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The Impact of Artificial Intelligence on Photography and Painting in the Post-Truth Era and the Issues of Creativity and Authorship

Gerçekötesi Dönemde Yapay Zekanın Fotoğraf ve Resim Sanatlarına Etkisi ve Yaratıcılık ile Sahiplik Sorunları

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Abstract

In arts, especially visual arts, humans have perfected their skills to create distinctive experiences by combining a multifaceted interplay between the substance and design of images. Innate mechanisms of this process have remained unknown so far, and no artificial system with similar capabilities exists yet. However, the increasing prevalence of artificial intelligence in arts has drastically changed what seems to be the underlying constants, such as artistic creativity and authorship of artworks. This phenomenon becomes even more commonplace in the post-truth era as facts become fiction in competing versions. Although art has not always been searching for truths, artificial intelligence powered by generative adversarial networks puts the entire concept of art in a much larger context. In such a context, this descriptive-qualitative study based on literature review, which aims to discuss the impacts of artificial intelligence on photography and painting in the post-truth era and the issues of creativity and authorship, first explains the concept of generative adversarial networks and then examines a sample of their uses in photography and painting with concrete examples. Later, the study discusses the effects of artificial intelligence driven by generative adversarial networks on the art market and analyzes the concept of creativity and the issue of authorship because of those impacts in the context of works of art. Finally, the notion of post-truth is explained, and what the advent of artificial intelligence is likely to mean for art in the future within the framework of post-truth is questioned. Results show that the lines between art's expressive and demonstrative functions are beginning to blur, while the border between fiction and reality is becoming increasingly blurred. AI powered by GANs re-contextualizes the meaning of the truth in artistic endeavors as it happens whenever a novel medium or technology appears and is increasingly adopted by more people at various paces and rates.

Keywords: *Artificial Intelligence, Deep Learning, Generative Adversarial Networks, Art, Creativity*

Öz

Sanatta, özellikle görsel sanatlarda insanlar, görüntülerin özü ve tasarımı arasındaki çok yönlü etkileşimi birleştirerek ayırt edici deneyimler yaratma becerilerini mükemmelleştirmiştir. Bu sürecin doğuştan gelen mekanizmaları henüz bilinmemektedir ve benzer yeteneklere sahip yapay bir sistem de mevcut değildir. Bununla birlikte, sanatta yapay zekanın ortaya çıkışı ve artan yaygınlığı, sanatsal yaratıcılık ve sanat eserlerinin yazarlığı gibi temel sabitler gibi görünen şeyleri büyük ölçüde değiştirmeye başlamıştır. Gerçekler, birbiriyle rekabet halindeki versiyonlarda kurguya dönüştükçe, bu fenomen gerçekötesi çağda daha da yaygın hale gelmektedir. Sanat her zaman gerçeklerin peşinde olmasa da üretken çekişmeli ağlar tarafından desteklenen yapay zekâ, sanat kavramını çok daha geniş bir bağlama yerleştirmektedir. Böyle bir bağlamda, gerçekötesi dönemde yapay zekanın fotoğraf ve resim sanatlarına etkisini ve yaratıcılık ile sahiplik sorunlarını tartışmayı amaçlayan ve literatür taramasına dayanan bu betimsel-nitel çalışma, önce üretken çekişmeli ağlar kavramını açıklamakta ve daha sonra fotoğraf ve resimdeki kullanımlarından oluşan bir örneklemi somut örneklerle incelemektedir. Daha sonra, çalışma, üretken çekişmeli

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ağlar tarafından yönlendirilen yapay zekanın sanat piyasası üzerindeki etkilerini tartışmakta ve bu etkilerden dolayı yaratıcılık kavramını ve sahiplik konusunu sanat eserleri bağlamında analiz etmektedir. Son olarak gerçekötesi kavramı açıklanmakta ve gerçekötesi çerçevede yapay zekanın ortaya çıkışının sanat için gelecekteki yansımaları sorgulanmaktadır. Sonuçlar sanatın ifade ve kanıtlama işlevleri arasındaki çizgilerin bulanıklaşmaya başladığını, aynı zamanda kurgu ve gerçeklik arasındaki sınırın da giderek daha da belirsizleştiğini göstermektedir. Üretken çekişmeli ağlar tarafından desteklenen yapay zekâ, yeni bir ortam veya teknoloji ortaya çıktığında ve giderek daha fazla insan tarafından çeşitli hızlarda ve oranlarda benimsendiğinde olduğu gibi, sanatsal çabalardaki gerçeğin anlamını yeniden bağlamsallaştırmaktadır.

Anahtar Kelimeler: *Yapay Zekâ, Derin Öğrenme, Üretken Çekişmeli Ağlar, Sanat, Yaratıcılık*

Introduction

There has always been an authoritative aspect of images. If they are changed, the memory, thus the history, changes because humans are an incredibly visual species, depending on their sense of vision, which, historically, has been remarkably reliable in distinguishing facts from fiction. Therefore, images still have an incredible amount of credibility regarding the issue of truth and its consequences. The question of for how long they will maintain that quality, however, remains unanswered in the era of post-truth, when the conception of truth based on physical, historical, epistemological, and sociological criteria is being problematized in support of a more self-centered, diverse, and relativist approaches, begging for more apparent answers more than ever.

Artificial intelligence (AI), powered by deep learning, which is a form of unsupervised machine learning using layered deep neural networks like generative adversarial networks (GANs) to go through visual data to generate new sets of that kind of data, has become a turning point even a totally new chapter for the world of art. It is not merely the representative reliability, or creative procedures of art transformed. However, its social, financial, and legal aspects are also being questioned due to the rise of AI driven by GANs, which pave the way for a plethora of applications based on experiential and experimental interpretations or evaluations instead of absolute standards and claims authoritative knowledge.

In such a context, this study first explains the concept of GANs and then examines their uses in photography and painting with concrete examples. Later, the study discusses the effects of AI driven by deep learning on the art market and analyzes the concept of creativity and the issue of authorship because of those impacts in the context of works of art. Finally, the notion of post-truth is explained, and what the advent of AI is likely to mean for art in the future within the framework of post-truth is questioned.

The study is descriptive-qualitative and is based on a literature review. As its sample, the study includes recent examples of artificial intelligence usage for artistic production in photography and painting to elaborate on the issues of creativity and authorship in the post-truth era. The analysis is done based on the artistic and expressive qualities as a means of artistic production. The main question that the study attempts to answer is how artificial intelligence recontextualizes and reshapes the concept of art, the commercialization of art, and the issues of creativity and authorship in the age of post-truth.

1. Generative Adversarial Networks

GANs are a part of an unsupervised machine learning framework developed by Ian Goodfellow and his colleagues in 2014. Generally related to AI and deep learning, these two neural networks, one of which is the *generator* while the other is the *discriminator*, are 'adversaries' and compete to outsmart one another so that one of them will always be the 'victor' of the 'battle' between them (Goodfellow et al., 2014). The aim is to create new, artificial data that can be accepted as genuine. GANs are used extensively to synthesize images, video, and voice (Nicholson, 2020), as shown in Figure 1, which explains their working principle.

