

# Patent Inventorship and Ownership Issues on Inventions Developed by Humans Using Artificial Intelligence\*

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*Artificial intelligence (AI) is immensely capable of questioning this human 'self-awareness' by replicating the human potential to think, sense and also to make decisions in any knowledge field. Advanced research in AI has identified increasingly diverse applications of AI all over the globe. One of the crucial aspects of these AI programs is; even though the instructions have been given by the programmers, the final creative output is sometimes generated by intelligent machines by taking decisions by themselves based on the dense neural networks. In view of the above, some argue that the inventorship rights for such inventions should be owned by intelligent machines. Nevertheless, researchers and legal experts suggest that the inventions developed by machines will always need human intervention and creative input. In this regard, this research focuses on inventorship and ownership issues in relation to inventions developed by humans using AI. This report has tried to resolve these issues by analyzing the statutes and case laws of US, UK, India and Japan. In addition, this report provides the opinions of technological and legal experts. Lastly, the report provides author's suggestions and recommendations which have proposed a framework model that would be helpful to decide the ownership and inventorship of inventions developed by humans using AI.*

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## I. Introduction

Human self-reference happens any time when we say 'I'. Artificial intelligence (AI) is immensely capable of questioning this human 'self-awareness' by replicating the human potential to think, sense and also to make decisions in any knowledge field.<sup>1</sup> Machine learning is a major class of artificial intelligence that enables machines to learn from their experiences without being explicitly programmed.<sup>2</sup> Machine learning has evolved from the studies of pattern recognition and

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\* This is a summary of the report published under the 2018 Collaborative Research Project on Harmonization of Industrial Property Right Systems under a commission from the Japan Patent Office.

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<sup>1</sup> Colin Conwell, ARTIFICIAL INTELLIGENCE IS NOT ABLE TO 'PRESS THE DELETE KEY' ON HUMANITY JUST YET, THE GUARDIAN (2015), <https://www.theguardian.com/commentisfree/2015/sep/27/artificial-intelligence-wont-press-delete-key-humanity-yet> (last visited Sep 17, 2018).

<sup>2</sup> Arthur L. Samuel, *Some Studies in Machine Learning Using the Game of Checkers. II—Recent Progress*, In: Levy D. N. L. (eds) *Computer Games I*, Springer, New York, NY (1988).

computational learning theory in artificial intelligence.<sup>3</sup> It reconnoiters the construction and study of algorithms that can learn from the provided data and make predictions or decisions accordingly.<sup>4</sup> Remarkably, when these machine learning approaches are applied to creative works of the real world such as literary works, art and music, these algorithms are actually learning from the input of the programmers and delivering creative outputs by taking their own decisions on how the final output should look. One of the crucial aspects of these artificial intelligence programs is; even though the instructions have been given by the programmers, the final creative output is generated by intelligent machines by taking decisions by themselves based on the neural networks that are similar to the human thought process.

There have been increasingly diverse applications of machine learning and artificial intelligence all over the globe. “*Can we take what humans think is beautiful and creative and try to put that into an algorithm? I don't think it's going to be possible for quite a while*” says Jason Toy the CEO of an upcoming company working in artificial intelligence<sup>5</sup>. Even though, many experts raised questions on the creative aspects of machine learning and artificial intelligence, there have been many instances where the intelligent machines have proved their creative efficacy.<sup>6</sup> Recently a news agency received a grant by Google to develop an intelligent program that would write almost 30,000 local news articles a month.<sup>7</sup> The Next Rembrandt, a 3D printed artwork created by an intelligent program is based on 168,263 Rembrandt painting fragments.<sup>8</sup>

Nevertheless, researchers and legal experts still argue that the inventions developed by machines will always need human intervention and creative input. With the support of such arguments, experts deny the idea of providing inventorship and ownership rights to intelligent machines.<sup>9</sup> In this regard, this research focuses on inventorship and ownership issues in relation to inventions developed by humans using AI.

## **II. Interpretation of Provisions and Precedents: Inventorship and Ownership perspective**

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<sup>3</sup> William L. Hosch, MACHINE LEARNING, ENCYCLOPÆDIA BRITANNICA (2016), <https://www.britannica.com/technology/machine-learning> (last visited Sep 17, 2018).

<sup>4</sup> Peter Wittek, *Pattern Recognition and Neural Networks*, in *Quantum Machine Learning*, 63–71, Academic Press, Cambridge, MA (2014).

