From: Kalin Hristov <kalin.hrist@gmail.com>
Sent: Sunday, November 17, 2019 10:29 PM
To: aipartnership
Subject: USPTO comment on AI policy and law
Attachments: Artificial_Intelligence_Copyright_Survey.pdf

Re: USPTO request for comments on the impact of AI on IP law and policy

To the Honorable Andrei Iancu,

Under Secretary of Commerce for Intellectual Property and Director of the United States Patent and Trademark Office

Dear Mr. Under Secretary,

I would like to thank you and the USPTO for facilitating a conversation on an important topic in the IPR field. I would also like to thank you for allowing me to share my thoughts and research on the intersection of artificial intelligence and intellectual property rights – an issue I have been researching and closely following for nearly a decade.

I recently conducted a study (comprehensive survey) among IP and tech policy professionals which covers some of the questions included in the Federal Register, Vol. 84, No. 210.

I am including a PDF copy of my findings (currently under review for publication) and a link to the paper online - Artificial Intelligence and the Copyright Survey.

https://kalin.org/publications/

I would also like to draw your attention to my recent publication titled Artificial Intelligence and the Copyright Dilemma (IDEA: The IP Law Review, Vol. 57, No. 3, 2017) which describes some of the issues related to the intersection of AI and IPR and sets forth a number of policy recommendations.

Once again, I would like to thank you and your Office for facilitating public debate on a topic which has the potential to affect intellectual property rights and the advancement of the American tech industry.

Kalin Hristov

Artificial Intelligence and the Copyright Survey

Kalin Hristov

Abstract

Artificial intelligence has emerged as a key contributor to American social, economic, and cultural development. *Intelligent* software has increasingly played a greater role in every creative industry. These industries rely on intellectual property protection to maintain equilibrium between productivity, remuneration, and competitiveness. American policymakers, however, have paid little attention to the intersection of artificial intelligence and copyright protection. This study has collected data from 57 AI scientists, tech policy experts, and copyright scholars through a survey and questionnaire. The data have shown that while intelligent software is an important contributor to American cultural development, half of respondents believe that the US Copyright Office is not prepared to deal with an influx of computer-generated works. In light of rapid developments in artificial intelligence, this could present a serious challenge to the American copyright system and future advancements in the AI industry.

Keywords: Artificial intelligence, AI, copyright, technology policy, survey, United States of America

1 Introduction

Artificial intelligence (AI) is a loosely defined term which has been around for decades. AI encompasses the idea that computer programs can perform functions typically associated with the human mind. Although most people are only familiar with AI as a collective term, artificial

intelligence may actually be divided into a number of unique sub-fields. Machine learning, natural language processing, robotics, and computer vision are just a few of the real-world applications of AI. Machine learning, and more specifically, its offshoot, deep learning, has been present in countless academic papers and news headlines as a result of achievements which seemed unfathomable just a decade ago. With the help of artificial neural networks – which closely resemble the structure and functionality of biological neural networks constituting animal brains – AI has been able to outperform humans on an average IQ test; create works of art indistinguishable from those created by humans; and beat professional human players in highly complex games (Silver et al., 2016; Spice, 2017; Wang, Tian, Gao, Bian, & Liu, 2015).

Artificial intelligence has also become the status quo in the day-to-day operations of most tech behemoths. Alphabet's Google search uses powerful algorithms to serve up results and advertising that are both relevant and engaging. Amazon's recommendation engine relies on machine-learning techniques that contribute to higher company profits and greater customer satisfaction. Both Microsoft and Apple offer personal-assistant services which contribute to simplicity and efficiency of everyday tasks. These are some of the best-known applications of artificial intelligence. In addition, so called generative algorithms have recently become a fast-growing segment of the AI industry.

1.1 Copyright and AI-produced Works

Generative algorithms are responsible for producing unique works of various complexity which differ from prior art. These works can be as a result of collaborative efforts between a human creator and an AI program, or entirely the result of independent AI processes

(Hristov, 2017; Thaler, 2013). In both cases, artificial intelligence is at least partially responsible for the production of innovative work. Instances of such works are becoming more common as AI use becomes more frequent. To date, books, songs, visual art and computer programs have all been created by generative algorithms (IBM, 2017). Advancements in the tech sector along with the development of new generative AI methods will likely contribute to a greater number and quality of AI-produced works, making intellectual property (IP) rights a pressing issue for artificial intelligence programmers and users. Programming and training an AI algorithm can be both time consuming and expensive. If AI programmers are unable to recoup their efforts through the financial benefits associated with IP protection, it is safe to say that many may be dissuaded from investing their time, money and expertise in AI development.

The United States lacks legislation and targeted policy that addresses the attribution of copyrights for AI-produced works. This would not be of concern if the US tech sector existed in a vacuum – not influenced or affected by outside forces or by the rapid development of novel AI technologies. In reality, most global actors, with even the slightest AI-research capacities, are actively jockeying for position as leaders of the international AI race. Japan and the European Union have dedicated resources and increased efforts in determining best practices when dealing with the attribution of copyrights for AI-produced works (Delvaux, 2016). China plans to funnel billions of dollars into its AI industry over the next few years in hopes of reinvigorating its slowing economy and overtaking the US as leader in AI research and development (State Council, 2017). The stakes are quite high, for US businesses and consumers. The right laws and policy could ultimately determine the global socio-economic outlook for decades to come.

An important reason for conducting this study is the fact that governments around the world have indicated their intent to adopt and invest in artificial intelligence as a way to improve

their citizens' welfare and contribute to economic growth. Recent initiatives in Japan, the EU and China have attracted media attention and signaled governmental readiness to turn a new chapter in the technological forefront by openly and effectively adopting AI. Setting up policy research-taskforces and investing billions of dollars in the future development of the AI industry are tell tale signs that the international AI race is well under way. Failing to establish a clear and effective policy path could ultimately affect America's global standing as a technological and cultural powerhouse. The implications of such an oversight have the potential to permeate every facet of American society.

2 Literature Review

Recent developments in AI have challenged the commonly accepted notion that human ingenuity is solely responsible for the production of creative works. Although human creativity is without a doubt the paramount force behind some of the most popular works known to man, non-human authors – including non-human animals and intelligent computer programs – have also been credited with the production of works which posses both an economic and esthetic value (Brueck, 2016; Cohn, 2018; Elgammal, Liu, Elhoseiny, & Mazzone, 2017; Kaufman, A. B., Butt, Kaufman, J. C., & Colbert-White, 2011). Using artificial neural networks which mimic the functions of a biological brain, Dr. Stephen Thaler – President and CEO of Imagination Engines Inc. – has been credited with the production of so-called Creativity Machines which generate copyrightable material with and without the assistance of a human author (Thaler, 2016). The resulting works are often the outcome of independent processes within the artificial neural networks and cannot be fully attributed to a human author under established copyright procedure

(Library of Congress, § 306). Works created as a result of automatic computer programs with limited or no human intervention are a topic of debate among intellectual property, policy, and tech experts around the world.

