

The background is a dark blue field filled with a complex network of thin, white, intersecting lines. Scattered throughout this network are several glowing, semi-transparent white circles of varying sizes, some of which appear to be connected to the lines, creating a sense of a digital or neural network. The overall effect is one of dynamic, interconnected data or information.

From Tool to
Autonomous Agent.
Investigating the
Present and Future of
AI as a Creative Tool
for Artists.

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Abstract

Due to recent rapid advances of AI we are even closer to the holy grail of artificial general intelligence, or the point in time that machines start thinking for themselves. This paper delves into the past the present and the future of AI, by exploring the computational tools that artists are using along with the works that they are producing. I investigate the history of technology in the arts and finally try to pick a glimpse into the future of AI based on the trajectory of the technology and the work of computational artists.

Artist, AI, tools, automaton, prosthetic

Introduction

After more than 60 years, the field of artificial intelligence is mature enough and set on a course to revolutionise all aspects of our life. Artists have already started embracing the exciting new technologies, directly and indirectly. Out of the many artists who are exploring the territory of Artificial intelligence, two of them stand out in my opinion, these are Mario Klingemann and Patrick Tresset. They both represent different sides of the spectrum of AI assisted art. Mario's work is using the latest discoveries in deep learning mainly focusing in the virtual aspect of its representation with two dimensional artworks, whereas Patrick's work is focused more into the embodiment of AI, by building robots that materialise in three dimensional space. As we know from the past, every disruptive artistic tool was bound to be received with scepticism from the general audience and artists alike. But maybe this time it will be different, because of the plethora of tools that are available and the possibilities that they bring.

This is the century where AI is becoming mainstream and it has already started revolutionising and disrupting all aspects of our lives today. For the very first time in human history a tool can do things that are regarded as smart or intelligent. It was inevitable that artists will find ways to incorporate AI in their art praxis and use it as a tool or as part of their work. Even before AI was available for general use, many artists used computers in their art. Some of them more engineers than artists gave birth to computational art.

A.I a brief definition

There have been plenty of opinions to the matter of AI, from the overly optimistic claims by the likes of Ray Kurzweil predicting that we will reach singularity in 2045 (Kurzweil, 2016) to the very dystopian, requesting for more oversight over the uses of AI in order to avoid potential pitfalls, a view outlined in an open letter and supported by many prominent figures including theoretical physicist Stephen Hawking. These various opinions and theories, they all have their own merit but the truth is that no-one can really know for sure what the future of AI will bring. Time and time again it was proven that even the biggest minds in the field were far from predicting the future of AI. Marvin Minsky, who is often considered the 'father of AI' and co-founded of the MIT Artificial Intelligence Laboratory in 1967 claimed "In from three to eight years we will have a machine with the general intelligence of an average human being" (Chase, 2015). His statement was based on the belief that the rapid increase of computational speed would inevitably result into the creation of artificial general intelligence, which proved to not be the case.

We have made great progress since the beginnings of AI research and in many aspects we have moved away from symbolic AI which is based on the relation between objects. This model of AI is

also known as GOFAIR ("Good Old Fashioned Artificial Intelligence and Robotics") a terms first coined by John Haugeland in his 1985 book *Artificial Intelligence: The Very Idea* into Deep Learning (Schmidhuber, 2015). GOFAIR was based on logical rules and relationships between objects which on hindsight was proven inadequate for human level thinking because it was lacking the semantic understanding of the world we live into. Despite the fact that there are still practical uses for GOFAIR, nowadays AI is less symbolic than it used to be and research is more focused into Machine Learning.

“Machine Learning is a current application of AI based around the idea that we should really just be able to give machines access to data and let them learn for themselves.” (Marr, 2017). The revolution of machine learning is silently present in most of our interactions with technology. Searching for images online, movie recommendations, playing videogames or even just the act of taking pictures with your smartphone involves some level of AI usage. You can look at an image recognition neural network and you will not find anything about recognising tables chairs, everything is much more abstract. In deep learning which is a different kind of machine learning, there are no predefined meanings of objects, “Deep learning allows computational models that are composed of multiple processing layers to learn representations of data with multiple levels of abstraction.” (LeCun, Bengio & Hinton, 2015)

Technology in arts

From applied pigments, to the printing press and photography, art was always determined by the technology used. Technology has been ever-present in art creation and art and technology were always linked together. Even more so today the plethora of technological tools have enabled artists like never before. But technology wasn't always accepted without resistance. Whenever a new tool was introduced there were always groups of people that questioned the created work and dismissed it as cold and inhuman or not real art. Walter Benjamin in his book, *little history of photography*, quotes an article in the *Leipziger Stadtanzeiger* criticizing the French daguerreotype technology “To try to capture fleeting mirror images," it said, "is not just an impossible undertaking, as has been established after thorough German investigation; the very wish to do such a thing is blasphemous. Man is made in the image of God, and God's image cannot be captured by any machine of human devising. The utmost the artist may venture, borne on the wings of divine inspiration, is to reproduce man's God-given features without the help of any machine, in the moment of highest dedication, at the higher bidding of his genius." and then he continues on to comment “Here we have the philistine notion of "art" in all its overweening obtuseness, a stranger to all technical considerations, which feels that its end is nigh with the alarming appearance of the new technology.” (Benjamin, 1999). Even artists themselves warned against the use of these new mediums, Sol Lewitt in his “Paragraphs on Conceptual Art” 1967 wrote “New materials are one of the great afflictions of contemporary art.”(Lewitt 1967).

