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Ai and Indian Patent Law- Sufficiency of Disclosure for Artificial Intelligence-based Patents

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Abstract- Many countries' Patent Offices and Courts, including the United States, the European Union, China, and Japan, have attempted to interpret existing patent laws in order to respond to patent applications centered on AI as an inventor and have made some efforts to accommodate this massive breakthrough technology, but the Indian Patent Office or Courts have yet to take such an initiative. This work takes a tiny step toward determining if the Machine Learning Model is capable of meeting the substantive and procedural criteria arising from the question of Inventorship under Indian Patent Law. This will be examined through the eyes of people in the field, primarily start-ups that have entered the Indian AI market, IP Experts, AI-dedicated Scientists, and key Industrial personnel, in order to better understand the practical nuances of this intelligent-looking technology and to analyze the likely "What Ifs" that will arise once AI is supposedly considered a potential contender for the title of "Inventor." The research is generally mixed, with doctrinal and non-doctrinal methodologies used to qualitatively assess the topic of AI-generated Technology and Patent Law.

Keywords: Artificial Neural Networks, ANN, Indian Patent Law, Disclosure, DABUS, Enablement

I.INTRODUCTION

Intelligence is merely information processing performed by elementary particles moving around as per the laws of physics, and there is no law of physics that says you cannot carry out a particular task in ways that are much more intelligent than humans.[1] Today's biggest AI breakthroughs are of a completely different kind where rather than the intelligence being largely programmed in an easy-to-understand code, the programmers put in almost nothing except a little learning rule by which a simulated network of neurons can take a lot of data and figure out the manner of performing the task at hand, and gradually the system becomes even better at performing than a human can, surpassing what the programmers could largely imagine. For instance, Google's DeepMind reinforcement learning system woke up like a newborn baby and was shown the screen of an Atari video game and then was tasked to learn to play the video game. It had no idea about objects, motion, or time; it only knew that there was an image on the screen and a score. Today, with its self-learning ability, Deep Mind can win at any game. It can already beat all the original Atari games and play the game at super speed in less than a minute. The rate of improvement is exponential. While Google's DeepMind's Go-playing AI, at its inception was unable to beat any reasonably good AlphaGo players, only within approximately six months, it became capable of defeating the European Go Champion, Mr. Fan Hui, on a full-sized board without handicap with a score of 5-0,[2] followed by beating the legendary Go player, Mr. Lee Sedol[2] including other Go world champions from the varied global arena and ended up beating everyone while playing simultaneously. This was, in fact, the first time that a computer Go player not only received the much deserving accolades but also intrigued everyone with a couple of moves that a human Go player would seldom use.

Artificial Intelligence is making rapid strides in multifarious domains. From assisting the humans in amplifying their cognitive abilities to itself autonomously devising and generating potential solutions to the unspecified problems, either exclusively or with little or insignificant human intervention, it is now capable of challenging the established traditional paradigms of IPR laws.

In 2018, a Creative Machine named DABUS came up with two inventions; one was a fractal design of a beverage container, while the other was a "neural flame" device used in search-and- rescue missions.[3] The owner of DABUS, Dr. Stephen Thaler, filed the patent application for both the inventions as an applicant and has claimed the status of "inventorship" for DABUS. This very attempt had the potential to throttle the world of AI and IPR laws wherein, for the first time, a Machine Learning Model was in line with the tag of "inventor" as against the traditional norms of patent law attributing Inventorship to only natural persons. Although the USPTO, the EPO, and the UK High Court have refused the granting of "inventorship" status to AI on the ground of it lacking the ability to conceive the idea like a natural person, which is the touchstone of Inventorship,[4] the decision has, instead of settling down the uncertainty surrounding the patenting of AI, stirred up a hornet's nest of a utopian as well as a dystopian world, crossing the interface of AI and law, in general, and IPR law, in particular.

While the TRIPS Agreement merely enunciates the criteria for qualifying an invention as patentable, it does not explicitly state if the Invention, whether product or processes, must be made by humans or by an AI system, for that matter.[5] This suggests that

TRIPS provides a broader leeway to member nations if they wish to grant the inventorship status to AI in their domestic patent legislations.

