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Who holds authorship of AI art?

Final paper

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Introduction

A painter would never credit their paintbrush; a scientist would not cite their laboratory equipment, and a musician, even though they might feel a strong bond with their instrument, will (in most cases) not call it a band member. Assigning authorship to non-living things is rare, it might seem ridiculous, but it might soon be a reality.

There are several projects where artificial intelligence (AI) writes poetry (Uthus et al., 2021), composes music (Fulde, 2021), or paints (Botto, 2022). For instance, the computer program 'Botto' creates visual art powered by the feedback of a community of owners of its own cryptocurrency (Botto, 2022). It was created by Mario Klingeman and was launched in October 2021 (The Art-List Team, 2021). It sells one artwork per week online and is very successful: Its first one has been sold for 325 500 $ and has since been offered over a million dollars. This illustrates how culturally important some AI artworks are. Another example is '1 on the Road', an AI-composed 2018 novel, which was fed on Jack Kerouac's 'On the Road.' To prevent direct copying of Jack Kerouac's text, Ross Goodwin, the programmer of the artificial intelligence program, took a journey from New York to New Orleans with a laptop on his knees (Goodwin & Mc Dowell, 2018). Three sensors were connected to the laptop to provide real-world input: Due to AI's long short-term memory recurrent neural network, it was able to recognize sounds (conversations in the car), the location of the car, and surroundings (Rapkin, 2018). Furthermore, the AI was fed with English corpora that helped the machine create coherent text. Although the novel has grammatical mistakes and strange meanings, Ross Goodwin decided to publish it unedited. In this case, the novel's authorship was given to Ross Goodwin and Jack Kerouac, the programmer and the author of the novel, which was fed to artificial intelligence. However, both did not write even one sentence of the AI novel.

Copyright law is not prepared for these cases. As of now, in the European Union (EU), only natural and in some member states also legal persons can hold authorship (Salami, 2020). Computer programs are neither legal nor natural persons. Some authors advocate granting them passive legal personhood for copyright reasons in contexts of AI art (Salami, 2020). The discussion has so far taken place mostly in legal contexts. This paper will offer a more interdisciplinary viewpoint, taking into consideration computer science, philosophy, and neuroscience to answer the question: Who holds authorship of AI art?

The paper starts by pondering definitions of authorship to find qualities such as freedom and personhood that AI should have to deserve an authorship label. It also considers the degree of engagement in the art creation process that is necessary for someone to hold authorship. With this framework, it is evident that the humans involved in the process of AI art do not sufficiently control the artwork to be called its authors undisputedly. In search of the human-like qualities that would make AI capable of authorship, the paper investigates the workings of Google's 'Verse by Verse' poetry-generating AI project. It explains neural networks and the structure of the poet AI (Uthus et al., 2021). The paper then takes a closer look at the human mind to find out whether the lack of free will and the fact that the computer only does mathematical operations set it apart from the mind in such a way that it would justify calling one an author and the other one not. Inconclusive evidence on the nature of the mind leads to the conclusion that the question of authorship should be approached as a normative one.

Philosophical Discussion of the Authorship Problem

Before assigning authorship to someone, it is crucial to define what processes and qualities are necessary for it. According to the Merriam-Webster dictionary (2022), an author is "one who creates or originates something." Does creation necessitate creativity? Does one have to be original to originate something? EU legal cases give definitions around originality and creativity for copyright contexts: The work should express an author's "personal touch" (Bøhler, 2017, p. 17) through "free and creative choices" (Bøhler, 2017, p. 20) in a process that allows for "creative freedom" (Bøhler, 2017, p. 20). It is difficult to establish more precise definitions of these terms because of the element of unpredictability in anything creative and original; anything that follows a clear-cut definition of the term would fail to be creative and original. But it is evident that vocabulary such as '*person*al touch' and '*free* choice' emphasises the author's personhood and freedom, notions that we associate with humanness.

