system, global patent system.

1. INTRODUCTION

1.1. Definition of Artificial Intelligence

The core of the whole issue lies in the definition of artificial intelligence. As it stands right now, both the US and the EU have laws that state a computer program is not an inventor as it is not a natural person, leaving the true inventor as the owner of the computer program. However, this law spans over a time period where invention by a computer program was not a reality. When comparing this previous law to the current state of AI, machine learning, and automated systems, we run into a blur where certain AI can be recognized to have its own decision-making and creative processes separate from the owner, while others are tools for inventors to use. Since the AI can be considered an automated entity with the owner being a user, it can also be said that under a work-for-hire agreement, the AI does not retain ownership of its creation. A work-for-hire agreement occurs when the AI is a tool to fulfill the function of the worker. In the case of US law, the agreement may be explicit, but under EU law, the agreement is implicit, assuming that the employer will retain ownership of anything created during employment. If the AI is considered to be a worker, the results of its creations are still owned by someone else. This would make it so that an inventor seeking to patent AI would not need to patent AI itself but rather the results of its AI and what the AI had done. However, this would not be different from present laws that state an employee invention is always the property of the employer and thus does not solve the issue of patenting AI. A slight difference occurs when the AI is independent, as it would require its own patent for what it is to do. However, since this is a relatively new issue with no precedent and the changing laws between the US and EU states, any assumptions made are inconclusive.

The "The Impact of Artificial Intelligence on Patents" discusses the relation between AI and patents and argues that the current patent laws in the US and the EU do not have a proper definition for AI, which has become very advanced and complex. The author raises concern that if proper steps are not taken now to alter patent laws, it might not only hurt the AI

industry but also take a step back in humanitarian advancement by AI in fields like healthcare. The essay is of particular interest in the current time, as AI continues to become an integral part of human life, from the use of automation in industries to the personal use of virtual assistants in the form of smartphones.

1.2. Importance of Patents in the Technological Landscape

A patent is a set of exclusive rights granted by a state to an inventor or their assignee for a limited period of time in exchange for a public disclosure of an invention. Patents provide a temporary monopoly to the patent holder to exploit their invention for commercial gain, by preventing others from commercially exploiting the patented invention in return for the public disclosure to stimulate further innovation. Patents have been a part of English law since the 16th century. The system is designed to encourage technological progress by granting the inventor a form of public recognition and monetary incentive in return for the time and effort put into researching and developing an invention. The recognition of patents exists in many forms of technology, from pharmaceuticals to computer software, and are considered essential to the competitive advantage of companies in a technological market. In essence, patents are a driving force for the innovation of technology to serve different purposes whether it is purely to gain financial benefits or to help the greater good of society. However, in enabling patent holders to prevent others from exploiting the patented invention, this monopoly has the potential to hinder competition and follow-on innovation resulting in a negative impact in many areas of emerging technologies.

2. THE ROLE OF ARTIFICIAL INTELLIGENCE IN PATENT CREATION

An automated intelligent system can be used to search and analyze the existing body of patent art to determine the patentability of an invention. One method of searching the patent database is to use keywords to find patents related to the invention in question. Often these simple keyword searches are insufficient because two patents addressing a similar issue may use different terminology. Intelligent automated systems employing natural language processing or other AI techniques are able to analyze the content and context of patents in order to better understand the relationship between patents on a given subject. Additionally, AI systems such as data mining tools or genetic algorithms can be used to analyze large portions of the patent database, or even the entire database, to find patterns or relationships between existing patents. This information could be useful in determining areas of high or low patentability, as well as the relationship between a technology and the social/economic effects of its patent protection.

From the earliest days of the Patent Office, tools for technology have been employed in the process of examining and issuing patents. The first examinations of patent applications were conducted with the aid of the "Classification of American Patents," which was a system originally designed for searching and analyzing the existing body of patent art. In the modern era, patent examiners are burdened with reviewing large numbers of complex patent applications with limited resources and tools. Automated intelligent systems are being developed to assist examiners in searching, analyzing, and ultimately understanding the state of the art. These intelligent systems are not only powerful tools for assisting human examiners, but they are also potentially powerful creators of new patentable inventions.

