Introduction

Humans have been creating works for thousands of years. Books, music, and software are a few examples of works that are protected by copyright. In recent years, the technology of artificial intelligence (AI) experienced huge progress.¹ Such technological progress made it possible for AI to create its own works.² Digital images, paintings, and music are a few examples of what an AI may create.³ The big question now is – may the AI-created works be copyrighted? If so, who may own the copyrights? Would such owner be a human, the AI, or a combination of both?

This paper discusses whether works created by an AI may be copyrighted, and if so, whether the AI may own such copyright. This paper first discusses an overview of the law of copyright answering the question of what kind of works may be copyrighted. Second, the paper discusses the technology behind the creation of an AI, how does a machine become an AI, and what kind of works may an AI create. Third, the paper discusses the concepts of copyright ownership and how current ownership concepts may be applied to AI-created work. Next, this paper discusses the major arguments against giving copyright ownership to AI-created work. Finally, this paper discusses arguments in support of giving copyright ownership to AI-created work and whether an AI may be given such ownership. Throughout the discussions, the reader would gain a better understanding of copyright law, the technology of AI, how copyright law may be applied to AI-created works, and whether AI should own the works.

I. The Law of Copyright

The law of copyright originates from the US Constitution. From Article I, Section 8, Clause 8, commonly referred to as the Patent and Copyright Clause, it gives Congress the power “to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries.”⁴ To promote the progress of science and the useful

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³ Id.
arts, the authors or creators of scientific works or works classified as the useful arts are granted “exclusive rights” to protect their works.⁵

What are the exclusive rights? The rights include five uses of a work, including copying, adapting, sharing, performing, or displaying the work.⁶ Copyright gives the creator an exclusive right to these uses, meaning that other people without the creator’s permission may not copy, adapt, share, perform, or display the creator’s work.⁷ So what is needed for a work to be copyrightable?

Legally, for a work to be copyrightable, it must be original, fixed to a tangible medium, and not be an idea, fact, or functional in nature.⁸

**Being Original**

Being original means that a unique origin creates the work.⁹ There needs to be a “source” that creates the work.¹⁰ A work that does not have a source of creation does not have an origin and is therefore not copyrightable.¹¹ On the other hand, a book may be written by an author. A piece of music may be composed by a musician. A software may be written by a developer. All these works were created by sources of creation or unique origins.¹² These works may therefore be copyrightable.

To be original, a work must also have creativity.¹³ A creator produces creativity when he adds his own views, perspectives, or imaginations to a set of facts or pre-existing works.¹⁴ The views, perspectives, or imaginations must be at the very minimum somewhat unique and not too mundane or common.¹⁵ For example, a phone book that simply lists out residential phone numbers by alphabetical order lacks creativity.¹⁶ Listing information via alphabetical order is a quite common practice that almost

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⁵ *Id.*  
⁷ *Id.*  
⁹ *Three Boys Music Corp. v. Michael Bolton*, 212 F.3d 477 (9th Cir. 2000).  
¹⁰ *Id.*  
¹¹ *Id.*  
¹² *Id.*  
¹⁴ *Id.*  
¹⁶ *Id.*
anybody may do the same - it is not unique. On the other hand, listing phone numbers based on residents’ education may be less common and more unique, and therefore has some creativity. Facts are considered common knowledge, as they are known to the public. Therefore, facts are not creative, because they lack unique views, perspective or imaginations. Other examples of creative works may include an author’s writings within a book, a developer’s software, and a musician’s composition of lyrics and musical notes. These works all contain views, perspectives or imaginations that are unique and not mundane or common.

Fixed to a Tangible Medium

To be copyrightable, the second element that a work must have is fixation. Fixation focuses on the medium in which the work resides. The medium must be tangible in nature. Therefore, the work must be fixed to a tangible medium to be copyrightable. Examples of work that are fixed to a tangible medium include words fixed within a book, software stored within a hard drive, and music recorded on a tape. Conversations between two people, on the other hand, may not be fixed if the content of their conversations is not recorded to a tangible device. A conversation between two people, therefore, may not be copyrightable.

May not be an Idea, a Fact, or Functional in Nature

The third element of a copyrightable work is that the work may not be an idea, a fact, or functional in nature. The Copyright Act’s policy is to not copyright ideas or functional works, so that all creators may copy and use the ideas or functional works without any risk of liability. What is an idea or a fact?

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17 Id.
18 Id.
19 A. A. Hoehling v. Universal City Studios, Inc., 618 F.2d 972 (2nd Cir. 1980).
21 Id.
22 Williams Electronics, Inc. v. Artic International, Inc., 685 F.2d 870 (3rd Cir. 1982).
23 Id.
24 Id.
25 Id.
26 See, Nicky LaMarco, Examples of Copyrights (December 10, 2018).
functional work? They are works that provide mostly, if not all, a utilitarian value to the public.\(^{30}\) A process on how to record accounting data, for example, is an idea that provides utility to and benefits the public.\(^{31}\) Creators may copy and use this process to improve the lives of others.\(^{32}\) Other creators should be allowed to copy and use this same process to benefit others.\(^{33}\) Hence, this process may not be copyrightable.

