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Patent Disclosure Requirement for AI-Assisted inventions: A Comparative Study of EU and India

Ashok Hemanth Upputuri† and Zehra Özkan Üner

Department of Intellectual Property Rights, Technology Policies and Innovation Management, Graduate School of Social Sciences, Ankara University, Turkey

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Patent is based on the concept of *quid pro quo*. It requires the applicant to draft the application in such a way so that it satisfies the doctrines of written description, enablement, and best mode. However, in case of AI-related invention, the situation is tricky. Most of the inventions carried out by AI has black box scenario—where the inventor also may not be aware of the fact how the invention was exactly carried out by the AI system. The current study delves into the situation regarding how patent offices in Europe and India are dealing with such scenarios. Focussing on the AI-assisted inventions, the study finds out that in Europe, there is a clear guideline about AI-related inventions. The guidelines are tighter than those of the US. On the other hand, India relies on guidelines on computer related invention.

Keywords: Artificial Intelligence, AI Invention, Patent, Disclosure, PHOSITA, Europe, India

Use of AI in Today's Life

AI, IoT, and Big Data have revolutionised the way individuals conduct business. The application of AI covers a wide variety of areas—autonomous vehicles to personalized medicine, and cyber security to diagnostics. Artificial intelligence (AI) can improve social well-being in the field of economic development, precision medicine, public welfare, and environmental protection by boosting technology efficiencies.[1] AI-based technologies are the future of transportation, service robotics, healthcare, education, public safety, entertainment.[2] One of the significant contributions of AI is digital assistants that include Amazon's Alexa, Apple's Siri, and Microsoft's Cortana. Nvidia employs AI to enable automobiles to think, learn, and see different driving scenarios. AI is used by companies like Audi, Benz, Toyota, Tesla, Volvo, etc. Google also employs AI to perform predictive search—guessing what the user is looking for.

Patent Disclosure Requirement Issue with AI Invention

One major issue with AI inventions is disclosure requirements. Mostly, all AI innovations are the result of black box operations by the machine. It is not possible to disclose it in the patent application and therefore it violates the basic criteria of sufficiency of disclosure for getting a patent.

Let us consider some cases of AI-generated outputs where disclosure requirement may be complicated.[3] First, let us consider it for nano-material compounds and then for customized cooking recipes for personalized nutrition. In the first case, chemicals can be computationally synthesized with AI-based tools, without doing physical experiments, and the optimal performance, characteristics, and structures of compounds could be claimed.[4] Patent examiner will not be able to understand how it was generated. Next, digital health companies are generating personalized nutrition chart based on medical history, food allergies, etc., with the help of AI-based tools. In both the cases, application of AI increases lack of transparency and may result in premature patent grant. In such cases, it is difficult to assess who can be PHOSITA and what is the skill level of PHOSITA at the time of invention. On the other hand, these kinds of inventions do not prove that the applicant was in possession of the invention while applying for patent.

Nowadays, companies are trying to guard the training data used for machine learning. However, this is contrary to the principles of the IP system as public disclosure is mandatory. Therefore, we may need to devise a new form of protection for AI inventions. A similar situation occurred there in the past when

†Corresponding author: Email: ashokhemanthuit@gmail.com

it was declared in Budapest Treaty that disclosure of microorganism is necessary in patent applications.

The disclosure problem in patenting is a subset of the accountability problem of AI-enabled machines. In this regard, we may think about "explainable AI" that refers to methods in the AI application in such a way so that the results can be understood by humans.[5]In this regard, let us take the example of *LLC* v *Facebook, Inc.,* where U.S. Patent No. 6,792,412 was owned by Hyper Search LLC.[6] The first claim in the patent reads as

"*A system for controlling information output based on user feedback about the information comprising:*

A plurality of information sources providing information;

At least one neural network module that selects one or more of a plurality of objects to receive information from the plurality of information sources based at least in part on a plurality of inputs and a plurality of weight values….."

As can be seen, the claim is unexplainable. In this context, inscrutability refers to the inability to comprehend how the model operated, how it was trained, or how information output was generated.

