Trakya Üniversitesi Sosyal Bilimler Dergisi
Aralık 2023 Cilt 25 Sayı 2 (375-396)
DOI: 10.26468/trakyasobed.1297678

Araştırma Makalesi/ Research Article

GENERATIVE ADVERSARIAL NETWORK AND DIGITAL ART INTERACTIONS WITH METAVERSE MARKETING

ÇEKİŞMELİ ÜRETİCİ AĞ VE METAVERSE PAZARLAMA İLE DİJİTAL SANAT ETKİLEŞİMLERİ

Kemal Gökhan NALBANT[*] , Sevgi AYDIN[**] , Şevval UYANIK[***]

Geliş Tarihi: 24.05.2023 (Received) *Kabul Tarihi: 13.10.2023 (Accepted)*

ABSTRACT: The application of machine learning, deep learning, and artificial intelligence is ubiquitous across various domains. The Generative Adversarial Network (GAN) is considered a remarkable deep learning architecture among its peers. Provided that an ample quantity of data samples is fed to the GAN model, it is feasible to generate novel samples of the same data category. This architectural design served as the foundation for numerous programs. The GAN has emerged as a prominent deep learning framework that has had a significant impact on the field of digital art. This article primarily focuses on elucidating the fundamental aspects of GAN, including its definition, operational mechanism, classification, practical implementations, and correlation with digital art. Simultaneously, inquiries pertaining to the definition of digital art, its practical implementations, and its correlation with the metaverse and digital marketing are being scrutinized.

Key Words: Generative Adversarial Network (GAN), Digital Art, Artificial Intelligence, Metaverse Marketing, Digital Marketing.

ÖZ: Makine öğrenimi, derin öğrenme ve yapay zeka uygulamaları çeşitli alanlarda her yerde bulunur. Çekişmeli Üretici Ağ (GAN), emsalleri arasında dikkate değer bir derin öğrenme mimarisi olarak kabul edilir. GAN modeline bol miktarda veri örneğinin beslenmesi koşuluyla, aynı veri kategorisinden yeni örnekler oluşturmak mümkündür. Bu mimari tasarım, çok sayıda programın temelini oluşturdu. GAN, dijital sanat alanında önemli bir etkiye sahip olan, önde gelen bir derin öğrenme çerçevesi olarak ortaya çıkmıştır. Bu makale öncelikle tanımı, çalışma mekanizması, sınıflandırması, pratik uygulamaları ve dijital sanatla ilişkisi dahil olmak üzere GAN'ın temel yönlerini açıklamaya odaklanmaktadır. Eşzamanlı olarak, dijital sanatın tanımı, pratik uygulamaları, metaverse ve dijital pazarlama ile ilişkisi ile ilgili sorgulamalar irdelenmektedir.

Anahtar Kelimeler: Çekişmeli Üretici Ağ (GAN), Dijital Sanat, Yapay Zeka, Metaverse Pazarlama, Dijital Pazarlama.

[*] Dr. Öğr. Üyesi, İstanbul Beykent University, kemalnalbant@beykent.edu.tr, ORCID: 0000-0002-5065-2504
[**] Dr. Öğr. Üyesi, İstanbul Beykent University, sevgiaydin@beykent.edu.tr, ORCID: 0000-0002-9507-5448
[***] İstanbul Beykent University, sevvaluyaniik@gmail.com, ORCID: 0000-0002-0277-5833.