The Next Rembrandt – a collaborative project between art historians, researchers, data scientists, and engineers – analyzed hundreds of paintings by Dutch artist Rembrandt to generate a new portrait in the painter's unique style using machine learning's deep learning approach (Yanitsky-Ravid & Moorhead, in press). The computer program used in the project accounted for virtually every minute detail in Rembrandt's entire collection. Gender, age, head direction, and even the amount of facial hair of subjects who appear in the artist's masterpieces, were all considered by the program when determining the final look of the AI-produced work. A facial recognition algorithm was part of the software that determined the geometric and stylistic look of human facial features used in Rembrandt's portraits (Microsoft, nd). The dimensions and placement of every feature were calculated by a separate algorithm and applied accordingly to the new painting. In addition, algorithms were used to determine appropriate use of lighting and shadows – two distinctive characteristics of a 'true' Rembrandt – and to determine the size, direction and type of brushstrokes used by the artist (Microsoft, nd). The end result was the Next Rembrandt, a new and unique portrait in the style of the artist that arguably only art historians and critics could discern from the 'real thing' (Microsoft, nd).

DeepDream, a computer program which algorithmically enhances images with the intent of generating new dream-like visual art, is another example of AI at work. Through the use of convolutional neural networks, DeepDream finds and enhances visual patterns in order to create psychedelic images which often have little in common with the original work (Auerbach, 2015). This method is first fine-tuned by a human developer and usually goes through a number

of iterations. The process performed by the algorithm responsible for the final work can most closely be associated with *pareidolia* – a psychological phenomenon in which the human mind responds to a visual stimulus (the original image) by perceiving a familiar or previously learned pattern where it does not exist (Zimmermann, 2012). An analogous example may be a child identifying animals or other familiar objects in passing cloud formations, or a novice stargazer observing human-like forms in the night sky. Although human input is required in the initial stages of the program, most of the visual output is quite unique and often falls outside the realm of commonly produced human artwork (Auerbach, 2015).

DeepDream's algorithmically produced images and the Next Rembrandt are representative of the majority of visual art produced by artificial intelligence. The common 'ingredients' appear to be prior images from which the AI may learn, and a human 'co-author' to initiate the creative process and guide the computer program. Exceptions, however, do exist. A method called creative adversarial networks (CAN), pairs up two neural networks – one to generate new images and a second to judge whether the images are unique enough not to be classified within commonly known art styles (Elgammal, et al., 2017). This approach builds upon generative adversarial networks (GAN) which have recently gained popularity in machine learning (Creswell, et al., 2018; Goodfellow, et al., 2014). With CAN, the objective of the AI program is to produce paintings which do not neatly fit within a single art style, while ensuring that the resulting works do not excessively depart from aesthetic norms (Elgammal, et al., 2017).

In essence, CAN-produced works incorporate the most appealing traits from DeepDream's novel images, and computer-generated art with established appeal like the Next Rembrandt. Images produced by creative adversarial networks are unique enough to be unlike any prior art (by falling outside of classic art styles), but also comply with commonly established

art norms which makes them more appealing to human observers than the psychedelic images associated with the DeepDream project (Elgammal, et al., 2017). By 'maximizing deviation from established styles and minimizing deviation from art distribution,' works could be unique from prior art while, at the same time, appealing to the general public (Elgammal, et al., 2017). A study conducted by scientists researching CAN noted that participants preferred AI-produced works to human-created art and deemed CAN works as more novel, complex, and inspiring in comparison to human works which neatly fit into any one established art style (Elgammal, et al., 2017).

Music is another creative realm recently infiltrated by AI. Aiva Technologies, a European startup, has created 'Aiva' (Artificial intelligence virtual artist), an AI that composes classical music which arguably rivals musical masterpieces created by the likes of Mozart, Beethoven and Bach (Kaleagasi, 2017). Aiva's music has so far been used in film soundtracks, by advertising agencies and game studios. The computer program has also been recognized as a composer and registered with SACEM – a French professional association which protects the intellectual property rights of its members and collects royalties for their work (Kaleagasi, 2017). In addition, Aiva has already released its first critically acclaimed album entitled Genesis and claims copyrights over the intellectual property of its work (Kaleagasi, 2017).

Aiva's success may be attributed to reinforcement learning techniques. With reinforced learning, the AI does not receive explicit instruction along each part of the creative process, allowing it a more autonomous role (Kaleagasi, 2017). The results are often more innovative and much less dependent on human intervention. By using classical music (which is largely in the public domain) and only relying on a human author in a limited capacity, it may be argued that Aiva is the main creative force behind the newly produced musical works. Some might even go

one step further (as in the case of SACEM) by attributing the computer program full authorship of its work in a legal capacity.

Notable literary works have also been produced by computer algorithms. 'The Day a Computer Writes a Novel' is a novella 'written' by an AI programmed by a team of researchers at Future University in Hakodate, Japan (Olewitz, 2016). The novella was one of 1,450 submissions received by the organizers of the Japanese Hoshi Shinichi Literary Award competition. Although the short novel did make it past the first round (unlike many of the human-written works), it was eventually eliminated by the panel of judges due to a lack of sufficient character development (Olewitz, 2016). 'The Day a Computer Writes a Novel' was, in fact, a collaborative effort between researchers who input the literary guidelines and a collection of words and phrases to be used by the AI in the writing process (Tarantola, 2016). It was the computer program's job to uniquely assemble all parts of the novel in an intelligible and thought-evoking way. According to the competition's judges, the AI-human collaborative work managed to do so, better than a lot of the literary works solely attributed to human authors (Olewitz, 2016).

Software writing AI has also recently grabbed headlines for its ability to perform better than human programmers. Researchers at Google Brain's artificial intelligence lab have designed software that has developed a machine-learning system responsible for benchmarking language processing software (Simonite, 2017). The software-generated software performed better than all previously published results of similar programs designed by human developers (Simonite, 2017). In addition, researchers at the non-profit OpenAI; University of California, Berkley; MIT; and Google's DeepMind, have all, with various degrees of success, been able to create AI-learning software which produces new computer programs (Simonite, 2017). Since AI algorithms ultimately serve a utilitarian purpose, they are ineligible for copyright protection. Some, however,

do fit the requirements for another type of intellectual property protection – utility patents. The source code of some AI programs, however, does satisfy the requirements for copyright protection, which means that researchers at Google, MIT, UC Berkley and OpenAI could ultimately protect the IP associated with their software-generating software if they chose to do so (Villasenor, 2014).

AI-produced content from nearly every category of copyrightable subject matter has recently been in the headlines of tech journals and IP law reviews. As the aforementioned examples of AI-produced works illustrate, each case varies in both creative complexity and human intervention. From the near-autonomous process of Dr. Thaler's Creativity Machine, to the carefully guided collaborative effort between human researchers and the AI author of 'The Day a Computer Writes a Novel,' human assistance may be either trivial or highly involved. It, therefore, comes as no surprise that the countless nuances of human-computer interaction in the creative process have perplexed scholars from the legal, ethical and policy fields.

2.1 Copyright and Artificial Intelligence

Two main bodies of work determine the guidelines and regulations currently affecting the copyright of computer-generated works. Although the US Copyright Act and the Compendium of best practices (issued by the US Copyright Office) do not expressly mention AI machines or their place in the creative process, they do offer a glimpse into the stance of the Copyright Office in the debate on copyright protection of AI-produced works.

In order for a creative work to be deemed copyrightable, a number of requirements must be satisfied. Copyrightable subject matter must belong to one of the categories

predetermined by the Copyright Office. In addition, a copyrightable work must also be original and fixed in a tangible form of expression (17 U.S.C. § 102). Originality under copyright law entails that the work must be independently created by the author and must poses a minimum degree of creativity (17 U.S.C. § 102). A tangible form of expression, on the other hand, may be any physical 'medium of expression, now known or later developed, from which they can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device (17 U.S.C. § 102a).'