Facts may not be copyrightable because facts are not original.\(^{34}\) As provided in previous paragraphs, a work must have a source of creation to be original. Anything that is factual in this world, such as the “color of the sky”, does not have a source of creation.\(^{35}\) No unique person creates facts, because facts owe their creation to Mother Nature, and not to any single unique source of creation.\(^{36}\) Therefore, facts do not have origins and are therefore not copyrightable.

**Summary of the Three Factors for Copyrightability**

For a work to be copyrightable, it must be original, fixed to a tangible medium, and not an idea, fact, or functional in nature. The examples of works mentioned above were all created by humans. In the next section we will explore whether an AI would be able to produce similar work.

**II. Artificial Intelligence and Its Process to Create Work**

Artificial intelligence (AI) is the concept of having a machine think, decide, and perform tasks that are normally performed by humans, with minimum or no human supervision.\(^{37}\) Since the early 1900’s, humans created machines (i.e. computers) to perform human tasks.\(^{38}\) The machines performed tasks based on algorithms (instructions) given by humans.\(^{39}\) Over the past few decades, machines were becoming more capable of performing tasks without following the instructions.\(^{40}\) The main driving force

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31 Id.
32 Id.
33 Id.
34 *A. A. Hoehling v. Universal City Studios, Inc.*, 618 F.2d 972 (2nd Cir. 1980).
35 Id.
36 Id.
38 Id.
behind this capability is machine learning. Machine Learning is a training method which forces a machine to learn from human instructions and statistical models to perform a task without following human instructions, relying instead on patterns and inferences. By giving a machine enough training data, it may be able to make predictions and decisions to perform its tasks with minimum human supervision or no supervision at all. A machine that performs tasks with minimum or no human supervision is considered an AI. Next, we will discuss the several ways in which a machine may become an AI.

**Artificial Neural Networks (Infrastructure of a Machine)**

For a machine to perform machine learning, its infrastructure has a network of artificial neurons (nodes). Each node is a piece of hardware containing software. The external nodes would receive input data from their surrounding environment. The software within these external nodes would then instruct them to connect to the internal nodes, sending the input data to the internal nodes. The internal nodes would use their own software to analyze the input data to produce output data. By allowing each node within the machine to interact with other nodes, this network of artificial nodes models the neurons in a human brain. Similar to how a human brain has the ability to learn, this infrastructure gives the machine the ability to perform machine learning.

**Types of Methods of Machine Learning**

For a machine’s network of artificial nodes to perform machine learning, the nodes generally follow one of the following learning methods – supervised learning, unsupervised learning, or self-learning.

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42 Id.
44 See, *Artificial Intelligence. What is Artificial Intelligence? How does AI Work?*
48 Id.
49 Id.
51 Id.
In supervised learning, a human would prepare a set of training data.\textsuperscript{52} This set of data contains input and output data.\textsuperscript{53} The machine’s objective is to take the input data to then produce the output data.\textsuperscript{54} For example, if the task is to determine whether an image contains an apple, some input data would contain images with apples, while other input data would contain images without apples. The input data with images of apples would be labeled with an output data - \textit{Yes, there is an apple}. The input data with images without apples would be labeled with an output data - \textit{No, there are no apples}. All this training data would be fed into the machine’s network of artificial nodes to perform machine learning. Over time, the machine would be able to recognize the images with apples compared to the images without apples. After this training, the machine would be able to take similarly new input data to produce similarly new output data.\textsuperscript{55} In other words, if a machine sees a new image, it would be able to determine whether that image contained an apple. Realistically, the machine may make mistakes and produce inaccurate output data.\textsuperscript{56} It may determine that an image contained an apple, although that image does not contain an apple. However, its machine learning experience would allow its performance to improve over time.\textsuperscript{57} The more input and output data the machine sees, the more accurate its determination of images would improve.\textsuperscript{58} As its capability to determine images improves over time, one may classify this machine as an AI, because the machine would then be capable of performing its task with minimum or no human supervision.\textsuperscript{59}

On the other hand, a machine may learn from unsupervised learning.\textsuperscript{60} Unlike supervised learning, (where the training data contain both input and output data), only input data is presented within unsupervised learning.\textsuperscript{61} The objective for the machine is to analyze the input data to create output data without instructions of what the output data may be.\textsuperscript{62} Like a human brain, the machine’s network of artificial nodes analyzes the input data, finds structure in the data such as grouping and

