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INTELLECTUAL PROPERTY RIGHTS IN ARTIFICIAL INTELLIGENCE

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INTRODUCTION

The thesis is devoted to the research of challenges that artificial intelligence (further referred to as “AI”) poses before intellectual property law and practice.

Importance and relevance of the topic. Despite the fact that studying of AI dates back to the middle of the 1950s, recent developments in this field and growing application of its achievements in software and hardware raise new questions about the future impact of AI on the modern concept of intellectual property. Especially influential factor in the context of this research is an elaboration of machine and deep learning which enable systems to analyse big sets of data and improve their performance of computational tasks through reinforcement learning without human interaction.

AI is already disrupting customary ethics, industries and economies. More and more companies are offering AI as a part of their products and services. For example, business giants as Amazon, Apple, Google, Intel, Microsoft, Salesforce, Samsung, and Facebook made development and implementation of AI one of their priorities. Further evidence that the future lies in AI is the launching of a non-profit research company called OpenAI by Sam Altman (Y Combinator) and Elon Musk (Tesla and SpaceX), which is focused on building and wide distribution of open-source tools for AI and the prevention of emergence of malicious super-intelligence.

Different surveys have revealed that: 62% of enterprises will apply AI by 2018, a market of AI will grow from $8 billion in 2016 to more than $47 billion in 2020. Even at present, there are number of day-to-day usable products that employ AI, among the most popular are: recommendation agents of Amazon, Netflix, Spotify, Pandora, biometric recognition systems, Tesla’s and Google’s self driving cars, voice assistants like Siri, Alexa, Google Now and Cortana, online customer support representatives on websites, smart home devices as smart voice controllers, energy managers, locks, alarms and cameras. Overall, AI is gradually transforming various industrial areas from entertainment to transportation, advertising and healthcare.

Moreover, there are several ways how advancements in AI can reshape the legal sphere. First of all, there are a number of creations based on AI that are capable to simulate human creative activity like generating music (Iamus, Mozart’s 42nd Symphony, Deep Mind), writing news reports, novels and poems (CGI, Project Voco, GOT-book, news that are produced by Yahoo!, Google, Facebook), drawing pictures (The Next Rembrandt, GANGogh, Vincent Van Bot), editing photos (Nividia, Deep Dream Generator, EnhanceNet-PAT), writing code (DeepCoder). This, in

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turn, undermines the standard perception of the “author” of work in legal doctrine, law and jurisprudence.

Secondly, European patent office recognizes artificial intelligence as one of the prominent software-driven inventions of the 4th industrial revolution along with 3D printing, drones, cloud computing, networked sensors etc. Such kinds of rapidly developing concepts should eventually bring changes to the current patent system (patentability criteria, granting cycles and designation of an “inventor”).

Besides, it could be mentioned that discoveries in AI sphere can simplify execution of administrative tasks in law firms, i.e. an AI engine can take search and analyze of intellectual property databases.

There are a number of works that are addressing key issues relevant to the topic of this research. For example, technological analysis of AI is the backbone for understanding AI as a copyright object or an invention. Authors like Ela Kumar (Artificial Intelligence, 2008), Michael R. Genesereth, Nils J. Nilsson (Logical Foundations of Artificial Intelligence, 2012) John Haugeland (Artificial Intelligence: The Very Idea, 1989), M. Tim Jones (Artificial Intelligence: A Systems Approach, 2015), Neeta Deshpande (Artificial Intelligence, 2009) have devoted their academic pursuits to exploration of this technology.

At the same time there are limited quantities of articles, books or guides that deal with understanding of legal aspects of protection of rights over the object which is constructed with the application of an AI or that consider possibility of emergence of ownership rights of AI and its creators and owners, over the results of the AI’s “creativity”. It would be prudent to mention some of the following works: Allocating Ownership Rights in Computer-Generated Works (Pamela Samuelson, 1985), Law, Computer Science, and Artificial Intelligence (Ajit Narayanan, Mervyn Bennun, 1998), Coding Creativity: Copyright and the Artificially Intelligent Author (A. Birdy, 2011), Intellectual Property Protection for Artificial Intelligence (Frank A. DeCosta III, Aliza G. Carrano, 2017), Artificial intelligence and copyright (A. Guadamuz, 2017). Due to the particularities of copyright law of the USA, traditionally American researchers pay greater attention to this problem. Moreover, majority of the studies have a piecemeal approach to the challenge that computer intelligence poses before intellectual property legislation.

In contrast, this thesis will analyze the problem referred at hand in more depth: how can rights of programmers and other people involved in creation of an AI system be protected and who will be the owner of derivative or sufficiently unique works produced by AI as a result.

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According to this scope of the research the aim of it is to identify weaknesses, gaps and conflicts in modern intellectual property law regarding AI technologies and prepare proposals for improvement of existing legal norms.

The primary objectives of the proposed paper were: 1) to examine the regulation of ownership on AI within the current intellectual property framework; 2) to determine a copyright/patent holder of the original AI software at different stages of its development cycles; 3) To determine the author of the self-learned AI; 4) to figure out concerns which arise from fitting the concept of AI into the legal framework currently in force; 5) to draw up suggestions how the current legal framework should be amended to tackle the challenges created by AI technology.

Consequently, the work was structured as follows:

The first chapter is covers matters related to determination of AI, history of the development of such technologies and existing variety of AI implementation approaches and their classification.

The second chapter gives a general overview of the applicable legislation in EU and Estonia relevant to the protection of intellectual property as pertaining to AI.

The third chapter deals with questions of particularities of AI as an object of intellectual property, i.e. different types of technologies that are fundamental for its development. For this purpose a concrete example of AI was chosen.

The fourth chapter points out clearly theoretical and practical ways to resolve questions that exist in the modern intellectual property legal framework.

For the conduction of the reported research, the following methods were utilized: historical method in the process of reviewing of AI evolution and changes in legal attitudes in doctrine of intellectual property law; conceptual analysis and evaluation methods for overview of the existing legal framework in the sphere; method of description for exploration of AI technology, various its types and undertaking of the case study; law-in-context and comparative method for analyzing of specific examples of granting AI products with copyright or patent protection and comparative studies of legislation and case law in the EU, the USA and Canada.

Keywords: Artificial intelligence, copyright, machine learning, neural network, patentability.
1. DEFINITION, HISTORY OF DEVELOPMENT AND TYPES OF ARTIFICIAL INTELLIGENCE

For further examination and exploration of AI as an object of intellectual property it is necessary to identify what an AI encompasses.

A term “AI” was proposed for the first time by American computer scientist John McCarthy in 1955 for the Dartmouth Conference which took place in the summer of 1956.

In today's science, there is no one universally accepted definition of AI, so it must be inferred from several perspectives: as a sub-discipline of computer science, as a field of engineering, as a particular capacity of a machine or a system.

A linguistic analysis leads to the conclusion that the AI can be defined by two terms:

1) intelligence, which is the ability of a living organisms to make a right decision when given a set of inputs and a variety of possible actions\(^3\), so it requires such brain activities as understanding, planning, analyzing, solving and reasoning;

2) artificial, which means something not real or natural - created by human beings by applying various scientific and engineering techniques\(^4\).

In combination, these two terms present a simple explanation of the AI should be a machine that is capable of simulating human behavior. Neeta Deshpande underlines four possible goals of AI: to create systems that think/act like humans or systems that think/act rational (does the right thing through processes and intelligence)\(^5\).

Currently the most comprehensive term of “AI” was introduced by S. Russell and P. Norvig as “non-human intelligence that is measured by its ability to replicate human mental skills, such as pattern recognition, understanding natural language (NLP), adaptive learning from experience, strategizing, or reasoning about others”\(^6\). Such a description allows emphasis on what features developers have envisioned to give to their AI powered products.