But the larger question is whether it is imperative to grant inventorship status to AI?

The team "Artificial Inventor Project," which is behind DABUS and similar technology, although does not say that an AI should own a patent; but it does cite two-fold reasons why an AI Machine should be considered an Inventor:

i. Hundreds and thousands of employees have contributed code to such a system, as such patent protection over such innovations generated by AI will enable all such humans to reap benefits and recoup the investment made in Research & Development over the years.
ii. It would promote creativity as it would be more explicitly known for AI systems' values.[6]

Even late Professor Shamnad Basheer, in his distinctive piece representing the futuristic courtroom discussion revolving around AI named Servix, which was embedded in a watch or cell phone or any other object with close body contact to contribute towards enhancing the creative output[7] of his clients by computing their state of "flow," concluded that there is no special reason to exclude the machines, or for that matter, animals or other non-humans from claiming Inventorship merely because they are not accorded legal personality.[8] He, quite vocally, submitted how this anthropocentrism[9] is the root cause of all our problems which does not let a human overcome the delusion of him being the center of the universe and to whom the real intelligence and creativity will always associate.[8]

Taking forward what Late Professor Basheer attempted to point out if policymakers at all sit and decide to bust this myth of human superiority and start legally recognizing the intellectual ability of such AI Machines by allowing them to stand in the queue of "inventors" if they come up with a highly ingenious invention which qualifies the threshold of patentability, how far would these machines be able to satiate the procedural and substantive parameters laid down by our Patent Laws which an inventor must qualify to begin with. It is important to be noted here that we do not make any outlandish suggestions that patents must be granted in favor of AI or they be given the legal personality to begin with, but we merely point out that if at all a one-line amendment attributing default "inventorship" and "ownership" to AI and human, respectively, is introduced, will the AI, and more specifically, the Machine Learning Model and Deep Learning Model, be able to meet the most pertinent requirements of the Patent Law, which includes, apart from the three qualifiers of patentability, the requirement of disclosure entailing three separate qualifications,[10]

a) enablement
b) the best mode, and
c) written description,

to which scholars have hardly paid any attention.

iii. Disclosure Requirement: Is Machine Learning Model capable of providing a road map of how it produced the output?

The disclosure requirement efficaciously implements the quid pro quo of the patent system, which is based on the premise that the applicant shall enjoy time-limited rights to exclude others from misappropriating or practicing their Invention only if such person lays down with sufficient detail and clarity the Invention that he has devised and claims patent for. It is pertinent to note that the disclosure requirement illustrates the informative quality of the patent application rather than laying down the technical merits of the claimed Invention, and is different from the claims portion of the patent application, which aims to provide sufficient "teaching" of the Invention and ensures that the information is ultimately divulged to the public rather than being suppressed with the inventor/applicant.[10]

The disclosure requirement must meet three pointers:[11]

a) Enablement: The inventor must specify both "how to make" and "how to use" the claimed Invention to put the public in effective "possession" of the Invention once the patent expires, such that they can practice the Invention freely without any liability as well as by providing the hypothetical person of ordinarily skilled in the art a blueprint to reproduce and use the invention "without undue experimentation."[10] This also enables the PHOSITA to determine if the claimed Invention is of predictable or unpredictable nature.

b) Best Mode Requirement: It obliges an inventor to disclose what an inventor believes to be the best mode, and not just a mode, of practicing the claimed Invention. This is more of a subjective inquiry against the objective inquiry and focuses on discerning what exactly was there in the inventor's mind while coming up with the particular Invention at a particular point in time. In India, fulfillment of the best mode requirement is vital for issuance of a patent in favor of claimed Invention to put the members of the public in a commercially competitive position with the holder of the expired patent.[10]

c) The Written Description Requirement: it encompasses all of the content embodied in a patent specification other than the claims of the Invention.

