Patenting Algorithms in an Internet of Things ('IoT') and Artificial Intelligence ('AI') World: Pathways to Harmonizing the Patentable Subject Matters and Evaluation of the Novelty Requirement [*]

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Constituting a disruptive technology, Artificial Intelligence ('AI') is impacting all industries. However, there are rising concerns that the patent system may not be fit for the future of innovation that is increasingly AI-related and intangible. Indeed, the execution of AI-related inventions requires some kind of computer implementation, thereby potentially reviving patentability issues related to computer-implemented inventions. Whilst patent offices around the world have found ways to adapt their patent systems to grant protection to software, difficulties remain in relation to algorithm-based inventions though they form a significant part of today's innovation. Currently, algorithms themselves do not qualify as patentable inventions. Even if algorithms overcome this first hurdle, concerns arise in relation to the application of patentability requirements such as novelty where national differences remain. This research evaluates the adequacy of the novelty requirement in relation to AI-inventions where many of the underlying concepts and technologies are not novel. The ultimate aim is to evaluate the adequacy of the patent system by looking at inventions that utilize AI, with a particular focus on the excluded subject matters and the novelty requirement. To this end, the research adopts a comparative analysis of these concepts in Europe (EPC countries), Japan and the United States.

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The current patent systems have mostly focused on protecting the physical structures and the configuration of physical systems. As the future of innovation is increasingly intangible, one of the main problems concerns the economics of algorithmic innovation. Constituting a giant network of connected devices, objects and people through the interplay of sensors, IoT relies on powerful and complex algorithms to collect and analyze data from different devices, and to then share the resulting information with applications built to address specific needs in real time. [1] All IoT projects will include an AI component. [2] Indeed, if IoT devices and components generate vast amounts of data, the analysis element can be substantially enhanced through AI. Where traditional data analysis techniques were not designed with the vast amount of real-time data in mind, AI can mitigate this problem through the interplay of machine learning algorithms. By simulating human behavior, AI creates actionable insights based on identified patterns from the connected devices without, in some cases, the need for any human intervention. Additionally, AI can help solve some of the interoperability issues between devices where operational technology systems have not been designed to allow devices to communicate with each other, or through the interplay of a central platform. However, AI algorithms also have the ability to produce a multiplicity of results to a given problem. Consequently, the functional description given to the machine may lead to a broad class of inventions without describing every single instance of the class individually. Should the patentee be given a monopoly over all the class of inventions including unpredictable ones or should it be more limited?

Currently, algorithms are excluded from the scope of patent protection because these are not considered to be 'inventions' for being too abstract of non-technical. [3]

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[1] Committee to Discuss a Next-generation Intellectual Property System, Verification, Evaluation and Planning Committee, Intellectual Property Strategy Headquarters, *Report of the Committee to Discuss a Next-generation Intellectual Property System—Toward the Construction of a Next-generation Intellectual Property System Adapted to the Rise of Digital Networks*, (April 2016), 4.

[2] And whilst this discussion is attracting more and more academic attention in Japan, authorities tend to focus on the implication of AI for creative endeavors rather than the effect for the patent system. Data-Related Assets Report, supra n. 2; Secretariat of Intellectual Property Strategy Headquarters, *Treatment of works created by AI (for discussion))*, (January 2016); Committee to Discuss a Next-generation Intellectual Property System, Verification, Evaluation and Planning Committee, Intellectual Property Strategy Headquarters, *Toward the Construction of a Next-generation Intellectual Property System Adapted to the Rise of Digital Networks*, (April 2016), 4-7; Similarly, in Europe, E. Fraser, 'Computers as inventors – legal and policy implications of artificial intelligence on patent law' (2016) 13(3) *SCRIPTed*, 307.

[3] The US members of congress consider a draft bill to eliminate the judicially created exclusions from patent-eligibility; see Chris Coons, Sens. Coons and Tillis and Reps. Collins, Johnson, and Stivers release draft bill text to reform Section 101 of the Patent Act (May 22nd, 2019) available at https://www.coons.senate.gov/news/press-releases/sens-coons-and-tillis-and-reps-collins-johnson-and-stivers-release-draft-bill-text-to-reform-section-101-of-the-patent-act.

Proponents for broadening the patent system to cover algorithms within its scope tend to argue that allowing algorithms to be patented would encourage innovation in the AI industry, enable the realization of the promises of the IoT, contribute to consumer welfare, and benefit society as a whole through the increase of trade and economic wealth. Opponents, on the other hand, argue that patenting algorithms would lead to the granting of monopolies over abstract ideas, stifle innovation, and lead to the exclusion of some players, which goes against the ethos the interoperability of devices and therefore, the potential of IoT.

Concerning the eligibility of AI algorithms, there are inherent difficulties linked to the fact that these complex algorithms are attempting to mirror human ingenuity, which is likely to trigger one of the subject-matter exclusions. Nevertheless, wanting to seize the opportunities of this technological field, the three jurisdictions (Europe, Japan and the US) have been very active in finding ways to find some algorithmic inventions eligible for protection. Assessing this type of inventions as other computer programs or computer-implemented inventions, all three systems allocate crucial importance to the reliance on hardware for eligibility purposes. Yet, differences exist in terms of the type of inventions eligible deriving from the differences in methods of assessment. Whilst the two-tier approach prevailing in Japan appears more favorable to inventors, the technical merit doctrine currently applied in Europe and the US is creating difficulties for the protection of AI algorithms. However, despite the innovation-friendly Japanese approach, there are also concerns that this flexible approach might be too laxed to efficiently differentiate between inventions using the laws of nature and the ones that do not.