The majority of researchers describe the history of AI’s development starting either from sixth-fifth century B.C., invoking Homer’s Iliad with a description of the winged Talos and Aristotle’s categorization of knowledge\(^7\) or from the 1930s concerning Kurt Gödel’s completeness and

\(^3\) M.T. Jones, Artificial Intelligence: A Systems Approach. New Delhi: Jones & Bartlett Learning, 2015, p.1
incompleteness theorems concerning provable and unprovable statements for systems.\(^8\) But in the context of this task, it is necessary to highlight key milestones and accomplishments of the evolution of AI technologies. The foundation for studies and research of AI was laid by Alan Turing in 1950, when he published a paper called “Computing Machinery and Intelligence” – the most prominent work in the sphere of philosophy of AI. In it, the author outlined the concept of the “Imitation Game” known as the “Turing Test” which is designed to identify if the machine is capable of thinking. The computer passes the test when a human interrogator cannot distinguish its written responses (received over a teleprinter) from those that could be given by a human being.

One of the earliest application of AI in real life took place in 1955 when Allen Newell and Herbert Simon created the first working AI program - the Logic Theorist, that produced proofs of mathematical theorems. On the basis of the Logic Theorist, they later created the General Problem Solver. In 1958 John McCarthy created the programming language called LISP which was capable of processing symbolic problems rather than digital ones. Basically, the period from 1956 (Dartmouth conference, that was mentioned above) up until 1974 is known as “The Golden Years of AI”. Among other significant achievements of scientists during this time timeframe were: 1) Unimate (the first industrial robot applied in a plant in the USA); 2) Herbert Gelernter's Geometry Theorem Prover and SAINT (heuristic programs for solving tasks in algebra and geometry); 3) STUDENT and ELIZA (programs that understood natural language, the latter was the first program capable to carry on conversation on any topic in English by supplementing phrases that it heard with new grammatical structures); 4) expert systems - knowledge-based programs for scientific reasoning in specific fields of studies, as DENDRAL (analyzed chemical structures) and MYCIN (produced medical diagnosis); 5) one of the first logic programming language PROLOG, which later replaced LISP; 6) WABOT-1 the first anthropomorphic robot that applied limb-control, vision and conversation systems.\(^9\)

However, after 1974 and up until 1980, AI research entered into dismay, due to the lack of funding and widespread criticism for a slow pace of progress in the field.

AI systems saw a boom after 1980s, when their algorithms were adopted to commercial use in Internet search engines, online shops, self-driving cars etc. To date, latest examples of success in AI development may include: the Deep Blue computer chess-playing system, that beat the world chess champion Garry Kasparov in 1997, IBM’s question answering system Watsons which won in the quiz show “Jeopardy!” champions Brad Rutter and Ken Jennings in 2011, Eugene Goostman


Last visited: 28.11.2017
chatbot claimed to be the first AI that passed the Turing Test in 2014\textsuperscript{10}, Google’s Deep Mind playing system AlphaGo that triumphed over Go (Chinese game) champion Lee Sedol in 2016.

Nowadays AI-powered products and services can be found in different spheres: industry, medicine, transportation, banking, surveillance, e-commerce, speech recognition and machine translation market, education etc.

In the most general sense, the type of AI can be discerned on grounds of their interned application, or approach to technical implementation.

In the sense of displayed and intended intelligence prominent types of artificial intelligence are:

1. Weak AI has also come to be associated with attempts to build programs that aid, rather than duplicate, human mental activities.\textsuperscript{11} All currently existing systems considered artificial intelligence of any sort are weak AI at most.

2. Strong AI is associated with the claim that an appropriately programmed computer could be a mind and could think at least as well as humans do.\textsuperscript{12}

The following paragraphs are intended to present the basic definitions and understanding of different technical approaches of creating and implementing AI:

1. Symbolic AI is the collective name for all methods in artificial intelligence research that are based on high-level "symbolic" (human-readable) representations of problems, logic and search,\textsuperscript{13} which approach has been dubbed Good Old Fashioned Artificial Intelligence\textsuperscript{14} based on the assumption that many aspects of intelligence can be achieved by the manipulation of symbols, an assumption defined as the “physical symbol systems hypothesis”.\textsuperscript{15}

2. Sub-symbolic approach to creation of AI incorporates methods which manage to approach intelligence without specific representations of knowledge.\textsuperscript{16} The sub-symbolic approach to creation of AI includes: early cybernetics and brain simulation, behavior based artificial intelligence, nouvel AI, soft computing, computational creativity, brain emotional learning based intelligent controller, AI which incorporates probabilistic methods (Bayesian network, Hidden Markov model, Kalman filter), AI with implementation of prediction models utilizing chaos theory, machine learing approach that utilizes artificial neural networks (hybrid neural network, recurrent neural network,
perceptron) and support Vector Machines (fuzzy systems, evolutionary computation, metaheuristic and swarm intelligence).

As it can be inferred from this non-exhaustive list, there are a number of ways in which one could approach the creation of an AI. To that end it must be noted that the technical peculiarities of each of the approaches would lend a specific problem, form a legal standpoint. Therefore, in the interest of practicality the presented work shall deal with the most prominently used approach in the state of the art, which shall be discussed in more depth in the case study of the presented work.

2. CURRENT LAW RELEVANT TO THE PROTECTION OF INTELLECTUAL PROPERTY OVER AI

2.1. OVERVIEW OF EUROPEAN LEGISLATION

A product powered by an AI can gain protection under copyright, patent, trademark and trade secret. In light of this thesis, some questions may arise that are not fully regulated in the EU, because the lack of legal harmonization in different member states, connected with the concept of authorship, requirements for joint authorship and features that illustrate originality of work.

First of all, it is necessary to make a view on the creator of an AI as the author in regards to the copyrightable source code. According to the Art. 4 of the WIPO Copyright Treaty, 1996, computer programs are protected as literary works within the meaning of Article 2 of the Berne Convention and their protection does not depend on the mode or form of their expression\(^17\). Article 10 of the TRIPS Agreement also states that: “Computer programs, whether in source or object code, shall be protected as literary works. Compilations of data or other material, whether in machine readable or other form, which by reason of the selection or arrangement of their contents constitute intellectual creations shall be protected as such”\(^18\).

On 7 June 1988, the European Commission issued the Green Paper on Copyright and the Challenge of Technology, where it confirmed the necessity for provisions of sui generis copyright protection for computer programs.

Under recitals 7, 8 of the Computer Programs Directive, any form of computer program can be awarded protection. In respect of the criteria to be applied in determining whether or not the computer program could be regarded as an original work, no tests as to the qualitative or aesthetic

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merits of the program should be applied\textsuperscript{19}. Nonetheless, recital 11 stipulates that only the expression of a program is protected, whereas ideas and principles which underlie any element of a program are not protected by copyright\textsuperscript{20}. Regarding the question of authorship, the directive recognizes only one criterion for eligibility of the creation – originality in the sense that it is the author’s own intellectual creation. The work does not have to be protected in its entirety, parts of it also can be treated as a whole work, since, as such, they share the originality of the whole work\textsuperscript{21} (Infopaq case). The same can be said about complex codes like videogames which may comprise of graphics and sounds (encoded in computer language). Such elements are also part of the code originality and are protected with the entire work\textsuperscript{22} (case Nintendo v PC Box). According to Art. 2 and 3 of the Computer Programs Directive\textsuperscript{23} the author of the computer program shall be the natural person or group of natural persons who has created the program or the legal person designated as the right holder.

Consequently, only programmers, who write an AI code and their employers, who can automatically get rights on that work (under the terms of a contract), can be considered as authors of the AI. Namely the programmer entitles the software to produce some output by execution of his code even with implementation of particular inputs from some user that limits creative freedom of its customers. These subjects are granted with standard economic (of reproduction, of communication to the public, of renting and lending, of distribution) and moral rights (to paternity, integrity and control of publication) to an AI code.