<sup>5</sup> IBM, The quest for AI creativity, (2015), <https://www.ibm.com/watson/advantage-reports/future-of-artificial-intelligence/ai-creativity.html> (last visited Sep 17, 2018).

<sup>6</sup> R.L. Adams, 10 POWERFUL EXAMPLES OF ARTIFICIAL INTELLIGENCE IN USE TODAY, FORBES (2017), <https://www.forbes.com/sites/robertadams/2017/01/10/10-powerful-examples-of-artificial-intelligence-in-use-today/#100d11c3420d> (last visited Sep 17, 2018).

<sup>7</sup> Julia Gregory, PRESS ASSOCIATION WINS GOOGLE GRANT TO RUN NEWS SERVICE WRITTEN BY COMPUTERS, THE GUARDIAN(2017), <https://www.theguardian.com/technology/2017/jul/06/press-association-wins-google-grant-to-run-news-service-written-by-computers> (last visited Sep 17, 2018).

<sup>8</sup> Tim Nudd, INSIDE 'THE NEXT REMBRANDT': HOW JWT GOT A COMPUTER TO PAINT LIKE THE OLD MASTER, ADWEEK (2016), <http://www.adweek.com/brand-marketing/inside-next-rembrandt-how-jwt-got-computer-paint-old-master-172257/> (last visited Sep 22, 2018).

<sup>9</sup> James Grimmelmann, *There's No Such Thing as a Computer-Authored Work - And It's a Good Thing, Too*, 39 COLUMBIA JOURNAL OF LAW & THE ARTS, 403 (2016).

## 1. United States (US)

Patent law of US is one of advanced patent laws all over the globe.<sup>10</sup> Analysis of specific sections and provisions of the US patent law would provide a better understanding of issue in question and would help to develop a solution for ownership issues related to inventions using AI. 35 USC 100 of US Patent act provides a list of 'Definitions' that describes some important words that are useful for this study. According to 35 USC 100 (a)<sup>11</sup> of United States Patent Act, "the term 'invention' means invention or discovery." According to 35 USC 100 (f)<sup>12</sup> of United States Patent Act, "the term 'inventor' means the individual or, if a joint invention, the individuals collectively who invented or discovered the subject matter of the invention." Similarly, Section 35 USC 100 (g)<sup>13</sup> of United States Patent Act defines the terms "joint inventor" and "co-inventor" as "any one of the individuals who invented or discovered the subject matter of a joint invention." According to 35 USC 116 (a)<sup>14</sup> of United States Patent Act, Joint inventions are described as "When an invention is made by two or more persons jointly, they shall apply for patent jointly and each make the required oath, except as otherwise provided in this title. Inventors may apply for a patent jointly even though (1) they did not physically work together or at the same time, (2) each did not make the same type or amount of contribution, or (3) each did not make a contribution to the subject matter of every claim of the patent."

## 2. United Kingdom (UK)

The current legislation of UK relating to patents consists primarily of the Patents Act 1977 amended and supplemented by the Copyright, Designs and Patents Act 1988 and the Patents Act 2004 and the Patents (Compulsory Licensing and Supplementary Protection Certificates) Regulations 2007.<sup>15</sup> According to Section 7(3) of the UK Patents Act 1977, "“inventor” in relation to an invention means the actual deviser of the invention and “joint inventor” shall be construed accordingly.”<sup>16</sup> The Patent Act of UK has detailed only the definition of the inventor and didn't address the issue of inventorship.

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<sup>10</sup> Donald Chisum & Janice M. Mueller, U.S. PATENT LAW SNAPSHOT, AUGUST 2015: SUPREME COURT THROTTLES BACK WHILE FEDERAL CIRCUIT SHIFTS INTO HYPERDRIVE, SSRN (2015), <https://ssrn.com/abstract=2649023> (last visited Sep 17, 2018).

<sup>11</sup> See 35 U.S.C.S § 100(a) (2018).

<sup>12</sup> See 35 U.S.C.S § 100(f) (2018).

<sup>13</sup> See 35 U.S.C.S § 100(g) (2018).

<sup>14</sup> See 35 U.S.C.S § 116(a) (2018).

<sup>15</sup> Patents: the basics, Out-Law.com - Legal news and guidance from Pinsent Masons, <https://www.out-law.com/page-5699> (last visited Jul 31, 2018).