Even though Artificial Intelligence (AI) as a word and a field has existed since the 1950s, it has posed few legal difficulties due to its limited implementation and applicability. This has sparked discussions regarding various well-established legal principles, particularly those governing intellectual property (IP) ownership, protection, and enforcement in relation to AI innovations and creations. A patent is a form of intellectual property right obtained for an invention. There are three basic criteria for an invention to become patentable: Novelty, Inventive step, and Utility. Apart from this, one important criterion for the patent application to satisfy the patent office is the sufficiency of disclosure of the invention. However, if AI is involved in the invention, multiple steps are within Black Box, and it is not possible to disclose the invention fully. Therefore, the disclosure issue arises with AI-based inventions.

Types of Invention Associated with AI

There can be different types of AI intervention in an invention, for example, AI-assisted invention, AI-created invention etc. In this study, we will focus on AI-assisted invention only.

Patentability in EU

According to the Guidelines for Examination in European Patent Office, there are four basic requirements for patentability:[7]

(i) "There must be an invention, belonging to any field of technology (see G-II);
(ii) The invention must be susceptible of industrial application (see G-III);
(iii) The invention must be new (see G-IV to VI); and
(iv) The invention must involve an inventive step (see G-VII)."

Disclosure Requirement

Article 83, Rule 42 (1) (e) says that *A detailed description of at least one way of carrying out the invention must be given.* The guideline does not require the applicant to disclose ancillary features of the invention. However, essential features must be disclosed. In this regard the guidelines are quoted below.

"*With regard to Article 83, an objection of lack of sufficient disclosure presupposes that there are serious doubts, substantiated by verifiable facts (T 409/91 and T 694/92). If the examining division is able, under the particular circumstances, to make out a reasoned case that the application lacks sufficient disclosure, the onus of establishing that the invention may be performed and repeated over substantially the whole of the claimed range lies with the applicant (F-III, 4).*

For the requirements of Article 83 and of Rule 42(1)(c) and Rule 42(1)(e) to be fully satisfied, it is necessary that the invention is described not only in terms of its structure but also in terms of its function, unless the functions of the various parts are immediately apparent. Indeed, in some technical fields (e.g., computers), a clear description of function may be much more appropriate than an over-detailed description of structure."

This sufficiency requirement becomes an issue in case of AI inventions.

Patentability, Disclosure, and Guidelines for AI Inventions

In the WIPO conversation on AI related invention, Judge Klaus Grabinski of Federal Court of Justice, Germany opined that in contrast to computer programmes or mathematical method, AI can train itself and adapt to its surroundings without the need for human intervention. However, the patentability

requirements of technical effect should hold in that invention. Therefore, patent protection may be available for application of a neural network and deep learning algorithm in a physical device that monitors and detects irregular heartbeats.

The patentability requirement of computer programs is not harmonized across jurisdictions. In some countries, it is not patentable at all and in some countries it may be patentable. However, a similar requirement holds true everywhere that a computer program having a technical effect in the real world is patentable. An invention should also have an inventive step, i.e., the invention is not obvious to a person skilled in the relevant art. In general, the person skilled in the art is understood to be a human. However, in case of AI invention, the question arises on who can be considered as a person skilled in the art.

When it comes to AI-generated inventions, some speakers of the WIPO conversation believe that no alterations are required at this moment to build new particular examination requirements. Others said that to accommodate certain inventions, examination procedures could need to be altered or specific rules adopted in patent examination. Some of them believed that present patentability criteria would be malleable enough to accept new coming technologies like AI. Many emphasised the significance of maintaining legal certainty by having a unified patent system and asked whether the arrival of AI could be an opportunity to reform patent law and create a consensus-based and harmonised worldwide regulation. Therefore, the question is what exactly the requirement for is disclosing AI-generated inventions; and whether the level of disclosure necessary varies based on the inventions being AI-assisted or AI-generated. On the other hand, whether an innovation that employs generic AI algorithms and well-known training data pairings shall meet the disclosure requirement without a description of the algorithms and the training data combination. One of the participants in the WIPO conversation suggested that AI-assisted or AI-generated inventions be subjected to a deposit system akin to the Budapest Trea Adopting a globally agreed-upon standard would a in the effective deployment of such a syste However, it was pointed out that the Budap Treaty's logic for depositing microorganisms did n apply to algorithms.