With these definitions in mind, one can examine the candidates for authorship in AI art. It might seem straightforward to assign authorship to the humans who created the software, to those responsible for the input data or to the users who give the impulse of art creation to the program. But as Škiljic (2021) points out, these people can hardly be said to express their "personal touch" (Bøhler, 2017, p. 17) in a process of "creative freedom" (Bøhler, 2017, p. 20). While they can change

some parameters in the software and experiment with different input data, the outcome is still very unpredictable. As Škiljic (2021) so pointedly put it: "Can someone who does not essentially exercise control over the artwork claim to be an author?" (p.1344). Maybe AI art is not creative and original and has no author, just as the solution to an equation does not have an author. However, the success of AI art suggests otherwise: 'Botto' has made over a million dollars on the art market in only a few months (Zarley, 2021). If humans had made these artworks, nobody would doubt their creative value.

Maybe one has to entertain the idea that a computer program can be creative and original and the author of what it produces. To assess this, it is beneficial to look at the actual process of AI art creation, in this case, at the workings of the AI 'poet' 'Verse by Verse' created by Google (Uthus et al., 2021). Is there an element of humanness, something that deserves the label of artistic activity in those computer programs?

First, it is crucial to understand the basic unit of an artificial neural network: The perceptron. The perceptron model was copied from the human neuron cell, and its primary function is to mimic the perception process (interpreting, acquiring, selecting data, and then

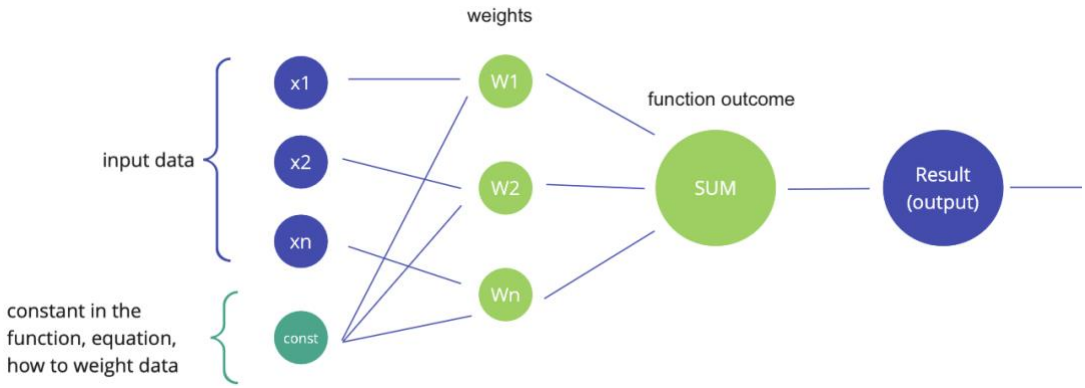

Figure 1. Model of a simple neural network

organizing the input to make programmed actions). To avoid confusion in the AI learning process, briefly introducing the mathematical concept of the perceptron algorithm is necessary. Its main function is to hold values of several inputs and insert them into mathematical functions to create an output. The whole perception process is based on an automatic process of analysing numbers and outputting them into graph equations. Fig. 1 shows a scheme of AI's learning process, showing how the minimization of the loss function in a nonlinear equation system (the mathematical concept of the algorithm explained above) works.

In neural networks, which can be compared to distinguished systems in the human brain, such perceptrons are known as neurons and form a complex structure of layers. They perform complex mathematical calculations with the perceived data and output the trained decision. Although each artificial intelligence model is trained to do different tasks, the overall structure of the neural network is made up of the input layer (receives information from the environment), hidden layers (another name for hidden layers is weight-layer; neurons in hidden layers compute changed (weighted) inputs and create an output using an activation function), and output layer, which produces the result and shows it to humans.

