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Enhancing the Concept of Generative Art

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Abstract: ***Art that was entirely or partially produced by an autonomous system is referred to as generative art. An autonomous system is typically a non-human entity that is capable of making judgments on its own about aspects of a piece of art that would otherwise require direct input from the artist. We have created a GUI which lists the applications which are based on the concept of generative art. Our GUI contains applications like random password generation, abstract artworks, map generation, wallpaper generation.***
Password generator will provide randomly generated passwords which would be derived from the images created using image generation algorithms/scripts such as EPWT and python's in-built random function which uses algorithms like mersenne twister, a pseudo-random number generator. This application aims to provide usefulness for old hashing algorithms which are getting obsolete day by day. Abstract artwork generator will generate random images for stimulating creativity of artists, designers, architectural and marketing firms for getting started on a new project. This generator uses general complex functions which contain scripts for different shapes and combinations. This approach is able to generate some innovative solutions and demonstrates the power of computational approach. A layout of the area with the requested coordinates and different constraints will be provided through map generating model. Wallpaper generation model will generate aesthetically pleasing wallpapers with adjustable features.

I. INTRODUCTION

A. Background

Generative art is a type of art made with the use of computer code or algorithms. It is art that is created by an autonomous system that is self-generating and has creative output that is unpredictable and unique. Generative art is created using algorithms and programming that can create unique visuals that are not predetermined by the artist.
Generative art involves creating a program or script that takes an input, such as a set of images or shapes, and then randomly generates a unique artwork from that input. The randomness in the output creates unexpected and often beautiful results. Generative art can be used to create digital art, interactive installations, sound art, and more. Generative art is often used to explore themes of chance, randomness, and the creative potential of technology.
Through the use of generative art, artists are able to explore concepts of randomness and chance, as well as create works that expand upon our understanding of the aesthetic potential of technology. This project seeks to explore the potential of generative art by creating unique pieces of art that are inspired by the natural world around us. By blending natural elements with the power of technology, this project hopes to create pieces of art that will inspire and delight viewers.

B. Motivation

Generative art is a fascinating form of art that allows its creators to explore the boundaries between art and technology. It is a type of art that is created using a set of rules and guidelines, which can then be modified and manipulated to create unique and unpredictable works of art. Generative art is a great way to explore creativity in a way that can be interactive and ever-evolving. Plus, it can be incredibly rewarding to see the end results of your work.

C. Problem Definition

The passwords that we use nowadays are generally hackable and as technology is developing over time, they become increasingly vulnerable to being compromised and falling into the wrong hands. People frequently use generic passwords like date of birth, favorite color etc. which can also be easily hacked by anyone knowing your interests and personal details.
Lack of available interesting, customizable options for beautification of maps. The currently available abstract art solution is single shape generator which do not provide the option of merging multiple shapes together. Lack of available interesting, customizable options for beautification of maps. The currently available abstract art solution is single shape generator which do not provide the option of merging multiple shapes together.

D. Scope

Generative art is an umbrella term for art created through the use of various algorithms and processes that are applied to create artworks. Generative art can encompass anything from digital art to sculptures or installations, as long as it was created using a generative process. Generative art includes a variety of techniques, such as artificial intelligence, procedural generation, computer vision, evolutionary algorithms, cellular automata, and machine learning. Generative art may also involve the use of randomness, interactivity, and self-organizing systems, as well as the creation of generative organisms or systems. The scope of generative art is broad and constantly evolving as new technologies emerge.