EXTENDED ABSTRACT

The use of machine learning, deep learning, and artificial intelligence is becoming increasingly widespread across a variety of industries and fields. The generative adversarial network, often known as a GAN, is widely regarded as an outstanding example of a deep learning architecture by its contemporaries. It is feasible to produce new samples of the same data type by giving the GAN model a significant volume of existing samples of the data to use as training. It is possible for the system to learn the capacity to detect the distinguishing qualities of a cat and, as a result, create new photographs of cats if it is given access to a huge dataset containing images of cats. The conceptualization of this building's architecture was used as the basis for a variety of other initiatives. The field of digital art has quickly become one of the domains that has been most significantly affected. The Generative Adversarial Network, often known as GAN, has quickly become one of the most well-known frameworks for deep learning and has had a considerable influence on the world of digital art. Elucidating the essential components of GAN, such as its definition, operational mechanism, typology, practical implementations, and association with digital art, is the primary topic of this article. This investigation explores the concepts of digital art, its applications in the real world, its links to the metaverse, and its implications for digital marketing at the same time. After completing an in-depth review of the current body of literature, it has been abundantly clear that there is a dearth of academic research pertaining to the subject of digital marketing and metaverse marketing as it relates to GAN. It is anticipated that this research will make a major contribution to the body of material that is already available. The GAN is a noteworthy model within the domain of machine learning. Generative Adversarial Networks (GANs) distinguish themselves from other artificial neural networks by their ability to generate novel and valuable data autonomously as well as acquire knowledge of data distribution and imitate it. To clarify, GANs have the ability to generate outputs autonomously through the acquisition of pertinent datasets. GANs have demonstrated the ability to produce proficient solutions across various domains. Digital art refers to any form of artistic expression that is created or exhibited using electronic devices, such as computers. Numerous digital art forms exist, including but not limited to illustration, animation, film, photography, music, and digital painting. Generative algorithms are a class of algorithms that are specifically designed to acquire knowledge and generate output. The utilization of software that incorporates a GAN algorithm enables artists to produce a diverse range of artistic creations. Furthermore, it is noteworthy that artificial intelligence has the capability to generate artistic creations. Through the utilization of the GAN algorithm and the input of data, artificial intelligence has the capability to produce innovative pieces of artwork. The significance of artificial intelligence in the realm of digital art is noteworthy, as it has the capacity to generate distinct pieces of art based on the artist's directives. This technology is poised to play a pivotal role in shaping the future of digital art. The metaverse presents a wide array of applications and possibilities that can be advantageous to individuals, corporations, and even governmental entities. It is evident that the output generated by artificial intelligence will hold greater significance in the coming years. The potential artistic output generated by these rapidly advancing applications is a subject of great interest. The emergence and proliferation of novel technologies have led to a growing prevalence of digital art and the concept of artwork in the digital realm. Digital marketing tools have enabled artists to reach previously inaccessible

audiences, allowing for targeted communication. Artificial intelligence is employed in the realm of the creative arts, much like its application in other domains.

1. INTRODUCTION

There are several deep learning architectures available today. Convolutional Neural Network (CNN), Recurrent Neural Network (RNN), and Generative Adversarial Network (GAN) are the main deep learning architectures. The GAN architecture, which has attracted the most attention recently, is used in many different programs. The most common examples are producing pictures of human faces, animals, nature photos, maps, etc. This algorithm can be used not only to generate new data but also to transform existing data into another concept. Such as converting from black and white to color pictures, painting drawings realistically, converting day pictures to night or night pictures to day, and converting from satellite photos to maps. Apart from this, the GAN also affects the digital art movement. A work of art can be obtained by processing many different datasets. These works of art can be exhibited in many different environments. Metaverse is one of them. Metaverse is a rapidly developing new technology (Nalbant and Uyanik, 2021). The metaverse is the universe in which humans can be included in an artificial physical environment through technological devices (Nalbant and Uyanik, 2022). In this way, some artworks were sold as Non-Fungible Token (NFT) and started to take their place in the Metaverse.

The GAN emerged in 2014 as the idea of Ian Goodfellow. Later, he published the GAN article. The term "digital art," which is a mix of art and technology, refers to all different kinds of artistic practices in which the artist makes use of technical tools to create their works. The artist uses computer programs instead of the materials he uses in traditional methods. The GAN has emerged as a prominent deep learning framework that has had a significant impact on the field of digital art. This article primarily focuses on elucidating the fundamental aspects of GAN, including its definition, operational mechanism, classification, practical implementations, and correlation with the domain of digital art. Simultaneously, this inquiry delves into the questions of defining digital art, exploring its practical uses, and analyzing its connections with the metaverse and digital marketing. The objective of our research is to provide a comprehensive overview of GAN and investigate its interplay with the metaverse and digital marketing.

GANs are a type of artificial neural network that lets users learn deep representations even without a lot of labeled training data. They are able to do this by using a competitive process in which two networks work together to send backpropagation signals. Image synthesis, semantic picture editing, style transfer, image super resolution, and classification are just some of the applications that may make use of the representations that can be learned by GANs (Creswell et al. 2018).

Image segmentation is used in a lot of different ways right now, from figuring out what's wrong with a person to letting cars drive themselves. This picture segmentation is an important part of computer vision, and it is much harder than other vision tasks because it needs low-level spatial information. Yet it is one of the most important works. Deep learning has had a particularly significant influence on the subject of segmentation, which has resulted in the development of a variety of successful models that are available to us today. In the subject of picture segmentation, the deep learning-associated GAN have been presenting some remarkable results (Aggarwal et al., 2021).

Upon closer examination of the literature, it is apparent that there is a dearth of research on the subject of digital marketing and metaverse marketing in relation to GAN. Kumar et al. (2018) introduced a GAN model for the purpose of generating orders on e-commerce platforms. Upon completion of training, the generator component within the GAN could produce a multitude of feasible sequences. Zhang et al. (2019) introduced a new framework for the GAN that employs the Multi-Layer Perceptron (MLP) as the discriminator and the Long Short-Term Memory (LSTM) as the generator. Their approach was utilized for the purpose of predicting the closing price of stocks. The LSTM-based generator is constructed to extract stock distributions from a given dataset in the stock market and subsequently generate data that conforms to these distributions. Conversely, the MLP-based discriminator was designed to differentiate between authentic stock data and data that has been generated by the generator.