Furthermore, Directive 2006/116/EC also counts down the duration of copyright protection based only on the lifetime of the author as of natural person: lasts for the life of the author and for 70 years after his death, irrespective of the date when the work was lawfully made available to the public\textsuperscript{24}

As was previously noted not all types of AI present the same legal problems, which are more evident in the aspects of copyright law, because of it is a failure to conclusively answer the questions: Will the programmer remain the owner of the code, if the AI is capable to change by itself (e.g. probabilistic programming systems of Gamalon, Inc)? What types of data can be used for

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\textsuperscript{22}Judgement of CJEU Case C-355/12, Nintendo v PC Box, para 23. Available on: https://www.ippt.eu/items/ippt20142301-cjue-nintendo-v-pc-box Last visited: 28.11.2017


teaching an AI (is it possible to use copyrighted works too)? Who owns the database generated by AI during its usage - supplier or user (generally this issue is regulated by a contract)? Who will own the rights of an artworks or inventions created by an AI?

According to theory, the programmer would still be the author of the initial source code, inasmuch it is obvious that the programe is the sole author of the code, if it remains in its original form. It can only be assumed that if the programmer creates a code which is capable to make alteration to itself, he creates a basis for creation of derivative works by the code itself. Despite the lack of definition in EU law “derivative work”, it is known that under Art. 2 of the EU Software Directive producing of derivative works without the author’s consent represents infringement of his moral rights of integrity of his creation: “the translation, adaptation, arrangement and any other alteration of a computer program and the reproduction of the results thereof, without prejudice to the rights of the person who alters the program”25 should be authorized by the right holder. The issue will be further developed in the chapter 4.

Traditionally, in order to train an AI to recognize patterns, thousands of images, videos, melodies and other copies of humans’ works are used. To circumvent liability for infringement of copyright on such materials, developers of AI either create such data by themselves or use licenses from third parties. Both alternatives, however, are time and money consuming. The Copyright Directive of the EU provides exhaustive list of copyright infringement exceptions, yet leave some discretion to the exceptions to the Member States. Pursuant to article 5 (3) (a) states may provide limitations to the author’s rights as: use for the sole purpose of illustration for teaching or scientific research, as long as the source, the author's name, is indicated26. Recital 34 and 42 of the Directive stipulate: 1) Member States should be given the option of providing for certain exceptions or limitations for cases such as educational and scientific purposes, for the benefit of public institutions such as libraries and archives, for purposes of news reporting, for quotations, for use by people with disabilities, for public security uses and for uses in administrative and judicial proceedings; 2) when applying the exception or limitation for non-commercial educational and scientific research purposes, including distance learning, the non-commercial nature of the activity in question should be determined by that activity as such (organizational structure and the means of funding are not the decisive factors)27. Bearing in mind that works that are used by an AI are not being made to the general public (used once or kept in a separate file/ library) and that their usage is

crucial for the creation of a non-biased AI, the concept of “fair use” should be revised to allow AI developers to use any work for the purpose of furthering technological development. Such modernization of copyright rules, would obviously keep pace with copyright reform in the Digital Single Market.

Last two questions are open-ended and require a more detailed study. Therefore, these issues will receive due consideration in the final part of the presented paper. Copyright protection, just like trade secret regime (as customer of an AI does not need to have access to the source code), does little in respect of creation of analogous products by third parties.

AI data processing systems are also eligible for patent protection. There are numerous examples of granting patents to AI products. According to the World Intellectual Property Organization (WIPO) between 2007 and 2017 - 3,054 patents were filed on AI. Those include: 1,030 applied for in the USA; 674 in China; 467 in the Republic of Korea; and the remainder in the EPO and other regional patent offices. In the USA such inventions fall within separate class 706 (AI), but according to WIPO class system, where AI are not allocated, they can fall under G10L (speech or voice processing), G06N (computer system based on specific computational models) etc.

The European Patent Convention of 5 October 1973 defines the following criteria for patentability of an invention: susceptibility for industrial application, novelty and involvement of an inventive step. It must be noted that a patent application may be filed by any natural or legal person, or a body equivalent to a legal person, according to the Art. 58 of the Convention.

While the Art. 52(2)(c) excludes from inventions programs for computers, the circumvention of this rule requires from the applicant only an indication of further technical effect that the program may have. In the practice of the Board of Appeal, such effect may be found e.g. in the control of an industrial process, in the internal functioning of the computer itself or its interfaces under the influence of the program, in effect on the efficiency or security of a process, the management of computer resources required or the rate of data transfer.

Therefore, inventions that apply machine learning approaches to fields in engineering (navigating a robot, game, controlling power supply) are generally granted patent protection more frequently by the EPO. Still there is an increased risk of claim features being considered to fall into the domain of mathematical methods or schemes, rules and methods for performing mental acts or

doing business and presentations of information (for example, algorithms that adaptively arranges icons on a smartphone). Thus, it is easier to acquire patent protection for an AI in spheres of audio, video, image processing, medicine or biochemistry. Conversely, advances in search, classification and natural language processing are more likely to be found as having “non-technical” features.\textsuperscript{32}

The same approach has been applied in the USA and Canada courts. For example, in the USA there were three cases on patentability of software products: Alice Corp. v. CLS Bank International, Versata Development Group v. SAP America Inc., Diamond v. Diehr, DDR Holdings v. Hotels.com and Enfish, LLC v. Microsoft Corp. In the last case the Federal Court of Appeal came to the conclusion that improvements of overall computer performance can be made not only through hardware, but through software too. The invention (the self-referential table) was not recognized an abstract idea, while the patent tech allowed faster searching, more effective storage of data other than structured text and more flexibility in configuring the database\textsuperscript{33}. Canadian Federal Court of appeal in the case against Amazon Inc. went further and held that a data-processing technique may be patentable only if it is only one of a number of essential elements in a novel combination, but not the whole invention\textsuperscript{34}.

Therefore, there is the range of problematic issues in the sphere of copyright and patent protection of AI that are topical for EU and some other countries, that will be addressed in further chapters.

2.2. THE CONSIDERATION OF EXISTING ESTONIAN NORMS

In regards to Estonian law, the legislation that relevantly pertains to the question of intellectual protection would be the Copyright Act and the Patents act. This section of the text shall be dedicated to the enumeration of relevant articles of the stipulated legal acts, after which an examination of their application to a AI program shall be provided.

There is the number of relevant to the topic provisions in the Copyright Act. The Copyright act is applicable in instances where the author of the work is an Estonian citizen, or in the case where the work is first published in Estonia, or not published but located in the Estonia, or if such works are protected by an international agreement to which Estonia is a part of.\textsuperscript{35}


The copyright act, in its Article 4(2), defines a copyrightable work as “any original result in the literary, artistic or scientific domains which are expressed in an objective form and can be perceived and reproduced in this form either directly or by means of technical devices.” Furthermore, the work can only be copyrighted if its the authors own intellectual creation.\(^{36}\)

Within the same Article 4(3)(3) it is stipulated that the copyright act establishes the possibility of copyrighting a computer program, whereas such awarded copyright protection is equated to that of a literary work and applied to the expression of the program in any form over the computer.\(^{37}\)

Article 5(1)(1) of the same act states that copyright cannot be applied to ideas, images, notions, theories, processes, systems, methods, concepts, principles, discoveries, inventions, and other results of intellectual activities which are described, explained or expressed in any other manner in a work.\(^{38}\)

Article 7(1) and 7(2) stipulate that a copyright ownership for a work occurs at the moment of the creation of the work,\(^{39}\) which moment is defined as an expression of the work in any objective form which allows the perception and reproduction or fixation of the work.\(^{40}\)

In the current framework of Estonia regarding copyright, the author of the AI program would be the creator of the AI program.

