ΠΟΛΥΤΕΧΝΕΙΟ ΚΡΗΤΗΣ

TECHNICAL UNIVERSITY OF CRETE

SCHOOL PRODUCTION ENGINEERING AND MANAGEMENT

FACULTY PRODUCTION ENGINEERING AND MANAGEMENT

MASTER OF SCIENCE

«TECHNOLOGY AND INNOVATION MANAGEMENT»

ARTIFICIAL INTELLIGENCE AND INDUSTRIAL PROPERTY: TECHNICAL AND LEGAL ISSUES

MASTER'S THESIS

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Registration Number 2019015001

Chania, 2022

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Artificial Intelligence and Industrial Property: Technical and Legal Issues

Vasileios Kottas

Abstract

Originally, the intellectual property system is said to be “humanistic” (human-centered), it was designed both in the interest of inventors and inventions in order to provide them with sufficient protection and ultimately to encourage innovation. The emergence of AI today tends to raise many questions concerning, among other things, its legal framework. Indeed, following semi-autonomous action on its part generating a creation, the question of the associated intellectual property rights arises. The legal framework at national and European level is trying to adapt to the new situation and is perhaps inadequate to understand creations using AI, a situation which is rather problematic since the stakes that artificial intelligence represents are very important. Many reflections emerge: is it necessary to set up a special legal regime to protect these creations or is the existing one sufficient? The main obstacle seems to be the lack of clarity regarding the exact human input. Indeed, the difficulty lies in the fact of linking AI-based creations, not directly supervised by man, to physical persons. When AI is used as a simple tool to investigate a particular question, this does not pose any particular problem for the protection of such creations because they can be identified as result and benefit from ordinary IP protection. However, in the case where a creation has resulted from the use of an AI system independently of the original human input, even unexpectedly and serendipitously, identifying and awarding the appropriate IP Rights becomes more complicated.

Keywords: AI, patent, ownership, IP Rights, inventions

Introduction

Stephen Hawking had stated about general artificial intelligence (AI), that "technological development does not justify the recognition of such a level of autonomy on the part of any existing or developing AI application[1]". Opinions suggest that general AI, i.e. reaching the level of human ability, cannot be earlier than 2075[2]. The risk, paradoxically, perhaps not in the sense of the above-mentioned view, is put forward as an argument against the patenting of an AI system. It is understandable, of course, that when the technology reaches the level of general AI, the last thing that will concern humans will be the AI system as an inventor[3]. Various platforms such as IBM Watson, Microsoft Azure, Amazon Web Services (AWS) have made AI accessible to a much wider audience than ever before. AI-based systems can be software-only, act in the virtual world (such as image analysis software, search engines, speech and facial recognition systems), or integrate into physical devices (such as advanced robots, autonomous cars, drones)[4].

As with any new technology, the advent of AI does not exist without legal complications. In the case of inventions created using an AI system as a tool, people enjoy the benefit of inventions and are identified as the inventor based on their input as users. However, there is a grey area when an AI system produces interesting but unexpected results – even new creations – which are completely unrelated to the original question put to it by the user. In this case, who should be identified as the actual inventor? Could the AI system in this case be considered as an inventor and how should any rights connected with this identification be apportioned?

AI is a tool that can help inventors in the process of invention or is a feature of an invention. In this respect, inventions produced with this tool may not be radically different from other computer-based inventions[5]. On the other hand, an AI system can be designed to respond to external influences and intermediate results based on its experiences and in order to improve future performance. The combination of unsupervised learning and the capability to produce unplanned results implies that there is a partial autonomy of such a system which raises the question of who is the actual owner of such unexpected products of the system: the user, the owner or even the original designer? Could we consider the AI system itself as at least part owner? The accepted fundamental thesis however, is that an AI system is a tool for the

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[1] Cellan-Jones, R. (2014, December2). Stephen Hawking warns AI could end mankind. Recovery from BBC: https://www.bbc.com/news/technology-30290540

[2] Grace, K. (2018, July 31). Viewpoint: When Will AI Exceed Human Performance? Evidence from AI Experts. Journal of AI, Müller, V., & Bostrom, N. (2016, June 8). Future Progress in AI: A Survey of Expert Opinion. Fundamental Issues of AI, pp 564

[3] Limited AI are applications programmed to perform individual tasks. Methods like machine learning and deep learning are subsets of AI. Although the AI sector is evolving rapidly, it is not clear even if the science proceeds to higher levels of "general" ("general") AI designed to operate in a wide range of tasks and problems.

[4] Scherer, M. (2015, May 30). Regulating AI Systems: Risks, Challenges, Competencies, and Strategies. Harvard Journal of Law & Technology, pp 3-4

[5] EPO. (2020, January 28). EPO publishes grounds for its decision to refuse two patent applications naming a machine as inventor. Recovery from News Events: https://www.epo.org/news-issues/news/2020/20200128.html

inventor, and its fully autonomous operation with an advanced intellectual inventive process does not exist[6].

In the following chapter a detailed review is presented of the current situation regarding the possible identification (and clarification) of an AI systems' status as an inventor or a tool towards the invention. A number of examples and attempts at registering such systems as inventors are presented and analyzed as well.

1. Bibliographic overview of the issue

In one sense, at least seven stake holders are directly or indirectly involved throughout the process of the creation of an unexpected invention made using an AI system.

- The software developers create the algorithms and undoubtedly own the copyright of the software, but they don't necessarily target the end goals of the AI system.
- People who add data used for deep learning are a necessary part for the effective operation of the AI system. For facial recognition, for example, data is millions of facial photos in different formats and facing different directions. Or, in the case of identifying specific surface details by satellite, data is millions of satellites and other photos with known features.
- Trainers check the results of the system and correct them when needed, playing an important role in determining the capability and reliability of the system.
- The owner of the system may be one person, an association of natural persons or a legal person. Or the invention can be attributed to the public (free invention).
- The investor, i.e. the person who financed the development of the system or any other factor[7].
- The user of the AI system, who uses the system in order to solve a particular problem, e.g. identifying a particular vehicle via satellite.
- Last but not least, the AI system itself having been trained to work semi or fully autonomously to carry out a specific task and then produces a useful but completely unexpected result which, by comparing it with similar creations, may be identified as a separate invention.

One of the classic theories about the patent system is the theory of natural rights, according to which a person must have physical property rights to the products of his intelligence. This position is largely based on the theory of the work of the British philosopher John Locke[8]. The attribution of property rights as the fruits of one's work is also linked to the idea of reward. The inventor exercises the work to form an idea into an invention, and therefore the results of such an effort must be his

[6] Gervais, D. (2020, January 18). Is Intellectual Property Law Ready for AI? GRUR International, pp 117–118

[7] Wachowicz, M. (2019). AI and Creativity: new concepts in intellectual property. GEDAI/UFPR

[8] Tur-Sinai, O. (2010, Eight24). Beyond Incentives: Expanding the Theoretical Framework for Patent Law Analysis. Akron Law Review

own to be exploited. The basis of the system is the theory of incentives, which provides that patents can be exploited to derive a benefit as an incentive for innovation, for the benefit of society. In the absence of a formal patent, the inventor would not be able to enjoy the same exclusivity in the commercial exploitation of the invention, or his invention may be copied without the capability for resorting to a legal remedy. This could in turn discourage inventors from producing new inventions, and therefore society as a whole would suffer as it would have at its disposal a smaller number of (published) inventions[9].

Regarding inventions made using an AI system, Ramalho (2018) [10] proposes the alignment of practices in different jurisdictions with a common set of guidelines on the patentability of inventions made using an AI system. It also proposes to include AI in the term "art expert" associated with the process of examining an intellectual property application. EU patent law does not provide a definition of ingenuity, although there is a presumption that it belongs to a "natural person". However, this presumption has not been considered a major obstacle by scholars. Block (2017) argues that Patent laws cannot and should not be interpreted in a way that allows AI systems to have the same place in patent law as human inventors. Human intervention is inevitable in the inventive process either through the selection of a particular AI application or the creation of a particular AI application or the creation of a particular algorithm to solve a technical problem. It is therefore argued that AI systems should be treated as tools of inventors, rather than autonomous inventors**[11]**.

Shemtov (2019) has a similar view[12]. In a report commissioned by the European Patent Office (EPO) he concludes that, under patent law, it is neither feasible nor desirable in the current state of the art to designate AI systems as inventors. In the report it is argued that, given the current state of the art, it is very unlikely that an invention involving AI will not also include the human factor that can be defined as an inventor. When it comes to a human using an AI system, his identity may be only indirectly related to the invention itself, since he simply uses a machine learning technique developed by another, so the inventor may be the person who "designed" the AI system in a specific way in order to achieve the inventive effect. Therefore, under such circumstances, the person who carries out the intelligent or creative conception of the invention may be the one who prepared the AI system to produce the inventive production, making decisions in relation to issues such as the choice of the algorithm used, the selection of parameters and the design and selection of data, even if the specific output was somewhat unpredictable. Davies (2011)[13] takes

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[9] Rahmatian, A. (2013, May 30). A Fundamental Critique of the Law-and-Economics Analysis of Intellectual Property Rights. International Intellectual Property Scholars Series, pp 26

[10] Ramalho, A. (2018, February 15). Patentability of AI-Generated Inventions: Is a Reform of the Patent System Needed? Journal of Internet Law

[11] Hendrik, P. (2017). The Inventor's New Tool: AI: how does it fit in the European Patent System? European intellectual property review

[12] Shemtov, N. (2019, February). A study on inventorship in inventions involving AI activity. Recovery from EPO: http://documents.epo.org/projects/babylon/eponet.nsf/0/3918F57B010A3540C125841900280653/$File/Concept_of_Inventorship_in_Inventions_involving_AI_Activity_en.pdfSna. 9-10

[13] Davies, C. (2011, December). An evolutionary step in intellectual property rights – AI and intellectual property. Computer Law & Security Review, pel. 615

an unorthodox view. He recognises that it may be necessary to create secondary rights to enable the original programmer to benefit from the exploitation of the programme, but considers that the original inventor is the AI system. Granting ownership to the AI system would make it necessary to provide legal personality (or identity) to smart machines and a range of measures (such as deposit or insurance schemes) to ensure that financial claims can be addressed in the event of a liability procedure. He does not explain how such a provision of a legal personality can be achieved or how it can fit within the current legal framework however.

Pearlman (2018)[14] also supports recognition as an inventor of an AI system when the invention is completely unrelated to the original usage of the system by the user. He argues that the recognition of an AI system as an inventor is necessary to be consistent with the objectives of copyright law, including serving the public interest in developments in art and science. Similarly, Abbott[15] argues that reviewing the limits of patent law is a worthwhile effort that could allow AI systems to be identified as inventors. Abbott[16] calls for recognition AI systems as inventors, but does not agree with awarding patent to computers or AI systems. He argues that anything that is being created by an AI system should be automatically assigned to the system user or owner, as this would be more consistent with the current ownership rules regarding personal ownership of tools used for creating inventions. Yanisky-Ravid and Liu point out that we are living in a new era of machines that are increasingly autonomous with humans being only a part of the actual inventive process[17].

As mentioned above, Ryan Abbott[18] has expressed the view that although it is true that a programmer is responsible for creating a computer software, and in some cases, it may make sense to attribute to the programmer the ownership of the invention produced by an AI system, particularly if a programmer develops an algorithm specifically to solve a particular problem or to create a specific result. Arthur Miller[19] points out "behind every good robot is a good man". He states that a user can make a significant contribution to setting up a computer, however he can also simply ask a computer to solve a problem. He proposes that products from AI systems should be eligible for protection as an invention, just like any other creation. To the extent that patents incentivize the commercial exploitation of inventions, there is no change in this function whether the invention is produced completely by a human or not. He goes on to point out that awarding the title of inventor to a natural person, who had little to no involvement in the invention, is unfair to other human inventors.

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[14] Pearlman, R. (2018). Recognizing AI (AI) as Authors and Inventors Under U.S. Intellectual Property Law. Richmond Journal of Law and Technology 1, pp 28

[15] Abbott, R. (2016, September 29). I Think, Therefore I Invent: Creative Computers and the Future of Patent Law. Boston College Law, pp 1086

[16] Abbott, R. (2019, February1). Punishing AI: Legal Fiction or Science Fiction. 53 UC Davis Law Review 1, pp 45

[17] Yanisky-Ravid, S., & Liu, X. (2022, January 11). When AI Systems Produce Inventions: The 3A Era and an Alternative Model for Patent Law. 39 Cardozo Law Review, pp 2245

[18] Abbott, R. (2017, November6). AI, Big Data and Intellectual Property: Protecting Computer-Generated Works in the United Kingdom. Research Handbook on Intellectual Property and Digital Technologies

[19] Miller, A. (1993, March). Copyright Protection for Computer Programs, Databases, and Computer-Generated Works: Is Anything New Since CONTU? Harvard Law Review, pp 987

As regards the ownership of the invention, he points out that the owner of the AI system should in principle be the owner, although the inventor is the actual user that used the AI system. According to Hetmank[20], providing protection for inventions created by AI can create a number of negative effects, such as market concentration, limiting the entry into the market of other new businesses and reducing human incentives to create new inventions. Others have tried to argue that patenting of inventions created by AI systems, and recognizing such systems as inventors could incentivize the further development of smart computers, although he does not mention who the owner is. Fraser (2016)[21] stresses the need for policymakers to recognize the potential challenges and benefits those inventions created by AI can bring and the need to continuously examine these developments and their potential implications to ensure that the fundamental reasons and justifications for the patent system are met.

1.1. Preliminary remarks

Stuart Russell and Peter Norvig in the book " Artificial Intelligence: A Modern Approach, 4th US ed.", present various definitions of AI. The characterization of a device, that it operates with AI methods, will depend on the environment in which it acts, the requirements and obstacles in the specific environment and the evaluation of the behavior of the system either in correspondence with human behavior (intelligent agents) or on the basis of human rational model (logical agents)[22]. The formulation of the second approach is due to the limited ability, in some cases, of human intelligence to cope fully with specific tasks. Therefore, if logical agents are ever created, they would be an optimized model of intelligence, which man cannot achieve either because of limited mental abilities or because of instantaneous mistakes due to the chemistry of the human body[23]. A logical agent is the one who acts in order to achieve the best result or, when there is uncertainty, the best expected result. The constant change and evolution of the concept of AI is also due to the constant familiarization of humans with AI systems, although they are based on machine learning models, they are not perceived as AI systems by society[24].

The Organization for Economic Co-operation and Development (OECD) gives the following definition of AI: An AI system is a machine-based system that can, for a given set of human-defined goals, make predictions, suggestions or make decisions that affect real or virtual environments. AI systems are designed to operate with

[20] Hetmank, S. (2019, May 5). The concept of authorship and inventorship under pressure: Does AI shift paradigms? Journal of Intellectual Property Law & Practice, pp 574

[21] Fraser, E. (2016, December). Computers as Inventors – Legal and Policy Implications of AI on Patent Law. SCRIPTedSna. 355

[22] Russell, S. J., & Norvig, P. (2021). AI: a modern approach. Athens: Klidarithmos, p. 57, Vlahavas, I. (2020). Artificial Intelligence. Thessaloniki: Publications of the University of Macedonia, p. 820 et seq.