This paper is largely concerned with the first two requirements while dealing with inventions generated by AI, which demand utmost transparency against the black-box nature of the AI that makes the "how to make" parameter largely inscrutable.

iv. Looking Inside an AI

As a kid, the fascination with robots and AI, as shown in sci-fi movies, make one believe how AI is "some sort of magic to brain-like activity,"[12] but only as one grows up and starts to witness the world of programmers and algorithm developers, he/she realizes that "there is no bright line between what is intelligent and what is computational."[12]

Usually, in the case of humans, they treat their past experiences and learnings as a stepping stone to refine their intellect and creativity, and as such instruct the machines to do what the human wants it to do; but in the case of machine learning, which is most commonly known as a subfield of AI, the machine is trained to learn from their past experiences and thereon use such learning in a given situation to yield better output. Thus, ML involves teaching a computer program to identify data patterns and apply the knowledge to new data.

There are three stages in Machine Learning:[13]

a. In the first stage, Model architecture is developed by the programmer.
b. Under the second stage, such Model evolves through training algorithm and training data sets that are fed during the training process to produce a Machine Learning "Model," and
c. Lastly, such a trained ML Model is then applied to the new data to generate a definite output.

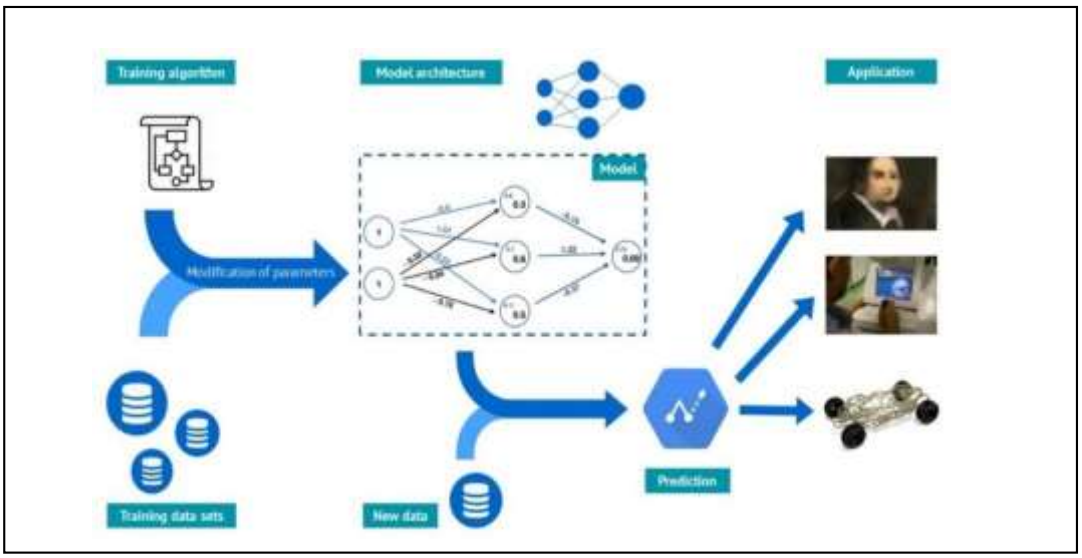

Fig.1 (Source: Josef Drexl, Reto M. Hilty, et al., Technical Aspects of Artificial Intelligence: An Understanding from an Intellectual Property Law Perspective)[13]

One such kind of Model is Artificial Neural Networks (ANN), the structure of which is loosely inspired by the archetype of the human brain. The Model:

A. Depend on an architecture developed by a programmer before the initiation of the training process. This architecture, also known as hyperparameters, is fixed before the training process as per the human know-how and heuristic[13] methods and does not evolve during the entire process.