II. LITERATURE REVIEW

1) What is generative art? by Margret a. Boden, Ernest A. Edmonds:

'What is art?' is one of the classic questions that philosophy has addressed over the ages, from the ancients to today. the art world itself--however suspicious it may be of computers in general, and however dismissive it may be of particular CG-art efforts--does sometimes award these new activities the coveted status of art. Sometimes, this happens in a specialised corner of the art world: for instance, London's Kinetica gallery (opened in October 2007), which is devoted to interactive, robotic, and kinetic art. But we have also mentioned two examples (others could have been cited) where major 'traditional' galleries clearly accept that traditional and CG-art are players in the same cultural ballpark. These were the Tate's one-man show of Cohen's AARON, and the Washington exhibition featuring Edmonds' work as a development of that of theColorField painters. The latter example is especially telling, precisely because it is not a show celebrating only CG-art. On the contrary, the Washington exhibition is putting CG-art alongside the precious bubble--or even inside it.

2) A Framework for understanding generative art by Alan Dorin, Gordon Monro, Jon McCormack:

A framework for the description, analysis and comparison of generative artworks is needed. Existing ideas from kinetic art and other domains in which process description is prominent are shown to be inadequate framework is divided into four major components: a description of a work's entities, its processes and their environmental interactions, and lastly, the outcomes experienced by the work's audience. This accommodates computational, physical, kinetic and virtual systems, allowing meaningful comparison between a wide variety of generative systems from the past, present and future. the problem with this approach is framework is its focus on features of the generative process, rather than artistic motivations.

3) Medical Image Generation using Generative Adversarial Networks by Nripendra Kumar Singh Khalid Raza:

GANs framework has achieved great success in the field of medical image generation and image-to image translation. We have discussed the weightiness of a significant rise in the study of medical imaging during the past 2-3 years. A detailed literature survey of GANs in medical imaging reported that about 46% of these articles are related to cross-modality image synthesis(Yi et al., 2019). A large section of research has focussed on the application of GANs in medical image synthesis of MRI imaging. The probable reason for the synthesis of MRI images is that it takes longer scan time for multiple sequence acquisition. Conversely, GAN effectively generates the next sequence from the acquired one, which saves time slots for another patient. The second reason may be the large number of MRI data set available in the public domain allowing researchers to have a surplus sample size for better model training.

4) The Easy Path Wavelet Transform: A New Adaptive Wavelet Transform for Sparse Representation of Two-dimensional Data by Gerlind Plonka:

EPWT when compared with the traditional tensor product wavelet transform, it is seen that the new EPWT needs less than one fourth of wavelet coefficients in order to achieve a similar PSNR. Here one needs to keep in mind, that with the two transforms not only the real wavelet coefficients themselves but also their positions in the wavelet vectors have to be stored.

For the EPWT we also have to store the path vectors, thus it is highly desirable to make these vectors as cheap as possible. The idea of relaxed EPWT is a first step in this direction. In our numerical experiments we have observed that the performance of the relaxed EPWT crucially depends on the choice of path vectors in all levels.

Therefore, one should think about other versions of relaxed EPWT with high performance and much cheaper path vectors. Instead of the simple method of favorite directions one may use more sophisticated extrapolation methods for obtaining the next component of the path.

5) A Region Based Easy Path Wavelet Transform for Sparse Image Representation by Renato Budinich:

We introduced a new method for compression of natural images, which applies an image segmentation method to the image before applying an EPWT-like method. We defined two region path-finding procedures, which are deterministic and do not depend on the single gray values of the pixels in the region. We used the defined transform to compute a lossy compressed version of the original image, obtained by setting to 0 all but the greatest coefficients and applying.

6) A new sparse representation of seismic data using adaptive easy-path wavelet transform by Jianwei Ma, Gerlind Plonka, Herve Chauris:

Seismic data show good performances of the EPWT method in this field. The next step would be to develop high-dimensional EPWT algorithm for sparse representation of large volumes of data depending on possibly five dimensions: time and two spatial coordinates for both sources and receivers.

Although the EPWT has surprising performances in terms of sparse representation of seismic data, at the current stage, the main lack of the EPWT is its high computation cost for searching and storing the path p. An alternative strategy to overcome this problem to some extent is to apply the EPWT in wavelet sub-bands. That means, one first applies a two-dimensional discrete wavelet transform to the data, and then applies the EPWT in each wavelet coefficient sub-band.