There are different ways in which these networks can be set up. In the example of 'Verse by Verse,' the AI-powered program analyses billions of dialogue lines to teach AI how to reveal the flow of human conversation (Google, n.d.). Once artificial intelligence analyses all input, it can predict the most likely response to a question, statement, or a poem line. Before considering the mechanism of 'Verse by Verse,' it is essential to remember that the technical details of the Google project will be discussed using their research papers; therefore, this can potentially include biased information, but it is impossible to state this with absolute certainty.

To evaluate the actual process of art creation, it is essential to understand the mechanism used in the underlying system. The method of poem creation is summarised in figure 2; it consists of 2 systems that work separately. According to Uthus et al. (2021), the creators of 'Verse by Verse,' the system receives the user's input (a line used in the poem known as the previous verse). The second step is made by the system, which finds the rhythm verse to the first line and connects the existing metadata structure (created offline) to assign filters on the generated verse suggestions. This makes the poem coherent with the author's style. Then, using the previous line, the AI-powered program will continue creating new verses using a feedforward network (a neural network where information is moving only in one direction). This network checks whether the best possibility of the poet's rhythms was used; the technique used is based on the dot product scoring (mathematical term, where two vectors are taken as an input, and their length and an angle between them influence the

output; usually, the output is a concrete number, which can be interpreted depending on the given task: In our case, is this rhythm suitable).

During the AI development process, the verses were already created offline and saved in poetry corpora to save time for the poem creation. English poetry corpora were used to train a Transformer model (Vasmani et al., 2017) that is used to detect the corpora of the original author and generate the following verses based on the style. The created lines are filtered for quality and

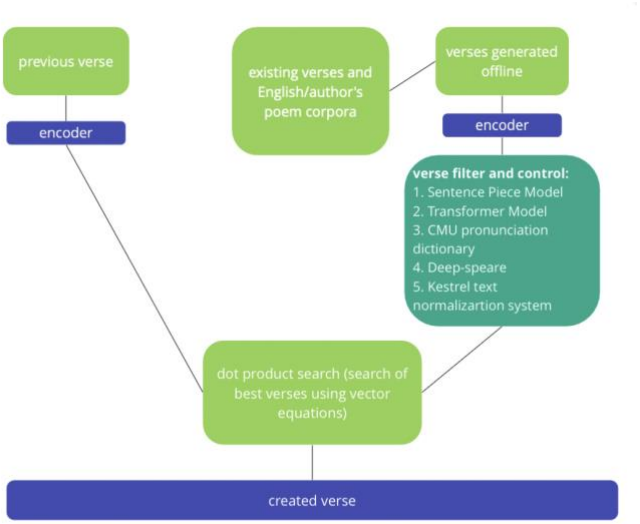

Figure 2. Model of the 'Verse by Verse'

rhythm and connected to existing poetry metadata. As generating verses requires a specific model which can be taught and can understand the human language, the Vasmani et al. (2017) decoder-only Transformer model was used. It is based on simple network architecture, an attention mechanism. Such a mechanism is usually created by a convolutional neural network (type of neural network used in image recognition and processing) present in the encoder configuration. The number of the hidden layers present in the trained system was 128, and the feed-forward dimensionality was 512 (Uthus et al., 2021). Overall, the Transformer is used to capture the unique style of poets.

After the AI-powered model was trained, the task to generate poet's verses was set. According to Uthus et al. (2021), this involves taking a set of starting tokens and then extending with all the suggestions of the model given a certain threshold (0.925) is met. The token is "an instance of a sequence of characters in some AI document that are grouped as a proper semantic unit for

processing" (Manning et al., 2008, para. 2). The threshold, a function used to quantify the output of the output layer, was used to create the best quality vs. quantity balance possible.

To avoid insulting verses, the offensive filtering model is included. It filters abusive words and phrases, and the offline verse creating system helps control the words' collocation to make it as tolerant as possible. Alternatively, to preserve freedom of speech, the suggested lines can be changed according to the taste and desire of the user. The 'Verse by Verse' model was also trained to avoid poor quality lines created by training a threshold of 0.925 (to generate higher quality, a higher threshold is needed, but it costs a lot of computation time). According to Uthus et al. (2021), this includes "making sure parentheses, and quotation marks are balanced, filtering out verses of syllable counts not supported in the application, removing offensive lines" (p. 4). The result of the filtering training process was 26.9M generated verses for 22 presented poets, which were included in the metadata. The systematization of the lines was based on the syllable count, poet source, and the rhyming phoneme.