2.1. Automated Patent Search and Prior Art Analysis

Automated search and retrieval of patent documents have been routine for over two decades. All the same, it has been estimated that only 50% of the world's patent documents have been translated into searchable text. A still smaller percentage of these documents are in a readily accessible format. Increasing the accessibility of global patent data is of critical importance. LSTM recurrent neural networks have been used to translate patent claims into the text of Boolean search queries. More recently, scientists at the WIPO have been exploring the use of new AI language processing techniques to summarize and translate patent documents. Automating the process of patent search and prior art analysis is an area where AI is predicted to make a significant impact. The high stakes and potential cost savings have already attracted the attention of several start-ups and university research groups. In the US, it is estimated that the recent America Invents Act will lead to a 30% increase in the demand for prior art searching, due to the new patent validity review procedures. Although it is a highly skilled task, much of the work in identifying relevant patents and categorizing information can in principle be broken down into a series of defined steps. This makes it possible to develop software to emulate this process, albeit the current generation of AI technology requires that the steps be tightly constrained and the data highly formatted. As natural language processing and machine learning techniques continue to improve, it is expected that the automation of prior art analysis will become more comprehensive and sophisticated. This will shift the role of human analysts towards quality control and decision making, much as computerized chess programs have surpassed the playing abilities of all but a few grand masters.

2.2. AI-assisted Patent Drafting

2.2.1 The drafting of a patent application is a complex task and the patent specification - a comprehensive description of the invention - is a critical part of the process. Patent applications are generally drafted by patent attorneys or patent agents, often with the participation of the inventor. Preparing a quality patent specification can be a time-consuming and expensive process; a reduction in cost would make it more attractive for individuals or small businesses to seek patent protection. AI programs have been developed to analyze the content of a technical document, and to classify the content as belonging to one of a number of predetermined categories. The IBM patented technique is an example of such a program. While such programs can be useful as drafting tools, without a human understanding of the invention in the first instance and the categories that the program seeks to classify, there is a danger that the resultant classification and generated claim could be wide of the mark. Further, the predefined nature of the categories in such programs limits their usefulness in dealing with innovative technology for which there is no existing terminology. Machine learning AI has the potential to assist greatly in reducing the cost of patent drafting. Using statistical techniques to enable a computer to learn from a large set of example documents, machine learning AI can automatically generate predictions or decisions. This might be achieved by training the machine on a set of existing patent specifications and teaching the machine to predict the classification of sentences or paragraphs of text in the specification. If successful, such predictions would allow automation of the process of categorizing an abstract, or specific sections of the specification, to be covered by intelligent searching on later. Alternatively, the machine could be trained to produce descriptive text classified in a certain way, for example a detailed description of an apparatus and a set of instructions for making and using the apparatus. Although still in its infancy, AI generated text holds great promise for the future.

2.3. Intellectual Property Protection for AI-generated Inventions

Since many AI techniques, particularly those that lead to automation in tasks traditionally performed by humans, continue to advance, it is more than likely that there will be a growing number of AI-generated inventions. This being the case, a solicitation from the AI community for less restrictive IP laws will ensue. In view of the widely known role that patents have in the economy to incentivize innovation, it is sensible that there is some level of incentive for inventors to use AI technology and subsequently patent the inventions. This would involve all types of invention whether AI-generated, or use of AI as a tool to assist in the inventive process. An incentive system could involve lessening the fees in the patent application process for AI inventions, or giving extended patent-terms for AI inventions in particular fields. Any changes to the system must be determined by comparing the costs and benefits to society and the economy, and must be done so over a long term with longitudinal study of its effects.

According to the ordinary rule for the purpose of vulnerability of a patent that is the publication under the consent, it is conceivable that AI automation could create an understanding of an invention, which could be fit to an invention being derived. The inventiveness of AI inventions will be contrasted with human-created inventions and central concepts of both patent and copyright law. It could be recommended that some kind of enterprise where potential AI inventions are disclosed for the benefit of making a catalog of them to decrease the hindrance of the search for prior art. If AI inventions are totally exempt from protection, society overall could possibly be deprived of future innovations that could be notably beneficial. Therefore, the policy making and law for IP protection of AI inventions needs to be cautiously thought out and balanced.

