

## **Request from the United States Patent and Trademark Office for Comments on Patenting Artificial Intelligence Inventions**

### **Comments by the European Patent Office (EPO)**

The EPO thanks the United States Patent and Trademark Office for the invitation to submit comments on patenting artificial intelligence (AI) inventions. We are convinced that this will further a common understanding of AI patenting which is essential to the technological development.

The EPO has discussed patentability of AI with its contracting states and the other IP5 Offices, gaining a shared understanding of critical issues important for the development in this technical area. This already contributes to increased legal certainty for the users of the patent system world-wide. To a large extent the EPO also involved users in this process, e.g. by hosting a very well received conference on patenting AI, as well as several “scoping workshops”.

The EPO is pleased to give the following comments based on EPO practice and the applicable legal framework:

**1. Inventions that utilize AI, as well as inventions that are developed by AI, have commonly been referred to as “AI inventions.” What are elements of an AI invention? For example: The problem to be addressed (e.g., application of AI); the structure of the database on which the AI will be trained and will act; the training of the algorithm on the data; the algorithm itself; the results of the AI invention through an automated process; the policies/weights to be applied to the data that affects the outcome of the results; and/or other elements.**

Artificial intelligence (AI) is a branch of computer science which is attempting to build machines exhibiting “intelligent behaviour”. The main enabler of AI is machine learning (ML). ML concerns algorithms allowing computers to self-improve at solving computational tasks, thereby involving mathematical methods.

The EPO understands that AI and ML are based on computational models and algorithms for classification, clustering, regression and dimensionality reduction, such as neural networks, genetic algorithms and support vector machines. Such computational models and algorithms are per se of an abstract mathematical nature. However, depending on how they are implemented, they may have a technical character and thus be patentable inventions.

AI and ML find applications in various fields of technology. For example, a neural network may be used in a heart-monitoring apparatus for the purpose of identifying irregular heartbeats. The classification of digital images, videos, audio or speech signals based on low-level features (e.g. edges or pixel attributes for images) are further typical technical applications of classification algorithms.

**2. What are the different ways that a natural person can contribute to conception of an AI invention and be eligible to be a named inventor? For example: Designing the algorithm and/ or weighting adaptations; structuring the data on which the algorithm runs; running the AI algorithm on the data and obtaining the results.**

From the perspective of inventorship, three types of inventions using AI technologies can be identified:

- human-made inventions using AI for the verification of the outcome,
- inventions in which a human identifies a problem and uses AI to find a solution,
- AI-made inventions, in which AI identifies a problem and proposes a solution without human intervention.

The person of the inventor is strictly connected with the determination of the claimed invention. Depending on where the invention lies, the inventor may e.g. be the software developer who set up an AI system, the person who trained the machine with data, the person who interpreted the output of an ML algorithm, the person who improved an AI algorithm to obtain a certain technical effect or who identified the technical application of an output of an AI system. For a broader analysis of these issues, we would like to refer to the [academic study](#)<sup>1</sup> on AI inventorship which was commissioned by the EPO.

**3. Do current patent laws and regulations regarding inventorship need to be revised to take into account inventions where an entity or entities other than a natural person contributed to the conception of an invention?**

Naturally, the inventor may use various tools in their inventive process, ranging from simple mechanical tools such as a hammer, to refined software and AI machines. It appears that AI is currently and may for the foreseeable future remain a tool for a human inventor.<sup>2</sup>

The EPC requires that the applicant designates a natural person as inventor (Article 81, Rules 19, 21 EPC).<sup>3</sup> Beyond this formal requirement, the EPO does not check the correctness or completeness of the designation of inventor. Any review of the principle that the inventor can only be a natural person or persons (in case of co-inventorship) would be linked to a policy debate about the role of the patent system, including the basic principle that patents are granted to natural persons in order to reward them for inventive contributions which benefit society. Such a policy discussion would need to take due account of the fact that patent law with its requirement of human inventorship is part of a system of protection of intellectual property which is based on principles shared globally and has been to a significant extent harmonised on the international level.<sup>4</sup> It would also

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<sup>1</sup> Dr Noam Shemtov, [A Study on Inventorship in Inventions Involving AI Activity](#), available here.