7) Diverse Image Generation via Self-Conditioned GANs by Steven Liu, Tongzhou Wang, David Bau, Jun-Yan Zhu, Antonio Torralba

We have found that when a conditional GAN is trained with clustering labels derived from discriminator features, it is effective at reducing mode collapse, outperforming several previous approaches. We observe that the method continues to perform well when the number of synthesized labels exceeds the number of modes in the data. Furthermore, our method scales well to large-scale datasets, improving Fréchet Inception Distance and Inception Score measures on ImageNet and Places365 generation, and generating images that are qualitatively more diverse than an unconditional GAN.

III. METHODOLOGY

A. System Architecture

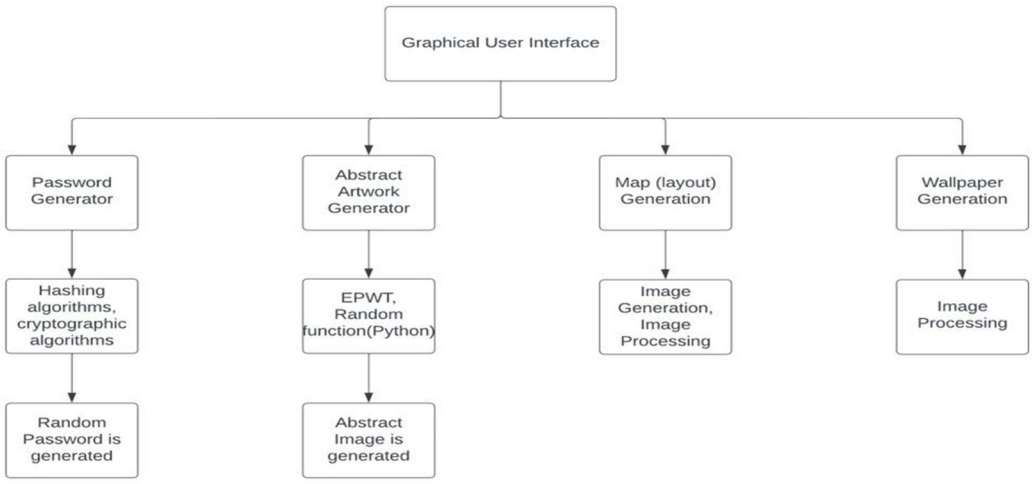

Fig. 3.1.1 Flowchart of system

B. UML Diagram

1) Use-Case Diagram

a) Actors

- User
- Generative model system

b) Use-Case

- Generate password
- Generate abstract art
- Generate wallpaper
- View map

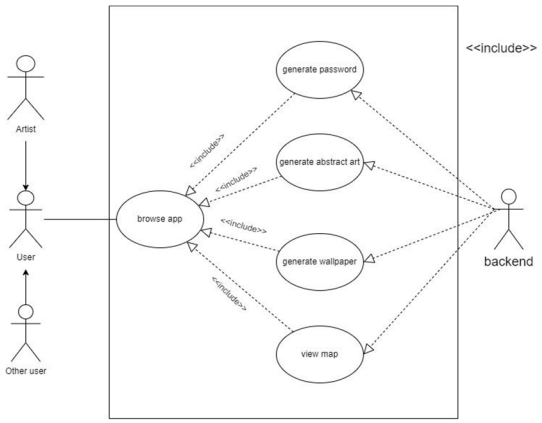

Fig. 3.2.1 Use – Case Diagram

2) Activity Diagram

Activity diagrams graphically depict the sequential flow of activities of either a business process or a use case. They can also be used to model actions that will be performed when an operation is executed as well as the results of those actions. They focus on the flow of activities involved in a single process. The activity diagram shows the how those activities depend on one another.