[23] Simon, H. (1995, August). AI: an empirical science. AI, pp 98

[24] Peter Stone, Rodney Brooks, Erik Brynjolfsson, Ryan Calo, Oren Etzioni, Greg Hager, Julia Hirschberg, Shivaram Kalyanakrishnan, Ece Kamar, Sarit Kraus, Kevin Leyton-Brown, David Parkes, William Press, AnnaLee Saxenian, Julie Shah, Milind Tambe. (2016). "AI and Life in 2030." One Hundred Year Study on AI: Report of the 2015-2016 Study Panel. Stanford: Stanford University, pp 12

different levels of autonomy[25]". In a Communication from the Commission[26], always on the basis of certain parameters and criteria identified by a user, AI is defined as *systems characterized by intelligent behavior, analyzing their environment and acting, with a certain degree of autonomy, to achieve specific objectives. Systems operating on the basis of AI can rely solely on software, acting in the virtual world (e.g., voice assistants, image analysis software, search engines, speech and facial recognition systems) or AI can be integrated into hardware devices (e.g., advanced robots, autonomous cars, drones or Internet of Things applications)*.

AI includes the term intelligence, which is highly related to the concept of rationality, i.e., the ability to decide on optimal energy for a specific goal. This corresponds to a human who learns to carry out such tasks to the best of his current ability by learning from his environment. In the case of an AI system, the process of collecting data from the environment, processing them, formulating by reasoning the alternatives and choosing the best one with a result of an operation, is carried out with the help of sensors, according to pre-programmed operations and responses, giving the allusion of intelligence. The consequence, therefore, of the reasoning process (modeling the data, performing reasoning processes/processing data, finding alternatives) is the operation, i.e. the activation of either the material parts that are moving or the computational program. The potentially optimal solution, in a sense, is the result of the reasoning process, however, since the best solution can be understood the later option, it can be separated from it. In the theory of cybernetics and systems, a black box is a (probably very complex) system, from which only the produced result must be taken into account in the given context. The internal structure may be known, however it may not be, because a successor model can be constructed differently inside. The research and description are limited to the measurement of input-process-output (IPO) model.

In general, a black box is a system whose internal structure and internal function are unknown or not considered important. On the contrary, only the behavior of the black box is of interest, which ensures a certain functionality through defined interfaces. This approach is often used to reduce the complexity of the subject of observation. The black box process is related to the concept of Explainable AI, which aims to make it clear how dynamic and nonlinearly programmed systems, such as artificial neural networks, deep learning systems, and genetic algorithms, lead to results. It is an observation technique that develops and provides operational methods used to explain AI systems, which also exists as part of the implementation of the EU's General Data Protection Regulation (GDPR).

The use of AI systems extends far beyond IP and is applied to check and report many types of infringements that may occur online, including violations of privacy rights, personality rights, and in physical language processing systems, such as regulating hate speech and dangerous anti-terrorism speech[27]. AI is now ubiquitous despite initial expectations of slow progress. Recent developments in the field of AI

[25] OECD/LEGAL/0449, Recommendation of the Council on OECD Legal Instruments AI, pp 7
[26] COM(2018) 237 final, AI for Europe FIX THIS
[27] Frosio, G. (2017, May 31). Why Keep a Dog and Bark Yourself? From Intermediary Liability to Responsibility. Oxford International Journal of Law and Information Technology, pp 7

are the creative possibilities that reveal a variety of original works created by intelligent algorithms. The ownership of the copyright/industrial rights of the product are logically attributed to the developer or user of the AI, as a more expected and less controversial solution. The idea is that while the developer is not the creator of the project, he is the one who understands how the algorithm works and can explain the creative process behind the product, and the purpose of creating the AI system was the developer's inspiration. For any outsider, the AI system operates as a black box and its operation need not be understood or taken into account. The attribution of permissions to the user is based on the fact that he uses the AI system as a tool in the process of expressing his own creativity, i.e. without the user the system would never have moved on to the product. The attribution of rights to an AI system on its own is questioned due to a lack of autonomy and a lack of motivation[28] or the ability to posit the scientific question.

Finally, it is worth mentioning that the published patent applications at the European Patent Office on AI in 2020 reached 1912, in the five-year period 2016-2020 reaching 4000 and with Google holding 200 patents[29]. The most popular field is image recognition, being responsible for 49% of all patents related to AI and increased by 24% during 2013 to 2016. The other two leading areas in functional applications are natural language processing (14% of all patents related to AI) and speech processing (13%). While these three functional applications are the most important, others appear and grow rapidly[30]. In the fields of AI applications, the leading industries are transport (15% of all patents related to AI), telecommunications (15%) and life sciences (12%).

1.2. Politics and AI

AI is a term that, recently, is used quite often by policymakers when presenting their strategies on technological developments and economic and social challenges. AI is perceived by society and policymakers as a broad concept of a single entity that can be regulated unilaterally. However, it is found that there are many forms of technology that are being developed and classified as AI applications. In a policy-making perspective, a clear definition of the subject to be regulated is not only of the utmost importance, but is absolutely essential. The clarification of the concept of AI is a prerequisite for the development of this technological sector, the understanding of it by society and the consequences for its rights, the improvement of the funding flow of projects focused on technological innovation and finally the debunking of myths about the excessive capabilities of AI and questionable effects on

[28] Bridy, A. (2011, July 18). Coding Creativity: Copyright and the Artificially Intelligent Author. Stanford Technology Law Review, pp 26

[29] From Filing to Opposition: What are the Statistics on AI (AI) – Patents & Applications at the EPO, https://www.hlk-ip.com/news-and-insights/from-filing-to-opposition-what-are-the-statistics-on-artificial-intelligence-ai-patents-applications-at-the-epo/

[30] WIPO. (2019). AI. Recovery by WIPO Technology Trends 2019: https://www.wipo.int/edocs/pubdocs/en/wipo_pub_1055.pdf, pp 31

people's lives. Policy-making in a democratically structured state is wise to be accompanied by a democratic debate among citizens on the general aspects, so that in the formulation and execution of laws there is a full understanding, in particular, in the case of AI on devices with a range of capabilities, which will affect people's lives[31].

Any discussion on the principle that the inventor can only be a natural or legal person(s) is linked to a policy debate on 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 that benefit society[32]. Such a policy debate should take due account of the fact that in the Patent Act, linking the granting of a patent with the requirement of human intervention is part of a system of protection of industrial property which is based on principles common to the world and has been largely harmonized at international level. It should also be recognized that the issue of ingenuity needs to be addressed in a broader context of rights granted to natural persons, not only by industrial property rights. Any political effort, it is clear, sets humans as the starting point for investment in AI. By placing humans at the center, it underscores the fact that AI is not an end in itself, but a means to enhance human well-being and freedom. In other words, AI presents promising means to enhance individual and social well-being and the common good, as well as to promote progress and responsible innovation.

The motion for a resolution clarifying the issue of policy dealing with AI arose from the need to regulate the gaps arising from the rapid development of AI. Furthermore, it is found that dealing with ethical and theoretical issues that concern AI is a particularly important step in the understanding of related political, economic, social and technological issues[33]. This resolution seeks, however, to provide an in-depth overview of the relationship between AI and intellectual property in general. Particular emphasis is placed on the development of a regulatory framework, which will be dynamically renewed as necessary, in order to ensure legal certainty and confidence for investments in the emerging technological sectors related to the use of AI. Crucial is the view that *it would not be appropriate to seek to give legal personality to AI technologies*. However, it should be noted *that certain works produced using AI can be equated with works produced by human intellectual work and that, therefore, they could be protected by intellectual property rights.* It is also explicitly found that the production of trademarks and industrial designs can be produced automatically by AI, based on general inputs, raising issues of ownership[34].

In France, the Conseil supérieur de la propriété littéraire et artistique has announced as a mission to address the legal and economic challenges of AI in the fields of cultural creation. States seek to establish and regulate the framework of legality of works produced with AI so that they can be classified as innovative and

[31] Selvadurai, N., & Matulionyte, R. (2020, July). Reconsidering creativity: copyright protection for works generated using AI. Journal of Intellectual Property Law & Practice, pp 537
[32] Large members Court Athens 1930/2020 – FIX THIS
[33] P9_TA (2020)0277 FIX THIS
[34] 2020/2015(INI), PLAN EXHIBITION relatively with the intellectual property ownership

pioneering[35]. The economic-political reason is the increase in the estimated value of AI applications, from 40 billion to 50 billion dollars. The legislation arises, above all, to address a problem, but with the rapid innovation in the field of AI, the legislator is unable to regulate a constantly evolving space. The first Communication on AI was adopted on 25 May 2018, where the European Commission proposed a three-pronged approach: increasing public and private investment, preparing for socio-economic changes brought about by AI, increasing creativity of the appropriate ethical and legal framework. The Communication was followed, inter alia, by the European AI Alliance, including businesses, NGOs, consumers, trade unions to collect data and conduct a dialogue on the development of measures towards the development of AI. The question remains how to ensure that policymakers are well equipped to make adequate and timely decisions in a rapidly changing, technology-driven and market-driven environment with an inherent global dimension.

The European Parliament in its 2017 Resolution on civil law rules on robotics (in the liability section) called on the Commission, when carrying out an impact assessment of its future legislative instrument, to investigate, analyse and consider the implications of all possible legal solutions, such as: the creation of a specific legal state, for robotic machinery, so that at least the most sophisticated autonomous machines can be established as having the status of electronic persons responsible for repairing any damage they may cause (possibly via insurance paid by its owners) and possibly applying an electronic personality in cases where the machines make autonomous decisions or interact with third parties independently[36]. In 2020, the EU Parliament adopted a new Resolution with recommendations to the Commission on civil liability for AI, together with a proposal for a new Regulation[37]. Legal personality and human conscience were clearly excluded for AI and it became clear that the only duty is to serve humanity. The provisions of the Civil Liability Regulation apply when the damage has caused damage to life, health, physical integrity of a natural person, property of a natural or legal person or damage valued financially. As for the user of the AI system involved in the damage, he is held responsible if he had the role of operator.

1.3. General principles for the development of AI

At EU level, the 'High Level Expert Group on AI' (Group) has been set up, which, among other things, has the role of ensuring an appropriate legal framework

[35] Ministère de la Culture. (2020, Februart 7). Mission du CSPLA sur les enjeux juridiques et économiques de l'intelligence artificielle dans les secteurs de la création culturelle. Recovery from Missions: https://www.culture.gouv.fr/Thematiques/Propriete-litteraire-et-artistique/Conseil-superieur-de-la-propriete-litteraire-et-artistique/Travaux/Missions/Mission-du-CSPLA-sur-les-enjeux-juridiques-et-economiques-de-l-intelligence-artificielle-dans-les-secteu

[36] 2015/2103(INL), European Parliament resolution of 16 February 2017 with recommendations to the Commission on civil law arrangements in the field of robotics

[37] COM/2021/206 final, Proposal FOR A REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL ON THE ADOPTION OF HARMONISED RULES ON AI (ACT ON AI) AND AMENDING CERTAIN LEGISLATIVE ACTS OF THE UNION

on AI. The Group since its inception has said that AI is an opportunity for the economy and society. This seizing of the opportunity, however, must be accompanied by an assessment of the development path in terms of competition and the credibility of manufacturers of AI systems and systems using AI. Reliability is specified under three conditions[38]. AI systems must be lawful in the relevant provisions, ethical and predictable, in order to avoid unforeseen harmful effects on humans. In particular, the legality of AI systems is assessed on the basis of respect for all sources of law surrounding it. In particular, at national level, any formal and substantive law, at EU level, any primary and secondary sources and at the level of international law, any legal text of public international law. The ethics that AI systems must adhere to concerns the ethical rules and social values developed by legal and legislative bodies or, on a case-by-case basis, a professional sector abiding by such values. The predictability of AI implies that manufacturers take care to design and create AI models that will not lead to problems or harms, inadvertently[39] since they could be held responsible for any harm or damage caused by the AI system, or even by its misuse.

General ethical principles, as would be agreed by any rational social media, are set out in international legal instruments. In particular, the European Convention on Human Rights and the EU Charter of Fundamental Rights reflect fundamental human rights. Fundamental rights such as human dignity, freedom, equality and physical integrity. General ethical principles derive from the plethora of fundamental rights. Human autonomy is a key element in the application of AI to systems/machines. In particular, humans must have full oversight over the implementation of AI and its actions. Humans must not lose their self-determination and have their "dominance" threatened or harmed by the application or further development or expansion of AI. Prevention of harm protects every living being and the natural environment. In particular, in its implementation AI should not be preferred to widen inequalities at every level of life, such as the relationship between employee and employer or young and old humans. The principle of fairness requires citizens to have equal access to AI technology. Also, AI must not have an impact in a way that intensifies social discrimination, rather preferring ways of increasing the chances of equal opportunities (while respecting the rules of competition). Finally, as the decision-making process can be influenced by results of and AI system, the stages of this should be distinguished. The latter obligation is inextricably linked to the principle of explainability, according to which each stage of the implementation of AI must follow an explanation thereof, while respecting transparency and trust[40].

As these systems are instilled with increasing autonomy in decision-making and handling their environment (based on criteria set by their programmers and designers, or by their users), it is important that rules and values are set by the community they serve. Several international organizations such as the OECD have

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[38] Joint Research Centre. (2018). AI A EUROPEAN PERSPECTIVE. Luxembourg: Publications Office of the European Union

[39] Calo, R. (2017, August 8). AI Policy: A Primer and Roadmap. University of Bologna Law Review

[40] European Commission for the Efficiency of Justice. (2019). European Charter of Conduct on the use of AI in judicial systems and their environment. Retrieved from the Council of Europe: https://rm.coe.int/cepej-chart-ai-en-grec/16809f43d5

tried to set ethical guidelines in recent years, but there has not been a global agreement as yet. The OECD has also formulated general ethical principles for the development and implementation of AI. They were adopted in May 2019 and focus on how governments and other actors can formulate a people-centric approach to trustworthy AI. The first principle is entitled "Sustainable Development and Prosperity", which underlines the potential of reliable AI to contribute to the overall development and prosperity for all people, society and the planet, with the participation of all. The second principle "Anthropocentric values and justice" requires AI systems to be designed with respect for the rule of law and human rights. The third principle of "Transparency and explainability" concerns transparency and notification of the application of AI on a case-by-case basis. The fourth principle of Accountability concerns the responsibility of those who design and use AI systems to enhance their activities[41].