<sup>2</sup> See e.g. Dr Noam Shemtov, [A Study on Inventorship in Inventions Involving AI Activity](#), available here, p. 9-10, with further references.

<sup>3</sup> The laws of the EPC contracting states appear to contain the same requirement, see [feedback](#) from the EPC contracting states collected by the EPO in 2018.

<sup>4</sup> Articles 3 and 4ter of the Paris Convention for the Protection of Industrial Property; Article 27 TRIPS Agreement; Article 4(1)(v) Patent Cooperation Treaty; Patent Law Treaty in particular Article 15.

need to recognise that the question of inventorship must be seen in a broader context of rights allocated to persons, not only by rights of intellectual property.

**4. Should an entity or entities other than a natural person, or company to which a natural person assigns an invention, be able to own a patent on the AI invention? For example: Should a company who trains the artificial intelligence process that creates the invention be able to be an owner?**

The European Patent Convention (EPC) requires that the applicant designates a natural person as inventor (Article 81, Rules 19, 21 EPC). Beyond the formal requirements of designation of inventor, the EPO does not verify the accuracy of the designation (Rule 19(2) EPC). Applicants are deemed to be entitled to exercise inventors' property rights (Article 60(3) EPC). In a case of a dispute, the national courts determine the person of the inventor (Articles 60(1), second sentence, and 61 EPC). The judgments of the national courts are binding on the EPO (Article 61(1) EPC and Rule 20(2) EPC).

The right to a European patent belongs to the inventor or their successor in title (Article 60(1) EPC) and rights to inventions and patents are transferable (cf. Rules 22, 85 EPC).

Accordingly, if the natural person who trains the AI process is the inventor, that person may have the right to file a patent application. If such a person is not the inventor, they may obtain the right to the invention from the inventor by assignment or by another type of succession. If a person who trains the AI system creates a new invention using an earlier invention, they may be able to obtain patent protection for a dependent invention.

**5. Are there any patent eligibility considerations unique to AI inventions?**

AI inventions belong to the area of computer-implemented inventions (CII) and are patentable according to the criteria developed by the case law of the EPO boards of appeal and reflected in the Guidelines for examination in the EPO.

The EPC offers patents for "any inventions, in all fields of technology" (Article 52(1) EPC;). Article 52(2) EPC defines inventions as having technical character by excluding matter from patent protection that is exclusively non-technical. Given that the exclusions only apply to non-technical matter claimed "as such" (Article 52(3) EPC), the EPO practice based on the established case law of the EPO boards of appeal requires examination of the claimed subject-matter as a whole for technical character. In determining the technical character, all features of the invention are taken into account that contribute to solving alone or in combination a technical problem, i.e. a problem in a field recognised as technical.<sup>5</sup>

In practice, technical character is acknowledged, if the claimed subject-matter requires the presence of any technical means, e.g. a computer or indeed any other device. It follows that any computer-implemented method and any device constitute patentable inventions.

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<sup>5</sup> T 641/00 COMVIK.

The detailed criteria for patentability of AI inventions are reflected in the Guidelines for Examination in the EPO ([G-II, 3.3.1](#)).

**6. Are there any disclosure-related considerations unique to AI inventions? For example, under current practice, written description support for computer-implemented inventions generally require sufficient disclosure of an algorithm to perform a claimed function, such that a person of ordinary skill in the art can reasonably conclude that the inventor had possession of the claimed invention. Does there need to be a change in the level of detail an applicant must provide in order to comply with the written description requirement, particularly for deep learning systems that may have a large number of hidden layers with weights that evolve during the learning/training process without human intervention or knowledge?**

An application must disclose the invention in a manner sufficiently clear and complete for it to be carried out by a skilled person (Article 83 EPC). This requirement ensures that a patent is only granted in return for the applicant making the invention available to society.