Case Laws

AI is primarily a data-driven technology that uses unique datasets to train AI computer models. An AI computer model can take fresh data as input and predict, classify, or generate output findings for use in a number of applications once it has been trained. In this regard, we may choose to discuss the case of a PCT application (PCT/AT2006/000457) that was granted in the US through the US National Phase but was rejected in EPO.[8] The guidelines for examining AI-related inventions are clearly mentioned in EPO.[9]

"Artificial intelligence and machine learning are based on computational models and algorithms for classification, clustering, regression and dimensionality reduction, such as neural networks, genetic algorithms, support vector machines, k-means, kernel regression and discriminant analysis. Such computational models and algorithms are per se of an abstract mathematical nature, irrespective of whether they can be trained based on training data."

As a result, just asserting a machine learning model (e.g., a 'neural network') does not always constitute the adoption of "technical means" under EPO legislation. However, the guideline also defines what can be called a technical contribution.

"Artificial intelligence and machine learning find applications in various fields of technology. For example, the use of a neural network in a heart monitoring apparatus for the purpose of identifying irregular heartbeats makes a technical contribution. 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."

The EPO Board of Appeals rejected a machine learning-based patent application in 2020 because the specification did not fully disclose how the artificial neural network was developed. Therefore, just asserting a machine learning model (e.g., a 'neural network') does not always entail the employment of "technical means" under EPO legislation.

The main claim of the application is shown below.

"*1. A method for determining the cardiac output from an arterial blood pressure curve measured at the periphery, in which the blood pressure curve measured at the periphery is mathematically transformed to the equivalent aortic pressure and the cardiac output is calculated from the equivalent*

aortic pressure, characterized in that the transformation of the blood pressure curve measured on the periphery is converted into the equivalent aortic pressure with the help of an artificial neural network, the weighting values of which are determined by learning."

As can be seen, the specification just mentions the involvement of an artificial neural network and that the weight values were determined by learning. Article 83 of EPC states that "The European patent application shall disclose the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art". Therefore, the disclosure must be written in such a way so that it enables a person skilled in the art to reproduce the technical teaching in the claimed invention based on his knowledge on that day.

Next, we need to understand whether the specification related to "artificial neural network" meets the requirements of sufficiency of disclosure and enablement. The Board decided that the specification did not *"disclose which input data are suitable for training the artificial neural network according to the invention, or at least one data set suitable for solving the technical problem at hand.*" The Board also found that the specification *"merely reveals that the input data should cover a broad spectrum of patients of different ages, genders, constitution types, health status and the like.*" Therefore, the person skilled in the art cannot carry out the invention. As a result, the Board decided that the specification did not comply with the sufficiency of disclosure requirement according to Article 83 EPC.

We can conclude that where a patent application has been filed in EPO regarding an AI or machine learning model, the specification needs to include an example of training data set, and trained weights, otherwise it should sufficiently describe the input used to train the model.

Patentability in India

The Government of India allocated a significant fund for research, training, and skilling in new technologies like AI in 2018. This is an increase of 100% over previous investments. The Govt designated AI as one of the most powerful weapons in the fight against the country's numerous difficulties. Some notable instances are the government's use of tools like MyGov Corona Helpdesk, Aarogyasetu, and CoWin to tackle the COVID19 pandemic.

A NASSCOM Report[10] on AI patent landscape in India showed "*More than 70% of the technology patents filed in India are from emerging technology domain. Among them, AI accounts for 6% of all emerging tech patents in India. India is ranked 8th in AI patent filing 60%+ of patents filed originated in India. With 93% share, Machine Learning was the most popular AI technique; Computer Vision with a share of 36% was the leading functional area."*

India's patent legislation is governed by the Patents Act of 1970. It advises and assists the Indian Patent Office (IPO) and courts in determining whether a product or process is patentable or not. Absolute novelty, inventive step, and industrial applicability are the three main criteria for patentability of inventions.

Section 3 mentions the non-patentable subject matters in India. The patentability of software inventions in India must be considered in light of Section 3(k) of the Patents Act, 1970, and the Office of the Controller General of Patents, Designs, and Trademarks' Guidelines for Examination of Computer Related Inventions (CRIs).