A crude example of a copyrightable work is a photograph of the popular tourist attraction – and arguably one of the most notable symbols of freedom of expression – the Statue of Liberty. The photograph would satisfy all requirements set forth by the US Copyright Office. It fits within the 'Pictorial, graphic, and sculptural works' category of copyrightable subject matter defined by the US Copyright Act. The photograph would be considered fixed in a tangible form since both its digital (electronic file format) and physical (paper print) copies can be 'perceived, reproduced, or otherwise communicated…directly or with the aid of a machine or device (17 U.S.C. § 102a).' Although lacking novelty, the picture would also be deemed original since the photographer most likely single-handedly snapped the photo with some form of creative influence – be it angle of the shot, lighting, composition, or even creative filter – applied to the resulting work.

The place of AI in the creative process, although seemingly similar to other mediums of artistic expression, does not perfectly satisfy all requirements set out by the US Copyright Act or the guidelines listed in the Compendium of best practices. In fact, independently produced AI works are not copyrightable due to one major restriction – the human author requirement stipulated in the Compendium of best practices (Library of Congress, § 306). It should be noted

that unlike the US Copyright Act, the Compendium of US Copyright Office Practices is not a legal document, but an internal aid used to streamline the copyright attribution process. As such, it appears that the copyright limitations of AI-produced works are procedural as opposed to legislative or policy-related.

2.2 Current Opinion on Copyright of AI-produced Work

Scholars have weighed in on the decision of the US Copyright Office 'not [to] register works produced by a machine or mere mechanical process that operates randomly or automatically without any creative input or intervention from a human author (Library of Congress, § 313.2).' Expert opinion appears divided on the issue. The proponents of the first group argue that copyright protection of AI-produced works should be awarded to the developers of the AI or the human authors responsible for initiating the creative process. This position has already been applied by the UK, New Zealand and a number of other Commonwealth countries. The copyright of computer-generated works in the UK is attributed to 'the person by whom the arrangements necessary for the creation of the work are undertaken.' (Copyright, Designs and Patents Act., § 9 (3), 1988) This notion is arguably the easiest way to implement copyright protection for computer-generated works and is a popular among IP scholars and tech industry researchers. Annemarie Bridy, a seasoned IP scholar, sees the UK's approach as a viable solution to the copyright dilemma currently facing the AI industry. Bridy (2012) points out that copyright may theoretically be passed on from the AI machine to its human programmer or user through the made for hire doctrine of the US Copyright Act. The doctrine examines the intellectual

property rights of 'work prepared by an employee during the scope of his or her employment (17 U.S.C. § 101).'

Kalin Hristov (2017) further contributes to Bridy's solution by proposing that 'employee' and 'employer' should be viewed as relative terms within the scope of the made for hire doctrine. This reinterpretation would prevent AI produced works from falling into the public domain by effectively assigning their copyright to a human author. The doctrine simply transfers all legal rights and responsibilities from the author-in-fact (the computer program which produced the work) to the author-in-law (the legal person – human author or corporation who was responsible for the AI or initiated the creative process) (17 U.S.C. § 201b). This method is significant since it resolves a number of long-standing issues which have been plaguing the tech intellectual property field for quite some time. Since machines (AI) are not legal persons, they cannot enjoy the financial incentives or account for the legal responsibilities associated with copyright protection (Adriano, 2015). Human authors and corporations, on the other hand, are fully capable of fulfilling all obligations associated with copyright protection, including any future legal challenges which may arise from copyright infringement (Solum, 1991).

James Grimmelmann sees computer algorithms as yet another form of expression for human creativity. According to Grimmelmann (2015), the novelties of AI works coupled with the complexity of the algorithmic process have contributed to a superfluous alarm for change of the US Copyright Code, when in fact computer programs are no different than any other tool used by a human author, and no special status should be given to algorithmically generated works. Although Grimmelmann (2015) believes that copyright protection of such works should be vested with humans, he sees 'new copyright doctrines of computer-generated works [as] a terrible idea.' Simply put, AI programs are a medium for expression – just like a camera, a

canvass, or even a pen and paper – as such, no legal or policy changes are necessary in order to ensure the uninterrupted operation of the US intellectual property system.

According to the US Copyright Act, only the authors of a creative work may obtain copyright protection (17 U.S.C. § 201a). With the exception of the above mentioned made for hire doctrine, this rule generally indicates that only those directly responsible for producing a work may enjoy the benefits associated with its copyright. As a result, some scholars have argued that the term 'author' should be reinterpreted to include both human and non-human creators. Professor Ryan Abbott is a leading proponent for the legal rights of non-human authors and inventors. Along with Colin Davies, Abbott has independently argued that intelligent computer programs should be considered legal authors and inventors under relevant intellectual property law (Abbott, 2016; Davies, 2011). This seemingly novel approach is forward-thinking at its core and will undoubtedly resolve some of the issues related to independently produced works falling into the public domain. A number of complications, however, may arise due to existing limitations in AI design and the American IP system. First, AI machines are not legal persons and cannot be held accountable for their actions under current intellectual property law. Second, computer programs are not influenced by the financial incentives associated with copyright protection – a cornerstone of the US Copyright Act and a driving force behind the creation and dissemination of creative works. Without a clear consensus among experts, a survey and questionnaire were used to collect and quantify data from AI scientists, tech policy experts, and intellectual property scholars. The methods used and the data collected have been detailed in the following sections of this paper.

3 Study Methodology

A cross-sectional study was conducted over a 45-day period through a trusted third-party website popular for providing survey and questionnaire services. The website was also used to analyze a portion of the collected data. The survey sample was chosen from a sampling frame which consisted of experts in public policy and intellectual property from primarily US higher learning institutions ranked within the top 20 positions determined by the US News and World Report. To ensure that that the sample of experts was adequately selected, their online institutional profiles were closely examined and only members with additional expertise related to emerging technologies or creative works were included in the final survey sample.

In addition, to account for experts in the fields of public affairs and intellectual property law who are not part of institutions ranked in the top 20 positions of the US News and World Report, or the fact that some of the top scholars in IP law and public affairs may not be from US institutions, an additional measure was introduced. Authors of the most downloaded articles on the Social Science Research Network (SSRN) at the intersection of artificial intelligence and intellectual property were also included in the survey sample. To determine sample members' eligibility, their article description and provided keywords were examined. Authors with highly downloaded papers on the SSRN with a combination of the keywords: artificial intelligence; AI; machine learning; deep learning; intellectual property; IP; copyright, were also considered eligible as members of the survey sample after their online institutional profiles were examined and their relevant expertise was confirmed.

3.1 Survey

The survey was sent to 350 experts determined through the aforementioned methods. In addition, a thirty-member pretest group, whose members were not part of the primary 350 experts, was established to test the efficacy of the survey. The results of the pretest group were not factored into the final data obtained from participants from the primary 350-member group. Both experts from the pretest group and the primary group were alerted about the survey via email. Potential respondents were given a brief introduction to the survey and were made aware of its type, topic, purpose, number of questions, estimated completion time, and intended use of collected data. In addition, the author of this study briefly introduced himself and his institutional affiliation. Contact information was provided in case questions or concerns associated with the survey were to arise.

A total of 22 questions were deemed appropriate for the first draft of the survey. After a number of revisions and advice from colleagues, the final draft for the survey comprised of 12 questions [see Appendix 1]. All questions were agree-disagree on a 5 point Likert-scale. Available choices for respondents were: strongly agree; agree; neutral/neither agree nor disagree; disagree; strongly disagree. Both the number of questions and the response method were chosen to encourage a high level of participation and a high rate of survey completion among the sample group. Survey brevity and simplicity were key characteristics which contributed to this objective.