The program itself could be subject to copyright in its traditional sense, inasmuch Article 4(3)(3) prescribes for it. Theoretically, the program could be subjected to copyright in the event it was never utilized, and remained in its original form. Once the AI program has been used for its intended purpose, its core structure and coding is changed in such a way that it no longer represents an expression of the original creator, but rather a derivative work of the original. Therefore, the problem resides in the fact that the ownership of the copyright cannot be attributed to neither the creator, nor the AI program itself, as the former is not the creator of the derivative work, and the latter is not perceived as a legal entity in the current state of the legislation.

The right of authorization is in the present case derived from Article 13(1)(5) of the Copyright act.\(^{41}\) The lawfulness of the programs alteration of itself as a lawful user is prescribed under Article 24(1) which stipulates that unless otherwise prescribed by contract, the lawful user of a computer program may, without the authorization of the author of the program and without payment of additional remuneration adapt and transform the computer program in any other manner.

\(^{36}\) Copyright Act, \textit{op.cit.}, Article 4(2)
\(^{37}\) Copyright Act, \textit{op.cit.}, Article 4(3)(3)
\(^{38}\) Copyright Act, \textit{op.cit.}, Article 5(1)(1)
\(^{39}\) Copyright Act, \textit{op.cit.}, Article 7(1)
\(^{40}\) Copyright Act, \textit{op.cit.}, Article 7(2)
\(^{41}\) Copyright Act, \textit{op.cit.}, Article 13(1) (5)
if this is necessary for the use of the program on the device or devices, to the extent and for the purposes for which the program was obtained, or for the correction of errors present in the program.\textsuperscript{42}

To that extent, it should be observed that, while the Copyright act explicitly stipulates in Article 28(2) and 28(3) that an author of a work can only be a natural\textsuperscript{43} or a legal person,\textsuperscript{44} such a definition is absent in the case of the “lawful user”. If the legal status of an AI is raised to that of a limited understanding of a person in a legal sense, the meaning of the term “lawful user” could be extended to encompass the AI program as a “robot-agent”, thus solving the problems of its ever changing nature and ownership over it.

The Estonian Patents Act regards the inventor as a natural person or persons, who has created an invention as a result of his or her inventing activities.\textsuperscript{45}

The Patents Act itself stipulates that algorithms for computer programs are not regarded as the subject of inventions,\textsuperscript{46} however, “computer-implemented inventions are patentable, if they are new, have technical character and involve an inventive technical contribution to the prior art.”\textsuperscript{47}

Article 8 of the Patents Act stipulates that an invention is patentable if it posses the following elements\textsuperscript{48}:

1. Novelty which can be claimed if the invention does not form the state of the art
2. Involvement of an inventive step which is, having regard to the state of the art, not obvious to a person skilled in the art.
3. Susceptibility to industrial application, demonstrated by the plausibility of inventions manufacturing or use in economy.

Article 9(1) opts for the possibility to apply for patent protection for one, or a group of inventions, so linked as to form a single general inventive concept.

In the current legal framework of Estonia, since an AI program could be patented in the event that it fulfills the set conditions of solving a technical problem, novelty, involvement of an inventive step and industrial applicability. Every future iteration of the AI program could be patent protected under the original patent application, inasmuch it would be linked to the original iteration through a general inventive concept. The problem that would arise in the case at hand is that of

\begin{footnotesize}
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\begin{enumerate}
\item Copyright Act, \textit{op.cit}, Article 24(1)
\item Copyright Act, \textit{op.cit}, Article 28(2)
\item Copyright Act, \textit{op.cit}, Article 28(3)
\item Patents Act, Article 6 (2) (5)
\item “Can a computer programme or a mobile app be patented?” Available on: http://www.epa.ee/en/general-info/frequently-asked-questions Last visited: 29.11.2017
\item Patents Act, Article 8(1) (2) (4) (5)
\end{enumerate}
\end{footnotesize}
proving the technical effect of the program, inasmuch the program itself need to present a technical solution which solves an unsolved technical problem.\footnote{“Can a computer programme or a mobile app be patented?” Available on: \url{http://www.epa.ee/en/general-info/frequently-asked-questions} Last visited: 29.11.2017}

3. ARTIFICIAL INTELLIGENCE AS AN OBJECT OF INTELLECTUAL PROPERTY. CASE STUDY ON GOOGLE DEEP DREAM

Within the scope of presented work, Google’s Deep Dream program was chosen based on the fact that it is a supervised feed-forward multi-layer convolutional neural network, inasmuch such a technical approach of creation of AI is most commonly used in the state of the art.

In 2016 Google held in San Francisco an exhibition of works created by Deep Dream with human input, that ended with an auction for gathering donations for the Gray Area Foundation for the Arts, the most expensive of works cost $8 000. Taking into consideration that number of famous artists, as M. Akten, C. M. Kosemen, M. Klingemann, M. Zamagi, had applied Deep Dream software to their original works, it is crucial to turn to issue regarding the actual owner of the output that Deep Dream produces. This brings up the question of the author of the output that Deep Dream produces, because theoretically its ownership can be assigned to the person, who submits the photo, to the software engineer, to the person that conducts supervision training of the program or to the public domain.

3.1. EXPLANATION OF TECHNICAL BASIS OF GOOGLE’S DEEP DREAM

DeepDream is a computer image recognition program created by Google software engineer Alexander Mordvintsev which utilizes a convolutional neural network to find and enhance patterns in images.

Artificial neural networks (ANN) consist of a large number of fairly simple units, so-called parallel working neurons, and operate as information processing systems, whose structure and functioning principles are inspired by the nervous system and the brain of animals and humans. The neurons communicate by sending information in the form of activation signals, along directed connections, to each other,\footnote{Kruse, R., Borgelt, C., Braune, C., Mostaghim, S. and Steinbrecher, M., 2016. Computational intelligence: a methodological introduction. London: Springer, p. 9.} thus forming a network.

DeepDream would be classified as a convolutional (feedforward) multi-layer Perceptron which utilizes the backpropagation learning technique. To clarify the definition presented, we must observe the meanings of the presented terms:
1. Convolutional neural networks are hierarchical neural networks whose convolutional layers alternate with subsampling layers.\textsuperscript{51} What this means is that the network has a multitude of layers of artificial neurons which extract localized features from input images by dividing an image into areas which are the convolved with filters. Every divided image area is then further divided and re-filtered until the vectors of the vectors of the most prominent features are classified.

2. A feed-forward neural network, also called a multilayer Perceptron is a network which is a directed in such a manner that it does not it utilize closed paths or loops.\textsuperscript{52}

3. Backpropagation is a training method of training artificial neural networks, which requires a known, desired output for each input value - it is therefore considered to be a supervised learning method,\textsuperscript{53} meaning that the network must be inputted with known corresponding correct outputs, in order to be able to correlate the correct output with the most common feature of the inputted data.

In the case at hand the simplest way to explain the technical process of ANN is to demonstrate it with the training process of DeepDream. DeepDream was trained by displaying millions of training example tagged images to it and subsequent gradual adjusting the network parameters until the network yielded the desired classifications (tags).\textsuperscript{54}

Each individual image was processed by the initial input layer, which then divide the image into several areas, from which it could extract the most prominent feature. The next layer of neurons would further divide the image into smaller areas, in which it would further accentuate the most prominent feature, and so forth, until the ANN would divide the image into individual pixels, where the vector of the feature can be associated with the correlated correct output. The solution of the whole network was presented as a result of the final layer of artificial neurons.