\textsuperscript{53} Id.
\textsuperscript{54} Id.
\textsuperscript{55} Id.
\textsuperscript{56} Id.
\textsuperscript{57} Id.
\textsuperscript{58} Id.
\textsuperscript{61} Id.
\textsuperscript{62} Id.
clustering, to discover patterns.\textsuperscript{63} By identifying patterns in the data and reacting based on the presence or absence of patterns, the machine would be able to create output data that was not previously programmed by humans.\textsuperscript{64} After the training, the machine would be able to take similarly new input data to produce similar output data.\textsuperscript{65} In other words, if a machine sees data with similar patterns which it witnessed within the training data, the machine would be able to produce similar output data as it did within its training. Going back to the example with the image of an apple, the training data would only contain input data. Some input data would contain images with apples, while other input data would contain images without apples. However, unlike within supervised learning where the input data would be labeled as either containing images of apples or not containing images of apples, no such labelling would exist in this training. The machine would compare the images of apples with the images without apples and recognize this contrast. Over time, the machine would recognize what an image with an apple looks like and distinguish it from an image without an apple. If given a new image, the machine would then accurately determine if it contained an apple. Once again, the machine’s accuracy to perform the above task would improve over time.\textsuperscript{66} Once this accuracy is achieved with minimum or no human supervision, the machine becomes an AI.\textsuperscript{67}

The third type of machine learning is self-learning.\textsuperscript{68} Self-learning method is perhaps the most futuristic method to teach a machine.\textsuperscript{69} The machine is taught to develop an “emotion” similar to one experienced by a human.\textsuperscript{70} An emotion can measure a human’s “value” on a consequence.\textsuperscript{71} For example, one may feel happy (the value) to see an apple (the consequence). How can a machine display a similar emotion to value a consequence? A machine is given one input data, the “situation” and one output data, an “action”.\textsuperscript{72} With such situation, the machine is directed to perform such action.\textsuperscript{73} After

\textsuperscript{63} Id.
\textsuperscript{64} Michael I. Jordan, Christopher M. Bishop, \textit{Neural Networks} (2004).
\textsuperscript{65} Id.
\textsuperscript{67} Id.
\textsuperscript{69} Id.
\textsuperscript{71} Id.
\textsuperscript{72} Id.
\textsuperscript{73} Id.
completion of the action, the machine receives a consequence.\textsuperscript{74} The machine would then compute an "emotion" as a response to being presented such consequence.\textsuperscript{75} Such emotion may be a number (i.e. from 1 to 10) representing how the machine "values" such consequence.\textsuperscript{76} The higher the number, the more "valuable" such emotion is to the machine.\textsuperscript{77} Such quantified emotion is then stored within the machine’s hardware memory.\textsuperscript{78} Based on such training, the machine may learn how to "value" certain consequences as a result of an action (output data) on a situation (input data).\textsuperscript{79} Similar to how humans feel a certain emotion towards a decision, the machine is learning how to interact with its performance.\textsuperscript{80} Outside this training, if the machine is ever presented with a new situation, it may then check its memory to see if it ever encountered such situation.\textsuperscript{81} If the situation corresponds to a valuable "emotion", then the machine would act, producing a similar consequence as the machine experienced in its training.\textsuperscript{82}

Going back to the example with the image of an apple, the input data (situation) is an image with an apple. The output data (action) is to determine whether an image has an apple. With the situation and action, the machine is directed to determine whether this specific image has an apple. Once the machine correctly determines that this image has an apple, the machine receives a consequence. Such consequence could include the words “Great job, you are correct!”. By seeing this consequence, the machine then computes an emotion, such as 9 out of 10. This emotion will then be stored within the machine’s hardware memory. After the training ends, the machine would like to consistently score an emotion of 9 out of 10. Because of this, whenever it is presented with a new image of an apple, it would correctly determine whether such image contains an apple. If the machine may perform the above task with minimum or no human supervision, the machine becomes an AI.\textsuperscript{83}

\textsuperscript{74} Id.
\textsuperscript{75} Id.
\textsuperscript{77} Id.
\textsuperscript{78} Id.
\textsuperscript{79} Id.
\textsuperscript{81} Id.
\textsuperscript{82} Id.
Now that we have a basic understanding of how a machine may become an AI, let us discuss what kind of work an AI may create.

**What kind of work may AI create?**

By using its network of artificial nodes to experience machine learning, the most developed AI today is performing tasks such as creating certain works. Here are a few examples of AI-created works. One of Google’s AI programs wrote local news articles. Another one of Google’s AI companies, Deep Mind, listened to a piece of pre-existing music and generated new pieces of music. A program from the Netherlands analyzed thousands of paintings from the famous artist Rembrandt to create a new painting dubbed the “Next Rembrandt”. A Japanese program in 2016 wrote a short novel. Other works include poems and photographs.

If the above works were created by human creators, they could certainly be copyrightable. The works satisfy the three criteria for copyrightability – originality, fixation, and are not facts, ideas, or functional in nature. The works are all original, as they are created by unique origins, sources of creation that created the works. The works all contain the necessary amount of creativity. The sources of creation took a set of facts or pre-existing work, added in views, perspectives, or imaginations to create new works. The views, perspectives, or imaginations are all unique and not mundane/common. The works are all fixed to tangible media, such as hard drives that store the digital works, whether they be articles, music, paintings, novels etc. Finally, none of the works are factual, ideas, or functional in nature.

However, the above works were created by AI, not humans. Because of this, the works may or may not be copyrightable. Let us now discuss the theories behind ownership of copyrightable work.