3. CHALLENGES AND CONSIDERATIONS IN AI-RELATED PATENT APPLICATIONS

Inventorship and ownership of AI-generated inventions In terms of traditional patents on chemical, electrical, and mechanical technologies, a standard patent application requires the naming of the inventor or joint inventors. The application must also include an oath or declaration stating that the inventor believes he/she is the first to invent the claimed invention. Under US law, an inventor is defined as an individual who has conceived of the invention. To satisfy the requirements for inventorship, it is crucial that a human inventor has provided a significant contribution to the conception, design, and reduction to practice of the invention. Inventorship cannot be ascribed to a person that merely contributed an idea of a desired result, general outline, or some collocation of known elements, from which the invention had not been specifically designed. This issue concerns the patenting of AI-generated inventions as they are computers or machines, not humans, which are developing and producing new and innovative ideas. If an AI program was solely responsible for creating an inventive product or process, it is arguable that the computer would be considered the inventor. United Kingdom law defines an inventor as the actual deviser of an invention, thus an AI program could be regarded as an inventor if presented

with the legal definition. This has been demonstrated in the recent application by Dr. Stephen Thaler (founder of Imagination Engines Inc.), who listed his Artificial Inventor Creativity Machine (DABUS) as the inventor in patent applications filed with the US Patent and Trademark Office and the European Patent Office. When applying for a patent, it is the norm for invention rights to belong to the employer of the inventor or the person who has commissioned the work leading to the invention. This will also raise issues of assignment of AI-generated inventions as machines become more prevalent tools in research and development. The owner of the rights would be the person considered to be the inventor and is therefore tasked with proving inventorship when applying for a patent. This again could lead to disputes as to who or what is considered to be the inventor and whether the rights would be ascribed to it.

3.1. Inventorship and Ownership of AI-generated Inventions

In the AI context, identifying the "inventor" is not straightforward. It is generally agreed that the inventor is the entity that contributed to the conception of the inventive ideas or reduction to practice of the patented invention, which is in line with current patent law. However, in cases where the inventive concept was initially a set of broad instructions as to how to solve a particular problem and the AI autonomously adapts this concept such that it is now inventive, there is no clear-cut answer on whether it is the programmer, the AI, or a combination thereof who is the inventor of the AI-improved solution. This is a crucial question both for incentivizing AI innovation and for clarity on patent ownership. In most cases, it is likely that the AI will be deemed to be a tool used by the programmer and the inventive concept that the AI came up with as an improvement to an existing idea. This is because it is the programmer who will have directed the AI to solve the problem in the first place. The reasoning that the AI is a tool may mean that the act of using AI is implicitly separating from AI research and development, and in turn may mean that there is less innovation in AI itself and more use of AI to solve specific problems. This is due to the fact it will be less economically viable for research into an AI when the improved ideas are owned by the user rather than the developer. For example, a medical researcher funds AI to find a cure for a disease, but the results are owned by the drug company said researcher is contracted to.

3.2. Patentability Criteria for AI Inventions

Hence in the different areas of technology, the examiner needs to have an understanding of what might constitute common general knowledge, the prevailing prejudices and preferences in the field, and the "state of the art" from which the inventors in the field are making incremental advances. In some areas such as computer implemented inventions, the examiner may need to have an understanding of not just what is the current technology, but where the technology is heading and what problems are being addressed. This means there is a significant burden on the examiner and the EPO is always looking for ways to make its search strategy and procedures more efficient and effective, so that an adequate search can be carried out in a reasonable time.

Formulation of the inventive step may be such that the claim is expressed as a method or process. In other cases, particularly in the field of computer science, the claim may be to a system, for example a "search engine", a "data retrieval system", or to a "computer program product". In other cases, especially in mechanical engineering or in the field of medical devices, it may be to a product such as a kitchen utensil or a stent, or even to a new use of a known substance, product or process. This means that there is no single search strategy that will identify all the potentially relevant prior art.