Sohn et al. (2020) analyzed the assessments made by customers regarding the value of product consumption, their intentions to purchase, and their willingness to pay for fashion items that were created using GAN, which is a form of artificial intelligence technology. Their study examined disparities in consumers' assessments of a product generated by a GAN versus a product that is not GAN-generated. Additionally, the study investigates whether revealing the utilization of GAN technology has any impact on consumers' evaluations. Shahriar & Hayawi (2022) explored at the potential of employing Generative Adversarial Networks (GANs) to create digital art automatically. For the synthesis of audio, picture, and video material, deep learning architectures known as GANs are often and successfully deployed. Their use in NFT arts hasn't been widely applied, though. They developed and assessed a GAN-based architecture for the creation of innovative NFT-style digital artworks.

2. THE GENERATIVE ADVERSARIAL NETWORK (GAN)

In the field of machine learning, the GAN is an interesting model. GAN is different from other artificial neural networks because it can come up with new, useful data on its own and learn to imitate how data is distributed. In other words, GAN can produce its own outputs by learning the relevant datasets. The GAN

algorithm basically works with two components. These are called a generator and a discriminator. The generator's task is to learn to produce the target output. The discriminator's task is to develop the ability to distinguish between authentic data and fake output created by the generator. While the generator tries to fool the discriminator, the discriminator avoids being tricked. Generative models generate new data; discriminator models distinguish between different types of data. That is, the generative model can produce new images of people similar to real people, while the discriminative model can distinguish between men and women. A GAN named StyleGAN2 imagined Fig. 1.

Fig. 1: A fake human face imagined by GAN

Source: Nvidia (2019). *Imagined by a GAN (generative adversarial network) StyleGAN2.* Access Date: 02/11/2022, https://thispersondoesnotexist.com/

Generic models capture complex distributed connections for images, such as "things that look like curtains will probably appear next to things that look like windows". A discriminative model, on the other hand, can learn the difference between "curtain" and "window" by looking at a few narrative models. While discriminative models try to draw boundaries in the data space, generative models try to model how data is placed across space (Google, 2022). Fig. 2 shows the distribution of the two models in space.

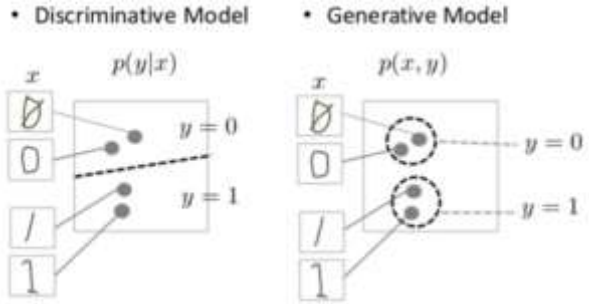

Fig. 2: Discriminative and generative models of handwritten digits

Source: Google (2022). *Background: What is a generative model?* Access Date: 02/11/2022. https://developers.google.com/machine-learning/gan/_generative

Figure 3 depicts the GAN operating principle. To begin, the GAN uses random noise as its input. After that, the generator will transform this noise into a meaningful output. The GAN may be made to output a broad range of data by sampling from various points within the target distribution. This can be accomplished by adding noise to the system. Once training starts, the discriminator quickly learns that the first outputs from the generator are fake because the generator has obviously produced fake output. As the training progresses, the generator produces good output to fool the discriminator. Discriminator gets worse at separating real and fake data, classifying fake data as real.

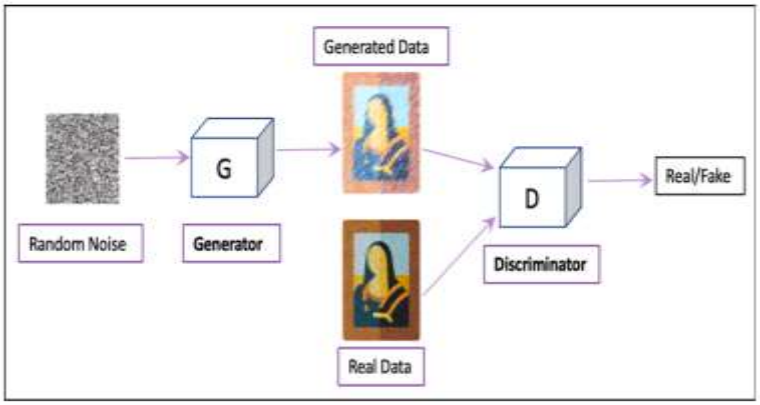

Fig. 3: GAN working principle

Source: Shahriar, S. (2022). GAN Computers Generate Arts? A Survey on Visual Arts, Music, and Literary Text Generation using Generative Adversarial Network. Displays, 102237.