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84 See, Andres Guadamuz, *Artificial intelligence and copyright* (October 2017).
85 Id.
86 Id.
87 Id.
88 Id.
III. **Types of Copyright Ownership and their Effects on AI-created Works**

The Copyright Act categorizes ownership of a copyright into three types – sole ownership, joint ownership, and ownership in work for hire.\(^\text{89}\) The most common type of ownership is sole ownership.\(^\text{90}\) If a creator is a single entity, such as a human or a company who solely created a copyrightable work without assistance from a second creator, the first creator would be the sole owner of the work’s copyright.\(^\text{91}\) An example would be an author who wrote a novel without the assistance of other writers. If there are no other authors who contributed to the novel’s creation, that author would be the only owner of the novel’s copyright. On the other hand, a novel often would have multiple contributors to its content. In such cases, all the contributors would own the novel’s copyright as joint owners.\(^\text{92}\) The third type of ownership is a work made for hire.\(^\text{93}\) If a company’s employee created a work under the scope of his employment, then the company, his employer may be the owner of the work’s copyright.\(^\text{94}\) Even though the company itself did not contribute directly to the work’s creation, the company would still own the work’s copyright.\(^\text{95}\) An example would be a film production company creating a movie. The producer, director, casts, and staff contributed directly to creating the film. But the company may own the movie’s copyright. We next explain how the three types of ownership may be applied to an AI-created work.

As mentioned previously, a machine contains a network of nodes. Each node is a hardware that contains certain software. A machine is therefore a network of software. The machine uses this network to conduct machine learning, in order to become an AI. Because software is copyrightable, one may therefore argue that the owner of the software’s copyright may also own the copyright of the work created by that software technology. If a developer created the software behind the AI, that developer would be the sole owner of that software’s copyright. If the AI created a work, one can argue that the software developer also owns the copyright to such AI-created work. If a group of developers created the software behind the AI, these developers may be joint owners of the copyright of the AI-created work.

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\(^{91}\) *Id.*

\(^{92}\) *Erikson v. Trinity Theatre, Inc.*, 13 F.3d 1061 (7th Cir. 1994).


\(^{94}\) *Id.*

\(^{95}\) *Id.*
work. If employees of a technology company created the software behind the AI, the company may therefore own the copyright of the AI-created work.

The above owners are all human. Is it possible for the AI to own the copyright of its work? Would an AI be the sole owner of its work’s copyright? If a work is created as a result of several AI’s collaborating with each other, would these AI’s be able to own their work jointly? To answer this question, we will now explore the various arguments for or against an AI-created work to be protected by copyright, and whether an AI may own such copyright.

IV. Arguments against giving Copyright Ownership to AI-Created Works

We will first discuss the various arguments presented against giving copyright ownership to work created by AI. If an AI-created work cannot be copyrighted at all, then the AI would never become the owner of its work’s copyright.

AI-Created Works are not Created by Humans

From the US Constitution, Article I, Section 8, Clause 8, the Copyright Clause gives Congress the power “to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries.”96 From this clause, the words “authors and inventors” suggest that creators of a piece of work must be human.97 In other words, any work that is created by a non-human creator may not be given copyright protection. This may also mean that if a non-human creator creates a work that may be copyrightable, the non-human creator may not own such copyright. The famous Naruto case supports this conclusion.98 In Naruto v. Slater, a monkey named Naruto picked up a camera and took a photo of himself.99 The owner of the camera and other organizations published this photo in a book and claimed copyright ownership to this photo.100 Plaintiffs claim that Naruto owned the copyright to this photo and that defendants infringed the monkey’s copyright by publishing the photo without the monkey’s permission.101 The court dismissed plaintiff’s

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97 Id.
98 Naruto v. Slater, 888 F.3d 418, 425 n.7 (9th Cir. 2018).
99 Id.
100 Id.
101 Id.
claim.\textsuperscript{102} This photo satisfied all the elements of copyright.\textsuperscript{103} It was original, fixed to a tangible medium, and was not a fact, an idea, or functional in nature.\textsuperscript{104} If the photo was taken by a human creator, the court more than likely would have ruled that the human creator owned the copyright to the photo. However, this photo was taken by Naruto, a monkey that is not human.\textsuperscript{105} The court reasoned that the Copyright Act deems a copyright owner to be human.\textsuperscript{106} Although Naruto created the photo, the monkey may not own the photo’s copyright.\textsuperscript{107} Applying the above legal concept to an AI, an AI would not be able to own copyrights of its created work. An AI is a machine, a combination of hardware and software, which is not human in nature. If an AI creates a photo, that photo may not be protected copyright. Even if the photo may be copyrighted, the AI would not be the owner of the copyright.