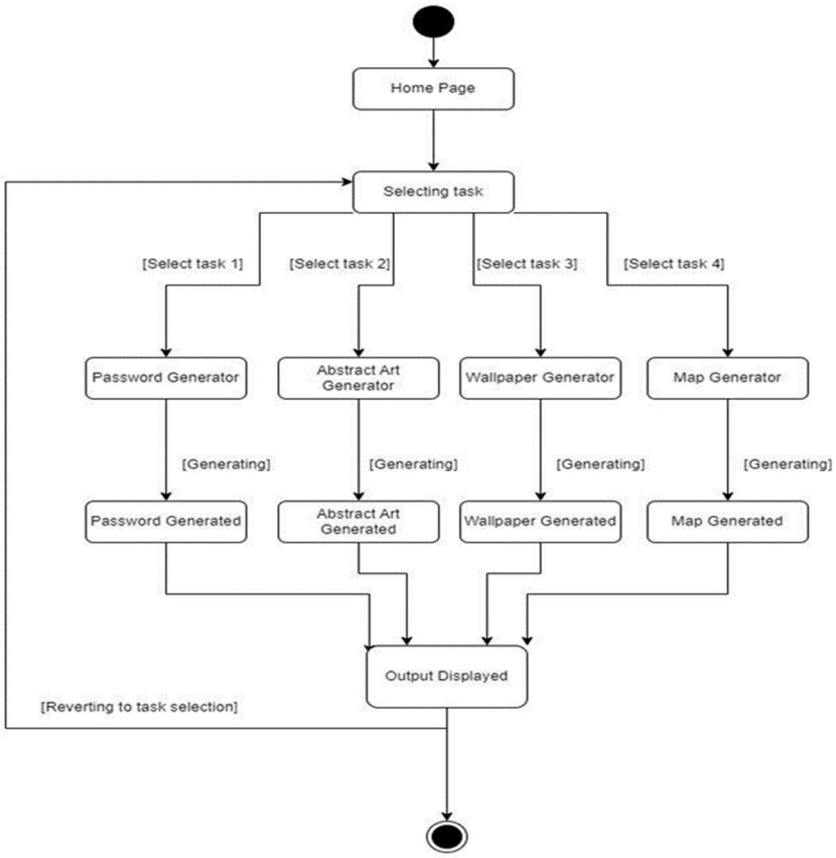

Figure 3.2.2: Activity Diagram to model the actions and the output of those actions when an operation is carried out in the system.

3) Class Diagram

Class diagrams are the blueprints of your system or subsystem. You can use class diagrams to model the objects that make up the system, to display the relationships between the objects, and to describe what those objects do and the services that they provide.

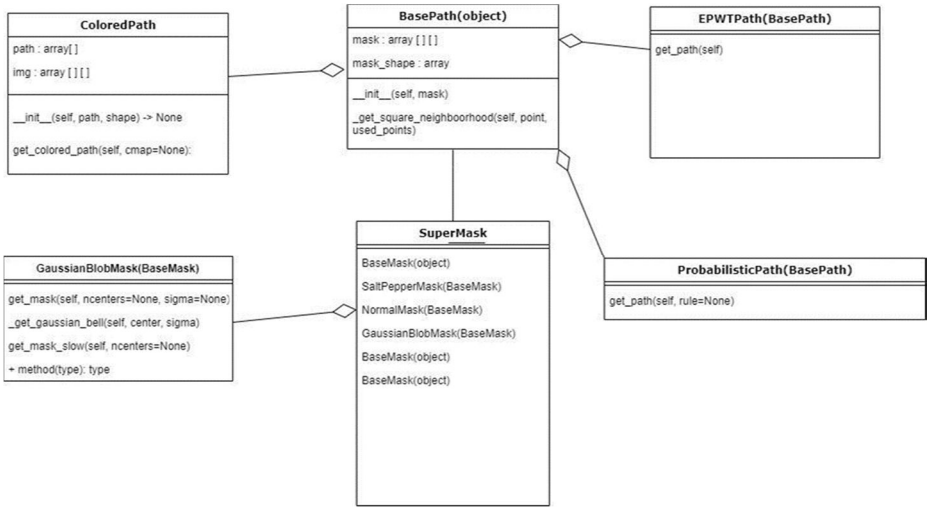

Figure 3.3.3: Class Diagram to show the connection between different software classes in the system.