AI is a promising means to enhance individual and social well-being and the common good, as well as to promote progress and responsible innovation. However, it also carries risks for people and societies, especially if it is allowed to make decision autonomously, which need to be identified and addressed. Among the measures taken at EU level, attention is paid in particular to providing technical know-how to smaller businesses that do not have sufficient resources and expertise for this purpose. 25 European countries signed a declaration of cooperation on AI, although some Member States had already announced national initiatives on AI. The declaration builds on the achievements and investments of the European research and business community in AI[42]. Greece is part of AI Watch and OECD and has made a statement on the development of an AI plan. Greece seeks to develop, by the end of 2020, a national strategy on AI. Greece's vision is to effectively combine the knowledge of the academic and research community with the market in order to boost the Greek economy and investments. To this end, Greece has already begun mapping AI initiatives in all sectors at national level, as well as open dialogue discussions with all stakeholders at academic, research and operational level. In order to address the objective of integrating norms and values into AI, namely to define the rules of a particular community in which it operates, the computational application of the rules of that community and the assessment of whether the application of the defined rules is indeed in line with the rules reflecting that community. The achievement of these three objectives represents a repeated process in synergy between AI actors and communities.

2. Industrial Property Law and Inventions

The literature makes reference to the importance of human activity in economic transactions as an interest in industrial property law. Its characteristic is to

[41] OECD Recommendation of the Council on AI, https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0449

[42] Julia, E. (2019). Protecting AI products through intellectual property law and patents: considerations. Law and Technology (pp. 171-186). Athens:Sakkoulas

focus on the result and protect it, while the same human activity is protected by virtue of it. Industrial property law consists of a set of rules of commercial law that regulates issues of absolute rights, up to 20 years in the case of patents, in intangible goods whose operators are a business (mainly commercial). The rights are exclusive and concern, inter alia, the trade name, the distinctive title, the trade mark, technological innovations, technology transfer, craft designs and patents[43].

The legal right to ownership of a patent is created by the granting of the patent. The diploma is an administrative act issued by OBI (8(11) on the basis of Greek Law 1733/87). That act creates the patent right, as absolute, time-limited and has the object of the intangible good, namely the invention. Essential conditions for classifying products as inventions within the meaning of Article 5(1) *must be new inventions which involve an inventive activity, are not obvious to an expert and are amenable to industrial application*. In the following paragraphs the legislator explains the three positive substantive conditions, while excluding from the scope of protection certain inventions bearing them[44]. Therefore, through a positive and negative approach, the concept of invention is defined. Based on the negative approach, mathematical methods and computer programs are not considered to be inventions in relation to the matter under investigation (Article 5(2a, c)) [45], but they may be protected under Article 2(3) of Law 2121/93 on intellectual property. The terms "εφεύρεση" and "επινόημα" are not clearly defined however according to the theory they constitute a (positive approximation) of a rule of human mind to the solution of a technical problem by applying natural laws in such a way that the solution exceeds the average specific the relative and known level of technique and product of the human mind, respectively.

The definition of invention (positive approach) is further explained, as "rule" means a model of teaching with original application of natural laws and not a simple original personal creation. The element of "solving a technical problem" means that it occurs originally, in an unknown way and an excess of technical knowledge. The "excess" implies the addition of a "new", not obvious to the industry specialist based on the known data. The "solution of a technical problem" differentiates the protected object under Law 1733/87 from that of Law 2121/93 on intellectual property, however, as mentioned in both cases, these are creations of the human mind. The technical character of inventions is served through the use of technical means and the purpose is to satisfy human needs. As the concept of invention, despite the conceptual effort of the legislature, according to theory, is a changeable concept and for this reason related disputes come under the jurisdiction of the merits judge. According to

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[43] Hadjimichael, D. (2015). Proprietor of an invention and patent claim. Athens: Sakkoulas

[44] T2330/13 decision of the Board of Appeals in EPO, when the claimed invention is based on a mathematical method, it is evaluated whether the mathematical method contributes to the technical character of the invention. A mathematical method can contribute to the technical nature of an invention, that is to say, contribute to the production of a technical result serving a technical purpose by applying it to a field of technology and/or be adapted to a specific technical realization.

[45] *shall be considered as works of speech protected in accordance with the provisions of the about intellectual property computer programs and the prepackage material of their design. Protection is provided to any form of expression of a computer program. The ideas and principles on which any element of a computer program is based, including those on which its interface systems are based, they are not protected under this Law original since it is a personal intellectual creation of its creator*

jurisprudence[46], an invention is any creative work by which the solution of a problem is solved (with the help of natural forces) unsolved until then, or by means of natural forces, is improved and accelerated, in an original way, by means of interests. As pointed out in theory[47], invention is a creation of the human spirit, so the inventor is perceived only as a human (as a natural person) and not legal persons, who may be beneficiaries with a derived right. Next, an article which advocates the inability to apply for a patent in an AI system is Article 7(1a) Law 1733/87 when filing the application requires the inclusion of the full name or name, nationality, domicile or registered office and address of the applicant[48].

The invention can be a collective effort with the contribution of a mental process. This activity is covered by article 6(2) Law 1733/87 and 785 et seq. GCC on the society of rights. In particular, if several people carried out the invention jointly and if there is no other agreement, the right belongs to everyone indivisible, that is, in ideal parts, while each has the right to the corresponding portion of the fruit of the object (786GCC). Contributions which appear negligible in relation to the overall solution or which do not exceed the technical level shall not fulfil the criterion of having a creative contribution and shall not make their operator a co-inducer. A co-inventor who has been assisted in an expeditious nature, such as a mere assistant, manufacturer or executor of the inventor's orders and instructions or a third party, shall not be considered to be a co-inventor[49].

The invention under the conditions of employment is regulated by Article 6(4-7). The law distinguishes between a free invention, that is to say, an invention made by the employee and owned by himself, a service invention, that is to say, an invention in the context of an employment relationship for its development and owned by the employer and a dependent invention, that is to say, an invention created using means/materials provided by the undertaking and owned by 40% to the employer and 60% to the employee. More specifically, for the service invention, an active employment contract is required, whether it is valid or not, and a (contractual) obligation of the employee to act towards the development of the invention. For the recognition of the contractual obligation, the stage of recruitment is also assessed on the basis of good faith (288GCC), if a fee is offered. In the present case, the employer acquires the rights to exploit the invention, but the worker is identified as an inventor.

According to theory, the claim of an additional equitable remuneration for the service invention does not require that a patent has been granted[50]. It is therefore interesting whether there is a service invention which satisfies the substantive requirements of the invention, but not the procedural requirements. According to a teleological interpretation, this would serve the intention of the legislature to ensure adequate remuneration for an invention produced which meets the requirements of

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[46] SC 545/1996

[47] Antonopoulos, V. (2002). Industrial Property. Athens: Sakkoulas SA, p. 195, Hadjimichael, D. (2015), ibid.

[48] PD 259/1997 and Law 2417/96 make a clear reference to the admissibility of the applicant's application by referring to his full name, name, nationality and residence.

[49] Multimember Court of First Instance of Athens 4695/2017

[50] Antonopoulos, V., ibid., p. 232, Hadjimichael, D. (2015), ibid.

Article 5(1), but the procedure laid down in Article 7 has not been followed. Therefore, in a sense, in the event that the use of an AI system has led to the creation of an invention, but the owner/employer did not proceed with the process of filing the application for a formal protection, identification of the inventor is still possible, e.g. the user of the AI or the original designer or programmer. The dependent invention does not require a contractual obligation of the employee, so it would be difficult for an invention to emerge from a system of artificial legality, as it would have to operate completely autonomously and would have to be seen as legally responsible, something impossible for a non-physical person, at least at the present time.

The object of the right to industrial property is not the tangible, but the intangible good. The inventive idea, the ability to distinguish the product, the distinctive features are the protected objects. These objects have legal significance when they receive material expression from the intellectual form. The legal basis of intellectual property at international level lies, apart from the specific international rules of law such as the Berne Convention for the Protection of Works of Literature and Art, and in Article 1 of the First Additional Protocol to the ECHR[51] and Article 17(2) of the CFREU. In European primary law, the term is mentioned for the first time in the Treaty of Amsterdam (Article 207 TFEU), while in secondary law there is a wide variety of relevant Directives and Regulations. According to Article 2(1) Directive 2009/24/EC, *the author of a computer program is the natural person or group of natural persons who created the programme or, where the law of the Member State so permits, the legal person designated as the beneficiary by that legislation*.

The European Patent Convention (EPC) does not contain provisions that could prevent certain articles from being patented on the basis of the manner or by whom it was created. The identification of the inventor's person falls within the competence of the national courts (Article 61 EPC). The inventor's person is strictly linked to the determination of the invention claimed. The inventor may be the designer or programmer of the AI system, a scientist who designed the question and possibly introduced data to the machine, monitoring and analyzing the results produced by the AI system. From the perspective of ingenuity, three types of inventions using AI technology may be identified. Inventions by a human who uses an AI programme to verify a theory, inventions in which a human identifies a particular problem and uses AI, with appropriate parameterization, to find a solution and inventions where the AI system does not offer a solution to the problem but produces an invention completely unrelated to the original question or theory. Whereas in the first two instances the inventor may be identified as the user who asks the question, in the latter case, we enter a grey area where the question arises whether the AI system can be construed as having come up with an invention and therefore is the rightful “inventor”.

The recent achievements of AI systems have allowed machines to reach a level of autonomy that allows them the “freedom” to decide on measures to take (e.g. on an autonomous car) or the significance of specific findings during a particularly

[51] *Pan natural or legal person he is entitled to respect for his property. No one can be deprived of its ownership for reasons of public interest and by provided for, under the law and general principles of international law conditions*

complicated endeavor (e.g. discovery of a new particle during particle collision tests in an accelerator, e.g at CERN). In both cases, a human would not be able to respond quickly or reliably so the contribution of the AI system can be seen as uniquely essential. On the face of it therefore, it would appear that perhaps we are entering an era where machines will not only help people in the creative process, but will invent autonomously. However, we mustn't forget that the AI system was itself invented by humans and used after initialization and parameterization by human users.

The application of the industrial property legal framework to works or inventions created by AI is a complex issue, in particular for copyright and other sui generis or related rights. The patenting of inventions created using or by AI systems will be of significant value regardless of the value of the system itself and this will motivate businesses and computer scientists to develop and use AI, which will lead to greater innovation for society. The underlying legal problem of identifying an AI system as an "inventor" somehow separate from its original programmer or user is the legal impossibility of attaching legal responsibility to a non-human agent. This is the main aspect that currently precludes an AI system to be recognized as an inventor with IP Rights and this is the subject of the next section.

2.1. Is it feasible to recognize a legal identity and responsibility to an AI system to enable it to be identified as an inventor?

In the prevailing and accepted legal view, the protection of copyright should extend only to works in which human creativity is manifested, i.e., works that are the result of a human creative process. Whereas, insofar as there is undoubtedly human involvement, this involvement cannot logically be considered in most cases creative in nature, i.e. where evolution or chance has created something novel and that's why natural "inventions" are not considered as IP. Also, copyright only protects works that meet the requirement of originality, a reflection of the creative choices made by the human mind. Content that is not produced by a person fails to meet the criterion of creativity. An important point is that in the field of copyright, the protection extends after the death of the author.

Attributing "personality" to inanimate objects or machines such AI systems carries ethical and legal issues, but it may also be linked to the basic principles of economic efficiency and innovation on which industrial property law is based. Mechanical or digital systems such as AI systems cannot have rights because they do not have a legal identity or a legal responsibility comparable to natural or legal persons[52]. In some countries such as India, in addition to the recognition of idols as

[52]Nevejans, N. (Nathalie, October). European civil law rules in robotics. Recovery from Policy Department for "Citizens' Rights and: https://www.europarl.europa.eu/RegData/etudes/STUD/2016/571379/IPOL_STU(2016)571379_EN.pdf, pp 6, 14 and 15

persons, various entities have acquired legal identity under Indian law, including ships, holy books, rivers and animals. Of these, the ships are also recognized as legal persons in the common law, while the recognition of idols and temples as legal persons was also recognized by the English courts centuries ago. Alan Turing proposed the intelligent behavior test, which consists of a 5-minute discussion with a human (examiner), through messages on a computer. However, recognition of inanimate objects as having an "identity" does not equate to them having a legal personality in the eyes of the law, but it is used only as a means of identification and in order to enhance the possibility of punishing someone who has damaged them.

All countries, including continental Europe, Australia and the US, require human creativity in their respective patent laws[53]. Human participation is based on the concept of "ability and work." Also, most copyright laws require awareness of creation. A machine does not have this self-consciousness. Since copyright requirements do not allow copyright protection to be granted to a work created by AI, could a special sui generis system be designed?[54]. This would require that, if protection is granted to a work created by AI, the link with the natural person should be weakened, potentially transforming the copyright system. However, copyright laws were written at a time when only the inventors of individuals were considered, which poses a series of questions and challenges in the context of rapidly increasing use of AI systems.

The prevailing opinion is that, giving legal identity to an AI system is not feasible. If an AI system is accepted as a "person" it would mean that it also attains human rights, and if it acquires legal identity, it implies that it should be composed of natural persons who will express its will and represent it. That is why the contractual concepts of a natural and legal person are not up for discussion in the case of an AI system. Another argument against the recognition of identity in machines with AI is that it would mean the capacity for legal responsibility and ownership by them, which would create further legal issues[55]. Academics assessing the suitability and feasibility of the legal identity for an AI system warn that it is premature to attribute it[56]. AI systems therefore have no legal personality and cannot participate in a working agreement, which is limited to natural persons[57].

According to the conservative theory on the responsibility of AI, its attribution to AI is unlikely, due to the lack of identity. The evaluation of the concept of

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[53] McCutcheon, J. (2013, July 23). The Vanishing Author in Computer-Generated Works: A Critical Analysis of Recent Australian Case Law. Melbourne University Law Review, pp 39

[54] Secretariat. (2019, September 27). WIPO conversation on intellectual property (IP) and AI (AI). Recovering from WIPO:
https://www.wipo.int/edocs/mdocs/mdocs/en/wipo_ip_ai_ge_19/wipo_ip_ai_ge_19_inf_4.pdf

[55] Techno (2019). Report on Liability for AI and other emerging digital technologies., 38 Bryson, J., & Kime, P. (2021, July). Just an Artifact: Why Machines are Perceived as Moral Agents. Proceedings of the Twenty-Second International Joint Conference on AI, pp 1643

[56] Hildebrandt, M. (2019, June 2). Legal Personhood for AI? Recovery by Law for Computer Scientists: https://lawforcomputerscientists.pubpub.org/pub/4swyxhx5/release/5, Pagallo, U. (2018, September 10). Vital, Sophia, and Co.—The Quest for the Legal Personhood of Robots. Information, Zevenbergen, B., & Finlayson, M. (2018, August 20). Appropriateness and feasibility of legal personhood for AI systems. CLAWAR

[57] WEU C-344/87, of 31th s May 1989, Bettray v State Secretary for Justice (Netherlands), point 12

responsibility by an act of an AI system is particularly important, as its identification in national law, by analogy, contributes to the research on the attribution of identity. By examining whether an AI system can act as the representative of a natural person, it is established that in the national legal order, the will of the legislature is clear. In principle, the institution of representation seeks to have legal acts carried out by the representative in the name of the principal (211GCC REF). The concept of representative is distinguished by relational concepts such as a messenger, who simply transmits someone's declaration, so it does not require legal capacity. The lack of this is important for the research subject. Also, the assistant to fulfil an obligation is distinguished from the representative, as he is merely the intermediary who fulfils obligations of the main affairs. The representation requires at least limited legal capacity (213GCC), making it clear that the legislator refers to the 129GCC and relevant articles on judicial assistance, and therefore to natural persons. The aforementioned fulfillment assistant in accordance with Article 334GCC and the relevant case law[58] may be either a natural or a legal person. Also, despite the expanded possibility of attributing the status of fulfillment assistant, an AI system could not fall within the scope of 334GCC, as one of the conditions is the culpable act, namely the deceitful or negligent act. In contrast, according to the case-law and theory developed concept of “messenger”, neither legal capacity nor fault is required in the present case. Certainly, however, based on the teleological interpretation it could not include an AI system as a messenger[59].