3. TYPES OF GENERATIVE ADVERSARIAL NETWORK (GAN)

This section provides an examination of the various types of GAN.

3.1. Progressive GAN

When using a progressive GAN, the initial renderer layers create pictures with a relatively low resolution, while subsequent renderer layers add details. This method enables GANs to be trained more quickly than other equivalent non-progressive GANs, and it also results in pictures with a greater resolution. Fig. 4 shows the progressive GAN architecture.

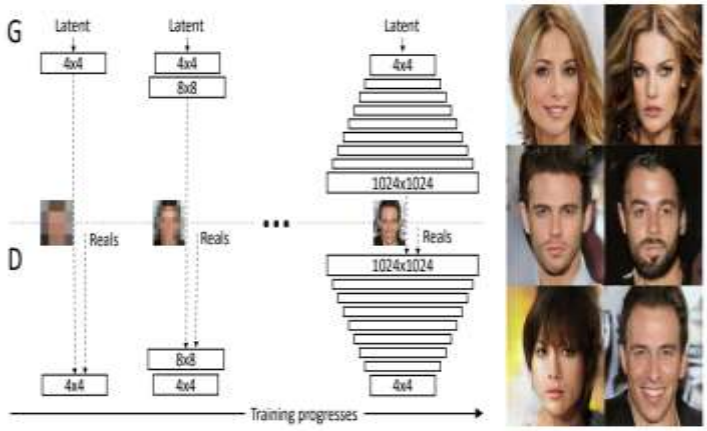

Fig. 4: Progressive GAN architecture

Source: Karras, T., Aila, T., Laine, S., & Lehtinen, J. (2017). Progressive growing of gans for improved quality, stability, and variation. arXiv preprint arXiv:1710.10196.

3.2. Conditional GAN (CGAN)

In this GAN type, a class label or additional information is provided to both the generator and the discriminator. The additional information helps the discriminator find conditional probability rather than joint probability. Figure 5 shows the conditional GAN architecture.

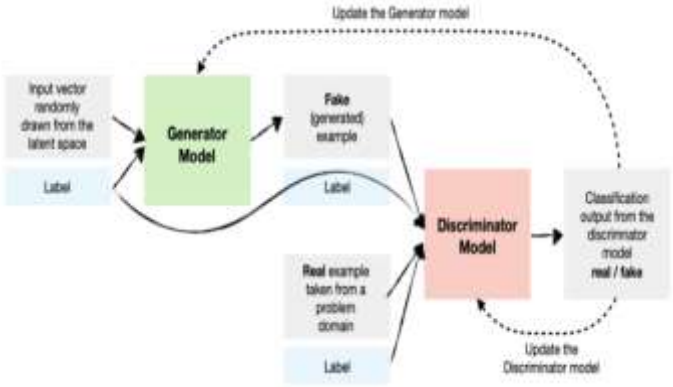

Fig. 5: Conditional GAN architecture

Source: Dobilas, S. (2022). *cGAN: Conditional Generative Adversarial Network — How to gain control over GAN outputs.* Access Date: 02/11/2022. https://towardsdatascience.com/cgan-conditional-generative-adversarial-network-how-to-gain-control-over-gan-outputs-b30620bd0cc8

3.3. Deep Convolutional GAN (DCGAN)

The DCGAN is one of the most popular and successful network designs for GAN. It substantially consists of complexity layers without maximum pooling or completely connected layers. It uses convolutional strides and transposed complications for the downsampling and the upsampling. Fig. 6 below is the network design for the generator (Radford et al., 2015).

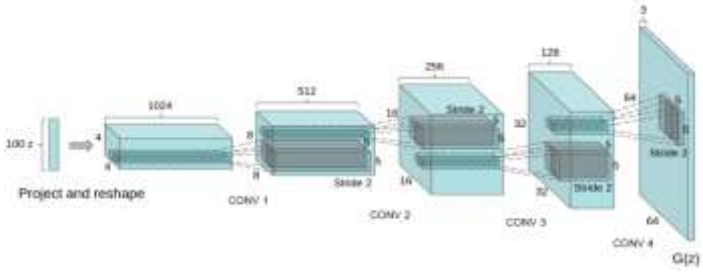

Fig. 6: The Deep Conditional GAN network design for the generator

Source: Radford, A., Metz, L., & Chintala, S. (2015). Unsupervised representation learning with deep convolutional generative adversarial networks. *arXiv preprint arXiv:1511.06434.*

3.4. Cycle GAN

Cycle GAN learns to change pictures from one cluster into pictures from another cluster when it makes sense. The training data for Cycle GAN is just two sets of images. The system does not need any tags between images. For instance, RGB imagery may be derived from SAR imaging, multispectral imagery can be derived from RGB imagery, map routes can be derived from satellite information, and so on. Figure 7 contains examples of translated images.