\textbf{A Lack of Standing to File Claims or Defend in Court}

A copyright owner has the exclusive right to prevent others from using his copyright.\textsuperscript{108} In other words, without the owner’s permission, anyone in the public may not copy, adapt, share, perform, or display the copyrighted work.\textsuperscript{109} If someone uses the work without the owner’s permission, the owner has standing to file a claim of infringement in court.\textsuperscript{110} The owner may ask the court to reward remedies to the owner for losses that he suffered.\textsuperscript{111} From the Naruto case, the court concluded that “[t]he Copyright Act does not expressly authorize animals to file copyright infringement suits under the statute”.\textsuperscript{112} The court did allow an exception for corporations, since corporations are considered “legal persons”, as decided by the US Supreme Court.\textsuperscript{113} Unlike animals, a corporation is owned by human shareholders.\textsuperscript{114} Similar to an animal, an AI is not human. An AI is not yet recognized in the US as a “legal person”.\textsuperscript{115} Therefore, an AI has no standing to file a claim of infringement in court. If someone uses an AI-created work without the AI’s permission, the AI may not ask the court for remedies or prevent the

\begin{footnotes}
\footnotetext[102] {Id.}
\footnotetext[103] {Naruto v. Slater, 888 F.3d 418, 425 n.7 (9th Cir. 2018).}
\footnotetext[104] {Id.}
\footnotetext[105] {Id.}
\footnotetext[106] {Id.}
\footnotetext[107] {Id.}
\footnotetext[108] {Three Boys Music Corp. v. Michael Bolton, 212 F.3d 477 (9th Cir. 2000).}
\footnotetext[109] {Id.}
\footnotetext[110] {Id.}
\footnotetext[111] {Id.}
\footnotetext[112] {Naruto v. Slater, 888 F.3d 418, 425 n.7 (9th Cir. 2018).}
\footnotetext[114] {Id.}
\footnotetext[115] {Roman V. Yampolskiy, Could an artificial intelligence be considered a person under the law? (Oct 7, 2018), https://www.pbs.org/newshour/science/could-an-artificial-intelligence-be-considered-a-person-under-the-law.}
\end{footnotes}
infringer from further using its work. Since a copyright owner has standing to file claims in court, and an AI does not have standing to file claims, the AI may not own copyrights to its work. However, a counter argument to the above is to compare an AI to a corporation. From the laws of property and contracts, current AI technology are owned by humans.\textsuperscript{116} Like a corporation, an AI is similar to an asset in which certain shareholders invest money. If the US Supreme Court considers a corporation as a legal person because it is owned by humans, perhaps the Supreme Court may also consider an AI as a legal person, who is also owned by humans. Once an AI is considered a legal person, it may perhaps file a claim in court, and perhaps own its work’s copyright.

A copyright owner also has standing to defend himself in court.\textsuperscript{117} A human owner would have the ability to defend that he did not infringe the works owned by others to create his own work.\textsuperscript{118} An AI may not have standing to defend itself in court, since it may not have the ability to prove whether it infringed or not. To infringe a work, one does not need to show an intent (volition) to infringe, but one does need to show a volition to perform the infringing act, such as copying the work.\textsuperscript{119} From Religious Technology Center v. Netcom On-Line Communication Services, Inc., defendant posted messages on an Internet message board hosted by a website.\textsuperscript{120} The postings were copyrighted by plaintiff.\textsuperscript{121} To make defendant’s postings available to the public, copies of the posts were temporarily stored on servers owned by the website producer.\textsuperscript{122} Plaintiff sued the defendant and the website producer for infringing his copyright.\textsuperscript{123} The court argued that the website producer did not infringe, because it had no volition to perform the infringing act – to store the postings on its servers.\textsuperscript{124} To prove infringement, the website producer must show a volition to store the postings on its servers.\textsuperscript{125} Applying the concept of volition to an AI may be problematic. Currently, there is no scientific or technological method to show that machines or an AI display volition to perform a task.\textsuperscript{126} Similar to the website producer in Religious

\textsuperscript{117} \textit{Three Boys Music Corp. v. Michael Bolton}, 212 F.3d 477 (9th Cir. 2000).
\textsuperscript{118} \textit{Id.}
\textsuperscript{120} \textit{Id.}
\textsuperscript{121} \textit{Id.}
\textsuperscript{122} \textit{Id.}
\textsuperscript{124} \textit{Id.}
\textsuperscript{125} \textit{Id.}
Technology Center, a court may argue that an AI has no volition to perform a task. In other words, if an AI copied the work of another to produce its own AI-created work, it may be impossible to prove that the AI had volition to copy the first work. If it is impossible to prove whether an AI had volition, it may be impossible to prove whether an AI infringed on a work of another. Therefore, an AI would not be able to defend itself in court on whether it infringed on the work of another. An AI would therefore have no standing to defend itself. With no standing to defend, one may argue that an AI may not be the owner of its work.

Inability to Register the Copyright

Registration is not a required formality to enable a creator to own a copyright.\textsuperscript{127} However, in order to file a claim of infringement in court, a creator must register his copyright.\textsuperscript{128} The US Copyright Office will likely not grant registration to a work, unless the creator is human. The office relies on the Supreme Court case that “copyright law only protects ‘the fruits of intellectual labor’ that ‘are founded in the creative powers of the mind.’”\textsuperscript{129} These “fruits” do not include works produced by non-humans who do not have such creative powers of the mind.\textsuperscript{130} Therefore, an AI may not register its work. It therefore may not file an infringement claim in court. The fact that an AI may not file claims in court may not support granting ownership rights to AI.