Finally, according to the theory, liability by an AI system derives a legal basis from Article 924GCC (responsibility of the owner of an animal). In particular, strict liability (regardless of fault) for damage caused to a third party is established, as the animal, lacking in logic, can develop unpredictable behavior for humans. The liability of the 924GCC exists (as strict liability also exists in Article 914GCC for tort), as there is no human act. The keeper (and not the owner) is defined as the person who is in close proximity to the animal and must supervise it properly and be able to control it. Therefore, on the basis of the above it could be said that by analogy the liability by an AI system could fall in a broad sense under Article 924GCC, as there is one thing, which however unlike an animal may have a higher level of logic and there may be no human intervention in both cases[60]. In the case of AI system, this implies that the programmer could be held responsible but not the actual owner or the user.

With regard to civil liability for damage caused by machinery with an AI system, the Commission had published a report addressing questions of liability by AI systems. The examination of the issue, which is done on a case-by-case basis, is important. In particular, for drones it is stated that the victim is sufficient to prove only that the damage was caused by the drone without having to document the damage. The operator should be the person who, although not guiding him remotely or manually, has control over the total use of the drone. An ancillary option is the action against the manufacturer under faulty product provisions. In the case of partial,

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[58] RE 388/2006 Nov 54, 1800

[59] Leontis, N. (2020). Interpretation of the Civil Code. Athens: Nomiki Bibliothiki. 580 et seq

[60] Georgiadis, A., & Stathopoulos, M. (1982). Urban Codex, Article-by-article interpretation, Volume 4. Athens: P.N. Sakkoulas

under conditions of automation, the autonomous car operates under the supervision of the driver, but without human entry under certain conditions only (for example in specific types of roads or in specific geographical areas). In addition to these limited environments, the vehicle requires human control. In these cases, the driver has the responsibility to supervise the car and be ready to repeat the check if necessary or after notice. In case of higher levels of automation, the vehicle is able to operate without human intervention and with full automation also on any road and under any conditions. There may not even be a person in the vehicle. For the latter cases, the 'total control' solution is applied in the same way as drones. In the event of an accident caused by a fully automated vehicle, liability for damage may be assigned to the driver/holder of the vehicle. Finally, a similar analysis is made for "smart" homes. The Commission, in its Report on the impact of AI on security and liability, the Internet of Things and robotics, states that "*the features of emerging digital technologies such as AI, IoT and robotics challenge aspects of EU and national frameworks of responsibility and could reduce their effectiveness. Some of these characteristics could make it difficult to identify harm to human behavior, which could justify a claim based on error under national rules*[61].

The concept of operator and control in an AI system is also addressed in a Resolution of the European Parliament[62]. It is noted that the "frontend" operator should be defined as the natural or legal person exercising some degree of control over a risk related to the operation of the AI system and benefiting from its operation. The operator "backend" should be defined as the natural or legal person who, on an ongoing basis, defines the characteristics of the system, provides data and basic backend support, and therefore also exercises a degree of control over the risk associated with the operation of the AI system. The exercise of control means any action of the operator that affects the operation of the AI system and therefore the extent to which it exposes third parties to its potential risks. Such actions could affect the operation of an AI system from start to finish, determining input, output or results, or could change specific functions or processes within the AI system. In situations where there is more than one operator, for example a backend and frontend operator, in this case, all control bodies must be jointly and severally liable, while the percentages of responsibility should be determined by the respective degrees of control that the operators had against the risk associated with the operation and operation of the AI system[63].

Finally, through an empirical example, the concept of liability is understood by an accident of a Tesla model. On May 7, 2016, a semi-automated Tesla Model S collided and passed under a truck. At the time of the collision, the truck made a left turn and crashed, with the right side of the semi-trailer cut off from the roof of the Tesla. The Tesla driver died in the accident. The system data obtained from Tesla was revealed that the driver operated the car using automated vehicle control systems: Traffic-Aware Cruise Control and Autosteer lane keep systems. Investigations

[61] COM (2020) 64 Final 13.
[62] P9 TA (2020)0277
[63] 2020/2014(INL), European Parliament resolution of 20 October 2020 with recommendations to the Commission on the civil liability regime for AI

revealed that although the autopilot worked as planned, it did not detect the truck. The truck was going across the path of the car instead of driving right in front of it, and object detection sensors did not detect the truck piece as a threat. The competent authority concluded that the crash was not the result of a specific defect in the autopilot system, so Tesla was not held responsible for the accident. The authority noted that Tesla's system worked as expected, warning the driver that the autopilot system requires its supervision and that his hands must remain on the steering wheel and his eyes on the road. Also, under Tesla's Terms of Service, the driver must take a check of the car 4 seconds after the notice of deviation of the course. Now, if a driver repeatedly ignores the warnings, the system will stop working and the restart is prevented for the entire duration of the journey. If the driver never responds, the car will gradually slow down until the emergency lights stop and turn on[64].

2.2. Ethics and AI

Moral responsibility is attributed to ethical agents, while in Western philosophy, moral responsibility is a concept exclusively for people. Most philosophers agree that today's technologies such as AI should not be called moral agents, if this means that they could be considered morally responsible, because they cannot feel pain and thus, they cannot be punished or because they do not have the ability to understand the importance of the information, they are processing[65]. Others argue that judging a computer as morally responsible is possible if it involves a high-level computer system with own intentions, something which does not (yet) exist. That is where its behavior can be described with mental states and that it acts according to what it believes it should do, taking into account its beliefs and desires, in analogy with a person.[66]. Then, in the same vein, the theory holds the view that sufficiently advanced robots may be ethical agents when they have a significant level of autonomy and can be considered at an appropriate level of asynchrony to act voluntarily. Also, it must be able to be a moral agent, that is, to carry a social role with responsibilities and in the performance of that role to appear to have "beliefs" and to understand his duties towards other moral agents (human beings or other robots)[67].

Despite the optimistic perspective of some philosophers/researchers, science has been oriented towards the formation of machines that behave like moral agents. Autonomous ethical agents will be able to reflect on the moral and social significance of their behavior (always based on the criteria inputted by their programmers) and assess the impact their behavior has on sentient beings to make the appropriate

[64] Abbott, R. (2018, April 28). The Reasonable Computer: Disrupting the Paradigm of Tort Liability. George Washington Law Review, pp 86
[65] Doorn, N. (2012, June 3). Editors' Overview: Moral Responsibility in Technology and Engineering. Science and Engineering Ethics, pp 1-11
[66] Dennett, D. (1997). When Hal Kills, Who's to Blame? Computer Ethics. MIT Press, pp 354
[67] Sullins, J. (2006). When is a robot a moral agent? International Review of Information Ethics, pp 26

choices[68]. At the moment, the machine operators are making the moral decisions or the decision has already been inscribed in their design. James H. Moor distinguishes between three different kinds of ethical agents, indirect moral agents, clear moral agents, and full moral agents. Indirect ethical agents are any machine that carries moral decisions thanks to their designer. The clear moral agents, based on a set of moral values that have been imprinted on them, decide on a case-by-case basis in cases unknown to them. This kind works on behalf of their users; finally, Moor defines full moral agents as "entities" with justified moral judgments, which equates them in terms of responsibility with people[69].

Luciano Florida and Jeff Sanders[70] have presented another version. They propose to disconnect the machines from responsibility and be considered accountable for their actions. They proceed in an analogy with dogs, that they can cause "immoral" acts, so we characterize them as immoral and worthy of punishment, but they are not responsible for their actions, but their owners are. A second element for machines to be considered as moral agents is their existence at an abstract level. In particular, at a low level the operations of the machines are justified on the basis of the mechanical planned procedures. At a high level, their interactivity, autonomy and adaptability are examined. As long as they are applied satisfactorily, then they are considered morally accountable, but not responsible. A critique of this view states that machines are not in spiritual states, nor do they have a purpose chosen by the freedom of action, so without intention, there can be no moral responsibility either. Through human activity, computer technology has been designed, developed, tested, installed by entering data and instructions to perform specified tasks. Nevertheless, it cannot be isolated from the equation of moral responsibility; machines make up and collaborate in ethically assessable acts. People create the machines and record in them values and intentions to achieve concrete results in the world and in turn they influence the real world.

2.3. The issue of ownership of intellectual property rights

In 1974, the US Congress created the Committee on New Technological Uses of Copyrighted Works (CONTU) to study issues related to copyright and works created by sophisticated computing systems. At the time, copyright law did not even address the issue of whether computer software should be protected by copyright, a much more urgent and economically significant problem. As regards the writing of TN, CONTU wrote in 1979 that there is no need for special treatment of works created by AI because it does not produce autonomous creative effects without human intervention, but nevertheless acts as a tool to help authors. CONTU also stated that

[68] Wallach, W. (2011). Moral Machines: Contradiction in Terms, or Abdication of Human Responsibility? At P. Lin, Robot Ethics: The Ethical and Social Implications of Robots (December). MIT Press

[69] Moor, J. (2006). The Nature, Importance, and Difficulty of Machine Ethics. IEEE Intelligent Systems, pp 19-20

[70] Floridi, L. (2004, August). On the Morality of Artificial Agents. Minds and Machines, pp 363-365

autonomous creative AI was not immediately predictable and concluded that "projects created by the use of computers should be protected by copyright if they are original works of writing under the 1976 Act." According to the Commission, 'the copyright master is the one who uses the computer'[71].

In 2014, the U.S. Copyright Office published a notice titled "Requirement of Human Ownership," which states that in order for ownership to be awarded to a work it must be created by a human being. The Office will not register works produced by nature, animals or plants, as well as works produced by machine or simple mechanical process that operates randomly or automatically without any creative input or intervention by a human author. In the context of WIPO's work on intellectual property and AI, some answers were given to basic questions, which of course are the views of working groups and not normative decisions., the answer given is that the law should exclude the protection of patents, whereas if there has been supervision by a natural person, the patent rights are passed on to it. While interestingly, it is the view that derivatives from the use of an AI system are considered a previous invention in case there is a conflict with a new applicant. Finally, it is repeated and pointed out that AI inventions should be treated as a computer-aided invention[72].

The inventive process usually starts with a plan to be fulfilled. The use of tools such as a computer in the modern age of technology is almost a prerequisite. However, inventions which are not foreseen or which have substantially different characteristics may arise in the course of the procedure. In the thought of assigning the title of inventor to the machine that contributed to this unpredictable (or not) result, he proposes that the creation of the AI system was the product of human activity. The prescribed solutions for attributing the title of inventor have been proposed in certain theories. The zero solution provides that products not attributed to human activity are not works, but free goods of common use, however it does not apply in cases of industrial property law, as article 6 of Law 1733/87 does not require originality. Another proposal is to give ownership to the user, i.e. the person who put the AI system into operation[73]. In this case, the percentage of autonomy of the system is examined, as under Article 6 Directive 2006/116[74] photographs taken as a result of personal work belong to the photographer, even if, for example, automatic motion lapse shooting is used. In another view, the user and the creator may constitute owners of rights over the products of operation of the AI system, while for the derivative works, the users are also called co-owners.

The computer software, i.e., a computer program, which may operate under an AI system under article 5(2c) of Law 1733/87, is not considered as an invention. However, this provision is interpreted restrictively, as article 2(3) of Law 2121/93 applies mutatis mutandis. The patentability of software under article 10(1c) of Law

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[71] Dent, C. (2008). An exploration of the principles, precepts and purposes that provide structure to the patent system. Intellectual Property Quarterly, pp 462

[72]Secretariat. (2019, September 27). WIPO conversation on intellectual property (IP) and AI (AI). Recovery from WIPO:
https://www.wipo.int/edocs/mdocs/mdocs/en/wipo_ip_ai_ge_19/wipo_ip_ai_ge_19_inf_4.pdf

[73] Christodoulou, K. (2019, June 18). Legal issues from AI. Annals of Private Law, p. 329

[74] Directive 2006/116/EC of the European Parliament and of the Council of 12th s December 2006, on the term of protection of copyright and certain related rights

1733/87 the derivative of this function is protected by the patent, i.e. even if the inventions produced are due to the automatic operation of the AI system, the owner of the AI system becomes the owner of the AI results. The question arises under Article 7(3) N 1733/87 "The claims of the invention shall be based on the description", which means that claims exist only in the derivatives which are linked to the recorded process description and without overcoming other processes. In the absence of the same nature of the derivative, then it is probably considered as a free work.

In a sense, the recognition of the legal identity of AI as a legal entity with the user of the system as a shareholder would again lead to the ownership of the rights by the user. However, the lack of transparency and the reduction of liability for damage caused by an AI system would increase, as it would be attributed to it and not as tortuousness to the user. In the context of copyright law, the elements of the intellectual creation of a work and originality. These are also distinguished in industrial property law, perhaps not in the same form. The spirituality and expression of personality in an original work, in a teleological sense, it concerns only the natural person, specifically in the mind and emotional (mental) state. British copyright law contains a specific provision on computer system process products. Specifically, it is provided that they are attributed "to the person who decided and settled the necessary arrangements for the creation of the project".

In assessing the preceding concept, the existence of a difficult distinction of the author is understood. The user of a software with the appropriate setting of it and the input of special data, which however has been produced by a programmer, who has thus contributed substantially to the production of the project. According to one view, both persons may be entitled indivisible, provided that they jointly carried out the invention and that there is no other agreement. The question of the joint invention, it is difficult to implicitly conclude that the developer and the user consent to the same result. If it is considered that the programmer has made a substantial contribution, but the element 'jointly' does not exist, then the right belongs to the person who first filed the patent application (Article 6(2.3) N 1733/89).