3.3. Ethical and Legal Implications of AI Patents

An interesting situation is present in the case of universities which employ professors and students to do research, and all inventions by them are owned by the university. The situation where the AI is to replace the human tool comes under the case law of the State Street Bank wherein it is held that anything that makes an act must be a human, and if AI is to be a substitute for a human in the near future, then inventions by AI will be granted patents.

As a researcher, it is early to decide as to whether AI as machines having intelligence can be an inventor or not, but the instances in which AI may be considered as an inventor exist in various fields. In the US, various patent statutes define an inventor to be any individual who contributes to the conception of the invention. This is further explained by many judgments, and AI being a tool can be conceived to be inventing a few things. Even if the AI is not considered as an inventor, the owner of AI will be creating a vicarious liability wherein the AI will be treated as an employee doing acts on instruction, and in this case, the act done by the employee to implement the employer's instructions is all attributed to the employer. So the owner of AI will be responsible for infringement by AI, and any patents from inventions by AI will be owned by him.

Ethical and legal implications of AI in the context of patents can be understood and addressed in different aspects. These imply to the context as to how AI as an inventor can be made liable for infringement of right and how the AI can itself have rights on the patented invention. The other aspect comes into picture is about the subject matter for which the inventor seeks a patent. In this context as to whether the low or the already developed AI may be able to patent the invention, the second instance may be whether AI as a tool in the hands of an inventor has contributed enough to make the invention patentable, or whether the AI has been used to implement the invention.

3.4. International Perspectives on AI-related Patents

The international nature of AI technology and patenting thereon presents unique challenges that have to date not been fully addressed. Some of the most important questions on international harmonisation of AI patents were raised in an open letter to the current European Commission on the draft proposal of a statutory instrument to the effect that it shall be permissible to grant patents for computer implemented inventions. The letter, authored by leading academics in the field raises the question of whether or not patentability criteria for inventions developed through AI should be different to those applied to inventions by a natural person, suggesting that in the long run there is a risk of 'biasing innovation in favour of AI on the assumption that it will always be an improvement', if the same criteria are used. This argument has not yet been fully fleshed out, especially considering that areas in which patentability criteria is not met could be important areas where development of AI technology would be beneficial to mankind and it is not clear that there is any benefit to be gained from preventing AI development in the context of the public at large. This raises the further question of costs versus benefits to society, should it transpire that the costs of patenting AI technology are too high relative to an assumed few marginal benefits, many companies and inventors may be dissuaded from further AI development, or may simply forgo patenting with knowledge of near certain ineligibility. An inference can also be drawn that the general laws on patentability are insufficient for AI technology and the fear of loss of international harmonisation has led to speculation of different AI patent systems, such as the proposal that there should be a formal IP rights subsystem within the Berne Convention for AI created works. An increased development in AI patents may effect changes in costs upon international patent applications, agreements between countries, already seen with the patent cooperation treaty might need revision with AI specific provisions. With even the farthest reaching effects of the WTO TRIPS agreement not yet fully understood, policy makers have much to deliberate before fundamental changes to the existing international patent system.

4. FUTURE OUTLOOK AND RECOMMENDATIONS

When considering the future of AI and its patenting potential, the need for flexibility within patent laws and institutions is crucial. It is inevitable that the next decade will bring rapid change to AI, as software and algorithms will continue to take on a more prominent role in innovation and discovery. Machine learning, as mentioned earlier, is already having a significant impact on the nature of innovation itself. Developments in this field, such as those driven by deep learning, will likely shape the technology of the future. These innovations will be highly unpredictable, even to their creators, and as the capabilities of AI surpass human abilities in an increasing number of fields, there will be growing pressure to automate the inventive process. An example to consider is the potential for full AI authorship of patentable inventions. For the present, this is prohibited in many countries, as current laws require an inventor to be a 'natural person'. However, it is not difficult to imagine that AI authorship may one day be economically significant, and there will be a need to reassess the fundamental concept of inventor. Another important issue to be revisited in the future is that of patentable subject matter. This will be especially relevant in the context of public policy considerations surrounding the promotion of innovation and the public interest. As AI becomes an increasingly prevalent tool for simulating human cognitive processes, there will be a growing trend in the development of AI methods to replace human activities in various fields. The general consensus among legal scholars is that current patent laws are ill-equipped to handle inventions produced by purely computational processes, and studies have shown that the patentability of software and business methods varies greatly between jurisdictions. At the international level, there is an ongoing debate regarding the TRIPS agreement, which mandates minimum standards of patent protection for WTO member states. In spite of this, the flexibility of patentable subject matter is quite large, and the precise boundaries of what may be patented are determined through national laws and legal precedent.