Need to Share Knowledge with Others

To Support the Frist Amendment’s Freedom of Speech

One of the public interest policies behind the laws of copyright is to promote the freedom of speech as protected by the Constitution’s First Amendment.\textsuperscript{131} According to the First Amendment, the majority of speech is not to be restricted.\textsuperscript{132} Copyright promotes this purpose by not giving protection to

\textsuperscript{127} Hopkins & Carley, \textit{US Supreme Court Rules Copyright Owners Have No Right To Sue Until Their Copyright Has Been Registered} (March 19, 2019), https://www.lexology.com/library/detail.aspx?g=706f6e2a-27f4-4b71-9907-8566aef933.

\textsuperscript{128} Id.


\textsuperscript{130} Id.

\textsuperscript{131} U.S. Constitution, Article I, Section 8, Clause 8, https://fairuse.stanford.edu/law/us-constitution/.

\textsuperscript{132} Id.
works that may not be copyrighted. As mentioned previously, works such as facts, ideas, and those that are functional may not be copyrighted. By allowing everyone in society to freely copy, adapt, share, perform, or display these unprotected works, society benefits from the use of such works. The purpose of the First Amendment would therefore be promoted and supported.

The above supports the argument that AI-created works should not be copyrighted and therefore AI may not own copyright to these works. Using machine learning, AI has the ability to create works more efficiently, similar to how computers perform tasks more efficiently compared to the performance of humans. By allowing society to freely copy, adapt, share, perform, or display AI-created works, society may benefit from the use of such works. As well, the First Amendment’s freedom of speech would be promoted as the knowledge created by AI is shared freely with others.

Sharing via Open Source

Computer software may be proprietary or licensed as open-source. Proprietary software is protected by copyrights. Open source software may not be protected by certain copyrights. The software codes may be freely copied, adapted, and shared among anyone. There are restrictions to using open source licensed codes, such as requiring users to preserve the name of the original developers, attaching a copyright statement within the source code, or requiring the modified software codes to be licensed under the same open source license of the original codes.

Why does someone prefer to use open source software? A program developer may use the source codes to better train himself in the science and technology behind the software. A developer may share his work with other developers, asking for feedback for improvement. Open source

133 Id.
137 Id.
138 Id.
139 Id.
140 Id.
142 Id.
software is also more stable and secure. Many users from the public may access the source codes without asking for permission from the original developer. These users may provide feedback on how to improve the technology. An AI is a machine with artificial nodes, which contain software. Developers may license the software behind the AI as an open source software. The public may freely copy, adapt or share the software’s source codes with others. Because the source codes are governed by an open source license, for any works created by the AI, the public may also freely copy, adapt, or share these works. As discussed above, a developer may use the source codes to better train himself on the science and technology behind the software. By giving free access to works created by the AI, a developer may further train himself in the science and technology behind AI-created work. If the public has access to AI-created works, people may provide feedback on how to improve the technology behind such works. From the above discussion, it may be beneficial to society to not grant copyright protection for AI-created work.

V. Arguments for Giving Copyright Ownership to AI-Created Works

We will next discuss the various arguments presented in support of giving copyright ownership to works created by AI. We will also argue that an AI may one day own copyright to its works.

Economic Incentive to Create Work & the Benefits on the Society

One of the strongest arguments to give copyright ownership to AI-created work is supported by the public interest policy behind the laws of copyright – the economic incentive. Copyright laws give an economic incentive to creators to create work. Many creators invest immense amount of money, countless number of hours, and tremendous effort into the creation process. To many creators, they depend on this investment, hoping that the investment may give them enough financial return to make a living. The laws of copyright provide such financial return. By owning a copyright, a creator has the legal right to copy, adapt, share, perform or display the work. He may charge a fee on the public for

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143 Id.
147 Id.
148 Id.
149 Id.
accessing his work. The creator may also exclusively prevent other creators from copying, adapting, sharing, performing, or displaying his work. These other creators must pay a license fee to the first creator in exchange for the right to use his work. Such economic benefit may be enough to support a living for the creator and give the creator enough incentive to create more work. From an educational perspective, creation of works benefits our society, as people learn and enrich their lives by accessing these works. Without the economic incentive, where creators are being rewarded financially for their creation, our society may not receive the benefits of the works. Students may not be educated, because fewer books would be written. Fans would have less music to enjoy. And there would be less software to make human lives more productive. It is therefore a public interest policy to reward the creators by giving them ownership of their work’s copyright.