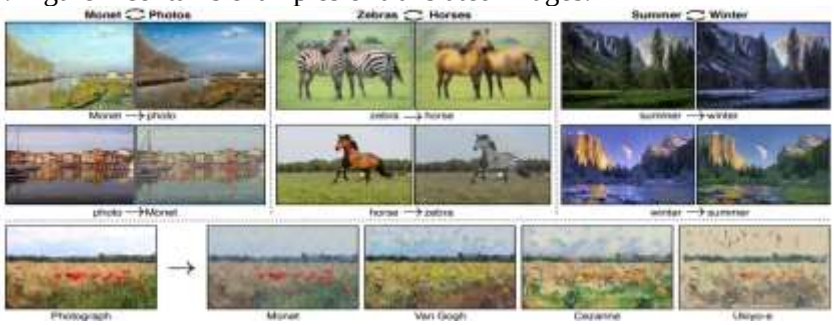

Fig. 7: Examples of translated images

Source: Zhu, J. Y., Park, T., Isola, P., & Efros, A. A. (2017). Unpaired image-to-image translation using cycle-consistent adversarial networks. Conference: Proceedings of The IEEE International Conference on Computer Vision (pp. 2223-2232).

3.5. Generative Adversarial Text to Image Synthesis

Text-to-Image GANs use text as their input and produce images that the given words can logically explain. A GAN was used to create the image of a flower that can be seen below. The GAN was given a textual description of the flower. It is important to keep in mind that the GAN in this system can only produce pictures from a limited number of classes. In Fig. 8, image outputs from the text are seen.

Fig. 8: Image output from texts

Source: Reed, S., Akata, Z., Yan, X., Logeswaran, L., Schiele, B., & Lee, H. (2016, June). Generative adversarial text to image synthesis. Conference: International Conference on Machine Learning (pp. 1060-1069). PMLR.

3.6. Style GAN

The Style GAN is an expansion of the Progressive Growing GAN, which is a method for training generator models that are capable of synthesizing very large, high-quality images via the incremental expansion of both discriminator and generator models from small to large images while they are being trained. The Style GAN is an approach for training generator models that are capable of synthesizing very large, high-quality images. Figure 9 shows the human images generated.

Fig. 9: The human images generated

Source: Karras, T., Laine, S., & Aila, T. (2019). A style-based generator architecture for generative adversarial networks. Conference: Proceedings Of The IEEE/CVF Conference on Computer Vision and Pattern Recognition (pp. 4401-4410).

3.7. Super Resolution GAN (SRGAN)

Super resolution GANs can improve the resolution of photographs by filling in areas of blurriness with more detail as required. For instance, the original picture on the left of Fig. 10 has been downsampled, resulting in the blurred image in the center of the figure. The more focused image on the right was generated by a GAN using the blurrier image as input.

Fig. 10: Image generated by super resolution GAN

Source: Ledig, C., Theis, L., Huszár, F., Caballero, J., Cunningham, A., Acosta, A., ... & Shi, W. (2017). Photo-realistic single image super-resolution using a generative adversarial network. Conference: Proceedings of The IEEE Conference on Computer Vision and Pattern Recognition (pp. 4681-4690).

4. GENERATIVE ADVERSARIAL NETWORK (GAN) APPLICATIONS

GANs can generate and use effective solutions in many areas. They can generate image datasets for large datasets and produce realistic photos of human faces. For example, they can generate a photograph of a human face similar to a celebrity, like in Fig. 11, or a human face that has never existed before. They can likewise produce similar, specific photos. For example, a plate of pasta, a cat, or a salt shaker.

Fig. 11: Images generated using the CELEBA-HQ dataset

Source: Karras, T., Aila, T., Laine, S., & Lehtinen, J. (2017). Progressive growing of gans for improved quality, stability, and variation. arXiv preprint arXiv:1710.10196.

They can generate many things, such as anime characters like in Fig. 12, human emojis, aged human face images, and 3D object models. While doing photo editing, they can turn the person in the real photo blonde, short-haired, smiling, or a different gender.

Fig. 12: Anime character images in different release years

Source: Jin, Y., Zhang, J., Li, M., Tian, Y., Zhu, H., & Fang, Z. (2017). Towards the automatic anime characters creation with generative adversarial networks. arXiv preprint arXiv:1708.05509.