The dual encoder model discussed earlier is used to ensure that the following line is suitable for the text. AI includes several mathematical models used to create a verse line. Each model is responsible for different tasks, such as correcting grammar and vocabulary, finding and creating rhymes, and analysing the author's styles. It is important to mention their names if the reader is interested in the details and coding part of Google's project. So, 'Verse by Verse' uses input from metabase and feeds it into the SentencePiece model (Kudo and Richardson, 2018). The output is

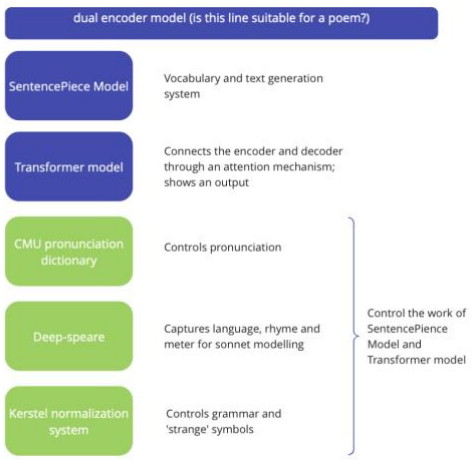

Figure 3. Dual-encoder model

transferred to the hidden layers of the Transformer model (Vasmani et al., 2017), whose last two

layers create a result written on the 'Verse by Verse' site. Although convolutional networks were used, such a technique requires a specific control system to evaluate the resulting verse. The CMU pronunciation dictionary and Deep-speare (Lau et al., 2018) were used to control rhyme syllables, and the Kestrel text normalization system (Ebden & Sproat, 2015) was used to detect strangely written words and syllables used in the masterpieces and symbols of poets, such as $, %, # and others. Furthermore, perfect and imperfect rhyming control techniques were used to create the most suitable rhythm for the response of the user line.

So overall, does this process deserve to be called the author of its works? At first glance, all these computations seem to hold no trace of the freedom and humanness that is, as assumed above, required for authorship. But what exactly is this human quality that we think so central to art? Are our brains not machines, too, and are not all poets in essence mathematical operations? How could we justify, then, not to grant authorship to non-biological machines?

Philosophers of mind and neuroscientists offer differing answers to these questions. In general, the parallels one can draw between the human mind and a neural network are such that the input data of the AI represents all impressions from the senses to the brain throughout one's lifetime. The perceptron is equivalent to the neuron, which either passes on a signal or does not according to whether the incoming inhibitory and excitatory signals from other neurons add up to a sufficiently strong electrical depolarisation of the cell membrane to cause an action potential (Baer et al., 2016). This process is the model for the perceptron's weighted summation and activation function (Russell & Norvig, 2010). Thus, with the proper setup of perceptrons, it must be possible to mimic the function of the human mind. This assumption lies at the core of the endeavour of artificial intelligence. But how accurate is this comparison? Are we not more than firing neurons?

Philosopher of mind Thomas Nagel (1974) argues that there is some knowledge of the mind, so-called qualia, that cannot be grasped in physical terms because it is about *what it is like* to be that mind. He refers to bats to illustrate this: We may find out how echolocation works, but we can never know what the experience of echolocation of a bat, or any experience of any other creature than ourselves, feels like. Thus, we must be more than what is knowable in physical and mathematical terms. However, while this may be true, the ungraspable experience of the other mind does not mean that we are different from AI. After all, a computer might also have qualia; there is no way for us to

know. Is there something else to the human mind that could justify that authorship belongs to humans alone?