<sup>16</sup> See Section 7(3), The Patent Act 1977, UK.

Manual of Patent Practice (MoPP) of UK has provided a better understanding on the concept of “inventor” and “inventorship”. *Section 7.12*<sup>17</sup> of MoPP has dealt with the inventorship issue detailing that “a two-step approach was necessary to determine inventorship. One must first identify the inventive concept and then determine who devised that concept.” with reference to *Henry Brothers (Magherafelt) Ltd v The Ministry of Defence and the Northern Ireland Office*.<sup>18</sup> It is clearly described in the *Section 7.12.1*<sup>19</sup> of MoPP, that “identifying the inventive concept is the primary step during the identification of inventorship. In *Stanelco Fibre Optics Ltd’s Applications*,<sup>20</sup> Christopher Floyd QC, sitting as a Deputy Judge in the Patents Court, commented “It is clear that a mechanistic, element by element approach to inventorship will not produce a fair result. If A discloses a new idea to B whose only suggestion is to paint it pink, B should not be a joint inventor of a patent for A’s product painted pink. That is because the additional feature does not really create a new inventive concept at all. The feature is merely a claim limitation, adequate to overcome a bare novelty objection, but having no substantial bearing on the inventive concept. Patent agents will frequently suggest claim limitations, but doing so does not make them joint inventors. Some stripping of a claim of its verbiage, may be necessary to determine the inventive concept, and consequently the inventor.” This statement was approved by the Court of Appeal in *Markem Corp v Zipher Ltd*.<sup>21</sup> In the case of joint inventorship, the question is therefore whether all parties are jointly responsible for devising the inventive concept.”

### 3. India

According to *Section 2(1)(j)* of the Indian Patent Act 1970, “invention” means a new product or process involving an inventive step and capable of industrial application.<sup>22</sup> Similarly, *Section 6* of Indian Patent Act 1970 defines persons entitled to apply for patents.<sup>23</sup> Specifically, *Section 6(1)(a)* states that “a person must be “true and first inventor” of an invention.” *Section 2(1)(y)* of Indian Patent Act 1970 details that “true and first inventor” does not include either the first importer of an invention into India, or a person to whom an invention is first communicated from outside India<sup>24</sup>. The Indian Patent Act 1970, has addressed only some basic aspects of the “invention” and a definition of detailing “true and first inventor”. However, [the Act] didn’t address the issue of inventorship and the kind of efforts a person should input to be an inventor or one of the inventors

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<sup>17</sup> Manual of Patent Practice. [MoPP] § 7.12 (2018).

<sup>18</sup> *Henry Brothers (Magherafelt) Ltd v The Ministry of Defence and the Northern Ireland Office* [1999] RPC 442.

<sup>19</sup> Manual of Patent Practice. [MoPP] § 7.12.1 (2018).

<sup>20</sup> *Stanelco Fibre Optics Ltd’s Applications* [2005] RPC 15.

<sup>21</sup> *Markem Corp v Zipher Ltd* [2005] RPC 31.

<sup>22</sup> See *Section 2(1)(j)*, Indian Patent Act 1970.

<sup>23</sup> See *Section 6*, Indian Patent Act 1970.

<sup>24</sup> See *Section 2(1)(y)*, Indian Patent Act 1970.

of a patentable invention. In this regard, it is considered that the approach to determine and identify the inventorship is left for subjective interpretation.

Identification of inventorship becomes more critical when there are multiple inventors from the same organizations or different organizations that have jointly provided inputs to the invention. The controller of patents during *National Institute of Virology vs. Mrs. Vandana Bhide* have made specific conclusions on the issue of inventorship.<sup>25</sup> Based on the above hearing, a list of factors has been provided to be considered for assessing the inventorship status of an individual. If an individual has to be considered as an inventor, he/ she should have made an intellectual contribution in achieving the final results of the research work leading to a patent. It is further detailed that “a person who has not contributed intellectually to the development of an invention is not entitled to be included as an inventor” and “a person who provides ideas to produce the ‘germ of the invention’ need not him or herself carryout the experiments. The person may take help of others. Such persons who have helped in conducting experiments, constructing apparatus etc. without providing any intellectual inputs are not entitled to be named as inventors.”