The survey process was initiated when the author contacted 30 pretest individuals via email. In order not to diminish the overall survey sample, the 30 pretest individuals were not from the general survey sample pool. Pretest group members fulfilled some of the above-mentioned criteria which qualified members of the primary survey group, but did not meet all stringent requirements associated with participation in the study. For example, some scholars affiliated with public administration or intellectual property departments from institutions ranked

in the top 20 list compiled by the US News and World Report were not deemed sufficiently compatible after in-depth review of their online institutional profiles. In addition, authors who had published articles uploaded to SSRN with few downloads were deemed ineligible for the primary participant group but were added to the survey pretest group.

Finally, a number of researchers with extensive experience in machine learning and other AI related offshoots were also included in the survey pretest group in order to ensure proper survey calibration and gauge the possible effects of discipline bias. The results of respondents from the pretest survey group were used to adjust the final survey but were not factored in this study.

After minor adjustments, the survey was sent out to the primary survey group via email. The email included a brief introduction and description of the survey along with an explanation of the surveyor's intended use for the gathered data and a link to a third-party website where the survey was hosted. After a week an email reminder was sent to sample members who had not yet responded. A final reminder was sent approximately two weeks after the final survey was dispatched. The survey was closed 45 days after the initial survey request was sent out. A 20 per cent response rate was recorded. Upon completion, results were analyzed for completeness and accuracy.

Results from a number of respondents were deemed ineligible due to the following inconsistencies. Respondents who completed the survey in a time frame shorter than what was deemed adequate and necessary by pretest data and through the surveyor's own prior experience were disqualified and their results were not factored into this study. In addition, respondents who overwhelmingly used the neutral/neither agree nor disagree option to convey their opinions were

deemed not knowledgeable enough on the topic. Their responses were also deemed ineligible and not factored into the final results of this study. The results from the remaining respondents were initially collated and analyzed with the survey website's proprietary tools. A total of 57 eligible survey responses were recorded. The compiled datasets were exported to relevant software where they were further analyzed and visualized for the purpose of this study.

3.2 Questionnaire

The second method used in this study was an open questionnaire [see Appendix 2]. The open questionnaire was formulated as a supplementary tool to the 12-question survey. Since responses to the survey were purposely limited to a set of predetermined answers in order to make it easier to quantify and analyze the gathered data, a follow-up open-ended question survey (open questionnaire) was conducted. The purpose of the open questionnaire was to enrich and explain the previously gathered quantitative responses. The combination of quantitative and qualitative methods was deemed both necessary and adequate to the research process, since the topic is both new and complex, requiring a comprehensive approach.

The open questionnaire was sent out approximately one week after the original survey was closed. A subset of respondents from the original survey was randomly chosen to further elaborate on provided answers through six open-ended questions. In addition to the original respondents, a new group was included in the open questionnaire process. Researchers and scientists from the top 20 AI research institutions, as determined by US News and World Report's rankings, also accounted for a fraction of respondents to the subsequent open questionnaire. The inclusion of AI researchers and scientists was done for two reasons. First, the

opinions and insights of AI experts were seen as a crucial part in determining solutions to an issue that affects the industry which they are ultimately responsible for creating and developing. Second, the original survey had an emphasis on the fields of public policy and intellectual property law, areas that most computer scientists and researchers are unfamiliar with. The final questionnaire sample was selected in an attempt to clarify and elaborate on previously raised questions from a number of different perspectives.

Potential respondents were again contacted via email. The email included a brief introduction to the open questionnaire, the surveyor's intentions, and a link to a third part website where the questionnaire was hosted. The questionnaire was open for 30 days. Two email reminders were sent, one week apart, to individuals who had not completed the survey. After the survey was closed, answers were collated and reviewed by the author of the study. Results were used to supplement data from the initial survey. The questions used in the open questionnaire were asked in an effort to better understand the opinions of public policy scholars, intellectual property experts and computer scientists on the intersection of artificial intelligence and intellectual property.

4 Study Results

4.1 Survey

The survey conducted for this study was sent out to 350 researchers and academics. The need for interdisciplinary expertise by respondents significantly lowered the study's population size. A total of 70 respondents – 20 per cent of the 350 experts contacted – completed the survey. To assure the quality and accuracy of responses, a set of requirements were imposed. The

requirements invalidated a number of the final responses. After a comprehensive analysis of responses, the final response dataset comprised of 57 experts.

4.2 Sample Demographics

The respondents' demographics were extensively analyzed in an effort to reduce bias and ensure data quality and scope. The survey respondent group comprised of experts specializing in a number of disciplines. After the institution profiles of all respondents were analyzed, it was established that approximately 58 per cent of participants listed one of their areas of expertise as either public policy or public administration. Six out of 10 (approximately 61 per cent) respondents specialized in intellectual property law. A third of experts (33 per cent) participating in the survey noted one of their main research areas as economics. Out of the above listed respondents, 82 per cent claimed to specialize in the technology field. For instance, according to institutional profiles, a great number of respondents concentrated their research on tech policy, while IP professionals usually listed their area of interest as tech related. In addition, 23 per cent of participants claimed to be proficient in software programming or were instructors in a computer science course requiring some form of programming abilities [see Fig. 1].

The demographic analysis also revealed additional trends. Although the author attempted to ensure a diverse sample of respondents, the majority of participants (approximately 75 per cent) were male, while around 25 per cent of those surveyed were female. Finally, respondents were analyzed based on the origin of their institution. Most participants (89 per cent) were employed at US-based institutions. The remainder of respondents, accounting for around 11 per cent of the overall total, comprised of members from institutions outside the US. Two

regions which trailed the US in regard to number of survey participants were Europe and East Asia, respectively.

4.3 Expert Opinion

Approximately 65 per cent of surveyed experts believed that computer programs, including AI software, were key contributors to the production of contemporary creative works like music, films, visual art, software, etc. Of those that did not answer that computer programs were primarily responsible for creative works, 28 per cent were neutral or undecided, while jus 7 per cent disagreed [see Fig. 2]. In addition, when asked if AI would contribute to a growth of creative works available to the general public, six out of ten respondents (61 per cent) either strongly agreed or agreed, while only 1 out of ten (9 per cent) either disagreed or strongly disagreed [see Fig. 3].

When it came to AI's impact on the United States' economic growth, experts were more divided. Roughly 43 per cent of respondents strongly agreed or simply agreed that an increase in the number of commercially available AI-produced works will stimulate economic growth. A similar number of experts (40 per cent) were neutral or neither agreed nor disagreed with the statement. Respondents were more certain about the impact of AI-produced works on the development of the AI industry. Approximately 63 per cent of surveyed experts either agreed or strongly agreed that an increase in the number of commercially available AI-produced works would stimulate AI industry growth. Nine per cent of survey participants either disagreed or strongly disagreed with the statement, while more than a quarter (28 per cent) were neutral or neither agreed nor disagreed [see Fig. 4].

While 61 per cent of survey respondents either agree or strongly agree that artificial intelligence will contribute to a growth in creative works available for use by the general public, around half of respondents (just over 50 per cent) believe that the US Copyright Office is not adequately equipped to deal with a growing number of computer-generated works. In addition, one in four experts had no opinion or was uncertain of the ability of the US copyright system to adequately address the rise of AI in the creative sphere, while the remaining 25 per cent believed that the current system was working adequately enough. [see Fig. 5].