Turning to novelty, first patentability requirement applicable in all three jurisdictions, appears rather unambiguous at first glance. Aiming to prevent double-patenting, differences exist in terms of legislation as well as practices from patent offices, likely to gain importance in the future, especially in relation to AI algorithms. For example, the way in which the state of the art is conceived varies from a jurisdiction to another. If secret prior art is novelty-destroying in Europe, this is not always the case in the US or Japan where secret prior art will only be jeopardizing novelty in relation to third parties' secret prior art, creating a risk of double-patenting and rise of patent thickets. But equally, the novelty thresholds differ. In Japan, where an 'enlarged' novelty concept prevails, inventors must be vigilant that obvious variants will be included, thereby heightening the novelty

threshold compared to other jurisdictions like Europe and the US. These differences reflect existing conflicting policy objectives which need to be addressed for furthering harmonization. It is therefore important for policy-makers to reflect on whether the patent system should focus primarily on rewarding the initial inventor or whether it should encourage applicants applying for protection for smaller improvements.

As patent systems are developing ways to adapt their systems to AI innovation and remain competitive on the international scene, there is a growing need to iron out national differences and further harmonize patentability requirements of national systems. Without this, current problems are likely to escalate. Bearing these issues in mind, this report examines the fundamental question of whether or not protecting AI algorithms by patent is necessary and desirable in light of the future of innovation and current developments. To achieve this, this research focusses on the subject-matters of patent protection and discusses the need to harmonize the novelty requirement for the purposes of IoT and AI.

This research report adopts a comparative approach looking at the practices of three of the five biggest patent offices in the world, namely the European Patent Office (EPO), the United States Patent and Trademark Office (USPTO) and the Japanese Patent Office (JPO). It will first analyze the justifications underlying the patent system (Section II) before turning to defining algorithmic innovation for the purpose of AI and IoT (Section III). This section outlines the features of the development of algorithms to highlight the characteristics of modern algorithmic inventions, providing the essential premise for the evaluation of the current patent systems. When addressing the issue of opening the patent system to algorithms, the social need to grant such protection (section IV) and the scope of patent protection for this technological field must be established. Consequently, Section V deals with the first hurdle for patenting algorithms. Reviewing legislation and cases, this section examines the excluded patentable subject-matters and emphasizes the difficulties in constructing algorithms as inventions. Section VI then considers the need to harmonize the novelty requirement further. Finally, Section VII concludes and makes a series of modest recommendations as outlined below.

Recommendations:

1 – **Limit the ineligibility of algorithms from patentability** by changing the **interpretation of relevant excluded subject-matters**. Only Europe has a statutory exclusion for mathematical formula. It could be envisaged that this exclusion limits itself to **simple algorithmic problems that can be achieved easily by the human mind**. Once there is an invention in a field of technology then this one should be patentable regardless of any further requirements linked to technicality.

2 – Countries should harmonize their approach to novelty: Jurisdictions should reflect on whether a whole-contents approach or a claims-based approach is desirable in light of the current innovation trends. Here, a **whole-contents approach should be preferred**. Furthermore, **self-collision should apply to both secret prior art originating from the applicant and third parties** to ensure that only valuable subject-matters are patented and avoid double-patenting issues.

3 – Both Europe and the US should **drop the technical character** doctrine: in both jurisdictions, this doctrine has led to a series of complexities and uncertainties. Here, focusing on the inventive concept as done in Japan contributes to the legitimacy of the patent system in the future.

4 – Further discussions on the rationale of the **disclosure requirement** should take place. Perhaps the jurisdictions under scrutiny should consider moving away from a system where applicants are merely required to provide information how to make and use the invention to focus on ensuring that information related to the reasons as to **why or how the invention works are specified.** [4] Equally, there is a need to ensure that the rules and processes included in a system are explained.

5 – **Patent offices must carry on their work on the dissemination of case studies in the area of AI and IoT-related technologies**: there is no denying that these are extremely useful for prospective applicants, patent examiners and add transparency in the application process. Here, it would be particularly helpful to know how much should be disclosed to meet the novelty threshold e.g. should the topology of the network be disclosed? Should the algorithms be provided? Or the parameters used?

[4] As already suggested by S. B. Seymore, 'Patenting the Unexplained' (2019) 96(4) *Wash ULO*, 707-752.

This requires careful examination as this could have dramatic consequences on the patentability of future inventions.

The patent system has survived three industrial revolutions without changing drastically and has the ability to survive a fourth, but there are still elements that can be improved. Whilst the current position amongst patent offices seems to be to approach the patentability of AI inventions on a case-by-case basis, current divergences in regime are likely to be of more central importance in the future. The current situation leads to the downplaying of the AI element in patent applications thereby minimizing the actual disclosure. This does not seem in line with the goals of patent law. Although the recommendations above might sound radical, eventually these changes are required to guarantee the societal benefits deriving from AI and IoT technologies. Without this, patent attorneys, patent examiners and eventually courts will be asked to make decisions on a case-by-case basis without fully taking into consideration the broader policy implications of these decisions.