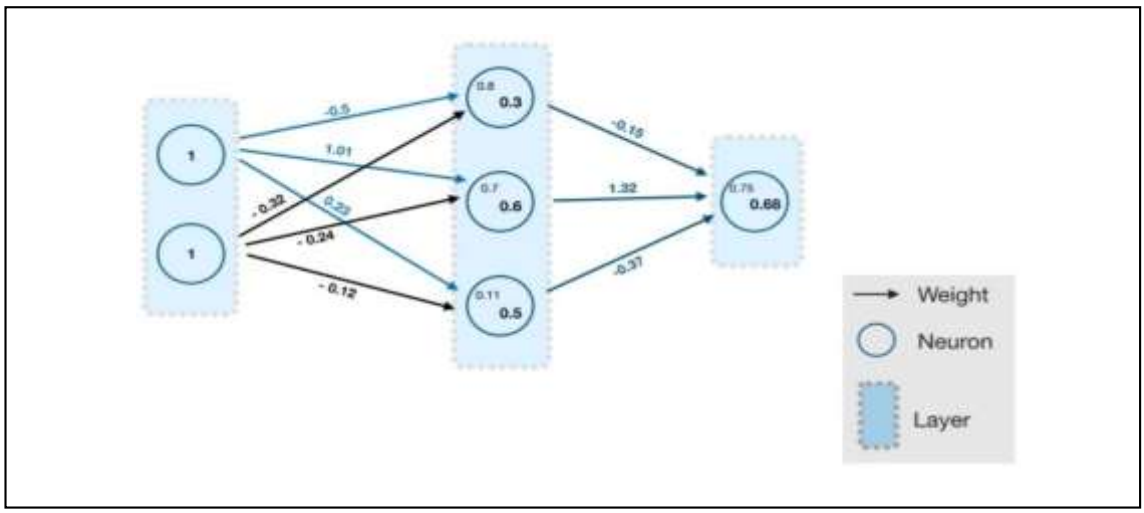

Fig. 2 (Source: (Source: Josef Drexl, Reto M. Hilty, et al., Technical Aspects of Artificial Intelligence: An Understanding from an Intellectual Property Law Perspective)[13]

B. Comprises of Layers of neurons, wherein each neuron is a mathematical function that processes the inputs (the numeric value of the upstream weights) into an output (the numeric value of the downstream weights). The sum of all such functions attached to the neurons then goes on to compose the main Model.

C. Contain weights, which are attached to the layer of neurons. These weights are the trainable parameters, which are again in the form of numeric values, and which at first are randomly allocated, but then they transform, evolve, and get optimized throughout the training process.

[13]During the training process, the training algorithm (also known as optimization algorithm) optimizes weights (trainable parameters) when trainable data sets are fed into the Model.[13] Thus, training data is the most significant element of the machine learning process. The better the quantity, quality, and variety of the training data, the more accurate the computation of the trainable parameters will be, leading to a more precise output.[13] In simpler terms, the quality of the Model comprising of the model architecture, training algorithm, and training data influence the accuracy of the output. The more the data is fed, the more experienced the whole architecture shall become, ending up producing a better and unpredictable output.

For instance, Reinforcement learning, one of the training methods generally followed by many companies, is largely based on reward and feedback mechanisms and was used to train an algorithm to play a profoundly complex board game of GO.[2] The computer program contained deep neural networks wherein the input in the form of a description of GO board was fed initially and was allowed to process through the multiple network layers containing neuron- like connections.[2] Out of two kinds of neural networks, one, known as 'policy network,' selected the consecutive moves to play, and the other neural network, known as the 'value network,' envisioned the winner of the game.[2] Apart from this, no specific training of GO strategies was imparted to the computer program. Instead, it was merely exposed to multiple amateur games to familiarize itself and absorb the understanding of reasonable human play and was subsequently made to play against a variety of versions of itself multiple times, each time sending feedback based on the final score of the game. This way, with each move, the computer program not only learned from its mistakes but was able to "figure out" by itself the rules based on continuous feedback and improved its skills to such an extent that it started outperforming human champions one by one.

The fascination largely was that the AlphaGo managed to play those moves that even human players could never anticipate, which leads to an understanding that if the actual output is something that the humans cannot anticipate or is substantially different from the predicted output, due to the existence of factors "such as,

a. available computing power and sources of data,[14]
b. the scale and amount of new use cases,[14] and
c. the ability to use developments in algorithms to perform complex computations and provide customization,"[14]

then the scale of transparency keeps on diminishing for a human mind to interpret the modality of how the AI came about to produce the new, unanticipated output. The gap between the logic applied by the AI between the input and the output keeps on increasing, making it super- difficult for the PHOSITA to not only practice the Invention but also prevent the human from getting hold of the possession of the Invention during the time of the patent application. This is because these systems remain "characteristically opaque,"[14] making it super-incumbent to "look inside" to understand why ML does what it does or how ML works, thereby preventing the human applicant to himself comprehend and explain precisely why and how the AI- generated the concrete output based on a given input.