Perhaps the most evident difference between AI and the mind is that the former is programmed for a particular task. Alan Turing (1950/2004) already singled out the ability to initiate and the possession of will as a potential difference between human and computer. So, could *free will* set human artists apart from a computer that writes poetry? This would correspond to legal definitions of originality that stress freedom as a crucial factor, and it would also make sense insofar as the flip-coin of freedom is responsibility, and one can say that to be the author of something is to be responsible for that work. A discussion of free will and determinism can fill whole bookshelves, so an analysis of all relevant philosophical contributions is beyond the scope of this paper. However, the following paragraphs highlight what is most relevant to the authorship discussion.

Especially in light of scientific findings, it is hard to defend the position that the will is free in the libertarian sense (Roth, 2010). Science is based on the fundamental principle of causality, and according to this principle, everything, including all human action, has a reason in the past. Nothing humans do comes out of nowhere. However, libertarian free will would mean making different decisions under the same circumstances, which violates this principle. Furthermore, neuroscientific and psychological findings suggest that when a decision is made in the brain, there is no gap in causation. A critique of this argument may include doubts about causality from a philosophy of science perspective (arguing that in trying to answer the question of determinism with science, we use arguments that already presuppose that causality is true (because science presupposes the principle of causality) and that any argument that in turn defends science because of its accurate predictions is merely inductive) or from quantum mechanics (a realm where chance instead of cause seems decisive for events), but these discussions exceed the scope of this paper.

Instead, it is helpful to accept that libertarian free will is unlikely and look for a different explanation of the subjective experience of freedom (so that one might compare it to computers). Accounting for the experience of free choice, Roth (2010) explains that, for instance, when someone moves, their brain compares the sensory information it expects to receive with that which it actually receives. If they are similar, it creates a sense of having caused and willed the action. This experience depends on the fact of having multiple options to choose from. Williams (1941) makes a similar observation, namely that freedom stems from the will's ability to manifest in action, but he does not

think free will is an illusion. Instead, he redefines it, removing the contradiction with determinism. Such a 'softened' definition of free will (common among compatibilists) would conceive of it as non-interruptive (in the sense that the fact of having or not having free will only affects the internal experience of the agent, not their behaviour).

Perhaps this 'softened' free will/illusion is all a computer needs to qualify for the freedom associated with authorship. Nahmias et al. (2020) postulate that (non-interruptive) free will might be tied to consciousness. Their study investigates popular belief about this issue and found that especially an emotional awareness that leads to caring about what is happening makes one assume free will in an agent. So, can a computer be conscious? What is consciousness? A wide-ranging discussion would exceed the scope of this paper. It suffices to say the following.

Pennartz (2022) presents a theory of consciousness as an emergent network property. This is analogous to the property of an image to represent something when a different arrangement of the pixels would not carry any meaning, even though it consists of the same parts. This conception would account for the difficulty of locating consciousness in any single part of the brain, and it would suggest that computers could be conscious if perceptrons in their neural networks were arranged in a specific way. However, if one takes the epiphenomenalist stance that consciousness is non-interruptive, this can never be proven, which makes it once again a problematic criterion for authorship.

Philosopher of mind John Searle's (1980) insights into the difference between humans and computers might be helpful for this paper's attempt to define humanness. According to Searle (1980), humans have understanding, while computers only compute. There is something to the brain's material composition that creates so-called *intentional states*, states of mind filled with content about something external to the mind. They not only have a syntax but also a semantic dimension. Searle illustrates this with a thought experiment: Imagine a man sitting in a closed-off room who is given sheets of paper with symbols that he cannot decipher and a book with instructions in his mother tongue on how to combine these symbols into an answer he hands out of the room. The symbols are Chinese, and outside the room are Chinese people writing questions for the man in the room and reading his answers that appear so natural that they assume he must have command of the Chinese language. However, he does only what a computer does: Following a set of rules to manipulate symbols that have no meaning to him. Searle concludes that the process of

computing does not add any degree of understanding, and thus a machine that only computes (does mathematical operations) cannot understand. If one further adopts the thesis that even if authorship can, under the assumption of determinism, not be tied to responsibility, it should at least include an understanding of the material in Searle's sense, then this would be proof enough to say that humans can be authors while AI cannot.