3.2. APPLICATION OF EXISTING LEGISLATION TO GOOGLE’S DEEP DREAM AND ITS ARTWORKS

Google DeepDream code was published as an open-source software on Github in 2014 by Alexander Mordvintsev, Christopher Olah, and Mike Tyka (who is the only contributor). It is licensed under Apache License 2.0., and at the same time, all images and derivatives contained in the repository are licensed under Creative Commons License 3.0.


\textsuperscript{54} Mordvintsev A., Olah C., Tyka M., “Inceptionism: Going Deeper into Neural Networks”, Available on: http://googleresearch.blogspot.co.uk/2015/06/inceptionism-going-deeper-into-neural.html Last visited: 05.08.2017
Apache License 2.0 is a low permissive license, so it doesn’t require the author of the modifications and derivative works to release them under the same license, as copyleft licenses do. It grants all its users with perpetual, worldwide, non-exclusive, no-charge, royalty-free, irrevocable copyright license to reproduce, prepare Derivative Works of, publicly display, publicly perform, sublicense, and distribute the Work and such Derivative Works in Source or Object form. Besides, it applies to copyrighted computer programs as well as to patented ones. The use of the trade names, trademarks, service marks, or product names of the licensor, in general, prohibited. The license permits personal, internal and even commercial usage, modification, distribution or selling of the code. The adjustment of the program is possible as long as its author provides a list of made changes and do not use a name that will indicate that the licensor endorsed it. The redistribution could be made on conditions of 1) attaching of the copy of the original license; 2) retaining of copyright, patent, trademark; 3) attributing prominent notices to changed files that they were modified. The Author of the derivative work is empowered to add his copyright statement if it complies with the conditions stated in apache license. The only exception exists for those, who submit contributions to the licensor and signed an agreement which couldn’t change terms and conditions of an initial version of the license.

Google Inc. is also the owner of number of related patents related with this creation: Object recognition in images, System and method for generating training cases for image classification, Object detection with false positive filtering, Artifact correction using neural networks and less connected - Learning semantic image similarity. Taking into consideration the EPC (Art.52 (2, c), practice of the Technical Board of Appeal of the European Patent Office (Computer program product/IB), Estonian Patents Act (§6(5)) it is highly improbable that such program could be patented, since it is not related to a technical field and doesn’t concern a technical problem. Of course, the program itself has a technical feature because neural networks through reprocessing of

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61 The Board of appeal concluded that the scope of exclusion provided by Art. 52(2)(c) EPC is limited to those programs that do not have technical character. Technical character of software can be found if it is the only/necessary mean for hardware in getting the further technical effects deriving from the execution of its instructions, which are not known as prior art. See: Decision of the Board of Appeal T 1173/97 of 01.07.1998, point 5.3, 6.6, 8. Available on: http://www.epo.org/law-practice/case-law-appeals/recent/971173ex1.html#q Last visited: 02.12.2017
given input may improve the performance of the network itself, but Deep Dream has a specific aim – repaint an image (not to enhance it, but to economy the amount of network bandwidth or to detect a target in an image etc.). On the other hand, it could be arguable, because there are numerous patents that were granted by EPO to the inventors of image processing systems comprising neural networks. It may depend on how the patent application will be formulated. For example, in the Vicom case of the Board of Appeal (about a method and apparatus for digital image processing which involved an algorithm for smoothing or sharpening the contrast between neighboring data elements in the array) the initial application was rejected as the physical entity represented by the data was not mentioned in the claim at all. However, an amended claim which defined the actual technical activity performed by the digital filtering for digitally processing image in the form of 2D array was defined as “real-world” application rather than algorithm. Therefore, the description of this AI would have to present eligible subject matter, preferably connected with traditionally patentable practical system as image processing, labeling, detection of the objects and so forth.

The program has users’ interface – Dream deeply. On the basis of Google’s code there have also been created a number of websites that have implemented it (Psychic VR Lab, Dreamscape etc.). Another similarly working site is the Deep Dream Generator. According to the terms of its usage, the owner of the account, who cannot be younger than 13 years of age, is solely responsible for content that he submits to the service (images, graphics, photos, audio and video clips, sounds, musical works, works of authorship and other). Additionally, Deep Dream Generator does not claim ownership over anything that user posts on or through the Service. Instead, it requires a grant of a non-exclusive, fully paid and royalty-free worldwide license to use the uploaded data, for example to make it public on different parts of the website. Name, logo and trademarks of the service cannot be used and the site cannot be changed by users without permission. The user is allowed to use the content generated by Deep Dream images if he owned the rights to the original images that were downloaded as an input. So usage of the Deep Dream AI for creation of derivative work (or adaptations) on the basis of copyrighted work, that user does not own is considered a violation of copyright. EU countries have differences regarding dealing with adaptations of copyrighted works, because these rights are strongly connected with the economic right of the author of on adaptation and moral right of integrity of the original work, as copyright of the original work will stay unchanged. Under recitals 32-35 of the Directive 2001/29/EC of 22 May 2001 on the

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harmonization of certain aspects of copyright and related rights in the information society. Member States can make exclusion for the right of reproduction (for example for usage by social institutions, public library, educational establishment, museums etc.). As a general rule, pursuant to the Art. 2(a) of the Directive there is an exclusive right to authorize or prohibit direct or indirect, temporary or permanent reproduction by any means and in any form, in whole or in part for authors, of their works. But it can be inferred, that it is legal to use the Deep Dream program in works that are in the public domain (copyright has expired/never existed), evidently licensed for reuse (for instance under Creative Common license - attribution/ attribution-noncommercial) or with the explicit consent of the author.

In a very limited sense, given the fact that Deep Dream is still in its core a computer program it could be compared with a photo editing tools such as Adobe’s Photoshop. In the case with this Deep Dream, the user is the one, who causes a creative process by choosing and uploading the photo to the application. However, the output that AI produces depends also on: 1) the source code, as the programmer of the neural network creates the basis and in a such way has restricted control over the result that the software produces; 2) definitions of common indicators (classification) which were build on data sets for object recognition by the trainer of the AI - which helps it to recognize patterns and exaggerate them within the output. The latter also indirectly determines how a corresponding correct output will look like.

The problem lay in stochastic nature or the image that user gets in the end, as how the program finds similarities seems like the process that resembles human’s creativity. There are tools that help to decipher the output and explain what each neuron tries to recognize on the picture and what happens on each layer, still high-level layers (more abstract) can produce unpredicted images. Due to the non-linearity of “input”, “output” and “hidden” layers (basic features-overall shapes-the best way to reimage), the process of how neural nets actually arrive at such dreamlike outputs is still a mystery to researcher.

Despite this fact, that the question of the authorship has a commercial value, it still does not have a conclusive answer. Since the Deep Dream source code is publicly available in principle it means that the programmer and the software doesn’t expressly state copyrights on the output of the

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Deep Dream. Nonetheless, the authors of the program request to identify images posted on the Google+, Facebook, or Twitter with #deepdream tag, so other researchers can check them.\textsuperscript{71} Publishers have different views on signing of the photos processed by the Deep Dream in digital editions. Some of them indicate the author of initial work\textsuperscript{72}, others indicate Google as the co-author\textsuperscript{73} or app with which the image was made in addition\textsuperscript{74}.

### 4. WAYS OF RESOLVING CONCERNS THAT EXIST IN MODERN INTELLECTUAL PROPERTY LEGAL FRAMEWORK

Examination of diverse aspects on the problem of legal protection of AI have revealed that majority of issues of concern can be resolved through an accurate determination in the legislation what is an AI and who will possess rights on its works based on its nature.