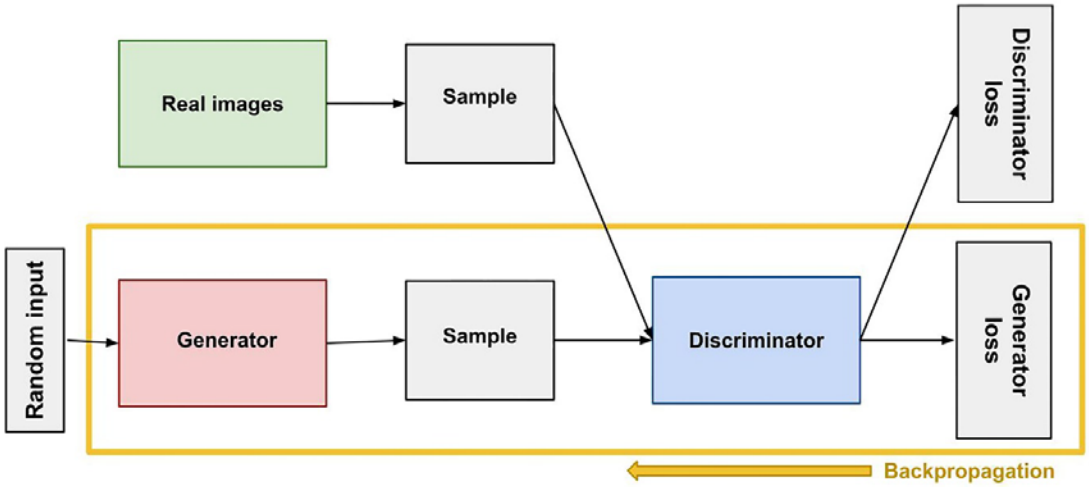

Figure 1. Structure and Working Principle of GANs (Developers.Google.com / Date Accessed: 02.05.2021).

As it can be understood from Figure 1, the generator network's task is to produce meticulously constructed data sets looking as real as possible by arbitrarily using actual samples from a predefined training set and creating new data by randomly modifying some of their characteristics, which are then passed to the discriminator network with the purpose of fooling it by getting those data sets approved as legitimate. On the other hand, the discriminator aims to distinguish the synthetic images sent by the generator as fake from the legitimate and authentic ones. To achieve this, the discriminator network has access to an arbitrary array of real images from the training set in addition to the counterfeit images passed on by the generator network, which the generator cannot access. The discriminator's task is to identify genuine and fake inputs. In other words, the discriminator appraises those images for authenticity, deciding if each instance of data that it reviews belongs to the actual training dataset or not. According to this assessment, both networks tweak their performance and get progressively better at their respective missions either to produce superior fake data sets or to increase the number of correct predictions of those sets. As Goodfellow et al. (2014: 1) rightly argue, such a structure might be considered "a team of counterfeiters, trying to produce fake currency and use it without detection, while the discriminative model is analogous to the police, trying to detect the counterfeit currency". As time goes on, they both excel in what they do and operate much better thanks to the continuous backpropagation, which informs both the generator and the discriminator of the consequences of their generation or discrimination activities.

Possibilities for GANs, which are a fertile field of research, are tremendous both for decent and dangerous purposes, as it happens whenever a novel technological breakthrough is made since they can learn to imitate any set of data. For exemplary purposes, GANs may be trained to create unnervingly analogous experiences like images, music, and speech. As these networks keep advancing in their jobs, they will only be expected to create entirely plausible or impossible samples to discriminate from the authentic ones. However, it should be remembered that, by training generative adversarial networks, AI is fundamentally equipped to understand our world regarding its structure, content, and operation.

2. Generative Adversarial Networks and Art

GANs, as explained above, can work with any data provided for them, and as such, there are literally countless possibilities to utilize them in any field of research. They have created new outlets for applications of AI like machine learning, which has habitually been about categorizing and learning the workings of a particular process, without mimicking it, or more accurately, without producing an analogous sample. However, this has now changed. Thanks to the GANs, machine learning, and wider scale, AI is not about identifying and classifying anymore. It learns from a dataset to 'understand' the content and operation of that dataset and creates new and totally original datasets. More importantly, GANs are probabilistic and not deterministic, which means that they do not always produce the same result after they are initially provided an array of specifications or parameters. Therefore, GANs always possess a random element that turns out new, different, and synthesized data every time, which feels authentic and amplifies the factor of surprise.

Photographs in Figure 2 effectively demonstrate this phenomenon. GANs have entirely generated all the images of these people. Moreover, whenever the site is refreshed, the networks behind the site synthesize a wholly new and never-before-seen photorealistic image. Most importantly, humans that these images 'belong' do not exist.

Figure 2. Nonexistent People's Images Generated by GANs (ThisPersonDoesNotExist.com / Date Accessed: 02.05.2021).

Since Alan M. Turing asked if machines could think in his seminal article *Computing Machinery and Intelligence* in 1950, steady progress has been made to develop a machine that can indeed 'think'. Throughout the previous 60 years since Turing asked

this critical question, research in AI has focused on machine learning, in which machines learn by searching patterns in data and making inferences with the least intervention from humans. Today, humans are on the eve of an AI revolution, which will be the critical technology of this century, and deep learning, which is a subtype of machine learning using levels of algorithms like GANs to categorize through data to make predictions, is fast developing the capability to create rather than only learn. It is even easier to create art by playing with this capability with a few mouse clicks. Figure 3 shows two faces, one on the left and the other on the right. A generative adversarial network created each face. It is also possible to modify the characteristics of each image by relocating the sliders and selecting the corresponding sample dimension. The result is quite like a painting from the 18th or 19th century.

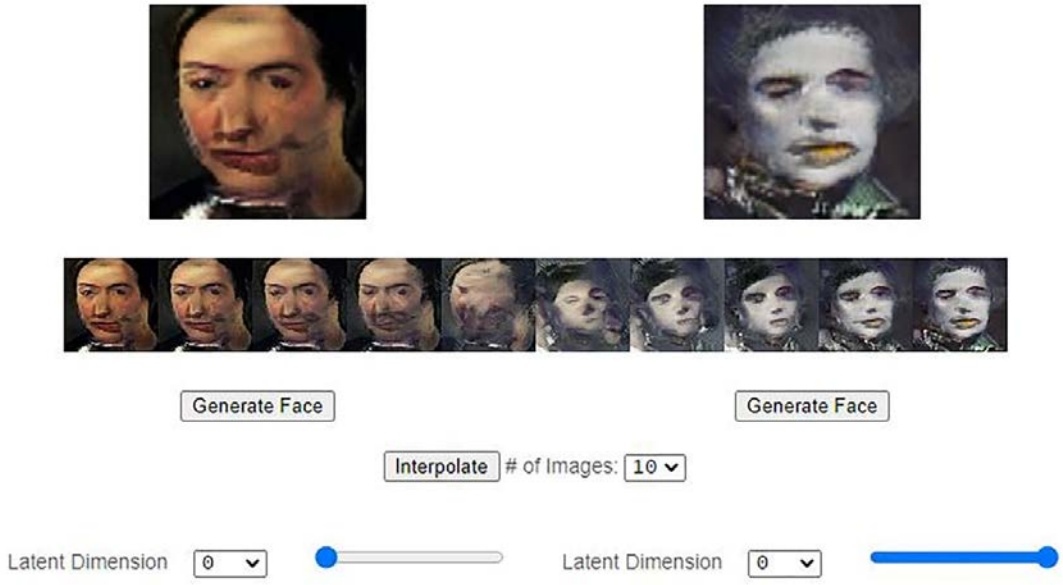

Figure 3. Images Generated by Adjusting the GAN Parameters (Samhannat.com / Date Accessed: 04.05.2021).

The history of art and technology have always been interconnected. Accordingly, both artists and artistic movements have often been characterized by the tools available at that time and place for humans to create works of art. The stone tools for carving, brushes made of animal furs, paints from the plant seeds and roots, and the camera obscura of the Renaissance let humans make art or depict extraordinarily beautiful scenes. Now, as a new tool and an unchartered territory for artists, AI supported by GANs has been further expanding the prospects of self-expression and artistic investigation. The distinguishing technology of the 21st century for making art will probably be AI, more specifically, the enhanced 'intelligence' of the GANs. Chollet (2017) emphasizes that "GANism (the specific look and feel of seemingly GAN-generated images) may yet become a significant modern art trend". Although the idea of machine autonomy still needs maturation in algorithms, AI and GANs now appear to reflect that pragmatic trend.