Disclosure Requirement

Section 10 of Indian Patent Act specifically mentions what needs to be included in a patent specification. Section 10 (4) states that

"Every complete specification shall-

(a) fully and particularly describe the invention and its operation or use and the method by which it is to be performed;

(b) disclose the best method of performing the invention which is known to the applicant and for which he is entitled to claim protection; and

(c) end with a claim or claims defining the scope of the invention for which protection is claimed;"

Legislations and Guidance

In India, there are no specific guidelines for AI inventions. However, there is a detail guideline for computer-related Inventions (CRIs), introduced in 2015 and amended in 2016 and 2017. Therefore, one needs to comply with the meet the computer-related Inventions (CRIs) standards. These recommendations are focused on computer/algorithm/software-based inventions, but they can also be used to AI-based ideas.

India has introduced special guidelines on Computer-related invention first as a draft in 2013, then as a full-fledged guideline in 2015, and further amended in 2016 and 2017. The CRI Guidelines added

the phrase "technical effect" to better describe "technical advancement" under Section 2(1)(ja) of the Patents Act.

"Section 2(1)(ja): inventive step means a feature of an invention that involves technical advance as compared to the existing knowledge or having economic significance or both and that makes the invention now obvious to a person skilled in the art."

In the CRI guideline document[11], it is clearly mentioned that

"The aim of this document is to provide guidelines for the examination of patent applications in the field of CRIs by the Indian Patent Office so as to further foster uniformity and consistency in the examination of such applications. The objective of this document is to bring out clarity in terms of exclusions expected under section 3(k) so that eligible applications of patents relating to CRIs can be examined speedily."

Grant of patents is quid pro quo to disclosure. If all patentability conditions are met, the applicant is granted patent rights for a limited period in exchange for disclosing his/her invention. According to the Patents Act of 1970, the applicant must define what the innovation is and how to perform it (Section 10 (4), Indian Patents Act 1970). The invention must be explained in detail to meet the "what" criterion, as well as the applicant's best method of carrying out the invention to meet the "how" requirement.

The requirements of "sufficiency of disclosure" are met in patent applications involving computer related inventions (CRIs) if the specification addresses the following:

(a) If the patent application is for a hardware-based innovation, each aspect of the invention must be detailed in detail with appropriate illustrations.

(b) If the invention relates to a method, the necessary sequence of steps must be clearly stated to separate the invention from the previous art, using flowcharts and other information essential to carry out the invention, as well as their modes/means of implementation.

(c) The operating relationship between various components must be defined.

(d) The expected result/output as specified in the specification, as well as any intermediate components/steps, must be described in detail.

(e) The best mode of performing and/or use of the invention shall be described with suitable illustrations.

(f) The specification should describe the invention's implementation in detail.

Even when the issue is one of hardware/software compatibility, the substance of the functionality as a 'method' must be assessed. In patentability cases, the focus should be on the invention's underlying substance rather than the specific form in which it is claimed. The Patents Act expressly excludes computer programme *per se*, and the exclusion should not be allowed to be circumvented simply by changing the claim's phrasing.

Case Studies: Granted AI Patents in India

In the absence of specific guidelines for AI-related inventions, the attention is shifted to find out real life examples of patents granted from the Indian Patent Office and to look at the claim structure.

To find out the granted AI patents in India, a search is carried out on Indian Patent Office website with the keyword 'artificial intelligence' in title of patent (Fig. 1).[12] The oldest application was filed in 2010, three in 2019, and two in 2020.