Forwarding to current time, despite having progressed away from the bounds of religious prejudice, we are faced with a new challenge, a technology that is able to create art with minimal input by the artist, a technology that is able to generate a style without input from the artist. For these facts alone it's unavoidable for AI not to face scrutiny and call in question the authenticity of the work. It's inevitable that the past will repeat itself and the use of AI powered tools will be criticized as with any other revolutionary tools in the past. In this case the fear is extending beyond the art world with numerous scientists and philosophers cautioning of its uses. But the genie is out of the bottle and the AI revolution can't be stopped. Artists, creatives and technologists alike can't wait to explore the possibilities that the constant stream of new discoveries in AI will bring. Which I will be further exploring down the line.

AI an artist's tool

Many artists around the globe are utilising AI tools in their work today. New advances in machine learning algorithms together with the abundance of Open Source code allow artists access to free software that is both very powerful but also relatively easy to use. Bellow I'm outlining some of the most widely used AI software.

Wekinator is one of the easiest to use. The setup and use is very simple and doesn't require any prior coding knowledge as explained on the Wekinator site: "Wekinator builds these models using supervised machine learning algorithms. Instead of creating the model function by writing code, you create models by providing training examples of inputs and the outputs that should correspond to them." (Wekinator, 2017)

For artists that are comfortable with writing code there is a plethora of libraries and frameworks ready to use. Neural Networks come in many flavours and capabilities, some of them are explored below.

CycleGAN which is based on GAN (Generative Adversarial Networks) is a collection of algorithms that are able to seamlessly transfer the style and characteristics from one picture to another (Junyanz, 2017). The quality of the results and speed of transformation are beyond the capabilities of even the most skilled artist. DeepBach is a statistical model which is trained on the chorale harmonizations by Johann Sebastian Bach and it's able to create very convincing chorales in his style, the technique used is outlined in this paper (Hadjeres, Pachet, Nielsen, 2017). Deeplearn.js a comprehensive machine learning library for web applications, that is written in Javascript, thus making it very accessible and easy to use. Finally, one of the most popular and widely used, is DeepDream a computer vision program by Google. Through various clever hacks it can generate dreamscapes like images, that can be abstract or hint to the data that the application was trained on. Deep Dream assisted art was widely reported and discussed in the art circles because of the sometimes grotesque results it generated but also because it was the very first time that Artificial Intelligence created something with undeniable aesthetic qualities making it mainstream and bringing the capabilities and the

existence of Artificially created art to the mainstream consciousness. In February 26th an exhibition was organised at Gray Area Gallery, featuring 11 artist's works that utilised the Deep Dream algorithm to create art.

The above tools and frameworks are just a tiny segment of what is available online and unlike traditional mediums, these are free and open for everyone to use in anyway possible. This is the first time in art history that tools are so readily available, democratising the art production process.

AI more than a tool

In exploring AI as a tool with its vast learning abilities and possibilities, there begs the question, whether creativity is only a human characteristic or can an artificial intelligent agent show signs of autonomy. AI and machine learning has been used in many aspects of art creation today and in the past. One of the oldest examples is AARON by Harold Cohen. It is a drawing robot that is able to autonomously make "freehand" drawings by observing the surrounding environment. It was first conceived back in the 1970s and its code was constantly developed to better understand and represent the world. Starting from more abstract representations, throughout time the system reached a higher level of sophistication. Looking back at the lineage of artworks produced by AARON the observer can sense an increase in skill level and a more refined sense of style while the system was becoming more mature. This draws parallels on how the skills of an artist mature throughout time.

Similar to AARON, one of the most recent examples of an AI assisted drawing automaton is Patrick Tresset's robot Paul. The robot was developed in collaboration with Oliver Deussen and has gone through many permutations. Paul is a set of servo motors, a camera and a drawing medium. Despite the fact that some of the automaton's movements are deliberately choreographed, like the constant movements of the camera giving it anthropomorphic characteristics, the algorithm that controls Paul closely resemble structures of the human brain. As explained in the paper "Artistically Skilled Embodied Agents", "When Paul draws lines, their paths are extracted from the responses of Gabor filters. Such filters are known to be good models of simple cells in the early visual cortex" (TRESSET, Deussen, 2014). The various parts that Paul is comprised of, from code to servo motors and the camera are contributing to Paul's unique drawing style and help in being perceived as a creative entity despite the fact that its style is based on Tresset's drawing style. This is outlined in P. Tresset, Oliver Deussen "Artistically Skilled Embodied Agents" paper where he mentions "If we consider the perceived creativity in both of the systems that we have presented in this paper, they are both perceived as being creative and artistic by the public at large and art specialists. Even we, the creators of the systems are very often surprised by the artifacts produced by Paul and e-David. There is a level of originality in each artifact and yet they can be perceived as displaying an autographic style." (TRESSET, Deussen, 2014). He continues by saying that more autonomy is needed for a truly creative system and this could be achieved through the use of Reinforced Learning.