Manipulation and mimicry of life have always been the subject and a part of artistic creation. Therefore, the synthesis of images and manipulation of data can be a potent tool for artists or art-related professions as they help narrow the gap between artists and

diverse resources as well as novel types of content and procedures of creation. It is possible to observe the indication of both experimental and professional applications of GANs in the field of art today. The introduction of such deep learning technology to artistic creation might seem ordinary and might not require much consideration at first, but it is a form of innovation and creation that, although previously technically possible if sufficient time and money are allocated, was not practically feasible before the advent of the GANs. Consequently, it is logical to suppose that the next phase of artistic endeavor, content, and procedures are going to be powered by automated manipulation, mimicry, and creation of AI driven by GANs, which have unique applications and corresponding impacts on arts, some examples of which are discussed below, thus help understand AI and question the concept of art itself.

2.1. Photography

The development of technology is a natural process; therefore, the benefits of AI and deep learning technologies like GANs have profound impacts on photography both as a form of art and business. Reanimated photographs are one example of those impacts observed in the field of photography because the ability of GANs to synthesize images makes it an ideal tool for photographic production either experimentally or professionally. Figure 4 and Figure 5 show how AI powered by GANs bring deceased people back to life by using just one of their photographs.

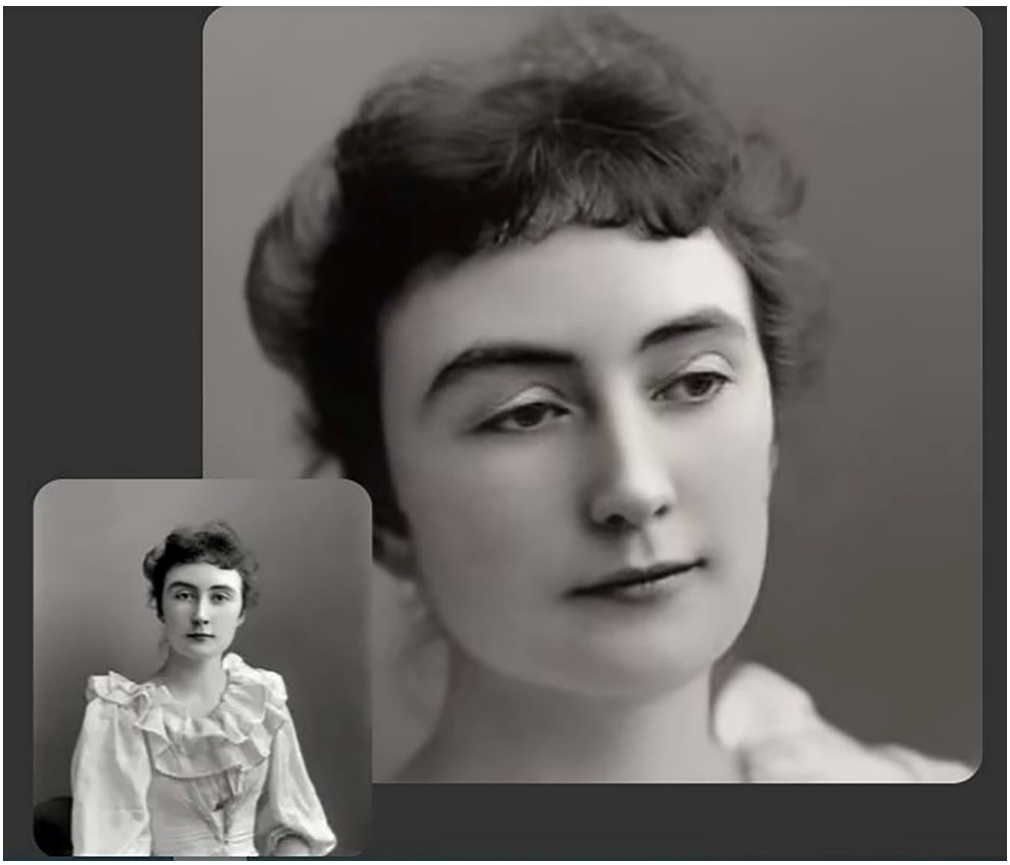

Figure 4. Photograph Reanimated by GANs **(**MyHeritage.com / Date Accessed: 04.05.2021).

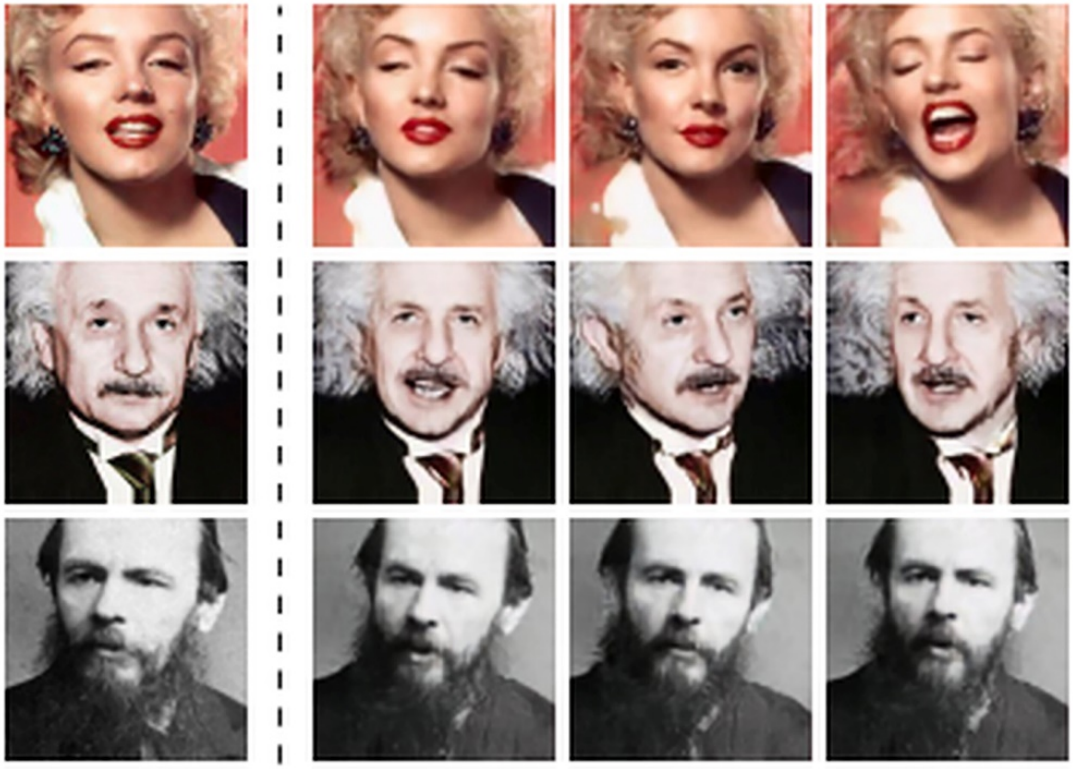

Figure 5. Photographs of Famous People Reanimated by GANs (Zakharov, Shysheya, Burkov, Lempitsky, 2019).

