Research on the Innovative Application of Digital Art in Cross-cultural Design Based on Artificial Intelligence Technology

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Abstract. In the era of digital media, the continuous updating of technology has driven the development of digital art. In this process, the combination of artificial intelligence and artistic inspiration realizes the link between different cultures technology, with machine learning as its core, can help artists and enthusiasts from all over the world to create unique works by learning from different cultures. However, both at the level of technical support and the process of art creation. Digital art creation combined with AI faces challenges. In the context of globalization, how to combine technology and art has become an urgent problem. In the future, AI technology is the development trend, and art combined with technology In the future, art combined with technology can promote mutual understanding among different cultural groups. To better meet the challenges, the joint efforts of various artists and technology developers are needed.

Keywords: Artificial Intelligence Technology; Intercultural Design; Artistic Creation

1 Introduction

The development of technology has changed our lives, and now we have entered the digital media era. In this context, the development of Artificial Intelligence provides unlimited possibilities for digital art creation. Digital art, at its earliest, can be traced back to around the 1960s and 1970s. Artists at that time tried to use computers to generate images and patterns, and the artworks in this period were very limited to early computer technology and looked rather simple and abstract. With the advent of personal computers and graphics software, artists in the 1980s created more complex and diverse computer artworks, which began to incorporate imagery and laid the groundwork for cross-cultural artistic exchanges. In the 1990s, the popularity of the Internet revolutionized the cross-cultural design of digital art. At this time, with the emergence of individual artists on the web, individuals created works that were instantly accessible globally and were able to interact with these works in real-time. The works produced during this period exemplify the social and connected nature of cyberspace. At the turn of the century, with the rise of mobile devices and social media, digital art became more socially engaged, with artists using platforms to collect the work of users from around the world, and combining this with their thinking to create works of art that reflect

multicultural perspectives. In recent years, with the rapid development of artificial intelligence technology, the creation of digital art has faced new opportunities and challenges.

2 Basic Concepts of Artificial Intelligence

To study the impact of AI on digital art, it is important to have a grasp and understanding of the concepts related to Artificial Intelligence. Artificial Intelligence is the science and technology that mimics the behavior of human intelligence, enabling machines to perform tasks that in the past were often only done by humans. Things such as learning, reasoning, language, and problem-solving. To better integrate technology with the arts, the following key areas of application are important.
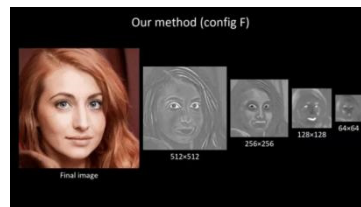

Fig. 1. NVDIA's GANStyle2.

Machine learning is at the heart of AI, enabling computer systems to learn from data. In the process of learning, performance is further improved and predictions or decisions are made. In the process of art creation, machine learning algorithms can analyze a large number of artworks, learn the styles as well as the characteristics of these artworks, and generate new artworks. The rapid development of AI technology has reached the point where it is possible to generate human portraits that are as good as the real thing, but at present, AI image artworks can't be generated completely independently of humans. **(Fig. 1.)**

3 AI in Digital Art

3.1 Artistic innovations

Artistry is one of the most important aspects of a digital artist's work, and the TeamLab team specializes in using technology to create multi-sensory art worlds. For example, in 'Forest of Resonating Lamps', **(Fig. 2)**the installation uses hundreds of beautiful lamps to create a forest of light and color. Each lamp is suspended in the air and, through sophisticated programming and sensor technology, responds to the viewer's proximity by changing color and emitting pleasant sounds. This form of artwork allows viewers to enjoy visual and auditory pleasure while visiting the exhibition.

Compared with traditional art forms, digital art can break the limitations of physical space and create a fantasy space independent of the real world. The close integration of technology and art enables artists to give full play to their imagination to create works that are not conventional and provide audiences with a new sensory experience.