The EPC requirement of sufficiency of disclosure applies equally to all inventions, including AI inventions. The description must disclose any feature essential for carrying out the invention in sufficient detail to render it apparent to the skilled person how to put the invention into practice. The assessment of sufficiency of disclosure is fact-dependent and may involve different considerations for inventions involving improvements of e.g. algorithms, training steps or classifiers. It is generally possible to enable the skilled person to reproduce the results of an AI algorithm by e.g. disclosing the underlying algorithm and/or the training steps involved (e.g. in the training of the classifier). EPO practice in assessing sufficiency of disclosure is explained in detail in the Guidelines for Examination in the EPO ([F-III](#)).

It is noted that the disclosure requirement has been harmonised internationally (Article 29.1 TRIPS Agreement).

**7. How can patent applications for AI inventions best comply with the enablement requirement, particularly given the degree of unpredictability of certain AI systems?**

A European patent application must disclose the invention in a manner sufficiently clear and complete to enable the skilled person to carry it out (Article 83 EPC). As with any invention involving a mathematical method, the application for an AI invention should elaborate on how a certain AI system and/or AI algorithm is being adapted to a specific technical implementation or how it is applied to a recognised field of technology.

For example if the invention relates to the AI structure, this structure is normally sufficiently disclosed if the skilled person can build it and reproduce its indicated result (output). To obtain such reproducibility, it is typically required that the application describes the correlation of input and output in detail. Such a description would explain why a certain technical effect is achieved.

**8. Does AI impact the level of a person of ordinary skill in the art? If so, how? For example: Should assessment of the level of ordinary skill in the art reflect the capability possessed by AI?**

The "person skilled in the art" is presumed to be a skilled practitioner in the relevant field of technology, who is possessed of average knowledge and ability and is aware of what was common general knowledge in the art at the relevant date.

The skilled person may be a group of persons, e.g. a research or production team. This is often the case for AI inventions, which usually encompass various technical fields. The skilled person may use AI if it is used in the relevant technical field.

The concept of the skilled person is explained in detail in the Guidelines for Examination in the EPO ([G-VII, 3](#)).

**9. Are there any prior art considerations unique to AI inventions?**

The considerations made when determining prior art for the assessment of novelty and inventive step are the same for AI inventions as for other types of inventions. The concept of state of the art is explained in detail in the Guidelines for Examination in the EPO ([G-IV](#)).

In practice, the more AI is used by researchers, industry and general public, the more anticipatory prior art it will produce. To match this, the patent offices assist their examiners with state-of-the-art tools for search and examination, which also can be effectively enabled by AI and ML.

**10. Are there any new forms of intellectual property protections that are needed for AI inventions, such as data protection?**

The European patent system provides a comprehensive framework for protecting AI inventions. It has witnessed many technical developments, notably in the areas of biotechnology, pharma and CII. The legal framework provided by the EPC has proved to be flexible and adaptable, thus enabling accommodation of technical developments into the framework of patent protection, including AI and ML.

**11. Are there any other issues pertinent to patenting AI inventions that we should examine?**

While the EPC is prepared to accommodate AI inventions, the development of AI technology poses questions for other areas of law and beyond: for society and ethics.

The impact of the development of AI technology on society, including changes in the right holders' position, employment market and ethical challenges that AI poses are also areas which may need to be addressed as the technological development progresses.

**12. Are there any relevant policies or practices from other major patent agencies that may help inform USPTO's policies and practices regarding patenting of AI inventions?**

Continuous exchange of policies and practices between the patent offices, in forums such as the IP5, contributes to aligning practices and increases legal certainty for the users of the patent system.

Therefore, the EPO would like to thank the USPTO for availing all interested parties to obtain the results of this questionnaire, as indicated on the invitation. The EPO looks forward to further exchange on the addressed topics within the good cooperation between the offices.