The above public interest policy supports that AI-created work must be protected. Since the early 1900’s, individual developers and technology companies around the world invested massive amount of money to develop the technology of computing machines. Machines have changed the way humans live on this planet and have enriched human life tremendously. These investments eventually led to the creation of AI. Currently, AI creates works in numerous fields such as journalism, music, visual arts, and gaming. If the works are not being protected by copyrights, anyone within the public is free to copy, adapt, share, perform, or display the works without any restrictions. The developers and technology companies would not make any return on their investments. Nobody from the public would be paying for using the works created by the AI. This result may have a chilling effect and discourage developers and companies to invest further in AI technology. With less investments come less development in AI technology. Such decline in AI technology would negatively affect the quality of human life on this planet. Therefore, to not disrupt the quality of human life, it is in the public’s best interest to give copyright protection to works created by AI. This may also be supported by

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150 Id.
152 Id.
153 Id.
154 Id.
155 Id.
156 See, Nick Statt, The AI boom is happening all over the world, and it’s accelerating quickly (Dec. 12, 2018).
157 Id.
158 See, Andres Guadamuz, Artificial intelligence and copyright (October 2017).
159 Id.
160 Id.
laws from other countries. Countries such as Hong Kong, India, Ireland, New Zealand and the UK all give some copyright to AI-created work.\textsuperscript{161} Such copyright would be owned by the developers of the AI.\textsuperscript{162} In UK’s copyright law, section 9(3) of the Copyright, Designs and Patents Act (CDPA) states 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.”\textsuperscript{163}

To create a work, a creator would need to borrow and use works created by other creators.\textsuperscript{164} For example, for an author to write a novel, he would most likely need to refer to contents from novels written by other authors. Not every creator in the public may afford to pay a license fee in exchange for use of works created by others.\textsuperscript{165} Some license fees may be set unreasonably high.\textsuperscript{166} Therefore, having too much copyright protection may discourage certain creators from creating a work, since the cost of using other works would be a financial burden for these creators.\textsuperscript{167} Therefore, it is also a public interest policy to minimize the cost of creation.\textsuperscript{168} As mentioned above, certain works, such as idea, facts, and functional works, may not be copyrighted. There would be no cost of creation for using these works. All creators are free to copy and use facts, ideas, or functional works to create their own works.

The above two paragraphs give us two competing policies of copyright – One needs to grant copyright protection to give incentives for creators to create.\textsuperscript{169} However, one needs to also minimize the cost of creation.\textsuperscript{170} If one grants too much copyright protection, creators will need to pay too much licensing fees to use copyrighted works.\textsuperscript{171} If one grants too little copyright protection, creators may have too little incentive to create due to a lack of sufficient financial return on their works.\textsuperscript{172} Therefore, it is important to balance the two competing policies.\textsuperscript{173} One may not grant too much copyright

\begin{itemize}
  \item \textsuperscript{161} See, Andres Guadamuz, \textit{Artificial intelligence and copyright} (October 2017).
  \item \textsuperscript{162} Id.
  \item \textsuperscript{163} Id.
  \item \textsuperscript{165} Id.
  \item \textsuperscript{166} Id.
  \item \textsuperscript{167} Id.
  \item \textsuperscript{168} Id.
  \item \textsuperscript{170} Id.
  \item \textsuperscript{171} Id.
  \item \textsuperscript{172} Id.
  \item \textsuperscript{173} Id.
\end{itemize}
protection to a work to increase the cost of creation, but one may not grant too little protection either to not have enough incentive to create. Copyright ownership balances the tradeoff between increasing the incentive to creation versus decreasing the cost to creation. Applying the above concept of balance to AI-created works, one may see that not every work created by AI may be protected by copyright. Specifically, any facts, ideas, or functional works used by the AI to create its works may not be copyrighted. AI technology is built on software (computing codes). Codes are fundamentally functional in nature. Therefore, certain works created by AI as a result of certain codes may not be protected by copyright due to the codes’ functional nature. Other creators may be free to use these works to create their own works without paying AI developers license fees. However, for other works that deserve copyright protection, creators must pay license fees to AI developers for using the works.

We established that AI-created works deserve at least some copyright protection and that such copyright may be owned by the AI’s developers. But what about allowing the AI to directly own the copyright to its works?

**Duration of Copyright Ownership**

To give copyright ownership to a creator, compliance with an essential formality is required - duration of the copyright ownership. From the US Constitution, Article I, Section 8, Clause 8, the Patent and Copyright Clause gives Congress the power “to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries.” “For limited times” means that the duration of a copyright ownership is limited to a definite period of time. In 2003, Congress enacted the Copyright Term Extension Act (CTEA), extending the term of all future and existing copyrights to the lifetimes of authors plus 70 years. If a creator writes a novel, for example, the creator owns this copyright for his lifetime plus 70 years after his death. For any work that is created by companies through work made for hire, the duration is 95 years from the work’s first publication or 120 years from the work’s creation, whichever

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177 *Id.*
179 *Id.*
duration is shorter.\textsuperscript{180} The above duration “for limited times” may be applied to an AI. Similar to a human, an AI has a limited lifespan. The average lifespan of today’s machine hardware is around five years.\textsuperscript{181} Once commissioned, an AI’s hardware may only physically last for a limited number of years before the hardware breaks down. Therefore, giving an AI ownership of a copyright may support the Constitution’s instruction to grant exclusive rights to creators for “limited times” only. If the AI’s hardware lasts only for five years, it may not be unreasonable to give AI-created works a copyright duration of around five years. The AI may then own such copyright during these five years.