Although reanimating people through computer-generated images has been possible since the 1980s and before the advent of GANs starting early in the 21st century, applications like these are one example of how photography might be transformed soon. Some people think that their loved ones coming alive through AI are weird and scary, whereas others might welcome the idea and consider such a breakthrough in photography delightful, as did the people who saw the first photograph at the French Academy of Sciences in 1839 felt. Besides, not every photographer can access state-of-the-art equipment for photography. Therefore, thanks to digital technologies like deep learning, all that needs to be done are to take some photographs which do not necessarily have to be as high quality, even with a mobile phone, and then synthesize them via GANs into what might be called a more democratic level of virtual photography. As with every technological breakthrough, the results of such a novel approach to photography are still contentious; however, it is quite difficult to ignore and remain indifferent to this new trend, which has already caught the attention of many photography professionals.

In addition to several other functions that range from generating cartoon characters (Jin et al., 2017) converting photographs to emojis (Taigman et al., 2017), generating images with much higher pixel resolution (Ledig et al., 2017), aging photographs of people with different ages from younger to older or vice versa (Antipov et al., 2017) and compensating for the missing pixels of a photograph in a process known as inpainting to repair the stability of its visuality (Yu et al., 2018) to recreating photographs of people with particular features like a certain hair color, type, expression or gender (Perarnau et al., 2016), particularly artistic usage of GANs include coloring legacy photographs in black and white to update them with a contemporary look, as shown in Figure 6 and Figure 7.

Figure 6. Samurai warriors circa 1860s (Floydhub / Date Accessed: 04.05.2021).

Figure 7. Paris in 1880s (Floydhub / Date Accessed: 04.05.2021).

Such an intriguing use both colorizes and restores images, the results of which are quite stunning. Previously restored with Adobe Photoshop®, black and white photographs appeared rather dull and pixelated with a lot of perceptual loss of the colors due to the brownish look. GANs, however, effectively compensate that loss via learning, thus solving the believable colorization problem and achieving artistic restoration by replacing the missing or damaged details throughout the process. At the end of this process, viewers can realistically see the scene that the photograph was a witness of almost a century ago really looked in the resulting image.

Fine arts, especially painting, are valuable talents that humans have mastered for thousands of years since the first paintings on the cave walls. It is believed that art is unique to humans and that only humans can create paintings from abstract ideas or concrete descriptions. Artists can draw a painting of a bird either by visualizing a yellow bird sitting on the brown branch of a green tree in a dark green forest under the blue sky in spring or reading that description on a piece of paper given to them, both cases of which do not present any difficulties for them. No computer or animal so far has matched the artistic capabilities of humans regarding fine arts, particularly paintings. This skill used to be assuredly limited to humans. There was no identified way describing how paintings can be drawn by algorithms given an input until the advent of GANs, a subdomain of AI powered by the neural networks in deep learning.

However, as Yi et al. (2019) demonstrate, substantial improvement has been made with the stylization of images by using deep learning, specifically with GANs. These neural networks can now transform photographs into works of art, as in Figure 8, by J.M.W. Turner (frame B, *The Shipwreck of the Minotaur*, 1805), Vincent van Gogh (frame C, *The Starry Night*, 1889), Edvard Munch (*The Scream*, 1893), Pablo Picasso (frame C, *Femme nue assise*, 1910) and Wassily Kandinsky (frame F, *Composition VII*, 1913), or turn original paintings from old masters such as Monet into real photographs, as exemplified in Figure 9.

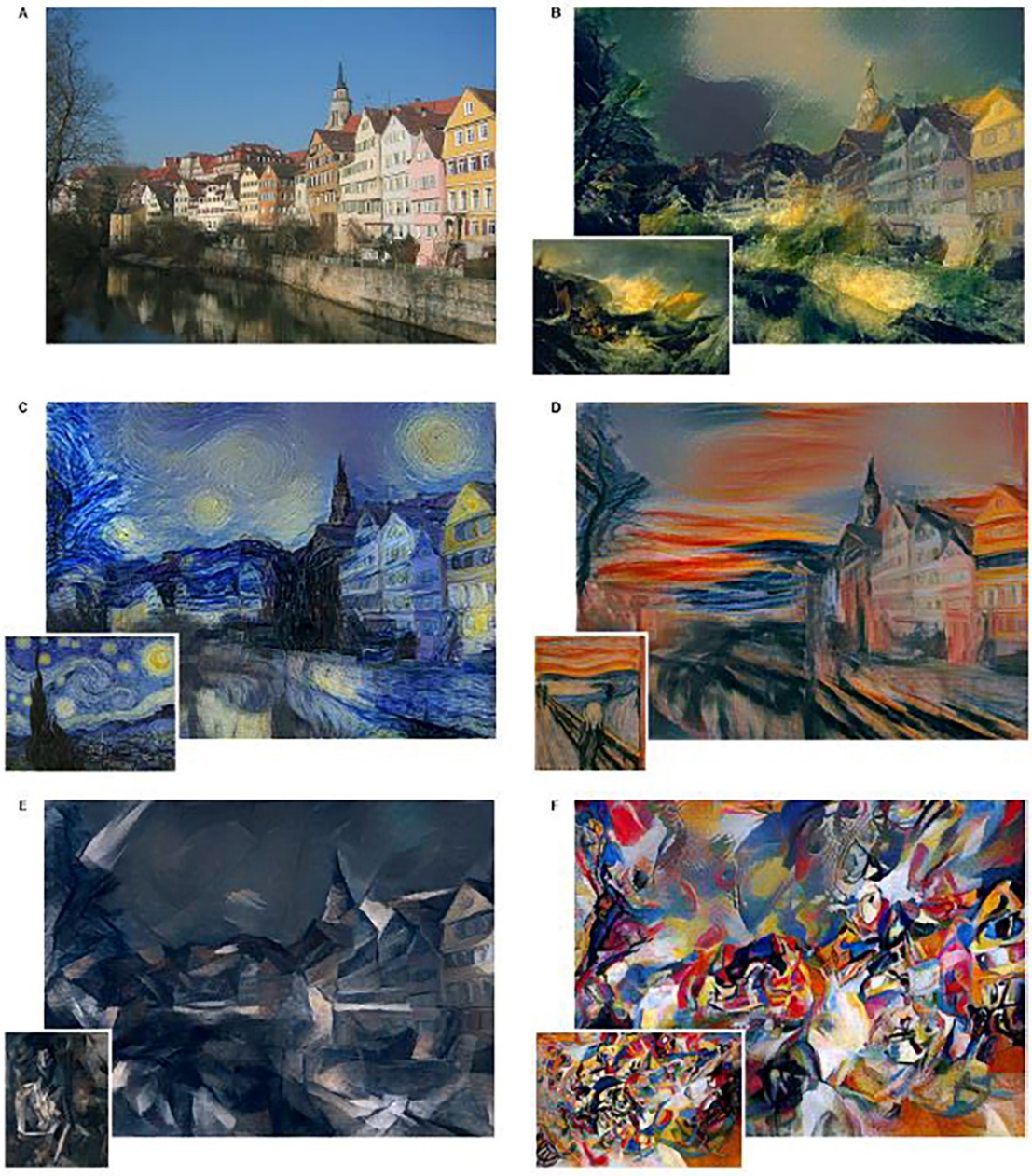

Figure 8. Transformation of photographs into styles of famous painters by GANs (Gatys, Ecker, Bethge, 2016).

For great artists like the ones mentioned, making a masterpiece has always been the peak of their careers, requiring years of practice, creativity, and an approach of trial-and-error with styles, which finally brings about genuinely unique and eternal works of art. While it took so much time and energy for the old masters of the past to create in a tiring process, today, their styles can now be easily imitated in minutes thanks to AI involving deep learning, especially GANs. This means that something rare and exhaustive can be created quickly and effortlessly, which is another example of how AI quickly becomes more adept in matching and probably surpassing human abilities.