But maybe there are other ways for enhancing the creative autonomy of a system by mimicking the way artists generate new works of art. This can be achieved by utilising a Creative Adversarial Network or CAN for short, that is able to create unique works of art by training on existing art and deviating from the taught styles. This new system has been developed on top of GAN. As described earlier, GAN is very effective at style transfer but it's limited when it comes into generating new unique artifacts. Based on this paper with the very self explanatory title: "CAN: Creative Adversarial Networks Generating "Art" by Learning About Styles and Deviating from Style Norms" CAN is able to achieve greater levels of creativity by training on existing styles and creating works of art that deviate from these styles. In order to evaluate the level of creativity achieved with CAN the researchers contacted a couple of experiments. One of these experiments took place at Art Basel 2016 and the CAN system generated artworks were presented next to artworks from real artists. The generated art was rated the highest, scoring better on, Intentionality, Visual Structure, Communication and Inspiration compared to the human created artworks.

"My Artificial Muse" is a collaborative artwork performed between two artists and an AI. All three agents were tasked with a specific job. Mario Klingemann configured and trained the neural network, the Neural Network that was using GAN generated an image based on a preselected human pose and artist Albert Barqué-Duran was tasked with painting the created image on a canvas with oil. The Neural network that was trained, or speaking in anthropomorphic terms, "inspired" by a plethora of paintings is for the first time dictating the style. Who is the artist and who is the automaton in this case. This works brings to mind Jean Baudrillard's "Simulacra and Simulation" 4th stage of the sign-order which is the pure simulation.

All forementioned AI systems are still highly dependent on the artist to set them in motion but after that they start developing their own styles or even in some cases acting as autonomous agents.

The future of the AI in art?

Are all these technologies parts of something bigger, will their unification at some point bring us even closer to the Artificial General Intelligence? And if yes what does it mean for human creativity?

The robotic automata assisted paintings and the algorithms used in machine learning bring an obvious parallel in mind. That the tool for the very first time in art history becomes much more than just a medium, it becomes an assistant not very different to the way some artists utilise the help of assistants in order to create their art based on their liking and ideas. This is a symbiotic relationship where the artist and the assistant inspire each other. It wouldn't be very unlikely to assume that new discoveries in voice recognition and spoken programming languages will enable machines to assist us seamlessly in the creation of art without the need of writing any code. Through the interaction new surprising discoveries will arise and the automaton will be an active inspiring partner in the creative process. Or maybe, as Harold Cohen multiple times has said "I'll be the first artist in history to have a posthumous exhibition of new work." (Cohen, 2007) foreseeing the autonomous future of AI agents.

The boundaries between human and machine will be blurred as never before. This is evident in Patrick Tresset work. After seeking treatment for a mental illness that he was suffering in his 30s he was left emotionless and too self conscious to paint and create art. He stated “I was able to function again ... but I lost my passion for art, for doing things by hand,” (Bosch, 2012). Effectively he is using a robotic automaton as a prosthetic for his loss of creativity, becoming a transhuman. So maybe the human and the machine are not as disconnected as they seem to be after all. Zylinska, in her 2002 edited collection *The Cyborg Experiments: The Extensions of the Body in the Media Age*, interviewed the futurist artist Stelarc who weighs in the relationship between humanity and technology: “The body has always been a prosthetic body. Ever since we evolved as hominids and developed bipedal locomotion, two limbs became manipulators. We have become creatures that construct tools, artefacts and machines. We’ve always been augmented by our instruments, our technologies. Technology is what constructs our humanity; the trajectory of technology is what has propelled human developments. I’ve never seen the body as purely biological, so to consider technology as a kind of alien other that happens upon us at the end of the millennium is rather simplistic.” (Zylinska, 2007).

Considering the medical and technological advancements a future fusion between human and the machine is inevitable. The resulted transhumans will be enhanced by machines and instead of competing they will compliment each other, providing us with great intellectual and physical capabilities. In this scenario AI will be further increasing our intellectual capabilities and not compete against our biological selfs.

Conclusion

The constant discoveries and innovations in the field have allowed artists to explore new artistic and philosophical territories. In some cases even utilise AI as a prosthetic and become transhumans. We have already reached a point where it’s difficult to distinguishing between human and artificial creativity and style. That is a sign for the things to come and based of the advances today, we should be expecting a future where AI and humans will be creating art as one.

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