They can convert semantic images to photographs and perform image-to-image translations like in Fig. 13. For example, you can turn a photo that is your own into a Picasso-style image. Or you can produce images of the Monalisa painting as an abstract painting.

Fig. 13: Semantic images to photographs

Source: Wang, T. C., Liu, M. Y., Zhu, J. Y., Tao, A., Kautz, J., & Catanzaro, B. (2018). High-resolution image synthesis and semantic manipulation with conditional gans. In Proceedings of the IEEE conference on computer vision and pattern recognition (pp. 8798-8807).

5. DIGITAL ART AND ITS APPLICATIONS

Digital art is any kind of art that is made or shown with computers or other digital devices. There are many digital art products, such as illustration, animation, film, photography, music, and digital painting. However, for a product to be defined as digital art, it can be transformed into a work of art with aesthetic interventions in a computer or technological device environment. There are many different types of digital art. Fields such as virtual reality (VR), augmented reality (AR), and artificial intelligence (AI) greatly influence today's concept of digital art.

In the VR experience, artists can create pictures and sculptures that are not physically visible but exist in the virtual environment with VR glasses, like in Fig. 14. In addition, artists can access various tools, such as many brushes and unlimited colors, with updated and improved programs. They can exhibit their works in a virtual environment such as Metaverse. They can also make physical outputs with 3D printers.

Fig. 14: "Mona Lisa Beyond the Glass": The Louvre's First Virtual Reality Experience

Source: Louvre (2019). Mona Lisa Beyond the Glass: the Louvre's first Virtual Reality experience. Access Date: 27/03/2023, https://www.louvre.fr/en/what-s-on/life-at-the-museum/mona-lisa-beyond-the-glass-the-louvre-s-first-virtual-reality-experience

In the AR experience, on the other hand, with this technology, which allows virtual objects to be placed in the outside world, computer-generated pictures, three-dimensional artworks, motion graphics, and animations can be transferred to physical spaces. While the artists exhibit these works through physical space, art lovers can interact with the works, and in this way, they become part of the work of art, as shown in Fig. 15.

Fig. 15: Augmented reality (AR) art work

Source: Klavins, A. (2022). 7 augmented reality ideas for interactive museum experiences. Access Date: 27/03/2023. https://overlyapp.com/blog/7-augmented-reality-ideas-for-interactive-museum-experiences/

The AI experience adds a very impressive aspect to digital art. With various algorithms, artificial intelligence creates important works of art. The GAN algorithm plays a very effective role at this point. Creative works of art are created with artificial intelligence software based on the GAN algorithm. These artifacts can be displayed in physical environments with projection. The best example of this is the work of Refik Anadol, as shown in Fig. 16.

Fig. 16: Machine Hallucinations: ISS Dreams

Source: Anadol, R. (2018). Machine hallucinations: ISS dreams. Access Date: 28/03/2023. https://refikanadol.com/works/machinehallucinations-iss/

6. THE RELATIONSHIP BETWEEN GENERATIVE ADVERSARIAL NETWORKS (GAN) AND DIGITAL ART

Generative algorithms are algorithms designed to learn and produce. Artists can create many different works of art thanks to software that has a GAN algorithm at its core. In addition, artificial intelligence can also produce art. With the GAN algorithm fed with data, artificial intelligence can create creative works of art. In this way, artificial intelligence has opened up a new field in digital art. Artificial intelligence, which produces unique works with the instructions given by the artist, is of great importance for the future of digital art. Many outputs can be obtained with many types of GAN algorithms. GAN can produce creative output by learning different styles. The most obvious example of this is Midjourney. Using the GAN algorithm as its basis, Midjourney creates a creative output with the text input. Fig. 17 shows one of the first A.I.-generated pieces to win a prize.

Fig. 17: Jason Allen's A.I.-generated work, "Théâtre D'opéra Spatial," took first place in the digital category at the Colorado State Fair

Source: Roose, K. (2022). An A.I.-generated picture won an art prize. Artists aren't happy. Access Date: 29/03/2023. https://www.nytimes.com/2022/09/02/ technology/ai-artificial-intelligence-artists.html

For countless years, people have been devoting a significant portion of their time and energy to the creation of the tarts as a means of communicating their creativity. The rapid growth of technology, and deep learning in particular, has piqued the interest of a significant number of scholars who are attempting to determine whether or not art can be generated by computers and algorithms. Applications such as synthesizing lifelike human faces and automatically creating captions from photographs have been accomplished with the help of GANs (Shahriar, 2022).