IV. ALGORITHMS

A. EPWT

1) *Introduction:* The Easy Path Wavelet Transform (EPWT) is a relatively new image processing technique which produces images that are sharper and more accurate than traditional methods. It is based on the wavelet transform, which is a mathematical tool used to decompose a signal or image into multiple frequency components. The EPWT algorithm uses a low-pass filter to decompose the image into four components, and then applies a thresholding technique to identify the most important edges in the image. This technique has proved to be very effective in improving image quality and detail, and is quickly becoming a popular choice for image processing applications.

2) *EPWT Working:* The EPWT algorithm works by decomposing an image into four components: low-frequency, high-frequency, edge-enhanced, and noise-free. The low-frequency component contains the most general information, while the high-frequency component contains the fine details and texture of the image. The edge-enhanced component is designed to enhance the features of the image, while the noise-free component is designed to remove any unwanted noise or artifacts. The EPWT algorithm then applies a thresholding technique to the four components. This thresholding technique is used to identify the most important edges in the image. The edges are then enhanced, and the noise is reduced. Finally, the four components are recombined to create a sharp, detailed image.

3) *Conclusion:* The Easy Path Wavelet Transform is a relatively new image processing technique which produces images with greater detail and accuracy than traditional methods. It is fast and efficient, and is easy to implement, making it a popular choice for many applications. The EPWT algorithm is quickly becoming a popular choice for image processing applications, and its popularity is expected to continue to grow in the future.

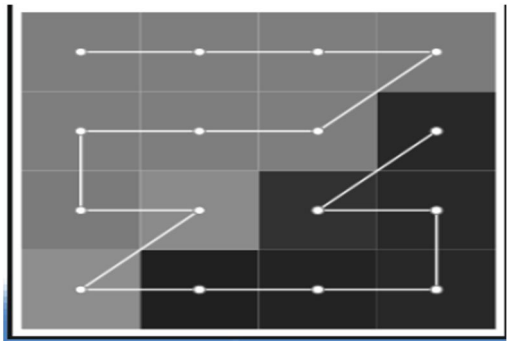

Figure 4.1.1 : EPWT algorithm

B. Mersenne Twister

Mersenne Twister is a pseudorandom number generator (PRNG). It is a type of random number generator that is based on a mathematical algorithm. This algorithm is designed to generate a sequence of numbers that appear to be random, but are actually generated by a deterministic process. The Mersenne Twister algorithm was developed by Makoto Matsumoto and Takuji Nishimura in 1997. It is a far more complex algorithm than earlier PRNGs and is capable of producing a much longer period of random numbers. The algorithm works by generating a sequence of unique numbers using a mathematical formula. It starts with an initial seed value, which is then used to generate a sequence of numbers using the formula. The sequence of numbers is then used to generate a random number. The algorithm is often used in computer games and simulations, as it is capable of generating a wide range of random numbers. It is also used in cryptography and other applications where a secure random number generator is needed. The Mersenne Twister algorithm is one of the most widely used PRNGs and is considered one of the most reliable and secure random number generators available. It is also relatively fast, making it ideal for applications that require a large number of random numbers to be generated quickly.

C. ROT-13

Rot-13 is a simple letter substitution cipher that replaces a letter with the letter 13 places further down the alphabet. It is a special case of the Caesar cipher which was developed in ancient Rome.