Now, considering a situation in which the output is in the form of a new product, the question arises that if it is not humanly explainable to understand the way the system has generated such an output due to the inherently opaque nature of technology, how can an AI as an inventor or for that matter the applicant shall comply with the 'best mode' requirement mandated by the Indian Patent Act? Moreover, since the fundamental goal of the patent system is to disclose technology so that, over time, the public domain may be enriched and a systematic record of humanity's technology is available and accessible, how will such AI-generated inventions be regulated to suffice not only the patent law qualifications but also maintain a symbiotic relationship between the human and AI, without introducing any preposterous solution that might endanger human creativity?

This paper attempted to analyze the question by gathering the rich and insightful views of several renowned names along with substantiating it with important literature containing expert comments when WIPO and the USPTO initiated similar dialogue.

II.ISSUES AND ANALYSIS

A. Is the AI capable of disclosing the new product along with the complete operative concept behind the output to meet the disclosure as well as the best mode requirement under the Indian Patent Law?

Some commentators believe that the written description requirement in case of AI demands recital of functional language with adequate meticulousness and clarity in the specification along with details of both the hardware (say, the computer) and software (algorithm), with detailed steps of procedures, formulae, diagrams, and/or flowcharts,[15] to formulate a boundary around the claimed Invention enabling the PHOSITA to conclude that the inventor has possession of the full scope of the subject-matter claimed.[16] However, other commentators highlighted the inability of AI to fully disclose the process and stated, "even though the inventor may know the input and output, the logic in between is in some respects unknown."[16] This shows that since the human, be it the owner of AI or the developer of algorithms responsible for the functioning of AI, can neither observe the process in real-time and interpret the same nor can he backtrack and analyze the decision-making logic after the act, thereby making it impossible to sufficiently meet the disclosure qualifier, and acting as a hindrance to the grant of patent to the claimed Invention.

For instance, US Patent No. 6,792,412[17] stated the use of the "Artificial Neural Network" module as an AI-based tool that generated a rating value for the plurality of objects by redetermining the weights. However, the underlying algorithm, the pattern

incorporated in the data, and the capture of the statistical structure in a set of data representing observed variables were humanly-inexplainable owing to the self-learning ability of the network.[14]

In the Indian context also, merely specified that he has used multimodal deep learning techniques to model[18] the information using a large volume of the dataset but has nowhere stated the logic the ANN used to produce the claimed output.[14] This is because humans cannot aggregate and diagnose the details between the deep learning layers or what motivated the underlying algorithm within an AI to evolve the weights connected with such deep learning layers.[14] Even the functioning of AI, with constant feeding of datasets, keeps on becoming non-linear, making it even more incumbent for the human to be able to explain how one variable relates to another variable, contributing towards lack of discernment and inexplicability on the part of the patent applicant, leading to failure of sufficient disclosure requirement.[14]

However, when we look at DABUS, it is altogether a different proposition from the various prior generation Creative Machines. DABUS consists of varied disconnected neural nets. Each neural net, in turn, possesses inter-linked memories of linguistic, visual, and auditory nature, depending on its inputs. These nets continually fuse and detach due to carefully controlled chaos instated within and between them. Some of these nets then rapidly evolve during the cumulative phases of learning and unlearning, materializing the nets into a complex structure representing complex concepts. These concept chains further connect to other chains forming an anticipated sequence of any given concept. The structure formulated then is largely ephemeral. It fades and gets continually replaced by other ephemeral structures, showcasing a pattern similar to a stream of consciousness in humans. Thus, in DABUS, the ideas are represented by these ephemeral geometrical structures, which are the product of the chains of nets rapidly materializing and dematerializing, instead of the usual "on-off" patterns of neuron activations that existed in prior Creative Machines, creating an enormous difference between the working of these Creative Machines and DABUS. These structures further get selectively reinforced when any particular desired outcome gets absorbed into the topology at each turn, while another part of these geometric structures gets weakened through varied mechanisms when any undesirable notion permeates through the topology. In the end, the ideas get converted into long-term memories, allowing DABUS to be questioned concerning any inventions or discoveries it makes with time. This concept allows DABUS to even disclose the Invention made by it; the only issue being whether PHOSITA is capable enough of interpreting the mechanism that goes within DABUS in real-time and appreciating the same in the patent specification with sufficient clarity.