When surveyed on the importance of copyright protection as an incentive for authors to make their works commercially available, approximately 55 per cent of experts either agreed or strongly agreed that copyright is an important incentive. The remaining respondents were split evenly, either taking a neutral position or disagreeing that copyright protection stimulates commercialization of creative works. When surveyed on the most important factor incentivizing the production of creative works, the majority of respondents (59 per cent) disagreed or strongly disagreed that monetary compensation was most important to artists, with only 21 per cent agreeing that financial gain was the primary incentive for the production of creative works.

4.4 Surveying the Stance of the Copyright Office

Expert opinion was also collected on the current intellectual property status of AI-produced works. Respondents were asked to share their opinion on the viability of various methods which may be used by the US Copyright Office when dealing with independently produced AI works. When presented with the statement, ‘The US Copyright Office should consider computer programs as sole authors of works they independently produce if there is no

creative input or intervention from a human author,' the majority of respondents (56 per cent) either disagreed or strongly disagreed, while one in three (33 per cent) took a neutral stance, and one in 10 surveyed agreed or strongly agreed. On the other hand, when presented with the statement, 'The US Copyright Office should consider humans as sole authors of works independently produced by the AI they own or have created, even if these works lack any creative input or intervention from a human author,' opinion was divided. Approximately 30 per cent of experts disagreed or strongly disagreed with the statement, nearly four out of 10 (39 per cent) were neutral, while around 32 per cent agreed with the statement.

Another statement attempted to gauge expert opinion on collaborative ownership of copyrights. When presented with the statement, 'The US Copyright Office should consider joint authorship between AI machines and their human developers, in cases where the creative works were produced by the AI without any creative input or intervention from a human author,' approximately 61 per cent of surveyed experts either disagreed or strongly disagreed with the statement, 23 per cent were neutral, while only 16 per cent agreed. The final statement presented to respondents was worded in the following manner, 'The US Copyright Office should deny copyright protection to works independently produced by AI without any creative input or intervention from a human author, releasing them into the public domain.' Of those surveyed, 17 per cent disagreed or strongly disagreed, 26 per cent were neutral, while a total of 56 per cent of experts agreed or strongly agreed with the statement.

4.5 Questionnaire

In addition to the conducted survey, results from an open questionnaire were also collected. Respondents shared their thoughts and opinions on a number of topics associated with AI-produced works and how copyright might affect the AI industry. For the purpose of brevity and clarity, three experts with representative answers for their respective fields were selected and their responses are detailed below. Respondent one is an intellectual property expert with decades of experience and a number of highly cited publications on the topic. Respondent two is a programmer with extensive knowledge in IP, who has worked for some of the biggest US tech firms. Respondent three is a computer scientist specializing in machine learning at a prestigious American research institution.

When asked if respondents believed that AI would contribute to a growth in the number of creative works available to the general public, Respondent one answered that it would take some time, but that eventually, 'AI will become capable of producing the same kinds of creative works as human authors – and perhaps do a better job.' Respondent two, gave a different response, emphasizing that AI will have a largely collaborative role, filling the position of an 'artist's assistant.' Respondent three saw the role of AI in the creative process as that of a 'tool' which would allow artists and writers to better focus on the creative parts of their job while 'automating a good deal of the drudgery.'

Expert opinion on the current stance of the US Copyright Office to deny copyright protection to works produced by non-humans (including AI machines), was also surveyed. According to Respondent one, 'The Constitution only permits copyrights for authors. It is unlikely that the original meaning of "authors" extends to AIs without moral personhood – which we are not even close to achieving today.' Respondent two expressed agreement with the current stance of the US Copyright Office, adding, 'The current law [only] covers human creation. Much

like a monkey could not own the copyright to the selfie it took, a program cannot either.' Respondent three noted the need for in-depth future debate on the topic, adding, 'This requires actual thought, not the usual lawyerly method of applying one inappropriate existing model or another. The copyright system is messed up in many ways, based on the assumption that "copying" a work meant using a printing press.'

When directly asked if copyright protection of AI-produced works would stimulate growth of the AI industry, Respondent one and Respondent three were uncertain, with Respondent three noting that although this question requires deeper thought, there need to be 'some incentives for creators and for those who create creative systems and for those who set up these systems and edit the results.' Respondent two, on the other hand, answered no, elaborating that the respondent '[didn't] believe AI is being developed for the purpose of creating works covered by copyright.'

When asked about creativity – one of the main requirements for copyright protection – and whether it is a human-only characteristic, respondents overwhelmingly agreed that creativity transcends humans and may be observed in both non-human animals and certain intelligent machines. Respondent one stated that 'both existing AI and some non-human animals exhibit creativity.' Respondent two strongly disagreed that creativity can only be prescribed to humans, additionally pointing out that 'creativity and what we decide to protect – thereby leading to more of it – are connected but different topics.' Respondent three further noted that creativity 'could be defined as a strictly human trait, but that would be a strange definition. Scientific creativity, or some aspects of it, is certainly something that machines can exhibit.' Respondent three also expressed his reservation if machines could ultimately understand humans well enough to create

works that appeal to them. Adding that such 'creativity is not yet demonstrated, but probably will be in time.'

5 Summary of Survey/Questionnaire Results

- Computer programs are key contributors to the production of contemporary creative works (films, music, software, etc.).
- AI will contribute to a growth in the number of creative works available to the general public.
- The US copyright system is not adequately equipped to deal with a growing number of computer-generated works.
- Copyright protection is an important incentive for authors to make their work commercially available.
- Uncertainty still hangs over the contribution of AI to economic growth.
- An increased number of AI-produced works will stimulate AI industry growth.
- Monetary compensation is not the most important factor in incentivizing the production of creative works.
- Divided opinion over the statement 'All contributors of a work should benefit from its commercial success.'

- Creativity is not just a human characteristic; it can also be found in non-human animals and AI.
- AI will become a key producer in creative works, although the timeframe for this is uncertain, according to survey participants.
- The US Copyright Office should not consider computer programs as sole authors of works they independently produce.
- Divided opinion over the statement 'The US Copyright Office should consider humans as sole authors of works independently produced by the AI they own or have created.
- The US Copyright Office should not consider joint authorship between AI machines and human developers.
- The US Copyright Office should deny copyright protection to works independently produced by AI.

6 Discussion

6.1 Study Limitations

A number of factors have fallen outside the control of the author of this study and should be taken into account by the reader. First, although the field of artificial intelligence has been around for quite some time, the intersection of intellectual property and AI has just recently started to gain research momentum. Technological developments coupled with the recent commercialization of AI by the likes of Google, Microsoft and Facebook, have turned what once

was a hypothetical issue into a real dilemma. As a relatively recent field of study, the intersection of intellectual property and artificial intelligence lacks widely available quantitative data and research outside of the legal field. Most papers on the topic are written by law professionals and IP law academics. Little attention has been given to the issue by policy scholars and data is sparse. As such, conducting an interdisciplinary study is both novel and necessary. One drawback from this approach, however, is the limited number experts familiar with all disciplines relevant to this study. Conducting surveys and obtaining quantitative data is a challenge since participants should be well-informed in public policy, IP law, and artificial intelligence (machine learning). Although the pool of knowledgeable participants in the AI-IP debate may be limited, their contributions are often more novel and forward thinking than scholars and experts with years of experience in just one academic area.