Fig. 2. Forest of Resonating Lamps(TeamLab).

3.2 Use of AI and digital technology

The use of Artificial Intelligence (AI) and digital technology has certainly fuelled a revolution in art creation. Combining AI, machine learning, sensor technology, and other tools, digital artworks can communicate with the audience in real-time generation techniques using AI algorithms that can change based on viewer interaction. Through machine learning techniques, artists can analyze and mimic different art styles. For example, in 'Floating Garden', AI algorithms analyze traditional paintings and enable digital flowers to mimic these styles, creating an art experience that mixes the modern with the classical. Based on this, combined with sensor technology, the artwork can interact with the audience.

Through these technologies, TeamLab not only creates stunning artworks but also provides a new way for viewers to interact and experience them. Allowing the audience to become co-creators of the story, in which they change the course of the story through interaction, thus making themselves part of the artwork as well. This sense of participation also deepens the audience's understanding and emotional engagement with the artwork.

3.3 Interactivity in Digital Art

In the realm of digital art, interactivity has become an important indicator of innovation, and TeamLab's artworks are more than just visual displays; the audience's participation is part of the whole artwork. Their art emphasizes the interactive relationship between the audience and the artwork, believing that the meaning of the artwork is realized and extended through interaction with the audience. The work 'Crystal World' demonstrates the charm of dynamic art. In this interactive digital installation, the viewer's behavior affects the visual effect of the whole installation. As the viewer moves, the light and colors in the space change, creating a dynamic and vivid art scene. This presentation is not only visually stunning but also enhances the viewer's sense of immersion.

4 AI in cross-cultural digital art

4.1 Digital Preservation of Cultural Heritage

Artificial Intelligence (AI) technology has been widely used in practice, and the application of digital media technology in display design has become more and more common combined with traditional design techniques has refreshed people's understanding of display design. In this context, how to integrate traditional art with AI technology in display design; and how to combine traditional art forms with AI technology and inject the vitality of the times into traditional art of different cultural backgrounds has become an urgent problem to be solved.

The digitization of cultural heritage uses 3D scanning and photogrammetry technologies, combined with AI to be able to convert physical cultural heritage around the world into high-precision digital models. Recently, the Google Art & Culture project, in collaboration with museums around the world, has used 3D technology and AI algorithms to enable users to browse museum collections around the world online, including some cultural heritage that cannot be visited on-site. In addition, viewers can also experience life in ancient civilizations through VR devices, such as Google's 'World Heritage Tour' project, which allows users to take a virtual tour of interactive displays at multiple world heritage sites.

4.2 Public Engagement in the Age of Digital Art

Interactive art installations incorporating AI can respond to viewers' behavior and personalize the interactive experience. In an exhibition at the Museum of Modern Art in New York, AI technology was used to analyze the facial expressions of viewers and adjust the display of artworks according to their changing moods. Some scholars have emphasized that 'art is the product of a collective activity that exists within a social structure.'[1]Interactive narratives in art require audience participation, so how to maintain audience engagement is a key issue. To solve this problem, it is necessary to understand the needs of the current masses, because only by satisfying the needs of different audiences can the masses be stimulated to participate in art creation.
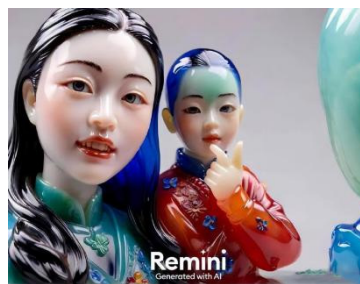

Fig. 3. Porcelain Doll Filter (Jade) by Remini.

Since the big model explosion in 2023, short video platforms such as Jitterbug, represented by a large number of AI effects, and AI applets, software cover all aspects of modern life, and high frequency of use gives rise to the need for users to seek a variety of digital art. Recently, a phenomenal AI image processing software called Remini (Fig. 3) has become very popular, and its 'clay style' filters have attracted countless young men and women from all over the world to participate in this network-wide art creation. The developers of Remini then introduced the 'Jade' filter after the 'Clay' filter to cater to Chinese users. This reflects that people's participation in digital art is increasing in different cultures, and to better adapt to the market and cater to groups from different cultural backgrounds, developers, and creators need to make corresponding changes.