Rot-13 is used for obscuring text, not for encrypting it. It is a method of hiding text so that only those who know the cipher can read it. It is often used for hiding jokes, puzzle solutions, offensive material, and spoilers in online conversations. Rot-13 works by shifting each letter of the alphabet by 13 places. For example, the letter A becomes the letter N, the letter B becomes O, and so on. To decrypt a Rot-13 message, simply shift the letters again by 13 places. Rot-13 is a weak cipher because it is easily broken by frequency analysis. This is because each letter is simply shifted by the same amount, leaving the frequencies of the letters unchanged. Rot-13 is also vulnerable to brute force attacks. An attacker can easily try all 26 possible shifts to break the cipher.

Despite its weaknesses, Rot-13 remains a popular choice for hiding text online. It is simple to implement and provides a reasonable level of obscurity.

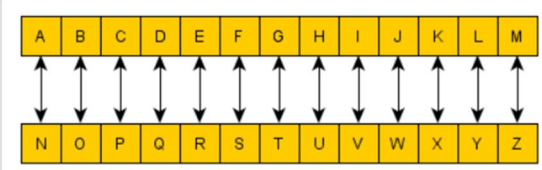

Figure 4.3.1 : ROT-13 algorithm

D. Hashing Algorithms

A hashing algorithm is a type of computer programming algorithm that creates a unique output from a given input. It is used to store and retrieve information from large datasets. Hashing algorithms are used for a variety of applications, such as data encryption, data integrity, data authentication, and digital signatures. Hashing algorithms are designed to be one-way functions, which means that it is difficult to determine the original input from the hash output. This makes it difficult for hackers to access sensitive data. Hashing algorithms also enable efficient lookups of data by creating an index of the data.Hashing algorithms are used in many areas of computer science and cryptography. In cryptography, hashing algorithms are used to create digital signatures and to verify the integrity of files. Hashing algorithms are also used in software development, to ensure that the software is not modified without the user's knowledge. There are many different types of hashing algorithms, each with its own set of advantages and disadvantages. Some of the most popular hashing algorithms include SHA1, SHA2, and MD5. Each of these algorithms is designed to be secure and reliable. SHA1 is the most widely used hashing algorithm. It is used in a variety of applications, including secure web communications and digital signatures. SHA2 is an improved version of SHA1. It has a larger hash length, which makes it more secure. MD5 is another popular hashing algorithm. It is used to check the integrity of files, and it is often used to create digital signatures. No matter which hashing algorithm is used, it is important to remember that they are not infallible. They can be broken by sophisticated hackers and malicious software. It is important to use strong passwords and other security measures to protect sensitive data. Hashing algorithms are essential for secure data storage and retrieval. They are used in a variety of applications, and they offer a reliable way to store and retrieve data. While no hashing algorithm is completely secure, they offer an important layer of security for sensitive data.