As the majority of international copyright treaties were drafted before emergence of AI, most of them do not precisely stipulate that an author should be a living human being. At the same time, it can be ascertained based on the moral rights that authors are granted, interests of authors that are taken into consideration, duration of protection of the copyright that it is applied on the basis of the author’s lifespan. However it is directly stipulated on the level of European Union that “in respect of the relevant intellectual property right, the nationals of other Members shall be understood as those natural or legal persons that would meet the criteria for eligibility for protection”\textsuperscript{75}. WIPO itself defines “intellectual property” as “creations of the mind”\textsuperscript{76}. Nevertheless, rights of authors in each Member State are, first and foremost, based based on national copyright laws.

In Europe the CJEU has also declared, particularly in its Infopaq decision, that copyright only applies to original works, and that originality must reflect the “author’s own intellectual creation.” That could be interpreted as: an original work must reflect the author’s personality, so existence of a human author is necessary for a copyright work\textsuperscript{77}.

\textsuperscript{73} K. Boehret. Google’s algorithms created all the art for an exhibit in San Francisco. The Verge. Mar. 1 2016., op cita.
Interestingly, in terms of comparative law, some countries like the UK, Ireland, India, New Zealand have an approach that can resolve the problem, if consider an AI only as a simple software. For instance, in the UK, the Copyright Designs and Patents Act 1988 sets out that: “In the case of a literary, dramatic, musical or artistic work which is computer-generated, the author shall be taken to be the person by whom the arrangements necessary for the creation of the work are undertaken”. “Computer-generated”, under the act is “the work generated by computer in circumstances such that there is no human author of the work”78. The question remains, what “arrangements” are “necessary” for each particular AI, but they unlikely will cover simple act of merely pushing a button to activate the software where another person has already created the software or inputted the data.79 After the Naruto case (Naruto v. David John Slater80) the Copyright Office of the USA clarified that “copyright law only protects “the fruits of intellectual labor” that “are founded in the creative powers of the mind”. As examples of such works the Office brought, among others “works produced by a machine or mere mechanical process that operates randomly or automatically without any creative input or intervention from a human author”. Notably, none of the examples apply an AI machine specifically programmed by humans to create a work of art.81

It could be mentioned that some natural processes (ice sculptures or lava tubes) and animals (sea lions, horses, dolphins, apps, elephants, pigs) capable to create objects similar to original artworks. In the case of future AI the question may whether their work will reflect originality on the part of the human, or whether choices were exclusively made by the computer82, but legal limitations of “authorship” can only lead to the conclusion that their outputs will be uncopyrighted at all. Obviously, the programmer acts creatively when is writing a code (creates a program that is capable to make “art”/ “another author”). Few would disagree, with the position that advocates still “human authorship” of AI “artworks”, on the basis that without an input natural person this software would not exist at all. Nonetheless, the programmer has no direct impact on the works, inasmuch the software composes the output independently after training. Such legal limbo in turn poses a threat to the owner of the IP and as a result, possible for the further development of the artificial intelligence and machine learning research area. For this reason it would be prudent to

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analyze the theory of such notions of “author”, “creation”, “creativity” and “originality”, in order to acquire an understanding of why the current legal framework cannot be applied to the state of the art AI.

As previously stated, EU law, as well as Estonian law, regards the creation as the author’s own intellectual creation and from which it institutes “moral rights” of the author to control the public disclosure and withdrawal of their works, to receive appropriate credit for his creation, and above all to protect their works against destruction or modification. Therefore it is obvious to conclude that this justification for a multitude of rights is made on the ground that a creation embodies and helps to realize its creator’s personality or will.

Legal instruments have not presented the conclusive definition of what personality or will may entail, however, it must be noted from the definition of the author’s creation and the moral rights that are given to the author that the legal instruments in this regard employ the “personhood theory” of intellectual property.

The idea for such an approach might best be explained in the Hegelian notion of (intellectual) property, which has had a great influence on the formation of intellectual property legal theory and subsequent legislation in Europe.

While the Hegelian notion of property is not a legal basis for analysis of the problem at hand, it does give a better understanding the abstract the undefined legal standards of “creation” and “creator”, as well as their correlation, presenting an overview of the “personhood theory” of IP on the basis of which one could argue of whether or not an AI could truly be regarded as “creative”.

Based on the Hegelian notion of property “the individual's will is the core of the individual's existence, constantly seeking actuality and effectiveness in the world”.

It must be emphasized that according to Hegel will represents “the unrestricted infinity of absolute abstraction or universality, the pure thought of oneself”. From will, Hegel infers personality as the “first, still wholly abstract, determination of the absolute and infinite will.” Personality is that which “struggles to lift itself above the restriction of being only subjective and to give itself reality, or in other words to claim that external world as its own”.

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Therefore it is obvious that the “will” seeks to appropriate the external world through personality; by imposing itself upon the world. Mental processes - such as recognizing, classifying, explaining, and remembering - can be viewed as appropriations of the external world by the mind, whereas the mind has to be imbued with both “will” and “personality” in order to be able to perform such mental processes as subject to its own choice. Intellectual property therefore must be viewed as an expression of the will, a part of personality, to the extent that it presents a expression of appropriation of the external world by the mind.

As is evident, in accordance with the Hegelian “personhood theory,” it is obvious that an AI is missing the defining elements that would lend itself in allowing the AI to appropriate IP rights – “will” and “personality” that are the driving forces in the notion in connecting the author with the intellectual property itself. Even so, the looming question of practical resolution of the problem of attribution of IP rights over the AI itself and its works, must be addressed in a optimal manner.

In regards to creativity, there is a multitude of definitions of creativity which can be applied, which range from including the notion of intelligence in creativity to including the whole creative cycle as a part of the creation. Therefore, it cannot be conclusively discerned whether or not the creations of the AI present original or new content.

Therefore, a most practical approach in this determination could be made as defining creativity as capacity to produce new or original ideas, insights, inventions or artistic products which are accepted by experts as being of scientific, aesthetical, social or technical value. The definition shows inherent problems in its application to the creations of the AI, inasmuch it cannot be objectively inferred whether or not the AI possess such capacity.

In regards of technical aspects of creation of the output, different kinds of AI work on different kinds of technical implementation, however, for practical purposes, the supervised feed-forward multi-layer convolutional neural network shall be observed, on the basis of which any conclusion made by the presented work would mirror only the implementation of legal norms to the described AI. However, from a practical standpoint, it must be observed that this kind of AI is most commonly used in the state of the art, as it produces most accurate results in prediction in regards to data that provides “fuzzy” input.

The listed AI functions on the basis of approximation of the patterns of the input test data as weighed against a desired output. Once the AI has been sufficiently trained by the data sets and

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achieves optimally valid output as compared to the desired output, the AI can produce patterns that are, in effect, the approximation of the most common patterns present in the training sets of data.

Consequently, the problem of application of the aforementioned definition lends itself in whether or not the content created by the AI can be viewed as “new or original”, to the extent that the creation is only going to represent output based on what the AI can infer from the input data as compared to the desired output.

In the scope of the definition a case to case observation would have to be made in determining whether or not a creation of an AI could be viewed as new or original, however the question of IP protection in this case is one of practicality, rather than a philosophical one. Given the fact that such content can subjectively be both dismissed and accepted for IP protection, further discussion would make the whole argument moot. For all intents and purposes new content is being created, and as such the question of its originality or novelty would not serve the purpose of solving the problem of legal uncertainty presented by the existing legal practice and norms.

The answer to the questions of sufficient understanding of “author”, “creation”, “creativity” and “originality” in regards to the AI itself, and its creation, might best be presented in the implementation of the “the-work-made-for-hire” doctrine. According to this legal fiction the employer/person for whom the work was made is considered the author (literally, his copyrights are bypassed). It is implemented in Estonian Copyright Act. In the context of the topic of this thesis the interest is paragraph 1 of the Art. 32 of the Act: The author of a work created under an employment contract or in the public service in the execution of his or her direct duties shall enjoy copyright in the work but the economic rights of the author to use the work for the purpose and to the extent prescribed by the duties shall be transferred to the employer\textsuperscript{94}. The proliferation of this doctrine on relationships author-AI could help to avoid two problems of: 1) vesting rights in a machine and ascribing to a machine the ability to respond to copyright’s incentives, as the programmer will be treated like an employer - as the author-in-law of a work made by another; 2) mix-up of the author’s author - programmer and the actual author - AI\textsuperscript{95}.