#### 4. Japan

According to a recent update, Japan already holds numerous patents in AI and, as at November 2016, was reported to have more patents in this area than any other country in the world.<sup>26</sup> According to *Article 2 (1)* of Japanese Patent Act, “‘Invention’ means the highly advanced creation of technical ideas utilizing the laws of nature.”<sup>27</sup> Japanese Patent Act didn’t provide any particular definition to “Inventor”. However, different case laws have answered the question of “Inventorship.”

A decision in the IP High court of Japan has provided detailed understanding on inventorship. In the case, Judge Ueda Hiroyuki has provided summary judgment describing that “In accordance with *Article 2 (1)* and the main paragraph of *Article 29 (1)* of the Japanese Patent Act, as well as the judgment of the First Petty Bench of the Supreme Court of October 13, 1977, which decided on the completion of an invention, an inventor is a person who was involved in the highly advanced creation of technical ideas utilizing the laws of nature, in other words, a person who was involved in the creative activity of structuring the technical ideas concretely and objectively enough to enable a person ordinarily skilled in the art to work it.”<sup>28</sup> The judge had also provided some guidelines on

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<sup>25</sup> Rajeev Kumar & Pankaj Musyuni, WHO CAN BE NAMED AS INVENTOR- AN INDIAN PERSPECTIVE, LEXORBIS, <https://www.lexorbis.com/who-can-be-named-as-inventor-an-indian-perspective/> (last visited Aug 2, 2018).

<sup>26</sup> Charlotte Walker Osborn, ARTIFICIAL INTELLIGENCE FORGES AHEAD OF THE LAW, EVERSHEDES SUTHERLAND (2017), [https://www.eversheds-sutherland.com/global/en/what/articles/index.page?ArticleID=en/tmt/Artificial\\_Intelligence\\_forges\\_ahead\\_of\\_the\\_law](https://www.eversheds-sutherland.com/global/en/what/articles/index.page?ArticleID=en/tmt/Artificial_Intelligence_forges_ahead_of_the_law) (last visited Aug 9, 2018).

<sup>27</sup> See Article 2(1) of Japanese Patent Act 1959.

<sup>28</sup> IP High Court decision dated 29 May 2008, 2007 (Ne) 10037.

“who is not an inventor” saying “[i] a person who took charge of general management for his/her subordinate researchers as a manager; [ii] a person who gave general advice or instructions; [iii] a person who merely compiled data or conducted experiments as an assistant according to the instructions of the researcher; and [iv] a person who assisted or entrusted the completion of invention by funding the inventor or providing facilities such as the use of equipment.” In addition, the judge added “In order to become an inventor, it is not necessary for a person to be involved in every process and it would be sufficient to be involved in the creation of the invention jointly with others. Yet, in order for multiple persons to become joint inventors, such persons must make a substantial contribution in the process of conceiving of an idea to solve the problem and giving a concrete form to the idea under an integral and continuous cooperative relationship.” A research report entitled<sup>29</sup> “Inventorship of Multinational Inventions” developed by “International Association for the Protection of Intellectual Property (AIPPI)” presented at the AIPPI Congress, Rio de Janeiro, October 2015 has provided interesting insights on the inventorship aspects in different countries including Japan.

### III. Review of Expert opinions

Since industrial revolution, humans have been assisted by different machines in many ways that are also part of different inventions. The rise of intelligent machines and their involvement in the development of an invention has been increased in the past few decades.<sup>30</sup> Now a days, developing an invention with the assistance of AI would usually involve efforts different individuals and different levels of inventive process. This scenario has led to inventorship issues in relation to inventions that are developed by humans using AI. Intellectual Property and technology experts all over the globe have different views and opinions on patent ownership and inventorship aspects of inventions developed by humans using AI.

In a meeting at WIPO headquarters on July 31, 2018, WIPO Director General Francis Gurry and United Arab Emirates (UAE) Minister of State for Artificial Intelligence Omar bin Sultan Al Olama discussed AI, big data and IP, as well as the importance of international cooperation.<sup>31</sup> The discussion covered specific applications of AI to IP administration. After the meeting, WIPO Director General Francis Gurry opined that “We need international cooperation in this area to ensure that the new technologies can be used for the benefit and welfare of humankind...I hope that WIPO

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<sup>29</sup> SARAH MATHESON ET AL., INVENTORSHIP OF MULTINATIONAL INVENTIONS, *International Association for the Protection of Intellectual Property (AIPPI) Congress*, <http://aippi.org/wp-content/uploads/2015/10/SR244English.pdf> (last visited Aug 6, 2018).