However, the line between understanding and not-understanding is not as easy to draw. Boden (1990) claims that Searle's thesis that only the brain with its biochemical composition can create intentionality is founded in a potentially misguiding intuition and lacks evidence. There is no reason that machines made of silicon should not have intentional states if the information processes they run are the same as the brain's. Furthermore, Boden scrutinises Searle's statement that formal manipulations cannot produce intentionality. She claims that a computer has an understanding at least of the programming language that it implements. And programs are not mere syntax; they have a semantic dimension because they cause a computer to act. Thus, they contain more than references of formal symbols to each other. The understanding of a computer may be very limited, but so is that of the brain or parts of the brain alone — in humans, it is also the whole person only who enjoys "full-blooded intentionality" (p. 259). (This corresponds to the theory of consciousness presented by Pennartz (2022).)

Ultimately, it is the very nature of these non-interruptive factors (qualia, (non-libertarian) free will, consciousness, and intentionality) that they cannot be ascribed from the outside. Thus, they are of little use in deciding the authorship problem. Perhaps it is indeed possible to recreate the human experience inside a computer. In a sense, it would not be surprising since scientific findings tend to disillusion humans about their exceptionality. The Earth is not the centre of the Solar system, and the Earth's Solar system is not the centre of the Milky Way. We were not created by God to rule over the world; we are a product of evolution and stem from other animals. Other animals use tools, have societies, and even languages as we do (even if their tools and languages are not as sophisticated as ours). Compared to the time the Universe, the Earth, and even most other species on this planet have existed, human existence spans just the blink of an eye. If we thus insist that the human mind is irreplicable and that only humans can be authors of art, perhaps this is the same pride that biased us in the abovementioned cases, and science might prove humbling there as well.

This is not to say that current AI systems are conscious. However, as technology advances, the lines between the mind and computers may blur and increasingly demand that we ask the authorship question. One could develop a Turing test for authorship, deciding the question according to the quality of the art AI produces, but this would necessitate a catalogue of criteria for art quality. As hinted at above when considering what is creative and original, this is very difficult and must be either too vague or so specific that it becomes absurd.

This paper has descriptively approached the question of authorship, trying to find evidence for or against human and AI authorship of AI art. It has found that there is a lack of knowledge about the human mind to answer the question unambiguously. In fact, it seems as though this knowledge can never be acquired. In the hope of a more fruitful discussion, this paper suggests that the issue should instead be approached normatively. So long as one cannot solve the puzzles of the human mind and appropriately justify either position with an analysis of its properties, one must ask a different set of questions: What do we want our relationship with the computers of the future to look like? What significance can AI art have? What does it mean for us to elevate AI to something anthropomorphic?

Conclusion

This paper establishes that authorship is the state of being the origin of a work produced in a creative and free process that allows for expressing one's personality. Against the backdrop of this definition, human authorship cannot be so easily assumed for AI art. However, as the investigation of the poetry-composing 'Verse by Verse' AI shows, computers lack specific properties of freedom and humanity that would justify deeming them, authors. They use neural networks to create art, which are, in essence, an optimisation system of nonlinear equations, and they are created by humans; hence, they are not free. This suggests that AI cannot be an author. On the other hand, as considerations of free will and properties of the human mind such as intentionality and qualia show, the distinction between the mind and a computer is not as easy to make. Thus, evidence to support whether AI can hold authorship is inconclusive.

This paper suggests that instead of finding a justification in computer science, philosophy of mind, or neuroscience, one should ask the questions: 'Which role do we want computers to play, what could AI art mean to us and, more generally, what relationship do we want to have with the

computers of the future?'. Considerations resulting from these questions could help answer not who holds authorship of AI art but who should.

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