In the current state of legislation, an AI does not present a legal entity that can have any claim over the changes it makes to itself, nor to any of its creations, which poses a problem in determining both copyright and patent ownership over the AI and its creations.

To that extent it can be concluded that an introduction of a limited scope of legal personhood of AI would, in effect, make applicable all already existing legal norms that have a problem with the

\textsuperscript{94} Copyright Act, op. cit, Art. 32(1)

absence of legal entity attribution in the present case, ie. in the form of creating an additional kind of legal entity – a “robot-agent”.

Such a “robot-agent” would in effect be hybrid between a legal entity and an object of ownership, inasmuch it would, in a legal sense, interact with other legal entities, while remaining the within the copyright of its creator. This would include the equation of the personhood of the AI program to the legal status of a natural or legal person, while still allowing for the ownership of the creator over the AI program.

This idea is not so radical, inasmuch the EU has already been moving in this direction. For example, in the draft report from 31.05.2016 with recommendations to the Commission on Civil Law Rules on Robotics the European Parliament calls on the Commission to elaborate criteria for an ‘own intellectual creation’ for copyrightable works produced by computers or robots. The idea of giving a limited scope of personhood to the AI and robots, as was written before, also exists in Estonia.

In regards to EU copyright law, the robot agent would be able to create alterations both of itself and of other works on the basis of Art. 12 of the Berne Convention (consent of the original author) with transferring only of economic rights on artwork to the author pursuant to the “the-work-made-for-hire” doctrine. Therefore, the alterations made to the original source code would be attributed to the AI itself as a legal entity, in the form of a “robot-agent” while still remaining the intellectual property of its owner. In a similar fashion, the “robot-agent” itself may create alterations to works of others, pursuant to the same provision, where the alteration itself would be subject to the exclusive right of the author to authorize such adaptations. The moral component of the copyright would be attributed to the “robot-agent”, while the economic rights based on such copyright would be translated to the author of the original work.

Provisions of the EPC, as well as the Guidelines for Examination of the EPO have not explicitly stipulated or implied that the ever changing nature of the AI would present a bar in its patentability. In the assessment of the application, the observance of the criteria (of whether or not the invention has a patentable subject matter, involves an inventive step, forms the prior art, is industrially applicable and is sufficiently disclosed) have to be met in order for the invention to be granted patent protection. The utilization of a “robot-agent” would serve the purpose of limitation of the scope of the AI to a singular entity, no matter what changes are presented within the AI itself.


It would serve as a theoretical outline of the entirety of what the AI entails, and as such, its iterative nature would not lend itself a problem to the application of patent protection, inasmuch all the future iterative changes would be protected by the already granted patent. Furthermore, in the an invention being created by an AI, the endowment of legal entity to the AI would make it possible so as to attribute the invention to the AI, as pursuant to Rule 19(1) of the EPC. It may be presumed that, since the works of the “robot-agent” give economical rights to the respective owner of the “robot-agent”, the patent application would in any event be approved if the owner would submit it.

In Estonian law, the copyright could be extended to the whole of the work, inasmuch the author of the work, in this case the creator of the AI, would be presumed to have given the authorization to the “robot-agent” to alter the work, while still remaining the owner of the program. The right of authorization is in the present case derived from Article 13(1)(5) of the Copyright act.\(^98\)

Attribution of the changes would then be attributed to the creator of the work, based on the implementation of the “work-made-for-hire” doctrine, on the basis of which the “robot-agent” would be treated as a contractual party to a “employment contract”\(^99\) between itself and the creator of the AI, where the “robot-agent” would perform a creation of a derivative work on a basis of an “employment contract”, whereas it would maintain the copyright to the derivative work,\(^100\) but the economic rights would be translated to the creator.

Interestingly enough it should also be observed that, while the Copyright act explicitly stipulates in Article 28(2) and 28(3) that an author of a work can only be a natural\(^101\) or a legal person,\(^102\) such a definition is absent in the case of the “lawful user”, as defined by Article 24(1), which stipulates that unless otherwise prescribed by contract, the lawful user of a computer program may, without the authorization of the author of the program and without payment of additional remuneration adapt and transform the computer program in any other manner if this is necessary for the use of the program on the device or devices, to the extent and for the purposes for which the program was obtained, or for the correction of errors present in the program.\(^103\) This could imply that the meaning of the term “lawful user” could be extended to encompass the AI program as a “robot-agent”, solving the problems of its ever changing nature and ownership over it, as an alternative to the utilization of the “work-made-for-hire” doctrine.

\(^98\) Copyright Act, op. cit., Article 13(1)(5)
\(^99\) Copyright Act, op. cit., Art. 32(1)
\(^100\) Copyright Act, op. cit., Art. 35(1)
\(^101\) Copyright Act, op. cit., Article 28(2)
\(^102\) Copyright Act, op. cit., Article 28(3)
\(^103\) Copyright Act., op. cit., Article 24(1)
The application of a “robot-agent” in Estonian patent law would be similar to that of the application in the EU law, in regards to dealing with the problem of its iterative nature. Additionally, in regards to patentability of an invention made by the “robot-agent”, pursuant to Art. 12 of the Estonian Patents Act, the right to apply for a patent would be vested in the owner of the “robot-agent”, inasmuch the creation of the invention would be subject to a fictional contractual obligation, as based in the “work-made-for-hire” doctrine.

Given the fact that the implementation of such a notion of a “robot-agent” presents a complicated issue that is applicable to a wider range of legal interactions that could be based on legislation that does not only pertain to intellectual property, it would be best if the notion of a “robot-agent” was addressed in a separate legal act, as well as amended in legal documents that would require such changes. For instance, Estonian Civil Code (by provision of separate chapter concerning passive legal capacity of AI in part 2, titled “Persons”), Patents Act (by adding for the grant of patent protection to future iteration which are contained within the “robot-agent”), Copyright Act (by including the robot-agent, author, trainer and user of the robot-agent).

**SUMMARY**

1. AI as an object of intellectual property law is a machine that is capable of simulating human behavior and can be programmed to its ability to replicate human mental skills (recognize pattern, understanding natural language, learning from their own experience, develop strategies, speculate etc). Such qualitative differences from simple software pose challenges before intellectual property.

2. AI has more than sixty years of historical development. Since 1955 humanity is gradually expanding sphere of implementation of AI programs. First introduced to science (for proving mathematical theorems, solving tasks in algebra and geometry) and industry, now AI powered products are used in medicine, transportation, banking, surveillance, video game industry, e-commerce, machine translation, educational and other fields.

3. In the most general sense, AI can be discerned on grounds of their interned application, or approach to technical implementation. In the sense of displayed and intended intelligence the, AI can be categorized as weak AI, which is created for a specific, narrow purpose and strong AI, which is associated with the claim that an appropriately programmed computer could be a mind and could think at least as well as humans do. All existing AI are considered weak AI.

4. Technical approaches of implementation of AI can be discerned into symbolic, which embodies all methods in artificial intelligence research that are based on high-level "symbolic" (human-readable) representations of problems, logic and search; sub-symbolic, which denotes an
approach to creation of AI which incorporates methods that manage to approach intelligence without specific representations of knowledge; and statistical AI.