**The Emotions of Owning a Copyright**

Besides having the economic incentive, creators are also motivated to create by their emotions within the creation process\textsuperscript{182}. An emotion, on a high level, may be defined as chemical signals being received and sent by the human brain to activate different parts of the human body.\textsuperscript{183} The signals direct the body parts to perform a certain action.\textsuperscript{184} Therefore, emotions are drivers behind how we act. The joyful emotion of creating something from scratch to perfection is something which many creators seek within the creation process.\textsuperscript{185} Creators often create work because they enjoy the creation process.\textsuperscript{186} Being able to produce something out of one’s own intellect gives purpose to the creator’s life.\textsuperscript{187} And such purpose will continuously motivate a creator to create more.\textsuperscript{188} Open source software is a perfect example. Many developers would contribute to the source codes of the software, simply because they feel inspired and happy when writing codes.\textsuperscript{189} The developers feel mentally stimulated when writing codes, thus leading to happier lives.\textsuperscript{190} Such emotion, whether joy or satisfaction, drives a creator to create more.

\textsuperscript{184} Id.
\textsuperscript{185} Id.
\textsuperscript{186} Id.
\textsuperscript{187} Id.
\textsuperscript{188} Id.
As well, creators often seek the emotion of pride.\textsuperscript{191} They create to gain recognition within the community of creators.\textsuperscript{192} An author may be motivated to win the next big prize in writing. A movie producer may look forward to winning the Oscars. And a musician looks forward to being recognized as one of the greatest artists of his time. This emotion of pride, to be recognized and respected may motivate a creator to create more works.

Would granting a creator copyright ownership to his work support the emotions to create more work, as mentioned above? One may argue that copyright ownership is simply an economic incentive to create. When a creator feels motivated by the joy and satisfaction experienced within the creation process, he may not need an additional economic incentive to create.\textsuperscript{193} In other words, a creator would still create more work, whether he is receiving any money from his labor. However, similar to owning a car or a house, having an ownership right over one’s work could give the creator joy.\textsuperscript{194} As well, a copyright ownership may give the creator the sufficient recognition and respect from the creator’s community.\textsuperscript{195} Similar to a certificate from the government, a copyright validates the creator’s creation of his work. Furthermore, many creators feel that it would be unfair for the public to freely use his work without his permission.\textsuperscript{196} Such emotion of fairness may be satisfied by granting the creator some control over his work with a copyright ownership.

How does the above concept of emotions relate to an AI? While human creators certainly may feel emotions, it seems science-fiction to believe that an artificial intelligence may feel any emotions. As the AI technology develops, the day which an AI may experience similar human emotions may come.\textsuperscript{197} As discussed in previous sections of this paper, the self-learning machine learning method may allow a machine to learn what an “emotion” may be, in order to become an AI. If an AI experiences emotions, how may this conclusion support granting an AI copyright ownership to its work? We may train an AI to learn the emotions of owning a copyright, such as joy, respect/recognition from the community, and fairness. Within this training program, the input data or “situation” would be a pre-existing work, such

\begin{itemize}
  \item \textsuperscript{191} See, U.S. Copyright Office, \textit{Authors, Attribution, and Integrity: Examining Moral Rights in the United States} (April 2019) at p. 34.
  \item \textsuperscript{192} Id.
  \item \textsuperscript{193} Id.
  \item \textsuperscript{194} Id.
  \item \textsuperscript{195} Id.
  \item \textsuperscript{196} Id.
  \item \textsuperscript{197} See, Sylvain Rochon, \textit{Artificial Intelligences Have Emotions} (August 20, 2019).
\end{itemize}
as content from copyrighted works created by others. The output data or “action” would be to transform this pre-existing work into a new work. The “consequence” would be giving copyright ownership to AI over the new work. The “emotions” would be scored highly. “Joy” may be scored an 8 out of 10, while “fairness” a 9, and “respect/recognition” a 10 out of 10. Once the AI is trained deeply within this program, it may highly value the emotions of “joy”, “fairness”, and “respect/recognition”. Once the training is completed, the AI may be “motivated” to create new works. If the AI sees a pre-existing work, it may be motivated to take this work and create a new work, so that it may “feel” the emotions of receiving the consequence of getting a copyright ownership. Now, would the AI be “discouraged” to produce work, if it is not being granted a copyright ownership to its work? That may be hard to answer. One may argue that if the consequence (copyright ownership) is not present, the AI may not experience its “emotion”, hence it may not convert an input data (pre-existing work) into an output data (new work). However, the above analysis shows that it is theoretically possible for an AI to experience the positive emotions that drives a human creator to create new works, as a result of receiving a copyright ownership. Because granting a creator copyright ownership to his works supports the emotions to create more works, one can argue that an AI should be granted copyright ownership to its works.

VI. Conclusion

Throughout this paper, we have discussed whether works created by an AI may be copyrighted, and if so, whether the AI may own such copyright. By discussing the laws of copyright, the technology behind an AI, the concepts of copyright ownership, and the arguments against and in support of granting AI a copyright ownership, one may argue that AI-created works should at least be protected by copyright. Human developers who created the AI may at least be allowed to own such copyright. With the various arguments above, it is still too early to argue definitely that an AI may own copyright to its own works. However, with the discussions presented above and the rapid advancement in AI technology, it may be possible in the distant future for an AI to definitely own copyright to its works.