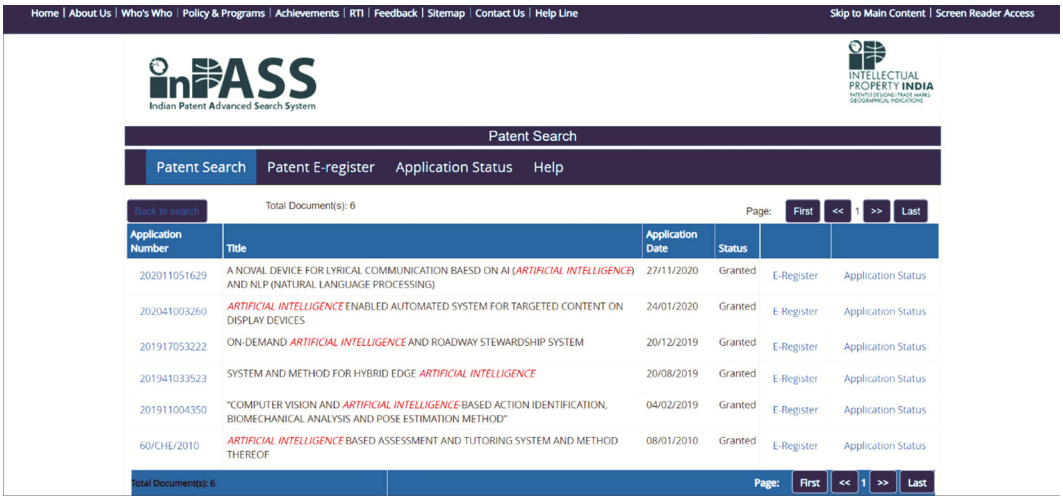

Fig. 1 — Granted patents on AI in India

ON-Demand Artificial Intelligence and Roadway Stewardship System

Publication date	21/08/2020
Application number	201917053222
Application filing date	20/12/2019

Objection Raised

The claims 1-18 are considered to be falling under the scope of section 3(k), The Patents Act, 1970 (as amended) and hence not allowable. Therefore, the invention claimed in said claims is not patentable.

Applicant's Arguments

The present invention provides an artificial intelligence based system and method for determination of traffic violations and objects of visual interest with data obtained from people. Further, the applicant humbly submits that even if techniques or mechanism such as artificial intelligence, neural network, deep learning etc. are used to implement the system, it does not make the same eligible for exclusion from the patentability. This system is implemented through hardware using various hardware components as mentioned in Claim 1 and should not therefore be considered as an algorithm/computer instructions & computer program per se and thus should be patentable.

Applicant would like to further respectfully but strongly assert that,

(a) The invention claims distinct physical and constructional features which are vital to the functioning of the invention i.e., camera, processor, neural network (devices included herein).

(b) There is a clear and tangible real world process is taking place when the invention is implemented involving a real time hardware-software-signal interaction which is vastly deviant from a mere running of an algorithm or software per se. For example, data/signal flow between cameras, processor, neural network (devices included herein) clearly indicates real time hardware-software-signal interaction.

(c) There is a plausible 'technical effect' through the invention *vis-à-vis* achieving efficient and effective analysis of ONLY the region of interest form the whole set of images/videos to efficiently determine traffic violations in lesser time and saving overall network as well as processing bandwidth/capabilities.

(d) The invention provides a technical contribution in facilitating safety and surveillance through the inter-related working of components which would not be otherwise achievable.

Thus at least in view of the above, the system as claimed in amended claim 1 should not therefore be considered as an algorithm/computer instructions & computer program *per se* and thus should be patentable.

A Novel Device for Lyrical Communication Based on AI (ARTIFICIAL INTELLIGENCE) and NLP (NATURAL LANGUAGE PROCESSING)

Publication Date	04/12/2020
Application Number	202011051629
Application Filing Date	27/11/2020

Claim 1 - An AI (artificial intelligence) and NLP (natural language processing) device (100) for vocalization, comprising: an input sound transducer, wherein the input sound transducer comprises of a microphone that produces an electrical analogue output signal proportional to acoustic sound wave acting upon its flexible diaphragm; a processing unit (104) connectable between input sound transducer and output sound transducer; characterised in that the processing unit (104) comprising; an AI (artificial intelligence) and NLP (natural language processing) chip working in combination that processes the electrical signal received from input transducer (102) and alternate its characteristics like amplitude, pitch, frequency, phase, intensity etc creating a good quality audio signal; an ADC (analogue to digital) convertor that convert the electrical signal received from AI and NLP device to its digital equivalent for transmission over region; and an output sound transducer unit (108), wherein the output sound transducer unit (108) comprises of a DAC convertor (110) and speaker adapted to convert received digital transmission into analogue equivalent and finally into the sound wave.

Objection Raised

1. Claims do not sufficiently define the invention. In view of the plurality of distinct inventions and the independent set of claims, the nature and scope of the alleged invention are not clearly understood. Inventive features should be brought out clearly under the characterized clause.