5. AI can gain protection under copyright, patent, trade name and trade secret. In the light of this thesis AI products were considered as forms of computer programs (that are protected as literary works by copyright) and inventions (that can be protected by patents).

6. Only programmers, who write a code for an AI and their employers, who can automatically get rights on that work (under the terms of a contract), can be considered as authors of the AI. These subjects are granted with standard economic (of reproduction/communication to the public/renting/lending/distribution that can be realized by a programmer(s) or his employer, if the code is a result of fulfillment of contractual obligations) and moral rights (to paternity/integrity/control publication) on AI code. Namely the programmer entitles the software to produce some output by execution of his code even with implementation of particular inputs from some user - limits creative freedom of its users.

7. Analyze of the current legislation showed that there are aspects in copyright law that fails to answer directly to the following questions: Will the programmer stay an owner of the code, if AI is capable to change it by itself (e.g. probabilistic programming systems of Gamalon, Inc)? Who owns the database generated by AI during its usage - supplier or user? Who will own the rights on artworks or inventions created by AI?

8. It was also revealed a gap in regulation of types of data that can be used for teaching an AI. Bearing in mind that works that are used by AI can be unavailable for the general public (used once or kept in a separate flat file/library) and their usage is crucial for creation of non-biased AI – technological development, concept of “fair use” needs to be revised and amended by giving a right to AI developers to use any artworks. Such modernization of copyright rules, should comply with the copyright reform in the Digital Single Market.

9. It was found that AI data processing systems are eligible for patent protection and WIPO statistics sows increase in the number of patent that were granted on them, especially in the USA and China. In Europe there is a risk of claim features being considered to fall into mathematical methods or schemes, computer programs as such, rules and methods for performing mental acts or doing business and presentations of information. Therefore, inventions that apply machine learning approaches to engineering fields (navigating a robot, game, controlling power supply, audio/video/image processing) are generally considered more positively by the EPO.

10. Theoretically, within the scope of the Estonian legislation, the program could be subjected to copyright in the event it was never utilized, and remained in its original form. Once the AI program has been used for its intended purpose, its core structure and coding is changed in such a
way that it no longer represents an expression of the original creator, but rather a derivative work of the original. Therefore, the problem resides in the fact that the ownership of the copyright cannot be attributed to neither the creator, nor the AI program itself, as the former is not the author of the derivative work, and the latter is not perceived as subject of law in the current legislation.

11. Similarly to the notions presented in the considerations of European law regarding patentability, pursuant to Estonian law, a patent can be granted to an AI that fulfills all of the requirements for patentability, such as being patentable subject matter, novel, involving a inventive step and susceptible for industrial application.

12. DeepDream is a computer image recognition program created by Google software engineer Alexander Mordvintsev which utilizes a convolutional neural network to find and enhance patterns in images. This network has a multitude of layers of artificial neurons which extract localized features from input images by dividing an image into areas which are the convoluted with filters. Every divided image area is then further divided and re-filtered until the vectors of the most prominent features are classified, while employing a feed-forward system. After that errors are back-propagated through the system in order to apply changes towards a more correct output.

13. Google DeepDream code is an open-source software which is licensed under low permissive Apache License 2.0., all images and derivatives contained in the repository are under Creative Commons License 3.0. Google Inc. also possesses five patents on related inventions. However, as the program has an aim reimagine an input, it not related to a technical field and doesn’t concern a technical problem patentability of the program in the EU was questioned. It was concluded that to get protection of the EPO description of the Deep Dream should present eligible subject matter, preferably connected with traditionally patentable practical system as image processing, labeling, detection of the objects and so forth.

14. The output that AI produces depends also on: 1) the programmer of the neural network that creates the original code and in a such way has a restricted control over the result that the software produces; 2) the trainer of the AI that defines common indicators that helps an AI to recognize patterns and exaggerate them; 3) the AI code itself, because the output that AI gives has a stochastic nature. There are tools that help to decipher the output and explain what each neuron tries to recognize on the picture and what happens on each layer, but high-level layers (abstract ones) can still produce unpredicted images.

15. Despite the fact, that the question of the authorship has a commercial value, it still does not have a neat answer: there are three beneficiaries that do not directly produce the after-image, but have an influence on it, and the software that processes the image, but do not have legal personality. Since the Deep Dream source code is publicly available in principle it means that the programmer
and the software doesn’t expressly state copyrights on the output of the Deep Dream (publishers have only requested to identify images posted on the Google+, Facebook, Twitter with #deepdream tag for further research).

16. Majority of issues of concern can be resolved through accurate determination in the legislation what is an AI and who will possess rights on its works based on its nature. However, it has been shown that such a definition has not uniformly been achieved in practice.

17. From the EU and subsequently Estonian legislation, it must be noted from the definition of the author's creation and the moral rights that are given to the author that the legal instruments in this regard employ the “personhood theory” of intellectual property. Such a theory can be best explained through Hegelian notion of property, which would bar the AI from authorship, inasmuch an AI is missing the defining elements that would lend itself in allowing the AI to appropriate IP rights – “will” and “personality” that are the driving forces in the notion in connecting the author with the intellectual property itself.

18. However, it must be noted that the question of AI authorship is one of practicality in, rather than philosophy. The “work-made-for-hire” doctrine may find itself the best solution to the practical problem at hand. According to this legal fiction the employer/person for whom the work was made is considered the author automatically.

19. To that extent it can be concluded that introduction of an additional kind of legal entity – a “robot-agent” with a limited scope of legal personhood would, in effect, make applicable all already existing legal norms.

20. In regards to European and Estonian copyright law, the “robot-agent” would perform a creation of a derivative work either of itself or works of other authors under Art. 12 of the Berne Convention (consent of the original author) and on a basis of a fictional “employment contract”, whereas it would maintain the moral rights to the derivative work, but the economic rights would be translated to the creator.

21. In regards to European and Estonian (inasmuch the legislation opts for same conditions for application of patent protection) patent law, the utilization of a “robot-agent” concept would serve the purpose of limitation of the scope of the AI to a singular entity. Its iterative nature would not lend itself a problem to the application of patent protection, since all future iterative changes would be protected by the already granted patent.

22. Introduction of a new legal entity on the EU level will require an amendment of the e Directive 2009/24/EC which would incorporate that the author of AI’s works would be the “robot-agent”, while the economic rights would be transferred to its owner. The European Patent
Convention would have to strictly address the question of the application of the “robot-agent” in order to allow patent protection of future iterations of the AI.

23. It must be observed that the question of legal regulation of a new legal entity “robot-agent” is far more broader issue than the question of AI as an object or subject of intellectual property law. Consequently, a creation of a separate legal act that would conclusively define the entity itself, its inherent nature, legal capacity and rights and responsibilities of its owner would be also necessary. On Estonian level, the introduction of a new legal entity would have to be also mirrored by amendment of the Civil Code (by provision of separate chapter concerning passive legal capacity of AI in part 2, titled “Persons”), Patents Act (by adding for the grant of patent protection to future iteration which are contained within the “robot-agent”), Copyright Act (to broaden the meaning of “author” as to include the “robot-agent”, and include the article concerning copyright in works created by an AI).
ABBREVIATIONS

EU – the European Union
AI – Artificial intelligence
Art. – Article
MI – Machine learning
EPO – the European patent office
WIPO – World Intellectual Property Organization
EPC – the Convention on the Grant of European Patents
BBAI – Behavior Based Artificial intelligence
ANN – Artificial neural network
LIST OF LITERATURE


23. M. Kaevats, ‘Estonia considers a ’kratt law’ to legalise Artificial Intelligence (AI)’.


LIST OF LEGAL ACTS


LIST OF JUDICIAL PRACTICE


**LIST OF OTHER RESOURCES**


APPENDICES

Photos of the authors before and after being processed by Google DeepDream (as utilized by DreamScope)