6.2 Study Impact

Out of the experts surveyed for this study, the majority (65 per cent) believed that software programs, including AI, were key contributors to contemporary creative works like music, film, visual art, and software. Since the entertainment/creative industry significantly contributes to the American economy, this belief indicates the important role of AI in American cultural and economic development (Department of Commerce, 2017; Siwek, 2018). A similar outcome was recorded when participants were asked if AI would contribute to a growth of available creative works. Six out of 10 respondents (61 per cent) were confident in AI's abilities to contribute to the growth of creative works available to the general public. These results show

that a great number of experts believe that AI's generative capabilities will surpass the limitations of private use, achieving commercial success.

Respondents were also confident about the positive impact of AI-produced works on the American AI-industry. Intellectual property rights are an important incentive for the commercial availability of creative works like films, music, visual art, and software. Around half of respondents, however, believe that the current US copyright system is not adequately equipped to deal with computer-generated works. It is important to note that not all participants in the survey were intellectual property experts. Survey opinions on this topic, however, were equally distributed between IP experts and respondents from other fields (economics and tech policy). Only one in four of the overall number of participants believed that the US copyright system was adequately equipped to thrive in the digital era. This notion is far from surprising, as the rapid development of the tech industry has resulted in an endless game of catch-up for government institutions responsible for relevant policy and legislation.

Although a significant number of participating experts agree that the current copyright system is ineffective when dealing with computer-generated works, few agree on the most adequate method to address this issue. In the case of independently produced AI works, previous research has indicated four potential approaches by the US Copyright Office: 1. attributing copyrights to a human author; 2. AI as sole author; 3. joint authorship (between a human and an AI); 4. denying copyright protection. None of these approaches has received overwhelming support by study participants. With 56 per cent of survey respondents echoing the current stance of the US Copyright Office, it appears that we are not yet at the proverbial crossroads requiring a change of direction in AI copyright policy. Divided opinion on the preparedness of the Copyright Office, however, signals the looming crisis at the intersection of artificial intelligence and

intellectual property rights. Perhaps, the quote that best summarizes expert opinion on the topic belongs to a seasoned American computer scientist who participated in this study. ‘This requires actual thought,’ he said, ‘not the usual lawyerly method of applying one inappropriate existing model or another. The copyright system is messed up in many ways…’

7 Conclusion

This study has collected data from 57 AI scientists, tech policy experts, and copyright scholars through a survey and questionnaire. The data confirms the significant role of intelligent computer programs in the American entertainment/creative industries. In addition, half of participants believe that the US copyright system is not adequately prepared for a future influx of AI-produced works. Respondents, however, fail to reach a resounding consensus on what changes should be implemented by the US Copyright Office. The divided nature of expert opinion and the limited data available to researchers studying intellectual property protection of AI works indicates the need for future research on the topic. This study has laid the groundwork for further investigation into the intersection of artificial intelligence and copyright protection. The survey and questionnaire have established a need for additional data and interdisciplinary research on a growing issue with the potential to significantly disrupt American economic and cultural development.

Figures

Figure 1

Note: A number of respondents listed multiple disciplines within their expertise area, as a result the total surpasses 100 per cent.