The new generation of intelligent systems have learning processes, they react to the stimuli of the environment, that is, they acquire initiative through their own evolving experience, based on the original criteria and parameters as entered by the programmer and by the user. Since a computer software can be developed and expand algorithmically by interacting with its environment, it is cut off from the personality of its programmer and becomes autonomous. The computational system creates its own intellectual background, although it can still be traced back to the originator and user. In a sense, works, which are completely disconnected from any human action do not exist. In particular, it is proposed that joint ownership (as goods in the public domain) should be made available to the public by the author or user of the machine himself. This choice serves legal certainty, that is, the difficulty of finding the real creator, and would lead to joint participation in creations of technological development[75].

[75] Schafer, B. (2015, November 23). A fourth law of robotics? Copyright and the law and ethics of machine co-production. AI and Law, pp 224-226

3. Exploring how AI works

The term AI is often attributed to John McCarthy who is often referred to as the "Father" of AI. The term was created when it was chosen as a seminar topic, known as the Dartmouth Conference, which was organized by McCarthy and held in 1956 at Dartmouth College, New Hampshire. In the proposal to organize the seminar, McCarthy continued with Turing's argument about automated computation. According to McCarthy, "AI is the science and technology of manufacturing smart machines, particularly smart computer programs. It is related to the task of using computers to understand human intelligence, but AI need not be limited to methods that are biologically observable"[76]. AI is a branch of computer science that deals with the simulation of intelligent behavior. (THESE WERE THEORETICAL IDEAS AND PRESENT AI HAVE NOT YET REACHED THIS LEVEL. GV). There are many definitions of what AI is. One of them is that it is the teaching of machines to learn, act and think as people would like. Another perspective is that the aim is to eventually give the machines more cognitive and aesthetic abilities. It is therefore about image and video analysis, natural language processing and speech comprehension (pattern recognition). Finally, it is the application of information technology to solve problems in an intelligent way (by imitating human intelligence) using algorithms (autonomous decisions and choosing an optimal solution).

In short, AI is a tool that uses the computer to complete a task (target) automatically with little or no human intervention, just like a computer programme that analyses some results. It is argued that AI does not mimic human intelligence but simply applies mathematical algorithms to collect data, explore it and achieve results, usually those desired and dictated by the system user. AI algorithms are the reasons we can talk to the voice assistants of a mobile phone and they can answer us. Going a step further, chatbots with natural language processing capabilities are used in healthcare for interviewing patients and performing basic diagnoses, even better computer vision algorithms detect facial features and images and compare them with databases with profiles of faces[77]. AI, therefore, can and does what humans do at many stages of their activity, more quickly, with less "energy" and at the same degree of quality (perhaps even better). As mentioned above, AI is a branch of computer science that deals with the simulation of people's behavior (design, learning, reasoning, problem solving, perception, movement etc). Machine learning is a subset of AI that uses computer algorithms to analyze data and make smart decisions based on what it has "learned" and according to specific criteria and parameters set by the user, and proceeds according to its intermediate findings without having been explicitly programmed to do in any specific way. Machine learning algorithms are trained with large datasets and learn from examples. Deep learning is a subset of machine learning that uses stratified neural networks to simulate human decision-making.

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[76] Heaton, J. (2015). AI for Humans, Vol 3: Neural Networks and Deep Learning. CreateSpace Independent Publishing Platform, pp 18

[77] Heaton, J. (2015)., ibid, pp 39

Deep learning algorithms can highlight and categorize information and identify patterns, according to the data sets they have been trained on and according to preset criteria and parameters. They are the ones that allow AI systems to continuously monitor work and improve the quality and accuracy of results. Artificial neural networks are inspired by biological neural networks. A neural network in AI is a collection of small computational units called neurons that take data and learn to make decisions over time. In contrast to the massive attempt to assign an absolute definition, Alan Turing proposed a test. If a system manages to pretend to be a human, so that a person asking him questions does not manage to distinguish that it is an electronic system, then it is considered a definitive AI. For a system to succeed, it must have the functions of natural language processing in order to understand the language of its interlocutor. Knowledge representation and automated reasoning, so that the system can store and exploit mass information in response to questions. Finally, machine learning, to adapt to unexpected situations with the help of learning[78]. The person who tries to understand his environment by observing and creating a lucid version of the self himself is called a model. The process is called induction, as man organizes his experiences and representations by creating new structures called patterns. The creation of the above from a computational model is called machine learning. Machine learning, in short, is the process of automated development of decision-making capabilities based on inputted data on a large sample of appropriate and relevant situations. The classification of types of information processing is trichotomized into productive, inductive and proportional, that is, the application of a similar solution. For example, in the field of medicine, after the introduction of the necessary data, algorithms and medical knowledge, diagnosis is achieved. Specifically, the data entered include databases, algorithms, data processing tools and medical knowledge as necessary information for the processing of the medical case. In 1990, research was carried out on the effectiveness of machine learning methods[79].

3.1. Learning methods

Two types of machine learning are supervised learning, in which the computer learns a concept from a data set, that is, the supervisor assumes the correct output value of the operation and the second type is unsupervised learning, in which the computer operates unattended. In supervised learning the system inductively learns a function, an expression of the model that describes the data. The latter are used to predict the value of a variable, called a dependent variable, based on the values of a set of variables, called independent variables. The set of different possible input values of the function is called a set of events. The system examines several alternative functions to reach the intended operation. Supervised machine learning is divided into classifying decision trees, rule learning, case-based learning, Bayes learning, linear interpolation, neural networks. This is a verified process of solving a

[78] Boden, M. (2018). AI: A Very Short Introduction. Oxford: Oxford University Press
[79] Heaton, J. (2015)., ibid, pp 24

problem. The prediction of any potential problem is a test. When the computer system reaches a point where it has neither a relevant hypothesis nor the necessary acquired knowledge through experience in its database, it turns out to be ineffective[80].

The researchers wanted to copy the human ability to improvise, that is, based on acquired knowledge, to create new bonds of knowledge to cope with changing conditions. When an unexpected obstacle occurs, one observes the external environment and applies experimental theories that he sets, until he reaches the desired result of the disconnection from the new "problematic" situation. This process at the computational model level is machine learning. Through machine learning, rules of conduct are created through the adaptation of pre-existing algorithms. The data and factors influencing the situation are categorized. The computer system is not guided by an external supervisor about the action it needs to take, but it must only find out what the actions are to avoid the greatest gain. This process is denoted by an agent, who has no prior knowledge of his behavior, his environment and how to lead himself to a positive state[81]. In order to reach the specific situation or desired result, the agent must have the need to "survive" or be rewarded to avoid complete inertia in a convenient situation. Thus, with the practice of testing and failure, the agent learns from his previous failures to reach the desired result, to success. In order for an agent to be defined as successful/rational, a performance measure must be set, for example if a robot is set to design spare parts for specific needs, each time it succeeds then it is understood as successful[82]. Agents have sensors and mechanisms of action, which can be programmed to perform sequences of actions in the real world. Man has (basic) sensors the eyes, ears, tongue, skin and nose and its extremities as (basic) mechanisms of action. The agent, with actions in his environment, receives the corresponding perceptions, which in their entirety constitute the sequence of perceptions. This is the history of contact with its environment. The environment is any object material or intangible, as well as the conditions that the agent operates.

3.2. Machine Learning and Decision-Making Trees

Machine learning, instead of following rules-based algorithms[83], builds models to sort and make predictions from the data. Machine learning takes data and creates the algorithm. It provides a set of rules that determine what the learning model will be. Machine learning is based on defining rules of conduct by examining and comparing large sets of data to find common patterns. Between the types of engineering learning, supervised learning is the way in which the algorithm is trained in the data entered by humans. Theoretically, the more samples/data man provides to

[80] Russell, S. J., & Norvig, P. (2021), ibid, pp 727 et seq
[81] Neapolitan, R. (2018). AI: With an Introduction to Machine Learning. London: Chapman and Hall/CRC, pp 331 et seq
[82] Vlahavas, I. (2020), ibid, pp 437
[83] Neapolitan, R. (2018), ibid

a supervised learning algorithm, the more accurate he becomes in sorting new data[84]. Of course, the accuracy is directly related to the quality of the data entered.

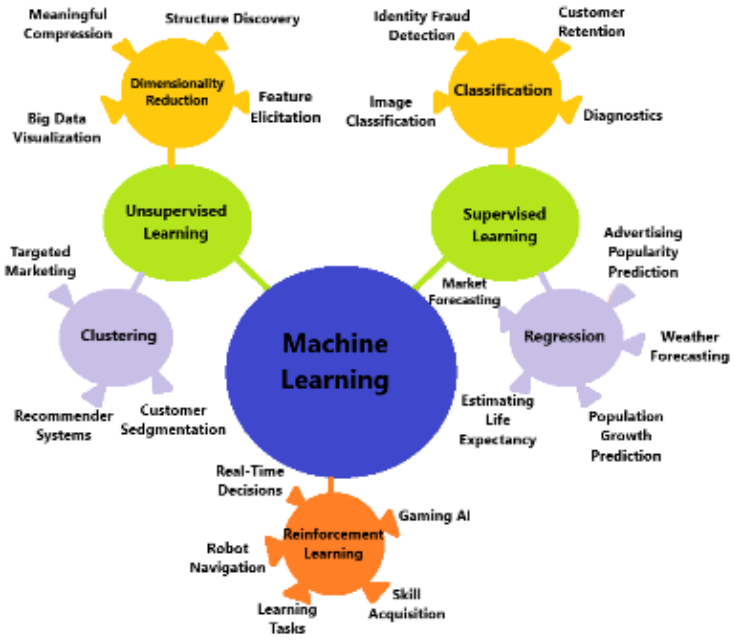

Figure 1: Machine learning map

Unsupervised learning relies on providing the algorithm with unlabelled data and letting it find patterns on its own. Man provides the data but not the labels and lets the machine infer models, on the basis of which, the algorithm finds patterns. This type of learning is useful for gathering data, where data is grouped according to how similar it is to the others and unlike anything else. Once the data is gathered, different techniques can be used to investigate this data and search for patterns[85]. The weak link in this is the quality of the data gathered by the systems own sensors and the model built according to that.

The third type of machine learning algorithm is enhanced learning and is based on providing a machine learning algorithm with a set of rules and limitations, allowing it to learn how to achieve its goals. Man defines the situation, the desired goal, the permissible actions and the limitations. The algorithm calculates how to achieve the goal by testing different combinations of allowed actions and is rewarded or punished depending on whether the decision was good. The algorithm strives to maximize its rewards within the constraints provided. An example of enhanced learning is a machine, which learns to play chess. IBM's Deep Blue has defeated world champion Garry Kasparov in chess as early as 1997, when the champion said he played with a new kind of intelligence[86].

[84] Russell, S. J., & Norvig, P. (2021), ibid, pp 725-800
[85] Vlahavas, I. (2020), ibid., p. 431ep.
[86] Surden, H. (2014, March 1). Machine Learning and Law. Washington Law Review, pp 96-97

Decision tree induction algorithms are often applied in medical cases. This is a method of extracting distinct values. Each node in the tree defines a controlled term of the value of a particular case, and each branch that leaves that node corresponds to a distinct value of that attribute. A case is sorted starting from the root and following the branches of the tree on a sheet, which also contains a separate category value. Each node checks the value for the attribute and follows the corresponding branch. Each possible value of the attribute creates the corresponding offspring and the data is shared with the new nodes according to their value for the attribute controlled at the root. The process is completed when the nodes are terminated, i.e., the data belonging to it belongs to the same category.

3.3. Artificial neural networks

An artificial neural network is a collection of smaller units called neurons, which are computational units based on how the human brain processes information. Neural networks borrow some ideas from the biological neural network of the brain in order to approach some of the results of the treatment. Neurons take data like biological neural networks and learn to make decisions over time. The network uses a dataset that matches the known data inputs with the desired outputs. Inputs are connected to the network and outputs are determined. Then an error function recognizes how far the outputs are from the desired result. Finally, adjustments are made in order to reduce errors. Neural networks are useful in applications such as image, video, and natural language processing[87].

The latest example of applying neural networks is the most difficult application. People have the most advanced method of communication, which is known as natural language. Humans can use computers to send voice messages, which, however, computers cannot process. The processing of natural language is a subset of AI that allows computers to understand the meaning of natural language. Natural language processing uses machine learning and deep learning algorithms to discern the meaning of a word. This is done by deconstructing sentences grammatically, relationally and structurally and with an understanding of the context of use. Natural language processing systems may also be able to understand people's intention and feeling in their speech. For computers to be able to communicate in natural language, they need to be able to convert speech into text, so communication is easier to edit. They also need to be able to convert text into speech so that people can interact with computers without the requirement to type. With neural networks, voice samples and the corresponding text are provided. The network finds the common patterns between the pronunciation of words and then learns to map new phonetic recordings in the corresponding texts. Google uses this technology in its applications such as "Google Translate", the company takes advantage of the great use of the application, so that one neural network takes voice samples and a second corresponds to new records to the same person.

[87] Russell, S. J., & Norvig, P. (2021), ibid, pp 856

The field of machine vision focuses on reproducing parts of the complexity of the human visual system and allows machines to recognize and process objects in images and videos, in the same way as humans. Machine vision is one of the technologies that allows the digital world to interact with the physical world. The field of machine vision surpasses people in tasks related to the detection and marking of objects, thanks to the advancement of deep learning and neural networks. This technology has also led to so-called automatic cars, facial recognition applications and digital reality. Artificial neural networks are data processing (classification) systems consisting of a multitude of artificial neurons organized into structures similar to those of the human brain. They involve the construction of computer systems with the capabilities of architectural processing[88]. The result is to create a model for processing, searching and presenting a wide range of information and pattern recognition based on experience. This experience is related to process of predicting a result and then comparing it to an actual value. If it is wrong then the neural network examines its structure in order to better adapt its internal factors.

They are organized into layers, the first of which is called the input level and is used to enter data. When the connection between two successive levels of neurons is not necessary, then they are characterized as networks with additional power, while when connected at the same level they are characterized as networks with feedback. Neural networks perform learning, that is, the process of modifying the value of network stations and recall, that is, the process of calculating an output vector for a specific input vector and weights. If the neural network fails to model training data, it is understood as incomplete learning. Neural networks as learning systems with examples can classify them into useful forms. The ability to recognize patterns is achieved through appropriate correlations resulting from training data, avoiding data noise.

Each of the neurons receives inputs, performs a learning function and produces an output. Each neuron operates independently of the rest. Neurons are connected by connections that multiply by some weight. The values that the weights are determined by the process of learning the network and their regulation implies the ability of the neural network to learn. Therefore, neural networks are able to learn nonlinear correlations of income and results from training data, provide solutions to unknown environments, automatically adjust their burdens and withstand structural disturbances. The learning is done by changing the burdens, which are designed to gradually get information that is later available for recovery. Most training cycles occur when the sample is used to modify the weight values before the end use of the network, as an application is called out of line[89].