With the advent of Non-Fungible Tokens (NFTs), digital artworks have reached a level of appeal that has never been seen before NFTs. NFTs, also known as non-fungible tokens, are a type of cryptographic asset that may be kept on blockchain networks. These assets constitute an unforgeable digital certificate of ownership. It is possible to include NFTs in a smart contract, which provides the owner with the opportunity to profit from a share of future sales. The creation of NFTs requires a significant amount of work, despite the fact that they provide digital artists with a multitude of benefits (Shahriar and Hayawi, 2022).

NFT technology solves one of the most important problems in the digital art world: the reproducibility and imitation of artworks. Digital artworks are easily reproduced and disseminated because of the widespread use of the internet. This situation brings along problems such as the unauthorized use of the artists' labor and the devaluation of their works. However, owing to NFT technology, digital artworks have become unique and immutable assets. Owning an NFT means being the sole owner of a digital artwork and preventing unauthorized use of the work. Also, NFTs increase the value of digital artwork. In the art world, uniqueness and rarity are factors that significantly affect the value of a work. Because NFT technology documents the uniqueness of digital artworks, it reinforces the perception that digital artworks are rare and valuable in the art market. This contributes to the recognition of digital art as an economically valuable asset. NFT technology is revolutionizing the art market. While in the traditional art market, the value and ownership of works are documented, in the digital art world, this process is more complex. NFT technology provides credibility and traceability in the art market by digitally documenting the uniqueness and ownership of digital artworks. Through NFTs, art lovers can create their collections without doubting the authenticity of their works.

7. DIGITAL ART WITH METAVERSE AND DIGITAL MARKETING RELATIONSHIP

People, corporations, and even the government all stand to benefit from the metaverse's vast range of applications and possibilities. The metaverse provides a user with a more immersive experience by making a multitude of data points accessible to the host across a variety of temporal and spatial dimensions. This is achieved through the metaverse. After collecting and analyzing these data points, more advanced analytic techniques may be used to target and retarget prospective clients in real time. Because of this, the target customers' trackability will be much enhanced compared to the effectiveness of conventional digital channels. The metaverse is able to generate a digital depiction of the actual world by making use of technology that will one day be referred to as extended reality (XR) for the next generation. People who engage in exciting content and interact with the metaverse by employing cutting-edge augmented reality and virtual reality technology will have the option to take part in an experience that is wholly immersive. Consumers

will be encouraged to play a game in order to acquire virtual products and to provide feedback on their preferences to marketers working in the metaverse. Because so many diverse individuals contribute content, the Metaverse platform will eventually be filled to the brim with pieces of art that are completely unique. It enables content providers in gaming, NFTs, entertainment, and other businesses to take advantage of the opportunity. It is necessary for content creators to have a working knowledge of XR technology if they wish to implement the aforementioned tactics for the development of content while operating within Metaverse platforms (Dwivedi et al., 2022).

Artistic images of visually productive artificial intelligence systems with GAN-based algorithms are generally more common in the NFT field. NFT is used to purchase digital artwork. In this way, the buyer gets the real work that cannot be changed. The importance of the metaverse here is that these digital artworks are exhibited in metaverse areas, and buyers examine the works in these areas. Metaverse hosts many exhibitions this way. As GAN art continues to be on the rise, it seems that NFT and Metaverse will take their place in the same rise. In particular, the NFT market is a desired platform in the era of works produced by artificial intelligence. An image of an NFT animation produced by artificial intelligence is shown in Fig. 18.

Fig. 18: Holly Herndon and Mat Dryhurst's Crossing the Interface (DAO) XIII

Source: Droitcour, B. (2021). GANs and NFTs. Access Date: 08/04/2023. https://www.artnews.com/list/art-in-america/features/gans-and-nfts-1234594335/robbie-barrat-ai-generated-nude-portrait/

Users of applications like Decentraland, Axie Infinity, and SecondLife have the ability to play-to-earn, own virtual land, and engage in a wide variety of other activities thanks to the usage of blockchain technology. Non-fungible tokens, often known as NFTs, are a type of cryptographic token that may be used to hold digital assets. These tokens include encoded information on the ownership details of virtual

goods. An NFT might take the form of digital artwork, a piece of in-game property, or something entirely else (Kaur & Gupta, 2021).

The proliferation of technologies such as 5G, VR, and XR is what is fueling the emergence of the metaverse age. The evolution of the metaverse is highly dependent on the use of newly developed technology. It is not possible to attain outstanding immediacy and immersion in the virtual world with technology that is limited to either software or hardware. The heart of the vital material consists of the visual works that are utilized in the metaverse. Visual artists have a very significant impact on the disciplines of creation that pertain to non-fiction narrative artwork, smart cities, cultural museum engagement, video games, and television and film production. Studying the art rules and creative techniques of the metaverse has the potential to enhance the current digital media presentation effect as well as the creative level of VR art; as a result, this will encourage more artists to participate in the construction of the metaverse (Qu et al., 2022).