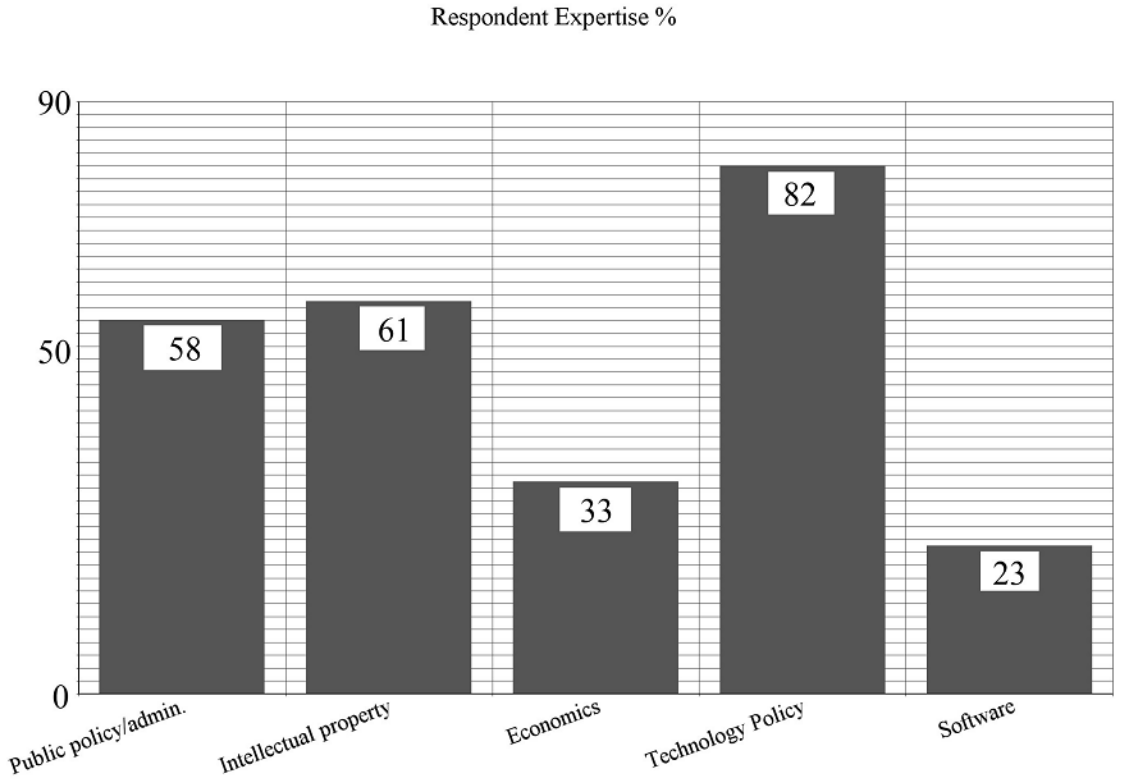


Figure 2

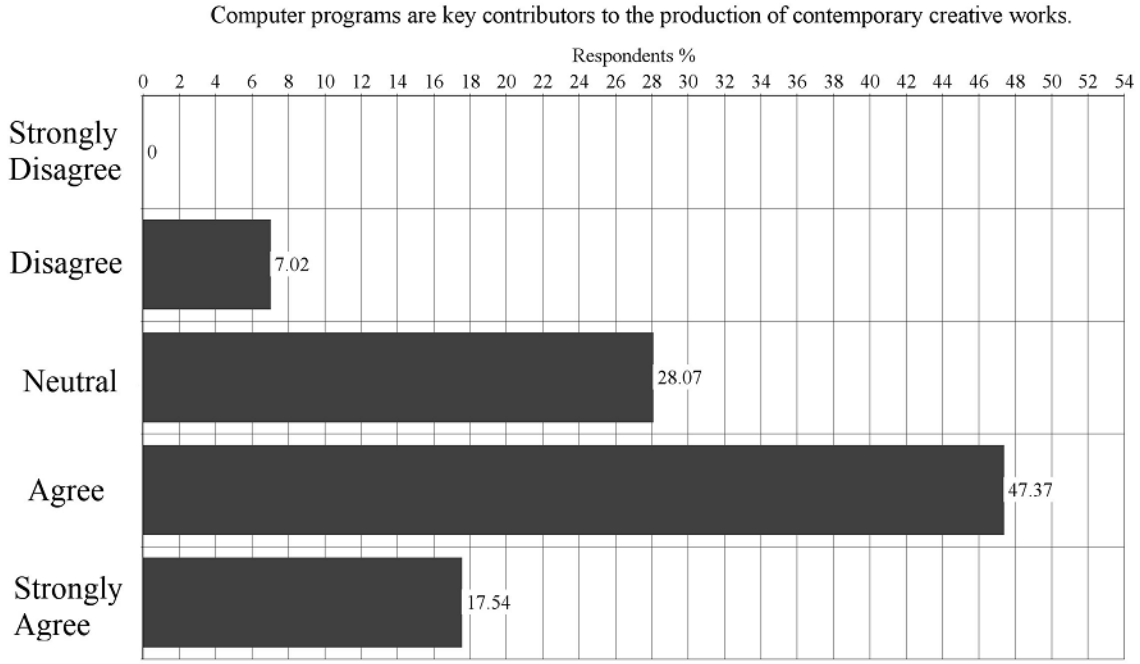

Computer programs are key contributors to the production of contemporary creative works.
Respondents %
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54
Strongly Disagree
0
Disagree
7.02
Neutral
28.07
Agree
47.37
Strongly Agree
17.54

Figure 3

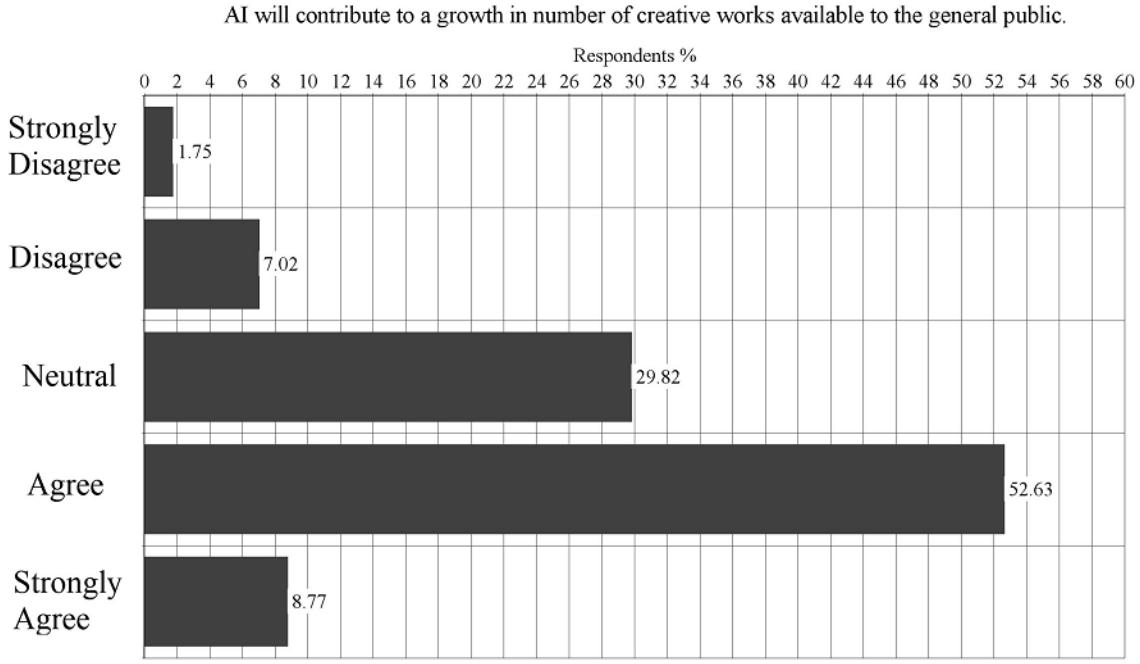

AI will contribute to a growth in number of creative works available to the general public.
Respondents %
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60
Strongly Disagree
1.75
Disagree
7.02
Neutral
29.82
Agree
52.63
Strongly Agree
8.77

Figure 4

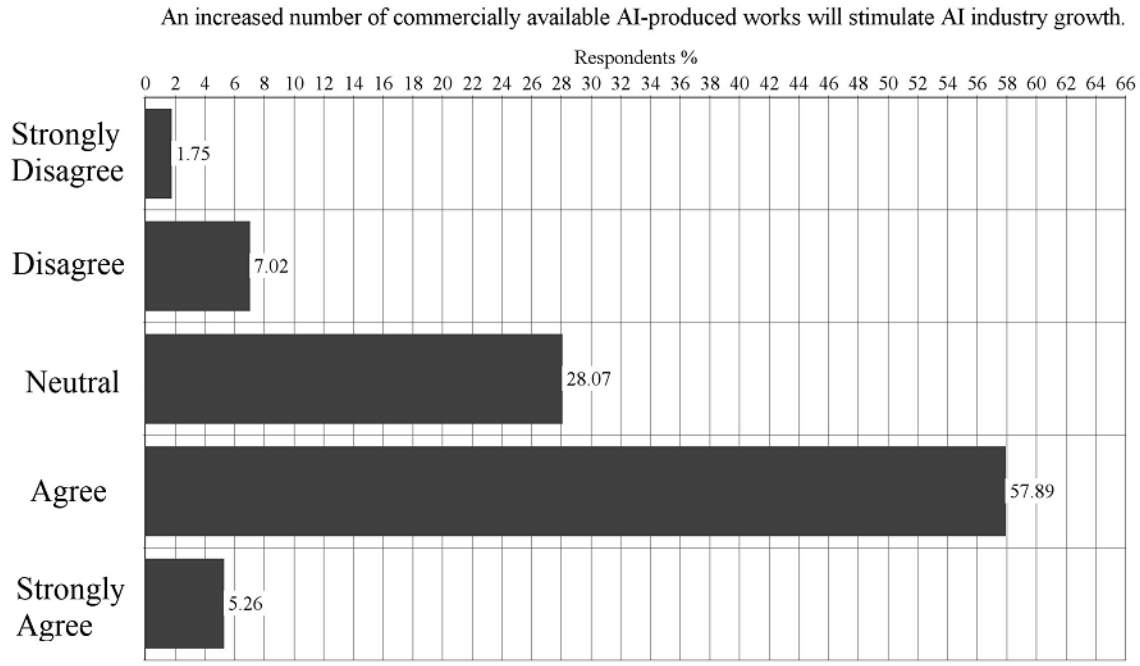
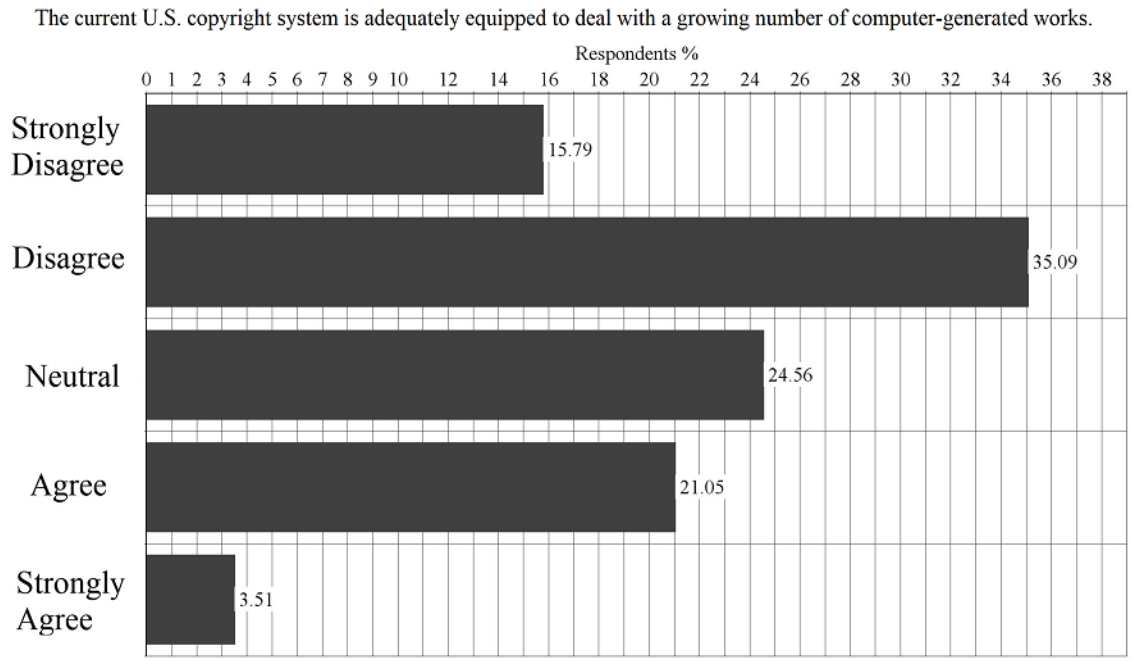