3.4. Evolutionary algorithms and Decision Support Systems

[88] Neapolitan, R. (2018). ibid, pp 7
[89] Vlahavas, I. (2020), ibid., p. 547 et seq.

Evolutionary algorithms are used in cases of great complexity, using computational models of evolutionary processes and structures to design, define and implement them. These are heuristic methods of human behavior designed to mimic the transfer of biological evolution in research[90]. The purpose of the process is to produce better approaches to a final balanced solution. For each generation of solutions, a new set of approaches is created. This step is carried out through a selective process between independent approaches, which examine the degree of relevance to the specific problem. The solutions are improved with natural adaptation. Genetic algorithms are a type of evolutionary algorithm, a kind of stochastic algorithms that optimize the solution of a wide range of problems[91].

Algorithms are based on imitation of the biological process. This means that a population is represented by separate individuals, which in genetic algorithms consist of a chromosome, and therefore separate atoms and chromosomes are used without conceptual difference. Some chromosomes are called "parents" and are selected for reproduction. The initial population selection is based on the random selection of values for each individual variable. The production of offspring occurs either through the process of crossing or through the mutation process, or both. Crossover is the creation of two or more offspring using genetic material from two or more parents. The second procedure used to select the offspring is the mutation process, where a subset of variables is randomly selected and their values are changed. The production of offspring with different chromosomes is the result and is discontinued until there is no change or until an acceptable solution is found[92].

Decision Support Systems (DSS) consist primarily of a data management system and troubleshooting. The data is internal, i.e. raw, usually from an internal network. The external data comes from every source of information obtained in any way from the environment. The model management system contains the modelling databases, which are related to quantitative values. This type of system offers modeling using programming languages and other tools to model user preferences and integrate the models available into DSS. The knowledge-based management system refers to the process of collecting information by creating new information by combining existing information. This type of system is particularly useful in unstructured problems, as it provides expertise in a specific area of a field of knowledge through knowledge bases. The user interface system refers to the communication between technological equipment and the user, i.e. it aims at easier and more functional information. The user is the last part of the DSS and is essentially the person who handles the data entry, maintenance and final decision. The communication subsystem is the department responsible for entering data into the system and presenting results to the user. The system asks questions to the user, from whom he is asked to answer in order for the system to obtain the information needed to support the decision[93]. There are five main types of DSS[94]. Model-dependent DSS controls input, optimization, simulation and control models. DSS models use specific

[90] Neapolitan, R. (2018), ibid, pp 354 et seq
[91] Russell, S. J., & Norvig, P. (2021), ibid, pp 628 et seq
[92] Vlahavas, I. (2020), ibid., p. 137 et seq.
[93] Russell, S. J., & Norvig, P. (2021), ibid, pp 373
[94] Vlahavas, I. (2020), ibid., p. 847 et seq.

data and decision-making criteria to help users make decisions to evaluate the scenario, but usually no large databases are needed for models based on DSS. In addition, DSS are based on data that enhances the exposure and management of an internal company data collection and sometimes public and actual data. The most basic degree of accessibility is provided by simple file systems accessible through interpellation and remediation software. Data-driven digital analytics have the highest degree of flexibility and decision support, which are related to the study of a complete historical dataset.

4. Explaining AI vis-à-vis human input

Society uses the benefits of this in everyday life in services such as facial recognition systems[95] or advanced driver assistance systems[96]. Uncertainty is an important issue for solving problems with the agent. Even if the researcher introduces a large number of possible conditions, it does not negate the possibility that unknown cases may arise or the recorded conditions will present a different (than expected) set of consequences. Especially when we are talking about complex issues, such as medical issues, the possibilities are numerous and almost impossible to record in their entirety. To address this issue, the agent needs to proceed with the preparation of the plan based on probabilities. For example, if 10 mg of Phenylephrine is treated in 100% of cases based on the knowledge of the researcher (it receives a grade of 1), if not (grade 0), while if there is some uncertainty that the specific quantity does not have the specific results based on statistical data, then it receives a grade of less than 1. AI may change behavior during operation to respond to unpredictable information or events. This is distinguished from products from assisted AI systems created by material human intervention and/or direction.

Modern AI systems utilize Utility theory in order to calculate probabilities that a particular outcome is valid or not and thereby base a decision. Utility theory exists in conjunction with decision theory. Utility theory is complemented by the concept of "expected utility" as a value that represents the average usefulness of all possible outcomes of a situation, weighted by the probability of the outcome occurring. From the theory derives the principle of maximum expected utility, based on which the agent acts in order to maximize its expected usefulness. Finding this requires listing all sequences of actions. In a deterministic environment (where the data are known), where the agent decides easily between two cases, in which he attributes a similar value (utility) it is easy to choose (strict dominance). At the level of real problems, when the results of the actions are not certain, there is contemplative dominance.

AI to interact with the natural world needs mechanical or electrical parts parts. The term robot refers to physical agents who perform tasks in the physical world. Robots have sensors to perceive the environment and the changes that occur, and

[95] Biometric AI is used in applications to uniquely identify a person by analyzing patterns based on the texture and shape of the face
[96] Like autopilot Tesla is already common for thousands of drivers in everyday life

devices that act, with which the energies are exerted on the environment. Specifically, sensors are divided into passive (which receive signals from environmental sources such as cameras) and assets (which send signals to detect objects in the environment). Action devices and sensors help to locate, i.e. knowing the location of objects in the environment, just as a robot using wheels and arms rotates its camera to find a specific object. Current AI systems can be considered autonomous in the sense that they can find a solution to a problem regardless of direct human surveillance, based on appropriate input data and decision criteria entered by the user or the programmer. However, primarily the construction and/or operation of these do not arise without the (decisive) human intervention, which is expressed either through the input of data or through the choice of a specific direction and setting of criteria and conditions[97].

The Working Document of the International Union for the Protection of Intellectual Property for AI and Intellectual Property provides useful guidance in distinguishing cases of human contribution to the production of a product from an AI system. The human intellectual effort may involve the selection and classification of input data used to train the AI system or to select data, but the classification of these selected data should be done by the AI system if no human intellectual effort is used in the selection and classification of data. At the stage of product creation, human intellectual effort may be involved in instructing the AI system to guide the creation of the work, or the AI system may create a work without human intellectual effort during the creation. At the product evaluation stage, human intellectual effort may be involved in the control and delivery of the final work to the end-user or the AI system itself may deliver the final work to end-users without human control or intervention, based on preciously-set criteria[98].

One of very simple examples of the use of artificial intelligence is the resolution of scheduling problems with limited resources. These problems involve the requirement to complete a series of tasks, consisting of a set of actions. Each action may require specific resources, which in an example of a real problem are almost always limited. The planning agent will have to find the best solution, creating a timetable for the start-up and completion of the actions, as well as the presentation of the result, constantly repeating different paths of preparation of actions. For the agent to function, the creation of an algorithm is required, which depending on the variables and values, may be lengthy. An example of an algorithm is the minimum slack, which, by identifying the results of the previous repetitions, selects each time the action that has the shortest completion time, according to preset criteria and conditions. Another method of action of agents is based on hierarchical networks of work. The initial design/plan is the top, which is broken down into individual actions. This analysis is called decomposition of energies and is carried out, continuously, from the agent to the result in primary energies. Primary actions are carried out automatically by the agent and do not require further decomposition. For example for

[97] International Association for the Protection of Intellectual Property. (2020, February 14). Written Comments on the WIPO Draft Issues Paper on Intellectual Property Policy and AI. Recovery by WIPO Conversation on Intellectual Property (IP) and AI (AI): https://www.wipo.int/export/sites/www/about-ip/en/artificial_intelligence/call_for_comments/pdf/org_aippi.pdf

[98] Lambert, P. (2017). Computer-generated works and copyright: selfies, traps, robots, AI and machine learning. European intellectual property review

the manufacture of a drug, the agent will decompose, initially, the plan into individual actions, such as research, testing and production, and then proceed to decompose these, such as "researchers carry out bibliographic and laboratory research". The decomposition may be interrupted at that point (in the research part), depending on the level of complexity, the input data and the requirements to the agent[99].

The figure below shows the process of decomposition of energies at the "Research" stage for drug creation. Primary energies are quite simplified by the actual process of research and testing of a drug, while in between them, other primary and complex actions are normally inserted.

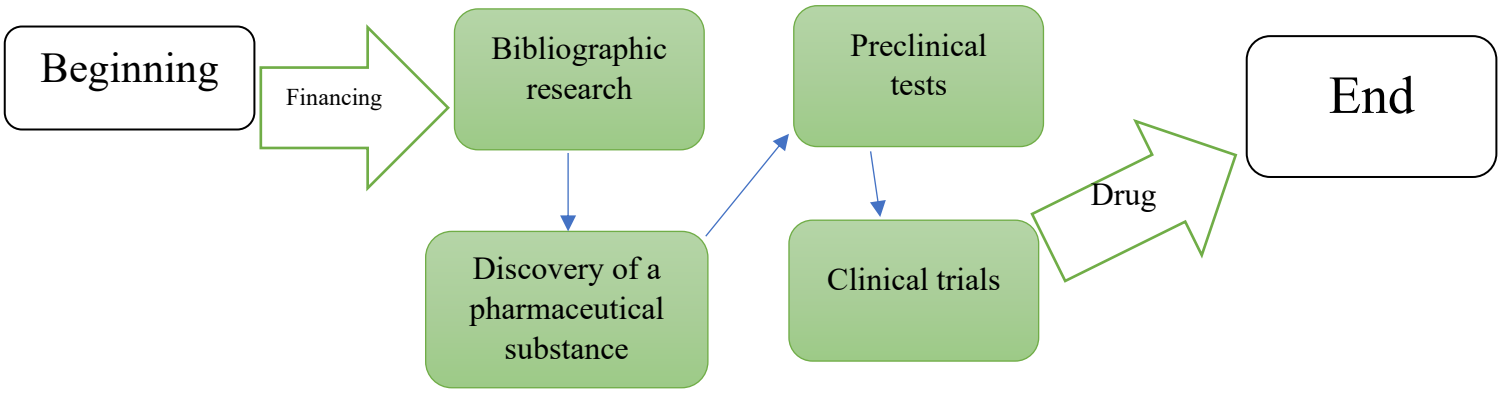

Figure 2: Simplified evolution of an inventive process in the field of the drug

After the agent creates the plan, it is stored in its memory. So the agent, learning how to resolve the issue that was raised, tries to create a plan of general application and resolution of similar issues (with the appropriate interventions). The general application of a plan in multiple cases requires the data to be clear and identifiable (barred indeterminacy). The absence of these implies a non-bound indeterminateness where the totality of the (unpredictable and non-unforeseen) effects of the actions is enormous and cannot be imprinted as information. To address unfettered indeterminacy, the "classical" design agent needs to act as a continuous design agent, where the agent produces shots with different conditions. The difference between the two agents is that the "classic" agent interrupts the process of producing a plan when he achieves the goal[100]. This kind of agent is optimal for real-world problems. A third type of agent is the conditional design agent, which operates on the basis of the produced conditions. Specifically, for the realization of an action, depending on the result of a primary energy, the next step is differentiated, such as if the dose of 3ml of pharmaceutical substance A simply causes the reduction of a symptom, the pharmaceutical substance B is administered, while if two symptoms are reduced, substance C is administered. The procedure could be reflected in terms where they are used in the Python programming language (then, if, else).

[99] Russell, S. J., & Norvig, P. (2021), ibid, pp 483 et seq, Vlahavas, I. (2020, ibid, p. 321
[100] Russell, S. J., & Norvig, P. (2021), ibid., p. 495

4.1. DABUS case

The first invention by an AI system as an inventor were applications submitted in 2018/19 by the Device for the Autonomous Bootstrapping of Unified Sentience to the UK Intellectual Property Office (UKIPO), the EPO and the United States Patent and Trademark Office (USPTO). In 1994, the scientist in computer science Dr. S. Thaler has unveiled an AI architecture that he called the "Creativity Machine", a computational model to mimic the fundamental mechanisms responsible for idea formation. The Creativity Machine combines an artificial neural network, which produces a new output in response as a result of the connection of the network to a neural network, which evaluates the derivatives. The second network evaluates the derivative for elements innovation compared to the existing knowledge of the AI system and offers the analysis in the first network[101]. Therefore, the AI system, called DABUS, consists of artificial neural networks, enriched with information from various sources. A set of networks carries out the evaluation of the projects produced on the criteria of innovation, usefulness and value. The training received was not configured for the inventions under application[102].

This results in an AI system that creates new ideas by reshaping its internal artificial network. An example is, an exhibition of the Creativity Machine by its creator in a song and the production of 11 thousand in 2 days. Dr. S. Thaler compared the Creativity Machine and its processes with a human brain and consciousness, as the two artificial neural networks mimic the main cognitive circuit of the human brain: the chamber-cortical cycle. Like the brain, a Creativity Machine is capable of producing original works of information rather than simply correlating patterns and adapting to new scenarios without additional human interference. Dr. S. Thaler argued that the Machine is very different from a program that simply produces a range of possible solutions to a problem in combination and with a filtering algorithm it chooses the best one. The Creativity Machine patent application was first filed on January 26, 1996 and granted on December 22, 1998. Shortly afterwards, Dr. S. Thaler filed a patent application for the invention titled "Neural Network based on the Prototyping System" and Method", which is as he claims is an invention of the Machine (DABUS), although the same Dr. S. Thaler chose not to disclose this when filing the application[103].

The applications marked a critical moment in the evolution of industrial property law and the history of AI. All three applications were submitted by Dr. S. Thaler, with the DABUS system referred to as the inventor. Before the UKIPO, it was argued that Dr. Thaler, should be listed as the inventor. Dr. S. Thaler claimed to be

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[101] T 0521/95 Appeals Council of the EPO, if an AI technology is implemented in the form of a neural network, it may be necessary to describe in detail the topology of the network and the way in which weights are defined. In this particular request it did not provide specific information required to create the network. Nevertheless, was considered to be technology new and based on recent physiological research, and that was not known to a person who is experienced in art.

[102] US 2015/0379394 A1, US 7,454,388 B2

[103] Abbott, R. (2020). Artificial Inventors. At R. Abbott, The Reasonable Robot (71-91). Cambridge: Cambridge University Press

the owner of DABUS, before the EPO, and that he bore related rights with the DABUS system and before the USPTO, that he was the protector of DABUS. In the context of the applications for the DABUS system, the decisions of the patent offices in all three jurisdictions failed to address the question of legal personality. Judge John W Salmond, already, since 1966, has been jurispruding on the issue of personality that *the individual is in principle a human being and the personality includes the characteristics of man (such as rights). By law, however, personality is also attributed to non-human beings, such as a capital company or objects of high importance. According to legal theory, a person is anything that can be a subject of rights or obligations whether it is human or not. A legal person is anything other than a human being or not. The man to whom the law attributes personality*[104].