Figure 9. Transformation of paintings of famous painters into photographs (Zhu, Park, Isola, Efros, 2017).

These examples clearly show what the GANs can achieve artistically as long as they are provided a large set of data to train with. What is quite a formidable task for humans, even the most talented artists, to imitate an artist's style like Monet, Van Gogh, or Cézanne is now turned into a task that is easily and instantly performed within minutes. Although it is still early to call these productions as masterpieces or photographs in the original sense of these words, AI powered by GANs is rapidly improving in terms of the concepts of creativity and artistic talent once securely thought to belong to humans only. They appear to have reached an intersecting point of art and technology that is increasingly more embedded in our visual culture.

2.2. Painting

From the time when AI took its first steps in the late 20th century, programmers and scientists have been investigating its ability to produce innovative products like poems, narratives, anecdotes, music, and paintings at the level of the human mind in addition to its potential for creatively solving problems. Such exploration is essential to prove that the algorithms of AI are intelligent because, as Elgammal et al. (2017: 2) point out, human creativity uses personal experience and contact with art at some point in the process. In other words, it is only natural that artists are constantly exposed to the works of other artists, and, in doing so, they witness a diverse array of art during their artistic performance, although it is still primarily unknown how artists incorporate this knowledge of previous experience and contact with art into their capacity to create new artistic forms.

Lately, deep neural networks such as GANs have had a revolutionary role in various applications in visual arts, some examples of which have been mentioned and exemplified above. However, they have reached a point where they can produce novel, complex, and inspiring images, which may soon lead to a redefinition of art or artistic creativity. A remarkable example is the well-known ‘living’ portraits by renowned artists like Leonardo da Vinci or Ivan Kramskoi in Figure 10, which provides a surreal sample for how GANs could be used to engage the audience and provide a much more personalized experience for the visitors to see those paintings in a unique and unprecedented way.

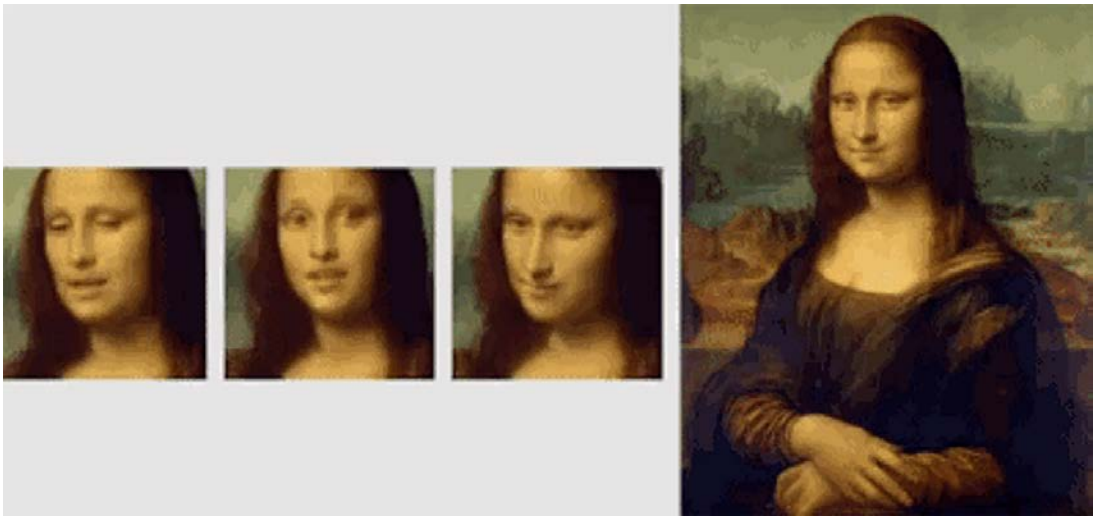

Figure 10. Mona Lisa reanimated by GANs (Cuseum.com / Date Accessed: 10.05.2021).

As these 'living' portraits illustrate, GANs offer entirely innovative methods to explore potential novelties in the world of art as well as in today's visual culture and engage the visitors as a part of this nascent technology, providing a humanistic and immersive touch in art as if the people in the portraits were real people. In addition to such a pioneering use, deep neural networks such as GANs also enable the visitors of art institutions like museums and galleries to experience a new type of interaction by bringing the greatest artists back to life when museums all over the world have been trying to integrate the latest technology like AI or virtual reality into their repertoire of tools to attract more visitors.

One such example is the *Dalí Lives* exhibition at the Dalí Museum in St. Petersburg, Florida (Kwok and Koh, 2020). This exhibition was made collaboratively through the recreation of Salvador Dalí using the machine learning that involves GANs by using films from the archives of interviews with him to train the networks on Dalí's face and speech (Waite, 2019). According to Lee (2019), this realistic Salvador Dali, which can be seen in Figure 11, highlights the incredible potential of GANs to help the visitors engage with art, art history, and figures from the popular culture and to have them empathize with great artists who lived many years ago and often merely appear to figure in the books of art history.

Figure 11. Salvador Dali Reanimated by GANs (Cuseum.com / Date Accessed: 10.05.2021).

Other than these artistically quite innovative use of the GANs, which make the experience of going to a museum more interactive, personal, and appealing for audiences, these deep neural networks are also able to produce a matchless work of art from a photograph that looks like as if it were 'painted' by a master, as Figure 12 shows, after being trained with a collection of paintings in a certain tradition like Renaissance style.

Figure 12. Synthetic painting generated by GANs (Schwab, 2019).

Such generation does not stem from a mixture of paintings stitched together to create a new form but is an entirely new application of deep neural networks, directly inspired by the photograph provided for them. Observing how GANs learn from an old painting and artistically apply what they have learned is a milestone for the art. It is also quite intriguing to experience the democratization of the art in the current context of AI and get a preview of what is still to come as faces are both easy and challenging since human eyes and minds are experts that can notice the smallest change in facial expressions or miscalculated proportions of features, which means that slightest errors are instantly visible to viewers.

However, it is getting increasingly difficult to distinguish between the real oil paintings by human artists and those images synthesized by GANs after a short training period with a set of real paintings, as shown in the works of Mario Klingemann in Figure 13. This Munich-based artist explores the limits of deep neural networks like GANs on different types of visual data.

Figure 13. Image of a Renaissance Oil Painting Generated by GANs (Klingemann, 2018).

It is still possible for an expert eye to see the inaccurate details in the unusually black left eye and the shadowy chin of the figure in the righthand image. Nonetheless, the ease of adaptation of the neural networks to generate an artistic image as complex as a human face is astounding. There are also cases like Google's Deep Dream, which identifies objects by scrutinizing every pixel in millions of photographs, learning how to differentiate between the colors and their shades as well as how to distinguish among objects and then figuring out how to position and classify objects with similar characteristics, thus, when prompted, recreating random mixtures of those objects purely from static noise through optimizing and remixing their findings. The results are rather nonrepresentational and resemble hallucinations or dreams, as exemplified in Figure 14.

Figure 14. Abstract Images Generated by Deep Dream (Mordvintsev, Olah, Tyka, 2015).

Although the Deep Dream was initially devised to help cognitive scientists and software engineers to experience what a generative adversarial network sees when it processes a certain image, it now creates new types of abstract and psychedelic art, which seems quite appropriate for the postmodern taste of contemporary art in the era. The efficiency of such AI components as deep neural networks, which count on existing photography to generate haunting images, also makes it worth questioning if they could turn out to be a tool for artists to interpret visual concepts or eventually help uncover the roots of creativity in general. In this aspect, the ghostly and surreal works of Robbie Baratt in Figure 15 and the Artificial Intelligence Creative Adversarial Network (AICAN) in Figure 16 pose more questions regarding the artistic capabilities of machine learning as well as the boundaries of AI.