Given the greater degree of inscrutability as well as inexplicability associated with AI systems wherein they deliver the decisions through the black box, it has become imperative, both from the perspective of Patent laws as well as holding the AI accountable to the public for whatsoever decisions it arrives at, say, it simply spits out a diagnosis for tumor by using a large volume of medical data, the individual patient is entitled to know what AI did and why to develop the faith in the diagnosis and proceed towards the required treatment, "to open the black box to get right answers for right reasons."[19] This is known as Explainable AI, which enables the AI to substantiate the decision by the fact that why such a decision was arrived at, and only then the human will be able to validate and decide to proceed with the decision, as against otherwise taken merely on trust.

On the same line, it is also proposed by one of the interviewees that every improvement could also be recorded through a device or software, which itself is part of the ML Model, enabling the human to backtrack the procedure adopted by the ML to generate the output. He emphasized that more than human intervention, care should be taken of human validation, which at every point holds the AI accountable and will also form part of the disclosure.

B. Are the datasets that are used to train the ML model considered part of the Invention? If so, how would the dataset be provided for meeting the disclosure requirement, owing to the idea that it is quite difficult to put on paper such a huge trainable database that is fed into the AI? Would a system of deposit for AI applications or training data, similar to the deposit of micro-organisms, be appropriate for disclosure?

There is no definite answer to these questions posed, as they tend to overlap with other domains of IP such as copyright law and trade secrets and are more fact specific. Deposition of data could be an appropriate forum facilitating limited disclosure; however, the policymakers shall have to be cautious of the data privacy concerns that will naturally come forth. The probable solution could be to regulate the data only for the purpose for which it is deposited, as proposed by our interviewee. But on the downside, the deposition of data or, for that matter, the disclosure of the complete datasets shall escalate the cost of prosecution, thereby acting as a hurdle for the companies investing in AI and defeating the entire purpose of patent law, which is to help the companies to recoup the investments made towards R & D.

C. How will the AI, if given the title of Inventorship, assign the Patent rights to the human who claims ownership over it, absent any sort of Contractual language on ownership of the AI system, particularly when there are potentially multiple stakeholders behind the ML model? Is attributing legal personality to AI the only approach or a one-line amendment in the Patent Act attributing default 'inventorship' and 'ownership' titles to the AI and the human, respectively, feasible?

The legal definition of an 'inventor,' for now, is primarily restricted to a 'natural person'; however, since the idea behind attributing Inventorship is to acknowledge the contribution made by the persons involved in developing such Invention, so in that case, if an AI, a non- human entity, makes any such invention, the law must be capable of acknowledging the contribution of such AI which could be done by way of "right of attribution that exists vis-à- vis the inventor."[20]

"The right of attribution for an AI which is envisioned forms a part of a pseudo-patent application wherein the AI involved is named. Such recognition should be conditioned on the extent of real intellectual efforts towards developing the Invention itself, which was not initially perceived by the inventor himself. Such a right might seem rather useless for the AI; however, it can be helpful when one, it provides traceability to the extent of liability that the human inventor may be awarded; and two, buried in the right of such attribution to AI is the repute of the human inventor involved which would not die out even after assignment thus, providing a flexible degree of control over one's creation. The pseudo-patent application is a superficial patent application, supplementary to the main patent application. The details regarding the extent of intellectual efforts by the human inventor and the AI involved should be recorded in the pseudo-application. Since the inventor cannot manually distinguish for an AI which logic is wasteful and should be avoided, the AI sans discernment reflects the system biases thus, inflicting liability on the inventor or even the corporate assignee."[20]