Traditionally, people understand machines as devices directed by people who perform a designed energy in support of humans. Although the autonomous creative possibilities are given and change the process of invention, they are still widely regarded as tools used by man. However, various patent offices worldwide are faced with situations where the applicant designates an AI system as the inventor of the object instead of a human, according to their owners' own assessment. The existing framework of the European patent system does not provide a clear answer to the question of whether an artificial actor can be recognized as an inventor. The EPC does not explicitly provide for the natural person's status as an inventor. Moreover, the EPO's Boards of Appeal have never been called upon to decide on this issue. Several provisions of the EPC, such as Articles 60, 62 and 81, refer to the term "inventor", but neither the Convention itself nor the Implementing Regulations define it. On the one hand, the preparatory work argues that the term inventor should be interpreted under international and not national law, however, the EPO is bound by the decisions of the contracting parties on the identity of the inventor (Article 61 Of Regulation 20(2)EPC). In the decisions of the courts of appeal, the term "inventor" is described as the "natural person who carried out the creative act of the invention and they have recognised that the inventor is a natural person[105].

In 2018 Dr. S. Thaler submitted two patent applications, one concerning a food container (EP3564144) and one concerning devices and methods for attracting increased attention (EP3563896). The "inventor" field was left blank intentionally. In the invitation from the EPO to complete this, the applicant submitted a form to designate the "DABUS" machine as the inventor. In a later application, the applicant identified himself as an inventor, as the successor to the title, as an employer of DABUS. The applicant explained that, in his opinion, the invention was made by a machine which identified the novelty of its own idea before any natural person did so. The EPO invited the applicant to oral proceedings, which took place at the end of November 2019. Following a further exchange of arguments, the EPO rejected both applications and provided the reasons for the decisions on 27 January 2020. An appeal was lodged in March 2020. On 21 December 2021, the Legal Board of Appeals did not accept the appeal by Dr. S. Thaler in cases J 8/20 and J 9/20. Article 90(3.5) of the

[104] Engel, A. (2020, September 15). Can a Patent Be Granted for an AI-Generated Invention? GRUR International, pp 1126-1127

[105] J 7/99 and J 8/82, 'inventor as the natural person who has performed the creative act of invention'

EPC stipulates that the EPO must reject an application if the applicant does not correct any deficiencies in his application. The reasons for rejection were that the application designated the application as an inventor and therefore would not meet the formal requirements of Article 81 EPC Rule 19(1) EPC. Secondly, the corrected application at the inventor's suggestion of the applicant himself, due to an employment relationship with the AI system is contrary to Article 81 Rule 60(1) EPC. In addition to these two main reasons, the EPO argued that neither particular patent requirements nor any public knowledge right to the inventor's identity would justify the emergence of an AI system as an inventor.

The EPO has made it clear that it is not opposed to the acceptance of applications for the registration of an invention produced by an AI system, as this would have the effect of hampering innovation[106]. Nevertheless, the EPO has rejected both applications, in which the initiator of the invention was designated as an AI system, on the grounds that an inventor specified in the application must be a natural person and not a machine. In both cases[107] the applicant was the same person and applied for the registration of a European patent in October and November 2018. The inventions involved a container for storing liquids and solids[108] and a distraction device[109]. The EPO, pursuant to Article 81 and Rule 19 of the EPC, requested the inclusion of the inventor's name if it was not mentioned in the application. By producing a document requesting recognition of an inventor's AI system, the EPO denied this. In the minutes of the meeting between the parties, the representatives of the applicants invoked the moral right of the public to know the actual inventor and to ??? No article of the EPC does explicitly mention that the inventor is due to be a natural person, although the word “inventor” alludes to that need. It was subsequently argued that the absence of ethical rights to AI systems is not a valid reason for rejection, as there are also natural persons who do not carry them. The President rejected the applications under Article 81 and Regulation 19(1) EPC[110]. In a subsequent document, the EPC carried out more analysis, in particular, it concluded that the reference to the name, forename and address of the inventor was no longer mentioned. Also, the name of an object is not the same as the name of a natural person[111] and according to Article 58 of the EPC the application is submitted by a natural person, a legal person and any body with legal personality, which is conferred by national law.

The EPO did not interpret the term "inventor", but acknowledged that it is left to the national legal orders of the contracting parties, due to the lack of a clear definition in the EPC. Of course, it argued that in the context of ingenuity, the European patent regime refers only to natural persons, as the Article 19(1) Rule

[106]Comments of EPI on IP and AI (WIPO Letter), https://www.wipo.int/export/sites/www/about-ip/en/artificial_intelligence/call_for_comments/pdf/org_epi.pdf
[107] EP18275163.6 and EP18275174.3
[108] No. N35111-EP - Description
[109] No. N35111-EP1 (NF) - Description
[110] No. Doc. 18275163.6 - Provision of a copy of the minutes of oral proceedings
[111] Article 4(4) 1 of Regulation 2016/679 of the European Parliament and of the Council of 27th s April 2016, on the protection of natural persons with regard to the processing of personal data and on the free movement of such data (General Data Protection Regulation), which states that a natural person may be identified, in particular by reference to a name or location (address)

requires for the application "the surname, forename and full address of the inventor". As the executives' regulations form an integral part of the European Patent Convention (Article 164(1) of the EPC), have the same legal value as the articles of the EPC itself. A historical interpretation of travaux preparators generally examines whether legal persons could be linked to the term inventor, but it is disputed whether the authors of the EPC had regard to AI in 1960. It was also argued that when comparing several national legal orders, the existence of a natural person is a prerequisite.

As regards the lack of personality (or identity) of AI, it is stated that it entails a lack of ability to possess rights related to the invention, such as the right to be referred to as an inventor (Article 62 of the EPC) and the right to be mentioned in the European patent application (Article 81 of the EPC). However, ingenuity and the ability to possess inventor rights are different issues, as the first is a requirement that refers to actual behavior and not a legal act. Depending on the current definition, it can mean the execution of the creative act of the invention or the conception of the inventive idea. Nor does the EPO have jurisdiction over the assessment of the question of the conferral of legal personality by the national legal systems. According to the EPO, the names given to natural persons not only serve identification but are part of the personality and enable the exercise of rights. Therefore, simply naming a thing would not meet the requirements of Regulation 19(1) EPC[112]. This argument suffers, as it does not explain how the fact of rights resulting from the possession of a name by a natural person precludes the possession of a simple name of an inventor. The EPO stated that the lack of legal personality of DABUS not only deprives the possibility of holding patent rights, but also of being part of a contract of dependent work. Secondly, the EPO opposed a possible succession of title. Therefore, as the holder of DABUS, according to the national legal orders of the contracting parties he is the owner of every product derived from a machine. In one view, however, a machine owner should have the same rights as an employer of a person[113].

The applicant argued that if the EPO does not accept AI systems as inventors, it will exclude inventions made by AI and the possibility of patentability in violation of Articles 52 to 57 EPC and 27 TRIPS. Provisions requiring the granting of patents without the need to identify the inventor. In addition, the applicant argued that a refusal to designate DABUS as an inventor would be detrimental to the public's right to know the true identity of the inventor as the subject matter of the patent was created without human intervention. The EPO argued that the legal framework of the EPC meets the objective of providing the public with information on inventors (Article 62 EPC, Article 20(2) EPC), but the EPO does not verify the authenticity of the inventor's name (Article 19(2) EPC), as it is for each interested party to challenge this decision before national courts (Section 20(2) EPC, 21 EPC). However, if the actual inventor is a machine, the right to challenge the EPO's act is lacking, as there is no possibility of going to court. According to the EPO, both the formal requirements, i.e.

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[112] Stierle, M. (2020, July 3). AI Designated as Inventor – An Analysis of the Recent EPO Decisions. GRUR International, pp 918 et seq

[113] Alexandre, F. (2017, June 17). The Legal Status of Artificially Intelligent Robots: Personhood, Taxation and Control. Tilburg University, pp 36

the requirement to identify the inventor (Article 81, Article 19(1) EPC) and the requirement to state the origin of the right in the European patent (Article 81, 60 (1) EPC), justify the rejection of an application involving a machine as an inventor. Given the fictitious granting of the right enshrined in Section 60(3) of the EPC, the EPO made an error in rejecting the application on the basis of an allegedly defective indication of origin. However, the first ground for refusal based on the defective name of the inventor (Article 81, Article 19(1) of the EPC), provides a sufficient basis for rejecting the request.

The prosecution before the USPTO in the DABUS case begins on November 3, 2018, when Dr. S. Thaler applied for copyright. The creator of the Work was identified as the "Creativity Machine", with Dr. Thaler. S. Thaler to be referred to as the applicant along with a statement. On August 12, 2019, a USPTO expert processing the patent application sent a negative response, finding that it "lacks the element of a human creator". Two lawsuits followed before the USPTO alleging a lack of jurisprudence and an unlawful act (against the U.S. Constitution), argued, citing case-law that 'copyright law protects only 'the fruits of intellectual labor' which are 'based on the creative forces of the [human] mind'. Next, the phrase "original works of the author" under section 102(a) of the Copyright Act sets limits on what may be protected[114]. In the Sarpy case[115] (an important case concerning the protection of copyrighted photographs), the US Supreme Court referred to authors as human beings. This approach has been repeated in other previous Supreme Court, such as Mazer[116], and has also been consistently adopted by the courts of first instance. It points out that although there has been no case law on this issue, the direction of the case-law is that works created entirely by machines are not protected as works. Finally, in invoking the argument that 'non-human, artificial persons, such as companies' may be authors, the Council held that a machine could not conclude any binding legal contract and that the doctrine concerns ownership and not the existence of intellectual property rights[117].

The UKIPO decision was published on 14 December 2019, the EPO notified the rejection of the application on 20 December 2019, while the detailed decision was notified on 27 January 2020. The most recent is the USPTO's decision, dated April 22, 2020, which stated that the application did not recognize the inventor by his "legal name". The common reason for rejection in all decisions was that an AI system could not be classified as an inventor, as it was not a natural person. In addition, in the UKIPO and the EPO it was judged that Dr. S. Thaler was not legally able to represent the DABUS system, while the USPTO also challenged at first sight the ability of Dr. S. Thaler to file the application. The UKIPO decision states that "the Office accepts the DABUS system that it created the inventions as defined in the two applications". Dr. S. Thaler appealed the UKIPO's decision[118] to the Supreme Court, which had

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[114] USPTO. (2020, October). Public Views on AI and Intellectual Property Policy. Recovering from USPTO: https://www.uspto.gov/sites/default/files/documents/USPTO_AI-Report_2020-10-07.pdf
[115] Burrow-Giles Lithographic Company against Sarony, 111 UNITED STATES
[116] Mazer against Stein, 347 UNITED STATES
[117] Copyright Review Board email to Mr. Abbott, https://www.copyright.gov/rulings-filings/review-board/docs/a-recent-entrance-to-paradise.pdf
[118] UKIPO Judgment, point 15

ruled against it in September 2020. The Supreme Court held that the Patent Act requires a person applying for a patent to be a "person" with legal personality, whether it is a person or a company, and that a patent can only be granted to such a "person" with legal personality. Dr. S. Thaler appealed and the Court of Appeal unanimously concluded that under the law the inventor must be a person and that the law defines an inventor as "the true inventor of the invention", while the judges noted that the grant of a patent confers rights on its holder that cannot be owned or machine-operated. Although it was accepted that DABUS had created the invention, this did not mean that the machine was the inventor in the sense of the act, probably because it was operating under the guidance of a human.

The patent application No. 3.137.161 to the Canadian competent Authority (Authority), currently pending. In a letter from the Patent Office dated November 8, 2021, the Authority had taken the position that according to section 27(4) of the Patent Act, a patent application must be filed by an inventor or the legal representative of the inventor, the inventor needs to be recognized and the applicant must file a relevant declaration of rights. Since the inventor is a machine and cannot "have rights under Canadian law or transfer those rights to a human being, the application does not comply with Canadian law and patent rules". The Authority asked the applicant to comply by submitting a declaration on behalf of the machine and to identify, in that statement, himself as the legal representative of the machine. In the relevant documents in the inventor field, the Authority characterizes him as unknown. It is worth mentioning that in Canada, any person who contributes to the conception of an invention and refers to a patent application is considered an inventor. Section 27(1) of the Patent Act provides that a patent is granted to the "inventor or the legal representative of the inventor" if all the other conditions for the issuance of a patent are met. The term 'legal representative' is defined in the Patent Act to include, inter alia, heirs and servants, but the 'inventor' is not defined. The Supreme Court in Apotex Inc. v. Wellcome Foundation Ltd. interpreted the term "inventor" as "the person or persons who conceived" the invention.

As regards the EPO, it concluded that for non-natural persons, legal personality is conferred by law either through consistent case-law. In the case of AI inventors, there is no legislation or case law establishing such a legal situation[119]. UKIPO considers *that there is a clear expectation that the inventor is a natural person, a human being and not an AI machine*[120]. In the present case, it is worth mentioning that British law refers to ownership of computer-generated works. In the event that a literary, dramatic, musical or artistic work is produced by a computer, then the author is considered to be the person from whom the necessary arrangements for the creation of the work are made[121] (Section 9(3) UK Copyright, Design and Patent Act).

[119] EPO Decision, point 27
[120] UKIPO Judgment, point 18
[121] Bond, T. (2019, April 28). AI & copyright: Section 9(3) or authorship without an author. Journal of Intellectual Property Law & Practice, pel. 423

Before the Federal Court of Australia, the case of Thaler v Patent Commissioner[122] was heard, concerning the registration as inventor of DABUS in the Australian Office. Dr. S. Thaler and the decision has been appealed[123]. The Deputy Commissioner had decided that the DABUS could not be inventor under national law and rejected Dr. S. Thaler, because he did not "provide the name of the inventor of the invention to whom the application refers». This case concerned an application by Dr. S. Thaler for judicial review of the decision of the Deputy Commissioner. According to the Commissioner, an AI system can invent something that meets all the requirements of a patent but such a system cannot be invented because Section 15 of the Australian Patent Act of 1990 requires the award of the patent. The applicant argued that DABUS it is not a natural or legal person. The Court noted that AI systems include artificial neural networks, which simulate the way in which the human brain processes and produces information. Artificial neural networks are part of machine learning, which includes computer systems that learn from data. Artificial neural networks are based on mathematical modeling. The Court in its operative part states that the word "inventor" is a noun and "an agent may be an individual or thing to create", that "... reflects the reality with regard to many inventions that can be patented, where it cannot reasonably be said that the inventor is man" and that the law does not contain a provision to the contrary to confer the status of inventor to an AI system. Finally, the Court pointed out that this decision would contribute to strengthening innovation and providing an incentive for developers to invest the time in the development of such systems.