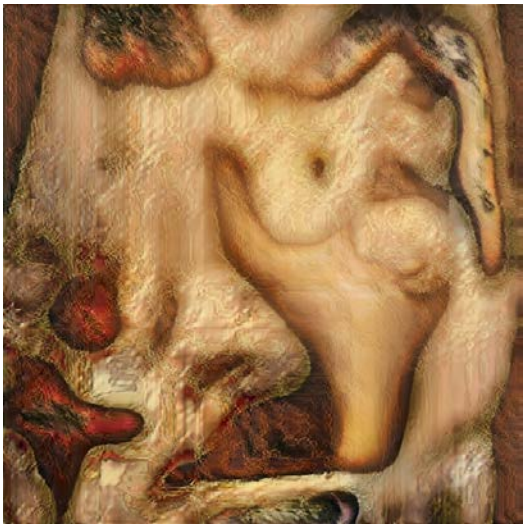

Figure 15. Nude Portrait Generated by GANs (Barrat, 2018).

Figure 16. Faceless Portrait #5 Generated by Creative Adversarial Network (Elgammal, 2019).

In addition to being an indication of the level of artistic 'creativity' and the contemporary 'taste' of the deep neural networks, these eerie-looking abstract images also make one wonder whether the machines are dreaming and how machines 'see' humans or how they 'think' they should look like even though it is common knowledge that they do not think, feel, or understand anything but 0 or 1. Observing such transformation of the art naturally begs the question of whether the artist in the known sense of the word had come to the end of the road just like when French painter Paul Delaroche allegedly declared as he witnessed the invention of daguerreotype and photography in 1839 or whether the art is about to go through another seismic paradigm shift as it did when Marcel Duchamp submitted his avant-garde, groundbreaking and landmark work *The Fountain* in 1917 to the Society of Independent Artists for an exhibition, which, although he paid the fee, was rejected because it did not meet the aesthetic, technical or social 'requirements' to be considered a work of art as well as being 'indecent' for public display (Naumann, 2012: 70-81). Revealing the anxieties of the art and artists when faced with transformative changes abruptly, these deeply uncomfortable thoughts merit consideration whether one is ready or not. It may still be early to pinpoint the disrupting repercussions of AI powered by GANs in the social order and art arena. However, it is already safe to point out its impacts on creating novel methods of seeing, understanding, exploring, and operating, which points to another one of their remarkable effects on the concept of art and the art market.

3. Commercialization of Art

Before the digital artist Mike 'Beeple' Winkelmann sold an NFT, non-fungible token, which is a cryptocurrency blockchain functioning as a certificate of authenticity of the artwork but not the artwork itself, of his work *Everydays: the First 5000 Days* at auction by Christie's for 69.346.250 dollars (Gerard, 2021), or even, *Sophia Instantiation*, the first digital work of art produced by AI of the famous social humanoid robot Sophia, developed by Hanson Robotics and made public in 2016 (Greshko, 2018) cooperatively with the Italian digital artist Andrea Bonaceto by combining his works and Sophia's own physical drawings or paintings, was auctioned for 700.000 dollars in March 2021, Mario Klingemann's *Memories of Passersby I* in Figure 17 was sold for 51.012 dollars (Alemoru, 2019).

Figure 17. Memories of Passersby I (Sothebys.com / Date Accessed: 23.05.2021).

However, this digital artwork by a fully autonomous AI using a complex system of GANs to create an endless stream of disquieting portraits of male and female faces was not the first of its kind to be sold in auction houses that have been growing more interested in the works of art produced by the deep learning of the GANs as AI has gained a stronger foothold in the world of art and art market. As Elgammal (2018) and Boisvert (2020) note, artists have been making use of AI to make art for the last fifty years, and the most well-known early examples belong to Harold Cohen, Lillian Schwartz, and Memo Akten, pioneers in employing computer graphics and AI in their artistic experiments. Nonetheless, due to the widespread media coverage and heated discussions that surrounded it, the most notable piece of artwork by the GANs sold at an international was the *Portrait of Edmond de Belamy* (Waelder, 2020) in Figure 18, a print on canvas portraying a fuzzy image of a man wearing a black suit and ironically bearing the signature of AI that created it in a mathematical formula such as *min G max D x [log (D(x))] + z [log(1 – D (G(z)))]*, which was sold for 432.500 dollars (Vincent, 2018), which was surprisingly much more than an estimate of 10.000 dollars before the auction.

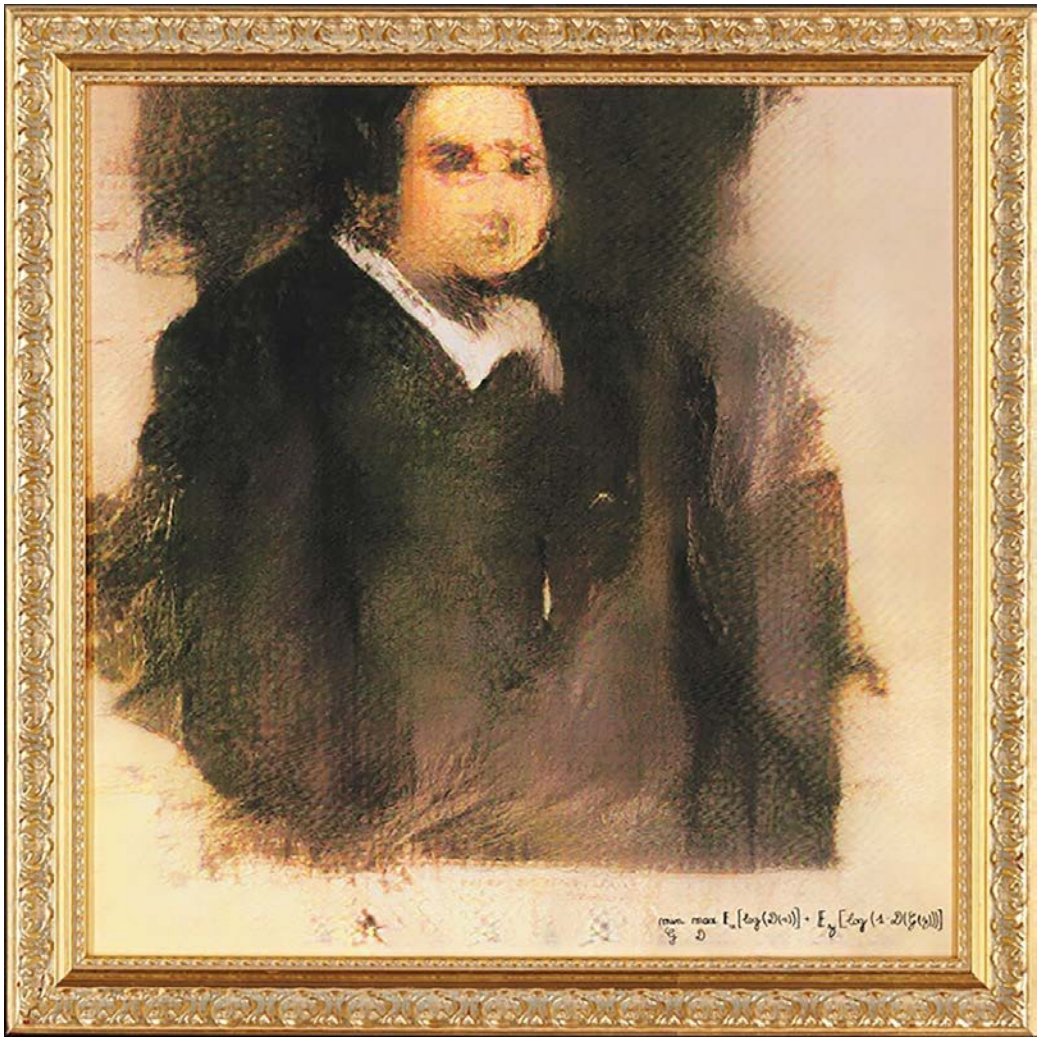

Figure 18. Portrait of Edmond de Belamy (Christies.com / Date Accessed: 27.05.2021).