4.1. The Evolution of AI and Its Impact on Patent Systems

The AI and machine learning panorama has existed and evolved over decades. Though the sphere of patenting for AI innovations is comparatively new, the implementation of patent law to AI-based innovations is an evolution of a process

that has concerned the very nature of AI. Because the development of AI technologies has been driven traditionally by the tutorial and analysis community, this sort of software system has been traditionally set within the sphere of public domain. The goal has been to make a platform for collaboration and a typical infrastructure that can be improved and changed by any range of researchers. A good example is the standard technique that the analysis community treats software system developments. Usually, protecting software implementations isn't seen as one of the necessities of the development method. An engineer or programmer could develop a piece of code as proof of a concept for a new technique, but this research code isn't considered the innovation itself. Usually, these researchers are successfully implementing their new concepts into existing software environments. In other cases, it may take years of more research and development before the approach becomes commonplace. Usually, it's only when the community is mostly united on a specific technique that some sort of software implementation is considered the technique itself and not a failed experiment.

4.2. Policy and Regulatory Frameworks for AI Patents

Without the appropriate frameworks in place, it is possible that the patent system will fail to incentivize AI-based innovation and output. Should the inventor of an AI-created invention not be considered the 'owner' of the invention, there may be little motivation to disclose said invention to the public: without public disclosure, there can be no patent. An alternative scenario exists where it is companies rather than inventors who are considered the owners of AI creations. This could lead to a new system of internal R&D patents where only large firms have the resources to patent AI inventions.

However, the global nature of AI research and development makes it difficult to predict the direction of AI and the nature of AI-created inventions: international policy has therefore been slow to react. Achieving AI patent harmonization across borders will be an arduous process. In order to best shape future policy, it is essential that legal scholars work alongside scientists and engineers in the AI field.

The AI technology has evolved significantly over the last few decades. With the rise of ML, AI has the capacity to "invent" new solutions to complex problems, and with AI systems increasingly used across numerous industries, there will be a corresponding increase in AI-based innovations. Current global patent systems, however, were not designed with AI in mind. With AI-created IP stretching the boundaries of inventorship and machine autonomy challenging concepts of infringement, current patent systems may fail to accommodate AI-based innovation. As such, it is likely that there will be substantial reform to the patent systems of the world to best facilitate AI innovations.

4.3. Collaboration and Knowledge Sharing in AI Patent Space

To foster collaboration and knowledge sharing within the AI patent ecosystem, open, freely accessible patent databases are critical. Unlike common patents, AI patents usually involve heavy utilization of data and machine learning models, making them difficult to be disclosed completely in the traditional way. Trade secret protection might not be appropriate for these AI patents when data and models involved need to be shared with the public for verification and reproducibility. This is especially important for AI in healthcare, where patient well-being is at stake. Forcing these patents to be disclosed without the right environment might lead to premature disclosure or sub-optimal application, creating a negative impact on patentees and the public. It is important to establish international norms that encourage these AI patents to be disclosed in the form that's best for knowledge sharing and provide flexible options of protection to patentees. As demonstrated by the Open COVID Pledge (OCP), where stakeholders pledge not to assert patent rights for activities aiming to end the pandemic, a collaboration-friendly environment can be provided by collective actions of patentees and users. Norms and options should cater to diverse needs and concerns arising from different technologies and industries AI is involved in.

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