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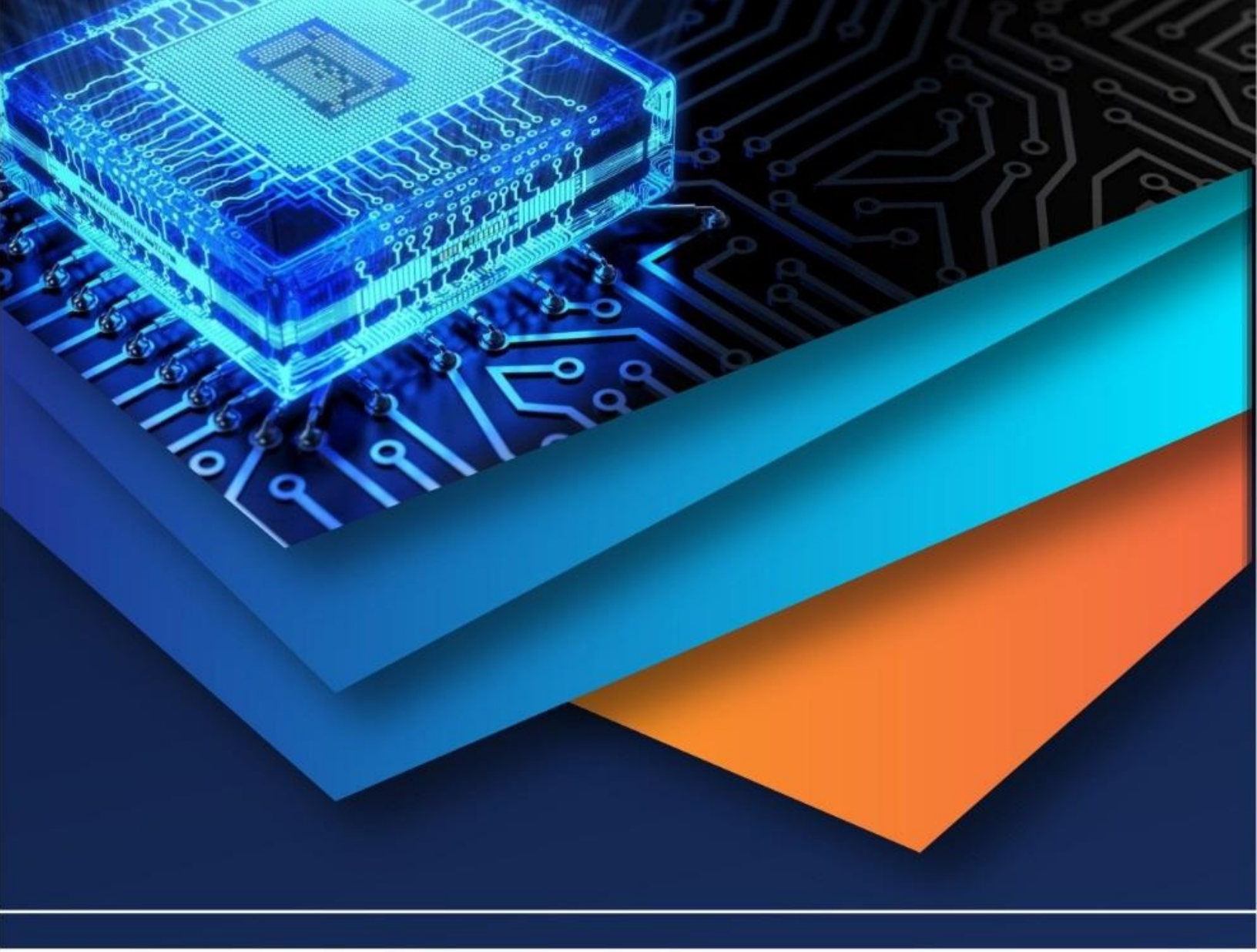
V. CONCLUSION AND FUTURE SCOPE

Generative art is a form of art that uses computer-generated algorithms to create unique and complex pieces of art. It often seeks to push the boundaries of traditional art forms by exploring the potential of technology to create new and interesting visuals. We have provided 4 main models, each of which have their own set of instructions and parameters that can be used to generate artworks. These 4 models include, Random Password Generation is an application based on generative art which allows users to generate random passwords of any length and complexity. Abstract Artworks is an application which uses a combination of algorithms and data to create abstract artworks. Map Generation is an application which uses algorithms to generate maps with different themes, like city layout or fantasy landscapes. Wallpaper Generation which uses algorithms to generate wallpapers of different sizes and styles, like abstract designs or nature scenes. Our project seeks to explore the potential of generative art by creating unique pieces of art that are inspired by the natural world around us. By blending natural elements with the power of technology, this project hopes to create pieces of art that will inspire and delight viewers.

Generative art is an ever-evolving field, and its future is full of possibilities. In the near future, generative art is likely to become more accessible to the masses, with more tools and approaches available to help create art. This could mean more opportunities for people to use generative art in their own creative works. Generative art may also become more interactive and immersive, with virtual and augmented reality experiences. Additionally, generative art could be used to create more complex and intricate artworks using machine learning and AI to create personalized and even interactive pieces. In the distant future, generative art may be used to create new kinds of art that could be used to tell stories, create virtual worlds, and introduce new ways of experiencing art.



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