The creators of this artwork, a group of artists, computer scientists, and researchers are known as the Obvious, supplied the open-source code of the GANs with a dataset of approximately 15.000 portraits ranging from the 14th to the 20th century, which was all out of copyright (Christie's, 2018). Interestingly, as Feteiha (2019) points out, Edmond Belamy in this 'portrait' is a part of the larger Belamy family, who are all fictitious figures in a family created with the GANs.

It is not their exorbitant prices which these works of art were sold for or the highly technical details and equations involved in the algorithms of the GANs creating unique patterns that make these transactions in the art market historic. In an aspect that could be viewed as the next chapter in the history of art, the fact that a digital work by AI was widely deemed art and that it was auctioned by one of the most prestigious auction houses which sold some of the greatest artworks in history makes it clear that the idea of art, artist, tools of creation and means of expression as well as the art market have come to a crossroads. Benefitting from the power of the GANs and AI, artists can exploit disarray as well as intricacy to discover unforeseen means of expression in an atmosphere like this. Such critical transformation, which involves a partnership between the artistic taste of humans and innovative, intelligent technologies of machine learning, might be still in its infancy; however, it is evident that it has already begun to leave its mark on the entire ecosystem of art and may lead to alternative art history in the following decade, acting as a strong catalyst to explore how art is conceived and created from now on in addition to what creativity represents.

3.1. The Issues of Creativity and Authorship

GANs are fed images considered artistic by humans, which enables them to recognize the shared attributes among those images and create completely original improvisational combinations every time they are run within the boundaries defined by humans. Whether this type of participation powered by AI should be deemed authentic creativity is a critical question to consider the outcome of the algorithms trained with curated images and artistic expression. As machines are fast expanding their capacity to create instead of just learning, it will become more interesting to discuss if they can be taught to be creative someday because the exact definition of what creativity involves and where it comes from has remained an elusively difficult question to answer, even after thousands of years of human artistic endeavor.

Nevertheless, the answer to this question is what is required to properly call the creations of AI beautiful, inspiring, or artistic since the result of the process performed by the GANs diverges unquestionably from all the art that has been formerly created by humans so far because the creative process with the GANs dramatically depends on the artist, who selects a compilation of images for the networks, which try to synthesize these inputs. Then, the artist slowly scrutinizes many images generated by the networks to curate a final image or set of images. What really happens is that the algorithm of the GANs cannot correctly imitate the input, creating surprising and distorted images instead. If the algorithm succeeded in mimicking the input, it would not be considered be interesting as art by today's postmodern taste of contemporary art. Therefore, to some extent, this process might be deceptive as it creates the wrong impression that machine learning is not only more complex but also more independent than it is, which is not the case right now.

Understanding what this process means is essential in describing the output of GANs and AI in general as art. If the overall creative process is taken into consideration without thinking about the final images, this type of art can be safely defined as conceptual art since what is artistic is not only the outcome but also the process and concept leading to that outcome, which contains the input data curated by the artist, the specific parameters of the algorithm of the GANs and the curation process carried out by the artist after the networks have done their job, which includes selecting and/or discarding the resultant images. If only the form is taken into consideration and the concepts that art deals with are ignored, this means the GANs are algorithms merely generating forms and figures by following the aesthetic standards that they synthesize from the input data through coding. However, if the whole process is considered, the idea of conceptual art rather than the traditional art of painting presents itself, in which there is a human in the process. This makes all the components art instead of only the image produced by GANs, which renders the entire process a partnership between humans and machines, effectively making AI a novel means for the artists, which saves them plenty of work.

Considering the art created by AI powered by GANs as a process-oriented type of conceptual art is also vital to solve the issues of attribution and authorship for two reasons. First, if the dataset used as input and the code underlying the algorithm of the networks were copied by someone else, how and to what degree the result could be deemed original remains a daunting question both for the artists and the art market, of which auction houses have always been a central part. Secondly, such a circumstance naturally raises key questions about not only the spirit of art and the concept of creativity but also the relationship of AI, or machine in a broader sense, with the artist and the issue of authorship because the ability of GANs to construct endless imagery is definitively a new challenge for the artists.

Some artists like Mario Klingemann seem to have welcomed this opportunity for creativity and incorporated the capacity of the GANs into their production, even making it a pivotal part of their artistic work, whereas some others like Robbie Baratt, Ahmed Elgammal, or collectives of artists like the Obvious appear to mediate, thus curating images from the flow created by those networks, which may sometimes be considered simply printing the artwork, thus interpreted as a rudimentary method to illustrate the artistic creativity of AI. The question of where the human factor lies, in either case, seems to be more relevant than ever to approach the issue of authorship as if the art is more broadly defined as an effort to make a claim about the world or to express sensations, apprehensions, and emotions, the art produced by AI can hardly be categorized as such since machine learning and the nascent GANs do not possess that impulse today and may never have that in the future.

This situation, however, cannot still fully answer the issue of authorship, which involves the algorithm of the GANs itself, as its ‘signature’ on the portrait in Figure 21 suggests, the people who wrote the code for the algorithm, those who originally created the paintings used by the GANs, the ones who put those paintings together and the one who curated the ultimate image or set of images. If creating the image makes one an artist, then AI is the author of that image. On the other hand, if having a vision or message to communicate to the rest of the world is what counts to be the artist, humans are the authors. Suppose, for example, that someone has used the products of a clothing brand and had the GANs produce new dresses. Could the original clothing brand claim rights to such a production? Or, one more personal note, would you like, even allow, someone to generate realistic pictures of humans via the GANs using the photographs that you

posted on your social media accounts? This seems to be what will happen soon if something designing something else has been designed through GANs. Who retains the rights to that something else may seem unimportant right now as the art market for works created by AI is still very shallow, but when it will be important appears to be approaching because the art market is fast growing in the works of art produced by AI, which makes the question of copyright and authorship a really critical point.

4. The State of Art After the Rise of Artificial Intelligence in the Post-Truth Era

As an adjective that has found more prevalent use lately, the term *post-truth* refers to situations "in which people respond more to feelings and beliefs than to facts", according to the Oxford Learner's Dictionary (2021). However, the prefix *post* in the word post-truth, in its specific usage, is not used in the chronological sense of 'occurring after an event'; rather, it needs to be considered as 'when the concept it comes before is considered insignificant or unnecessary' in the current sense of the word. Therefore, post-truth signifies the vanishing of mutual and unbiased criteria for the truth today. Similarly, Biesecker (2018) points out that it is "slippage between facts or alternative facts, knowledge, opinion, belief, and truth" (329-330), which means the post-truth is frequently used to talk about a period in which truths and facts have lost their importance in the face of beliefs and emotions.