2. The claims are indefinite, too broad and do not define the scope of the invention. Therefore, the

claims do not comply with the requirements of Section 10(4)(c) of The Patents Act, 1970.

3. Claims do not sufficiently define the invention. The distinguishing inventive feature over the prior art is not clear.

Amendment

An AI (artificial intelligence) and NLP (natural language processing) device (100) for vocalization, comprising:

an input sound transducer, wherein the input sound transducer comprises a microphone that produces an electrical analogue output signal proportional to an acoustic sound wave acting upon its flexible diaphragm;

a processing unit (104) configured between the input sound transducer and an output sound transducer;

the processing unit (104) comprising; characterised in that:

an AI (artificial intelligence) and NLP (natural language processing) chip processes in combination of the electrical signal received from input transducer (102) and alternate in amplitude, pitch, frequency, phase, intensity that creating a good quality audio signal;

an ADC (analogue to digital) convertor converts the electrical signal received from AI and NLP device to its digital equivalent signal for transmission over region; and an output sound transducer unit (108), wherein the output sound transducer unit (108) comprises of a DAC convertor (110) and a speaker adapted to convert received digital transmission into analogue equivalent and at last into the sound wave.

In view of the above, the following steps are advised for claiming IP protection for AI-based software:

- In your patent, describe hardware (such as a computer system, server, sensors, and so on) as well as AI algorithms.
- Declare the working method/process of an AI-powered gadget; and
- Avoid concentrating solely on AI programming codes/algorithms.

Case Studies: Patent Applications being Prosecuted at IPO

In addition to granted patents, the current study delves into the office actions of some of the applications under process at Indian Patent Office.

In this regard, the following search string was used to find patents from machine learning and deep learning areas filed at the Indian Patent Office in the Derwent Innovation Database.

CC=(IN) AND CTB=(((neural near3 network) or ((deep or machine or reinforcement) near3 learning)) AND (Artificial near7 assist*))

(CC stands for Country Code, and CTB stands for Claim Title Body)

A total of 49 applications were found (Figures 2-4). Graphical representation of the data is shown below.

Nineteen applications were published in 2021 and 13 in 2022. Among the applications, only few had objections from Indian Patent Office regarding the disclosure requirement (Table-1).

IN201841001593A: Objection raised by IPO regarding sufficiency of disclosure:

"Claim1-7 are not clear

The claim 1-7 of alleged invention is too broad in nature that the actual invention is not clearly made from what is claimed thus the claim should be