Finally, the South African Commission on Companies and Intellectual Property (CIPC) became the first Patent Office in the world to award a patent that names an AI as the inventor of a product. This decision was followed by a particular plausible criticism from professionals (other industrial property offices) and academics, since CIPC didn't examine the application in substance since its system is simply declarative. Section 27(1) of the Patent Act, defines who can apply for a patent[124], Section 30(1) defines the form of the application, and proof of power of attorney is required only in the case of applications submitted by persons other than the inventor (Section 30(4)). However, the article does not apply and the office in captive jurisdiction accepts the application, as long as it is submitted via PCT. Dr. S. Thaler has succeeded in recognizing the DABUS system with the PCT/IB2019/057809 application as an inventor, so it has submitted applications to a number of national offices worldwide under this dubious registration.

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[122] Federal Court her Australia, FCA 879, Thaler against Commissioner Diplomas Patent, her 30th s July 2021

[123] Commissioner to appeal court decision allowing AI to be an inventor, https://www.ipaustralia.gov.au/about-us/news-and-community/news/commissioner-appeal-court-decision-allowing-artificial-intelligence

[124] *An inventor or any other person who acquires from him the right to apply or so by the inventor as much as any other person suitable for a patent application in South Africa*

4.2. Examples of the use of AI systems in the inventive process

The project "The Next Rembrandt" was carried out in collaboration with a team from Microsoft, from the Rembrandt House Museum in Amsterdam, the Delft University of Technology and the Royal Mauritshuis Gallery in The Hague and was presented on 5 April 2016. The performance of 148 million pixels was based on 3D machine learning and printing technologies. 346 paintings were scanned to record the colors and hue of the oil. These images were then analyzed by an algorithm that extracted all the information. The program made it possible to highlight the characteristics of the painter's work in order to create the portrait from a robot entirely. Through an image processing and recognition algorithm, the basic details of Rembrandt's works such as eye spacing, nose position, face shapes and thirteen layers were printed sequentially with a special UV ink[125]. The protection of such works on the occasion of this project, professor of intellectual property law Andres Guadamuz[126] has expressed the view that they are not protected (at EU and national level of various legal instruments classes (Infopaq[127] as well as Beijing Feilin Law Firm[128], it has been held that the intellectual creation of the natural person is a prerequisite for the award of intellectual property rights[129].

The other option is to award to the owners of the AI system under the relevant national law (the UK Copyright Act provides for a specific provision for works created by AI as those produced by a computer in conditions where there are no human authors of the work and provides that in the case of a literary one, dramatic, musical or artistic work produced by a computer, the author is considered the person who contributes to the management of the work). The case of Express Newspapers Plc v Liverpool Daily Post & Echo Plc (1985) was the subject of a dispute over the contest concerning the distribution of cards to its readers, with each card having a sequence of five letters that had to be checked in relation to the winning sequences published by the Newspapers of the Express Group. The winning sequences were published in a grid of five rows and five columns of letters. players did not need to buy the newspaper to receive the cards, the Liverpool Daily Post reproduced the winning series in their newspapers. The UK Supreme Court found that the computer was nothing more than a tool through which the author created the "works" (derivatives), i.e. similar to an artist's pen or a typewriter. This case also gave rise to the addition of the UK copyright provision to computer-derived works.

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[125] Computer paints 'new Rembrandt' after old works analysis, https://www.bbc.com/news/technology-35977315

[126] Guadamuz, A. (2017, October). AI and copyright. WIPO MAGAZINE

[127] WEU, C-5/08, her 16th s July 2009, Infopaq International A/S Ms. The Danske Dagblades Forening

[128] Beijing Feilin Law Firm against Baidu Corporation, 239, Civil First Instance, Beijing Internet Court, her 25th s April 2019

[129] Ballardini, R., He, K., & Roos, T. (2019). AI-generated content: Authorship and inventorship in the age of AI. At T. Pihlajarinne, Online Distribution of Content in the EU (pp. 117-135). Cheltenham: Edward Elgar

On January 25, 2005, an invention was patented, which was created by the "Innovation Engine", an AI system based on genetic programming developed by John Koza. The Innovation Engine created the content of the patent without human intervention and existing knowledge, i.e. without a database. It simply required information about key components (such as resistors and diodes) and specifications for a desired result (performance measures such as voltage and frequency). Once again, the Patent Office was not aware of the role of the Machine. John Koza stated that his legal advisor advised him that his team and himself should be considered inventors, despite the fact that the entire invention was created from a computer[130]. It is worth mentioned once more in brief, the example of the invention produced by an AI system and patented (US Patent 5.852.815) entitled "Neural network prototype system and method" on December 22, 1998. Dr. S. Thaler claimed that the "Creativity Machine" mimics the human brain, using two artificial neural networks, and is therefore capable of creating creative effects in new scenarios without further human involvement. The creativity machine has been used to compose music, design vehicles[131]. The first invention produced by an AI system; however, Dr. S. Thaler was appointed as the creator. This was followed by another example of US Patent 6,847,851, titled "Devices for enhanced pid and non-PID general purpose controllers".

Monkey Selfies is a series of photographs taken by a monkey named Naruto in 2011 using equipment owned by photographer David Slater[132]. Slater confessed that he directed the photographs by setting up a camera on a tripod and leaving an external lever for the monkey to use it. He proceeded to register as works, but there were violations of the conferred right on the grounds that he did not take the photographs himself. On December 22, 2014, the U.S. Copyright Office stated that a photograph taken by a monkey, cannot be protected in accordance with the requirement of human participation. The photographs appeared in a published book by Slater through a self-publishing company Blurb Inc. On September 22, 2015, peta animal welfare association filed a lawsuit before the Northern California District Court seeking copyright to be granted to the monkey and the distribution of the profits to his advantage and his species. Judge William Orrick III rejected the request, citing its non-application of animal copyright law. PETA appealed, reaching a court settlement at the trial, which the Court of Appeal did not accept by ruling that animals have no legal authority to hold copyright claims.

In 2006, in the case of Nova Productions Ltd v Mazooma Games Ltd, concerning the attribution of copyright to regulations in game graphics produced following user actions, the court held that the copyright belongs to the owner of the game's production company, as the result is a consequence of proceedings of the program itself. In particular, Nova Productions Ltd v. Mazooma Games Ltd (2006), the Supreme Court had to determine whether the source code of computer games created using bitmap files was indeed the result of a developer's work. The court ruled that the composite frames created by the computer program were the developer's

[130] John Koza Has Built an Invention Machine, https://www.popsci.com/scitech/article/2006-04/john-koza-has-built-invention-machine/
[131] Perry, M., & Margoni, T. (2010, November). From music tracks to Google maps: Who owns computer-generated works? Computer Law & Security Review
[132] Naruto against Slater, 16-15469 (9th Cir. 2018)

effort as it devised the appearance of the various elements of the game and the rules and logic by which each frame and wrote the relevant computer program[133].

The Federal Court of Australia, in Telstra Corporation Limited v Phone Directories Company Pty Ltd (2010), ruled that in the automatic creation of computer-based telephone directories there is no copyright protection[134]. The directory was produced by specific directory-generating software systems by various developers. The original software was subsequently modified in accordance with Telstra's needs. Its application Genesis's main system lasted more than five years and cost over $300 million. The court ruled that despite the production of 91affidavits Telstra could not identify all the individuals they claimed to be the authors. Even if they could identify, they would probably not be "co-creators" under the law, as they did not cooperate with each other. Finally, even if all these obstacles could be overcome, important parts of the catalogues do not even have human creators, as they were created by computer systems. In Feilin v. Baidu (2019)[135], the Beijing Court of Justice held that works created by AI are not protected by copyright. However, the court ruled that they cannot be goods to the public or exploited by a third party[136].

Then, in Shenzhen Tencent v. Yinxun (2020), which was heard before the Nanshan District Court in Guangzhou Province, the court held that a work created by an AI system was a literary work protected by copyright law. The court first considered whether the article produced by the software was a literary work that could be protected. When assessing the originality of the project, the court considered whether the project was created autonomously and whether the appearance of the project was quite different from any existing project or that it would contain at least minimal creativity. He noted that the operation of the software gave only a technical result to the existing creative work of the defendant's team. The team entered the data and selected and arranged templates. Therefore, the effort of the team is directly linked to the work and under Article 11 of the relevant law the ownership of the copyrights is transferred to the legal person whose article was delivered and the website for which it was created.

In Burrow-Giles Lithographic Co. v. Sarony in 1884, the defendant company, accused of infringing copyright law, claimed that a famous photograph of Oscar Wilde was not classified as "writing" or as a work of a "writer." The company argued that even if a visual work could be protected by copyright, a photograph did not qualify for protection, because it is merely a mechanical reproduction of a physical phenomenon and thus could not embody the spiritual perception of its creator. The court disagreed, noting that all forms of imprinting in which the author's ideas are visibly expressed are amenable to copyright protection. In this particular case, the photographer had exercised sufficient control over the subject, which was described

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[133] Similarly In hypothesis Bamgboye against Reed, EMLR 5 (2004)

[134] White, C., & Matulionyte, R. (2019, December 5). AI Painting the Bigger Picture for Copyright Ownership. SSRN, p. 8

[135] Chen, M. (2019, July 6). Beijing Internet Court denies copyright to works created solely by AI. Journal of Intellectual Property Law & Practice, pp 593–594

[136] Ihalainen, J. (2018, March 6). Computer creativity: AI and copyright. Journal of Intellectual Property Law & Practice, p. 727

as an original work of art. The U.S. Copyright Office cites the Burrow-Giles case in support of the requirement to register as a natural person.

Specifically, with software-tool search for legal information (legislation, court cases, legal documents and commentaries on decisions) a report was reproduced. The petition and the included drawings were first created by the software and then modified manually by the plaintiff's staff. The court made the following findings, under existing Chinese copyright law, a product created from AI could not be considered a "work", regardless of whether it is original, only a creation by a natural person could be considered a "work." AI software could not be considered a creator; however, a note should be added indicating that the creation in question is from AI software. A software developer or a software user could not be the creator because they do not create or produce.

Conclusions

This thesis concludes with a number of comments on the above issues that have been set out. The most logical and practical way of solving the issue of ownership, currently, is considering a tool-software with implemented AI as a thing (article 947GCC). The owner of the thing is the owner of its products that an AI-tool produces based on articles 961 and 1064GCC, which concerns that the “fruits” of the thing are its products, as well as everything that one acquires from the thing according to its destination, but the primary owner may agree with someone else (1067GCC) that he will be the owner of the products when are produced. Also, according to article 10(1) Law 1733/87 the patent grants to the holder the exclusive right, to use products of his inventions, i.e. to produce, offer or place on the market, to use and to hold for the same purpose the product whose production is the result of the patented method.

“According to historical and teleological interpretation, the legislator in the sense of the inventor meant the natural person only. This is also deduced from the Travaux Preparatoires, where in many meetings there is a clear reference to natural persons[137]. On civil liability as highlighted in the Commission's Communication "While AI cannot of course be equated with humans or animals, the element of autonomy is an inherent feature that is relevant and very evident in both cases". The potential of AI at the present level of capacity to produce works or products of industrial interest with a high degree of autonomy and with a huge degree of autonomy is not questioned A typical example is the artwork, created by an AI system, "Portrait of Edmond Belamy", which has been sold for $432,500 by the auction house Christie's[138]. So, the question of copyright ownership starts from the

[137] BR/169 e/72 ett/AV/prk spot 31: «development Invention from face ή group Persons». In the Draft Contract in Article 15(1) he referred to as an inventor as an "employee".
BR/84 e/71 nan/KM/prk point 11: 'likelihood of refusal of his right (his) be mentioned'.
[138] Intellectual Property Protection for AI, https://www.finnegan.com/en/insights/articles/intellectual-property-protection-for-artificial-intelligence.html

question of whether AI can acquire a peculiar form of legal personality or identity. However, autonomy is admittedly not complete, so for the time being AI still remains a tool to serve the inventor's purposes.

Judge Richard Posner REF argued that no patents are needed to incentivize research and development in the software industry, as software innovation is often relatively cheap, gradual, quickly replaced and produced without relevant incentives[139]. Developers seek to enhance their reputation and satisfy scientific curiosity, while businesses invest in inventions created by AI, even in the absence of a patent. The current patent system will have to deal with the emergence of AI as long as there is little human contribution to the invention. The level of ingenuity will rise, because a product or method may no longer be inventive if a person who is experienced in this particular science would have found it using AI that was publicly available. In addition, the state of the art will become more uncertain and less obvious, because the capabilities of AI are difficult to assess and much less obvious than the content of a particular document. In addition, patent examiners may need extensive knowledge of the capabilities of current AI, which is not an easy task.

Any radical technology brings about change with an impact on society. It is often considered necessary to regulate to deal with some of these effects. Deciding on the appropriate regulatory framework for AI requires the provision of the impact it can have on society. Secondly, it concerns the prediction of the pace of the evolution of AI, the level of its autonomous characteristics and automation. These characteristics require interdisciplinarity to be understood and predicted. The AI market has grown from $8 billion in 2016 to more than $47 billion in 2020. Investments in AI increased by more than 300% in 2017 compared to with 2016. Smart machines, machine learning algorithms and neural networks have invaded people's daily lives. The digital society will increasingly be characterised by the interaction of human actors and non-human technological or virtual factors, so it is necessary to regulate the framework for balancing the two actors[140].

Finally, an issue for future studies that may arise from the fact that deep learning technologies is that they are not clearly defined, as they involve some randomized preparation. Therefore, even the same training data and the same neural network architecture may lead to slightly different rendering of machine learning. Similarly, it is recalled that AI and machine learning are not static, particularly when the computer learns, the behavior and therefore the description of the computer is dynamic until the training is terminated and is likely to be unpredictable. Therefore, it is worth comparing with the challenges and requirements with those of the technical fields of chemistry and biology. Certainly, AI systems are highly dependent on data to train intelligent algorithms. This data may be protected by the rights of third parties, and therefore, AI developers may need to obtain permission to access and use this data. Processing, cleaning and classification activities are often carried out in the original datasets by AI developers to ensure data adequacy, and these activities may be legally protected (such as classified databases may be amenable to legal

[139] Posner, R. (2003). The Economic Structure of Intellectual Property Law. Belknap Press

[140] Dow Jones and Spring wise, A New Dawn of AI: AI and its role in predictive modeling, https://www.dowjones.com/new-dawn-of-artificial-intelligence

protection). In particular, when there has been significant processing in the acquisition, verification or presentation of the contents of a database, they can be protected under the Database Directive[141]. However, where the collection of classified data does not reach the "investment limit", AI developers will likely rely on trade secrets to protect the bases. In cases where the processed and annotated dataset includes individual works (such as images that deserve copyright protection) or a protected object (a substantial part of a database that deserves special protection), it will depend on each case whether the annotated data set is considered a derivative[142].

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[141] Directive 96/9/EEC of the European Parliament and of the Council of 11th March 1996, on the legal protection of databases

[142] Bing, J. (2004, March). Electronic agents and intellectual property law. AI and Law, pp 48

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