Kreitner (2016) contends that the word post-truth was mentioned for the first time in the sense that it is used in today in 1992 when Serbian American author Steve Tesich employed it in his article *A Government of Lies* to talk about the negligence and complacency to ignore the facts and figures in the political and international scandals in the 1980s. However, according to the Oxford Languages, which announced the post-truth as the word of the year in 2016, the word had already been used before Steve Tesich in the chronological sense to mean 'after the truth was known' as an adverb (Oxford Languages, 2016). Arendt (1972) and Heit (2018) even date the first conceptual existence of the post-truth to Friedrich Nietzsche's famous essay *On Truth and Lies in a Nonmoral Sense* written in 1872. The differentiation of meaning, nonetheless, seems to have accelerated in the second half of the 20th century after World War II due to the increasing availability of television, mobile phones, the internet, social media networks, and the effortless proliferation of all kinds of media through these channels to spread both (mis)information and disinformation.

Post-truth is different from the conventional doctoring of the facts in terms of lowering them and experts' opinions on them to the secondary status of significance to appeal to the emotions of the public opinion. In its essence, post-truth symbolizes cynicism about facts and the corrosion of the common objective world because of both that cynicism and growing irrelevance of facts in public opinion, which paves the way for the 'personalization' of impersonal facts. Stoker (2017: 35-36) believes the post-truth does not simply mean suspicion about the truth and its relegation to irrelevance but that it mainly refers to a situation filled with distrust, deception, and competing versions of the facts, which results in deliberate ignoring the factual and concrete evidence in favor of one's beliefs and emotions.

McIntyre (2018: 135) argues that the post-truth is an extension of the postmodern era. This seems in line with Baudrillard's (2020: 150) simulation concept because our social life and the visual world became consumed by technology, lack of authority, and the flood

of images, simulations, and augmented reality, which has no physical or causal relationship with the objective facts. Therefore, as Baudrillard (2020: 12) acknowledges, in the post-truth circumstances of the postmodern world, it becomes inevitable that the reality is manufactured numerous times in countless varieties taken out of their context, which makes appearance and presentation the fundamental basis of opinions and reactions, and as Lyotard (2013: 8) underlines, weakens people's faith metanarratives such as truth, reason, legitimation, originality, freedom, and progress.

As the GANs have advanced, new and unforeseen uses for them have been discovered, which can be as amusing and innocent applications like satirizing celebrities (Parkin, 2019; Dangerfield, 2020), resurrecting the dead actors and actresses for the sequel films (Itzkoff, 2016; Robinson, 2015), and applying the dance moves of professional dancers onto amateurs (Vincent, 2018), but if used for sinister purposes by the wrong hands, they can be seamlessly turned into weapons of harassment (Morris, 2018), fraud (Lyons, 2020), political misinformation (Schwartz, 2018; BuzzFeedVideo, 2018) and propaganda (O'Neil, 2019), which are all warnings about the potential dangers of misrepresentation using deep learning networks and AI powered by them. This darker side of AI is known as deepfakes and involves superimposing the faces of celebrities or politicians on other people's bodies, in which the final image appears and sounds just like the original (Kinariwala, 2019). This is clear evidence that the world has reached a point where anyone who has access to a certain dataset and computers can create such videos to mislead the public opinion, disturb markets, including the one for the art, or even trigger problems for national security since deepfakes employ powerful machine learning and AI to generate or manipulate graphic and auditory content to deceive or mislead. There is already research into preventing this damaging use of GANs through forensic techniques (Agarwal et al., 2019). However, as soon as improvements are made in detecting deepfakes, the algorithm of the networks is upgraded to incorporate techniques to outsmart those advances (Vincent, 2019), and deepfakes are quickly becoming better and more believable, just like the nature of the GANs themselves. Consequently, it may soon become impossible to identify what is fake and true, even with novel techniques and countermeasures.

German literary and cultural critic Walter Benjamin quotes Paul Valéry, French poet and philosopher, in the opening argument of his renowned essay *The Work of Art in the Age of Mechanical Reproduction* that he wrote in 1931 as follows:

> "In all the arts there is a physical component which can no longer be considered or treated as it used to be, which cannot remain unaffected by our modern knowledge and power. For the last twenty years neither matter nor space nor time has been what it was from time immemorial. We must expect great innovations to transform the entire technique of the arts, thereby affecting artistic invention itself and perhaps even bringing about an amazing change in our very notion of art. We must expect great innovations to transform the entire technique of the arts, thereby affecting artistic invention itself and perhaps even bringing about an amazing change in our very notion of art (Valery, 1964: 103-104)".

When he quoted Paul Valery, Benjamin aimed to discuss the modernist era, when novel techniques and philosophies transformed what art meant and how it was understood at the turn of the 20th century; however, he may also be right today in the 21st century, when a similar confusion is being experienced in the world of art with the advent of AI after the progress made in deep learning components like GANs. Benjamin accepts that artwork has always been prone to be reproduced; nonetheless, his argument is focused

on the belief that “even the most perfect reproduction of a work of art is lacking in one element: its presence in time and space, its unique existence at the place where it happens to be (1969: 220).”, which also involves “the changes which it may have suffered in physical condition over the years as well as the various changes in its ownership (1969: 220)”. When considered within the context of the post-truth dynamics as discussed above, Benjamin’s thoughts become clearly relevant as new technologies such as GANs and AI that they support have been drastically altering the nature of both the process of artistic creativity and the issue of authorship. Aural and visual production of artistic content has never been more volatile than today. Moreover, as Paris and Donovan (2019) advocate, “truth is socially, politically, and culturally determined” (2); therefore, it is natural that channels of artistic production as well as the ownership of the final work of art is being shaken to its core by the social, political and cultural structures of the post-truth era.

In fact, AI has already turned into a tool in art, science, design, and architecture; therefore, the relationship between deep learning mechanisms like GANs and creativity is proving more challenging than it used to be, as the definition of art and artists is fast becoming blurred in the post-truth era. Traditionally, it has always been problematic for people to cope with the idea that machines can be intelligent and much more complicated to confess that they might also be creative. De Mántaras (2017) calls this new type of creativity computational creativity and defines it as “the study of building software that exhibits behavior that would be deemed creative in humans” (102), which seems appropriate for the current post-truth state of artistic endeavors as long as the process of production, not only its result, is considered when talking about artworks because this unique kind of creativity includes both technical and social challenges.

Every society needs to cope with how technology transforms its culture and its unique characteristics, and just like photography altered how the painting was understood when it was first invented in 1839, AI is now transforming how art is conceptualized and defined in the post-truth era, overflowing the boundaries of prescription by the ‘authorities’ in art or artists’ own sensations. As Benjamin (2001) maintains, the impacts of technology on art are complicated, and societies have an indispensable role to play in accepting new forms or techniques of art and depend on researchers and curators as knowledgeable institutions for more context on determining the truth. The solutions or answers to the questions or problems that AI, deep learning, or GANs may bring about are unknown. Without guidance from and confidence in such institutions, they may never be found out, and the process of accommodating AI into art may fail since art, by its nature, has always been a product of an interaction between society and technology.

Conclusion

This study investigates the concept of GANs, deep neural networks within machine learning and AI in general, and their uses as well as impacts on art within the framework of the post-truth era. Specifically, the study examines their uses related to photography and painting in addition to their impacts on the concepts of creativity and the issue of authorship. Eventually leading to the blurring of the lines between expressive and evidentiary aspects of arts, which could also be qualified as the borderline between fiction and reality, GANs are proof of how one’s feelings and beliefs have become more influential than objective facts in determining the public opinion about the concepts of art, artist, artistic creativity, and authorship of artworks. AI powered by GANs re-

contextualizes the meaning of the truth in artistic endeavors as it happens whenever a novel medium or technology appears and is increasingly adopted by more people at various paces and rates. At the current state of the art in the age of post-truth, creativity, fiction, and authorship do not seem to be qualities unique only an artist as artists have been using deep neural networks to create innovatively, exhibit what they have created in the most famous galleries and sell their work at renowned auction houses for great amounts of money across the world.

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