The most common definition of digital art describes it as any form of artwork (painting, music, video, animation, installation, web site, etc.) that is generated via the use of some type of computer equipment. Examples of digital art include animation, sound, video, installations, and websites. In this case, digital marketing makes use of this channel by providing relevant marketing information to artistic units in order to meet their requirements (Girchenko & Ovsiannikova, 2016). While the traditional art market is experiencing a slump, the digital art market is experiencing phenomenal growth. This can be attributed, in part, to the fact that the digital art market is connected with non-fungible tokens, which make it possible for any one-of-a-kind good to be mapped in a digital setting (Horky et al., 2022).

As a result of the answers to COVID-19, which sped up digital transformation and online interactions, more people are using Roblox, Zepeto, Minecraft, and Fortnite to play games and interact with other people. People are using metaverse platforms more and more, especially younger people who are used to doing things online. The market for these platforms is expected to grow quickly. So, businesses in a wide variety of sectors have started making active use of the metaverse for a variety of reasons, including advertising, performances, events, and education. Research on the metaverse is being carried out in a wide variety of domains as a result of the phenomenon's meteoric rise to prominence on the world scene. Also, the term "metaverse" has taken on a broader meaning since blockchain technology, NFTs, and a number of platforms have been introduced. Because the metaverse and real life are getting more and more connected, this new technology is having an effect on society as a whole, as well as the economy and culture (Hwang & Koo, 2023).

For digital artists as well as digital marketers, the GAN has become an essential tool. In marketing, GAN can help automate and personalize content production processes. For example, GAN can be used to create compelling images

and videos for specific customer segments. Also, GAN-based content can be used on social media platforms to get more engagement and conversions. By using these opportunities provided by GAN technology, digital marketers can establish stronger bonds with their target audiences and bring their brands to the fore. GAN has established a strong relationship between digital art and digital marketing and has significantly influenced both fields. While opening new doors of creativity for digital artists, it has also helped to improve content production and personalization processes for digital marketers. With the advancement of GAN technology, it is inevitable that we will see even more engaging and impressive artwork and marketing campaigns in the future.

8. CONCLUSION

The GAN is one of the most successful models in recent years (Elgammal et al., 2017). There are many productive artificial intelligence applications based on the GAN algorithm, and these applications are reaching very impressive points today. The outputs produced over certain metrics and datasets with the GAN algorithm are interesting. One of the areas most affected by GAN-based applications is the field of digital art. GAN-based artificial intelligence has brought a new perspective to digital art.

Artworks produced by artificial intelligence attract a lot of attention. It is clear that the work produced by artificial intelligence will be much more important in the future. The creative works that these rapidly developing applications will produce in the future arouse curiosity. As new technologies arise and become more prevalent, art and the notion of artwork are becoming increasingly digital. The rapid development of GAN technology raises curiosity about how creative works and works of art will be shaped in the future. In our digitalizing world, the concepts of art and artwork are becoming more and more digital, and thanks to digital marketing tools, artists have the opportunity to reach wider audiences. As a result of the tools that are made available by digital marketing, artists may now communicate with specific audiences that were previously out of their grasp. Artificial intelligence is utilized in the creative arts just like it is in every other field. The majority of the works that were created with the assistance of artificial intelligence are present in our everyday lives in some form or another. It is currently the case that a sizeable percentage of today's artists make their works with the assistance of AI, and it is anticipated that this percentage will soon expand as well. This trend is expected to continue in the near future.

The role of artificial intelligence in the art world brings with it ethical problems. Fundamental questions about the definition of art and by whom it can be produced form an important basis for evaluating the effects of artificial intelligence in the field of art. In the future, it is inevitable that there will be more in-depth reflection and intensification of social debates on the impact of artificial intelligence

on the creative processes of artists and the originality of art. The main basis of these problems is the question of what art is and by whom it can be produced. Considering the success of artificial intelligence in the fields of art and ethical issues, it is clear that these technologies will have great importance in our lives in the future and will be an indispensable part of our lives. Therefore, it is important for the art world and society to adapt and appropriately direct this technological transformation. The potential of artificial intelligence in the fields of creativity and art offers new and exciting possibilities for the art world when properly directed.

Ethical Declaration

In this study, all the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" were followed.

Ethics Committee Approval

Authors declare that the research is one of the studies that does not require ethical committee approval.

Conflict of Interest and Funding

No conflict of interest and funding has been declared by the authors.

Authorship Contribution Statement

All stages of the study were designed and prepared by the authors.

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