<sup>30</sup> Raymond Kurzweil, *The age of intelligent machines*. MIT Press, Cambridge, MA(1990).

<sup>31</sup> World Intellectual Property Organization (WIPO), WIPO DIRECTOR GENERAL AND UAE TOP AI OFFICIAL DISCUSS AI & IP, YOUTUBE (2018), <https://www.youtube.com/watch?v=0OER1isSJWk> (last visited Aug 9, 2018).

will be able, led by its member states to stimulate the discussion on the very important question of ownership which really governs access to data and also to algorithms.”<sup>32</sup>

#### **IV. Personal Interviews**

As a part of research, personal interviews have been conducted to understand the issues related to inventorship and ownership aspects of invention developed using AI. The interviews have been conducted with two experts, one of them is Mr. Hideto Kohno, a registered patent attorney in Japan with experience in filing patents in relation to AI. The second person is Prof. Hayaru Shono, a technology expert who has been working on AI and machine learning technologies in different projects. In-depth analysis and insights from personal interviews are provided in the main text of this report.

#### **V. Author's Opinions and Recommendations**

Digital revolution has boosted the use of computers in day to day life and computers have become part of human inventions.<sup>33</sup> Emergence of AI has eased the efforts of humans in the process of developing new inventions.<sup>34</sup> However, the creative input or idea for an invention has been from the human brain.<sup>35</sup> Now a days, the number of inventions that are developed using AI has been increased tremendously.<sup>36</sup> There have been arguments that AI has been providing the creative input in some inventions and hence they should be provided with inventorship or ownership rights.<sup>37</sup> Yet, it is suggested that we should first look into the human inventorship issues on inventions using AI. Comparative analysis of the specific statutes and provisions of US, UK, India and Japan has provided a better understanding of the inventorship and ownership issues of inventions developed using AI. Review of expert opinions and insights from the personal interviews has shed light on the practical aspects of the research issue. Considering the outcomes of the above research analysis, a legal framework model has been developed that would be helpful for inventors and stakeholders to decide inventorship and ownership rights on inventions developed using AI.

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<sup>32</sup> *Id.*

<sup>33</sup> Erik Brynjolfsson & Andrew McAfee, *Race against the machine: how the digital revolution is accelerating innovation, driving productivity, and irreversibly transforming employment and the economy*, Digital Frontier Press, Lexington, MA (2011).

<sup>34</sup> Chih-Wen Chang, Hau-Wei Lee & Chein-Hung Liu, *A Review of Artificial Intelligence Algorithms Used for Smart Machine Tools*, INVENTIONS, 3(3), 41 (2018).

<sup>35</sup> See Grimmelmann, *supra* note 9.

<sup>36</sup> Iain Cockburn, Rebecca Henderson & Scott Stern, *The Impact of Artificial Intelligence on Innovation*, NBER CONFERENCE ON RESEARCH ISSUES IN ARTIFICIAL INTELLIGENCE (2017).

<sup>37</sup> Ryan B Abbott, *Patenting the Output of Autonomously Inventive*, 10 LANDSLIDE 16–22 (2017); Modkova Antonia & Hemma Vara, *The robot revolution-reinventing inventorship*, INTELLECTUAL PROPERTY FORUM: JOURNAL OF THE INTELLECTUAL AND INDUSTRIAL PROPERTY SOCIETY OF AUSTRALIA AND NEW ZEALAND, No. 111, 11-18 (2018).

## **VI. Conclusion**

The pace of technological advancement has been gradually increasing every day. Artificial Intelligence is one of the most advancing technologies that is throwing challenges to the legal systems all over the globe including IP laws. Issues in relation to patent inventorship and ownership have been handled by different courts previously however, involvement of different experts and companies in the process of development of an invention using AI has increased the complexity of determining inventorship and ownership. Moreover, the applications of AI in different scientific fields has added more complexity to the issue as this increases the involvement of experts and companies of different expertise. After the careful analysis of different patent systems and considering opinions of different legal and technology experts through literature review and personal interviews, it is suggested that signing contract agreements before the collaboration would be helpful to prevent the ownership disputes in future. Similarly, a decision on inventorship can be taken by following the framework model proposed in this report. Lastly, it is advised that the future inventions of AI should not only be directed towards the betterment of AI but should also benefit the humankind.