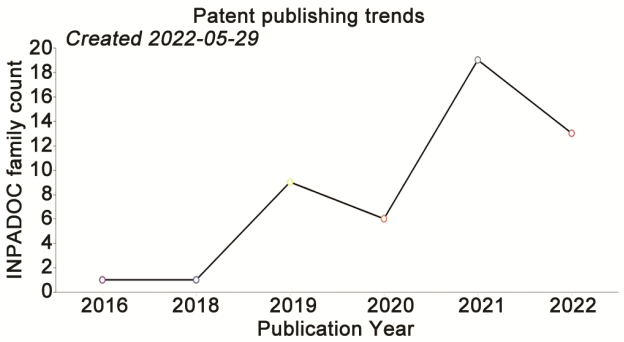

Fig. 2 — Publication of patent applications since 2016

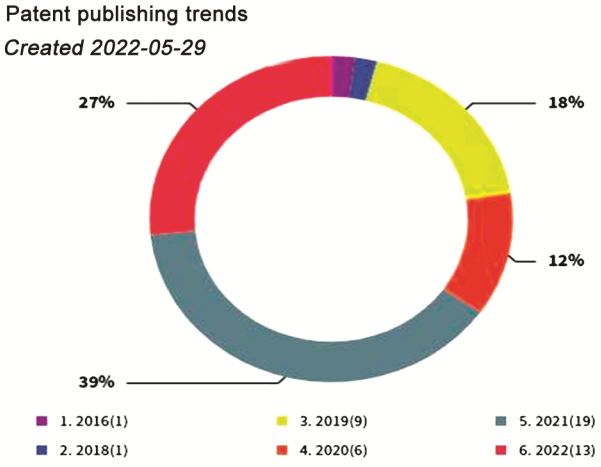

Fig. 3 — Trends in patent applications publication

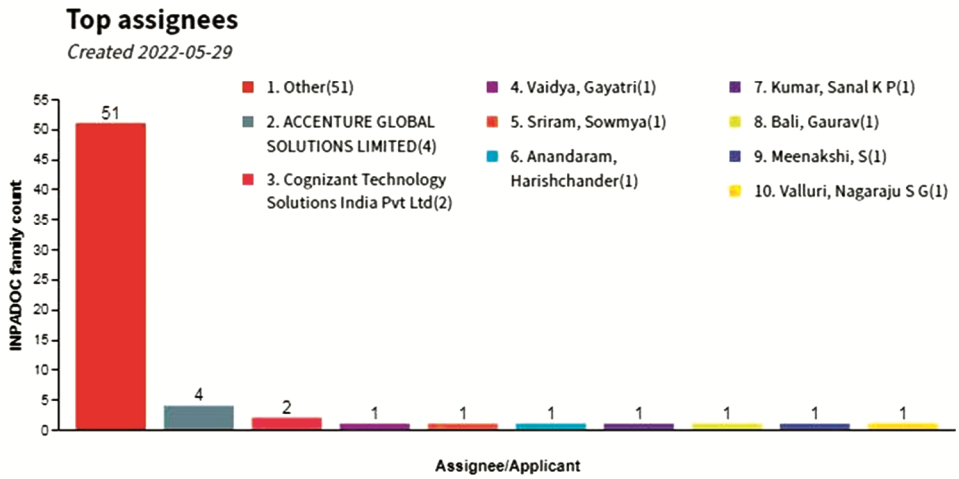

Fig. 4 — Assignee information

Table 1 — Patent application objected under sufficiency of disclosure

Application number	Title	IPC class	Filing date	Publication date
IN201841001593A	An automated system and method for detailed assessment of the learners driving class	G09	2018-01-15	2019-07-19
IN201814037344A	Artificial intelligence based risk and knowledge management	G06	2018-10-03	2019-07-05

amended as such to bring out the inventive technical features clearly as per section 10(4)(c) of The Patent Act, 1970(as amended).

At present the requirement of section 10(4) of the Act is not met. Therefore complete specification shall be amended to (a) Fully and particularly describe the invention and its operation and the method by which it is to be performed. (b)Disclose the best method of performing the invention which is known to the applicant and for which protection is sought.(c)Claims language should be consistent with the above said detailed description disclosure."

IN201814037344A: Objection raised by IPO regarding sufficiency of disclosure:

"The vague and imprecise term spirit in the description in the last paragraph [0115] implies that the subject matter for which protection is sought may be different to that defined by the claims, thereby resulting in a lack of clarity of the claims when the description is used to interpret the claims. Such statement should therefore be amended to remove this inconsistency."

In both the cases, IPO has said that "*The independent claims should be cast in the two-part form where appropriate, with those features known in combination from the prior art being placed in the preamble and the remaining features being included in the characterizing part."*

So, we can say that this is the basic form of drafting claim for IPO. Being one of the major Information Technology hubs of the world, India is expecting to see a rise in the AI applications in near future.

Conclusion

Generally, AI-generated output is inscrutable, as none can understand how the output was produced. This black box scenario poses challenge to the conventional patent disclosure system. Patent disclosure requirement is mainly based on three doctrines: i) written description, ii) best mode, and iii) enablement. Written description guarantees that the inventor indicates that the claimed subject matter was invented by the applicant. Best mode makes an inventor to disclose what he/she believes to be the best mode of practicing the claimed Invention. Enablement requires that a person of ordinary skill in the art be able to create and use the claimed invention without excessive experimentation based on the disclosure and information available to those versed in the art. A patent specification must describe the claimed invention in sufficient detail for one competent in the art to reasonably conclude that the

inventor had ownership of the claimed invention to meet the written description requirement.The disclosure requirements are an excellent tool that courts and patent offices can use to prevent foundational procedures from being patented. Patents on techniques with application potential in a multitude of areas are likely to hasten patent thicket difficulties, as Al provides cross-industry capability. Finally, it can be mentioned that at the WIPO discussion agreed that when discussing patentability, it's important to distinguish between AI-generated and AI-assisted inventions. It was generally agreed that AI-assisted inventions should be assessed under the current legal system.

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