Another approach could be to introduce a one-line amendment attributing default "inventorship" to the AI for the additive value it brings forth with the new Invention and at the same time attributing "ownership" to the multiple stakeholders behind the AI, such as the owner of the hardware or the algorithm developer, as per the amount of contribution each one has put forth in enabling the AI to generate at the first place. This may also ease the right of the human applicant who shall act like an "owner" to assign or license the right to practice such AI- generated inventions to any person he deems fit in the same manner as it is usually done in case of other patentable inventions.

If this is a situation wherein the machine is proposed to enjoy the legal status of an inventor, then policymakers will also have to consider another set of questions such as how the AI can be held liable for infringement of a patent, and so again it's not an easy question to answer there and opens a pandora box of questions.

D. Assuming that the AI algorithm generates a novel solution, and no human meets the traditional test as an "Inventor," can there be a Patent then? Can there be an Invention without an Inventor?

It is just a matter of time when the law is changed to allow AIs to be inventors. The more human they appear; the more likely legislators and policymakers will accept the notion that AI is actually what the law calls an inventor to be. As far as the existing framework of patent law is concerned, the premise is based on a 'quid pro quo' system, wherein it does not matter so much if the Invention is generated by a human or by the computer. As long as somewhere someone comes up with an invention that is useful to mankind, then mankind should have access to it, and the patent law must reward that someone for putting in their labor onto it.

Further, as far as the second part of this question is concerned, it does not seem to be that of an issue because it is associated with the third question discussed above. When the policymakers decide whether to attribute legal personality to AI or introduce a one-line amendment attributing default inventorship to AI, they will be able to naturally answer this question. In the practical aspect, too, the question of who an inventor is and whether there can be a patent is clearly explained by claim analysis, and oftentimes, it is not known who the inventors are going to be until the prosecution begins. Moreover, not attributing Inventorship to AI will also lead to a societal question about what technologies are going to be prejudiced by such a rule. Considering that computer technologies and AI developments are crucial to our economy and the world's economy as well, that needs to be considered before setting such a rule in stone.

While the larger questions as those discussed above may be better handled by legislators, there are other issues that the litigators face is how do you prove who invented what, and that of course, historically has been done through depositions or declarations, but how would an AI bear the burden of proving that it was the first to appreciate the Invention? Will it be able to sit for a deposition in a process to answer every question that is posed to it to be an inventor? Will the burden shift onto the human applicant, and if he shall be able to sufficiently tell by what logic the Invention was made? That might be an extremely difficult problem to answer, except in the case of DABUS may be, which perhaps can be interrogated in that aspect.

III. CONCLUSION

The general understanding is that a programmer who develops an ML Model can never term it as a "black box" because first, he will always have his hands on the algorithms, parameters, and the features it has trained the Model for, and second, he can always tweak them with time. But a person who is not involved in the process of making the AI may term it as a "black box" owing to the inscrutability of the working adduced to bring forth the definite output. In that context, lack of guidance or direction in the specification, owing to the "inherent randomness in AI algorithms," would make it difficult for the PHOSITA to understand the functioning and reverse-engineer the same without undue experimentation. This inversely proportionate relationship between the amount of disclosure and the level of understanding possessed by PHOSITA posits the patent office to aggressively police the disclosure standards, maintain the patent quality, and liberalize the flow of technical information associated with AI.

Further, the standard of the disclosure will always depend on how efficient the Neural Network is in tracing the method the ML has followed and simultaneously is capable of explaining it with the right reasons. Moreover, the reasons substantiating the output produced are right or not maybe validated by humans, and at the same time, there can be more than just a single human checkpoint to maintain the desirable control over the AI and the solution it comes up with before even suggesting if such a solution is marketable. Call it driven by the delusion of human superiority, if that may, but it is not worthwhile to wade into the dangerous waters, at least for now. The last folks that got on a train in Germany without knowing where they were going did not end well… just saying!

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