An increased number of commercially available AI-produced works will stimulate AI industry growth.
Respondents %
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66
Strongly Disagree
1.75
Disagree
7.02
Neutral
28.07
Agree
57.89
Strongly Agree
5.26

Figure 5


The current U.S. copyright system is adequately equipped to deal with a growing number of computer-generated works.
Respondents %
0 1 2 3 4 5 6 7 8 9 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38
Strongly Disagree
15.79
Disagree
35.09
Neutral
24.56
Agree
21.05
Strongly Agree
3.51

Appendices

Appendix 1

List of questions and response data from the survey segment of this study.

1. Computer programs are key contributors to the production of contemporary creative works.							
	Strongly agree	**Agree**	**Neutral / Neither agree nor disagree**	**Disagree**	**Strongly disagree**	**Total**	**Weighted Average**
Percentage	17.54%	47.37%	28.07%	7.02%	0.00%		
Participants	10	27	16	4	0	57	3.75

2. AI will contribute to a growth in number of creative works available to the general public.							
	Strongly agree	**Agree**	**Neutral / Neither agree nor disagree**	**Disagree**	**Strongly disagree**	**Total**	**Weighted Average**
Percentage	8.77%	52.63%	29.82%	7.02%	1.75%		
Participants	5	30	17	4	1	57	3.6

3. Do you agree or disagree with the following statement? The current U.S. copyright system is adequately equipped to deal with a growing number of computer-generated works?

	Strongly agree	Agree	Neutral / Neither agree nor disagree	Disagree	Strongly disagree	Total	Weighted Average
Percentage	3.51%	21.05%	24.56%	35.09%	15.79%		
Participants	2	12	14	20	9	57	2.61

4. Copyright protection is an important incentive for authors to make their work commercially available.

	Strongly agree	Agree	Neutral / Neither agree nor disagree	Disagree	Strongly disagree	Total	Weighted Average
Percentage	17.54%	36.84%	22.81%	21.05%	1.75%		
Participants	10	21	13	12	1	57	3.47

5. An increased number of commercially available AI-produced works will stimulate economic growth.

	Strongly agree	Agree	Neutral / Neither agree nor disagree	Disagree	Strongly disagree	Total	Weighted Average
Percentage	3.51%	38.60%	40.35%	14.04%	3.51%		
Participants	2	22	23	8	2	57	3.25

6. An increased number of commercially available AI-produced works will stimulate AI industry growth.

	Strongly agree	Agree	Neutral / Neither agree nor disagree	Disagree	Strongly disagree	Total	Weighted Average
Percentage	5.26%	57.89%	28.07%	7.02%	1.75%		
Participants	3	33	16	4	1	57	3.58

7. Monetary compensation is the most important factor in incentivizing the production of creative works.							
	Strongly Agree	**Agree**	**Neutral / Neither agree nor disagree**	**Disagree**	**Strongly disagree**	**Total**	**Weighted Average**
Percentage	1.75%	19.30%	19.30%	33.33%	26.32%		
Participants	1	11	11	19	15	57	2.37

8. All contributors of a work should benefit from its commercial success.							
	Strongly agree	**Agree**	**Neutral / Neither agree nor disagree**	**Disagree**	**Strongly disagree**	**Total**	**Weighted Average**
Percentage	10.53%	40.35%	40.35%	5.26%	3.51%		
Participants	6	23	23	3	2	57	3.49

9. The U.S. Copyright office should consider computer programs as sole authors of works they independently produce if there is no creative input or intervention

from a human author.							
	Strongly agree	Agree	Neutral / Neither agree nor disagree	Disagree	Strongly disagree	Total	Weighted Average
Percentage	5.26%	5.26%	33.33%	28.07%	28.07%		
Participants	3	3	19	16	16	57	2.32

10. The U.S. Copyright Office should consider humans as sole authors of works independently produced by the AI they own or have created, even if these works lack any creative input or intervention from a human author.							
	Strongly agree	Agree	Neutral / Neither agree nor disagree	Disagree	Strongly disagree	Total	Weighted Average
Percentage	10.53%	21.05%	38.60%	15.79%	14.04%		
Participants	6	12	22	9	8	57	2.98

11. The U.S. Copyright Office should consider joint authorship between AI machines and their human developers, in cases where the creative works were produced by the AI without any creative input or intervention from a human author.							
	Strongly agree	Agree	Neutral / Neither agree nor disagree	Disagree	Strongly disagree	Total	Weighted Average
Percentage	0.00%	15.79%	22.81%	42.11%	19.30%		
Participants	0	9	13	24	11	57	2.35

12. The U.S. Copyright Office should deny copyright protection to works independently produced by AI without any creative input or intervention from a human author, releasing them into the public domain.							
	Strongly agree	**Agree**	**Neutral / Neither agree nor disagree**	**Disagree**	**Strongly disagree**	**Total**	**Weighted Average**
Percentage	22.81%	33.33%	26.32%	12.28%	5.26%		
Participants	13	19	15	7	3	57	3.56

Appendix 2

List of the questions asked in the open questionnaire portion of this study.

1. DO YOU BELIEVE THAT AI WILL CONTRIBUTE TO A GROWTH IN NUMBER OF CREATIVE WORKS AVAILABLE TO THE GENERAL PUBLIC? IF SO, IN WHAT WAY?

2. DO YOU BELIEVE THAT AI WILL BECOME A KEY PRODUCER OF CREATIVE WORKS? IF SO, IN WHAT TIME FRAME?
   - Within 10 years.
   - Between 10 to 20 years.
   - This will require more than 20 years
   - AI will not become a key producer of creative works.
   - Other (please specify)

3. Do you agree with the current position of the US Copyright Office to deny copyright protection to works produced by non-humans (including AI machines) if the works lack any creative input or intervention from a human author? Why or why not?

4. Do you believe that copyright protection of AI-produced works will stimulate growth of the AI industry? Please explain.

5. Do you agree or disagree with the following statement? Creativity is a characteristic which is only observed in human beings. Please elaborate.

6. Please share any additional thoughts you may have on the participation of AI in the production of creative works (music, art, software, etc).

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