4.3 Ethical and Copyright Issues in Digital Artworks

AI technology has made it less difficult for people from different cultures to create digital art, but the ethical issues involved still deserve our attention. The technology of generating images using Artificial Intelligence (AI) has been widely publicized in Ope-nAI's DALL-E system

released in 2021.[2] One of the most prominent ethical considerations in the creation of AI art is the issue of copyright.

Fig. 4. Edmond de Belamy.

Since AI-generated art is based on a large number of existing artworks to learn and generate new works, this raises concerns about the copyright of the original works. a national survey conducted by the Pew Research Center in December 2022 found that 20% of respondents saw "using artificial intelligence (AI) to produce visual images from keywords" as a"major advance for the visual arts," and another 26% [3]saw it as a "minor advance".[4] So, whether the works created by AI have artistic value in themselves has become a question worth exploring, and in 2019, the exhibition 'The Pioneers' showed several paintings created by AI algorithms in Germany. Because these works were influenced by the styles of different artists, it triggered a controversy about whether AI artworks infringed on the copyrights of these artists. In addition to this, the definition of machine creativity involves whether AI is capable of having similar creativity to human artists.[5] And whether AI artworks have value. In 2018, Christie's auction house sold an exceptional painting at auction at Rockefeller Center in New York for the highest price in the house of $432,500, or about Rs. 3 million, and that price even exceeded the Picasso's work that was also up for bidding in the same auction. (Fig. 4)

5 Analysis of responses to the dilemma

Nowadays, art combined with artificial intelligence has become mainstream, and in such a trend of social necessity and globalization background, international cooperation and technical development support are particularly important. At the same time, intercultural exchanges still need to be strengthened. Through international cooperation, artists can learn from each other, share experiences, and jointly explore new ways of combining art and technology. In addition, international cooperation can help artists broaden their horizons and understand the artistic creation and aesthetic concepts of different cultures. For example, the UNESCO-supported Connecting Art & Culture program connects artists around the world through a digital platform, encouraging them to create works that reflect multiculturalism.

Another key factor in promoting the cross-cultural development of digital art is the support of technological research and development, which needs to be continually driven by AI technology to better support the arts. In this regard, the government can provide financial support, tax incentives, and other measures to encourage research institutions and enterprises to invest in AI technology research and development. At the same time, the establishment of

public R&D platforms and the provision of technical training can lower the threshold for artists and designers to use AI technology and help them make better use of these tools for creation. Google's art and culture department invites artists to collaborate with AI experts in the 'Artists and Machine Intelligence' (AMI) project to develop the application of machine learning in art creation. In addition, the development of intercultural design can also be promoted through the implementation of intercultural digital art workshops and international exchange programs. Hofstede's theory of cultural dimensions provides a valuable research tool for researchers and practitioners of intercultural communication to understand and analyze cultural differences.[6] In cross-cultural digital art workshops, the theory of cultural dimensions can be verified in practice, where designers learn to understand different cultures and respect intercultural differences, promoting effective cross-cultural collaboration. In addition, in the process of participating in international art exhibitions and festivals, they are not only able to present their works but also have in-depth exchanges and co-operation with their counterparts from all over the world. In recent years, many digital artworks have appeared in art festivals all over the world. For example, in the 59th Venice International Art Biennale in 2022, the theme of the China Pavilion exhibition was 'Meta-Scape', and the participating artist Liu Jiayu created 'Void Pole Stillness', which makes use of artificial intelligence, digital image, and technology to create an artwork with Chinese characteristics. Artist Liu Jiayu used artificial intelligence and digital image technology to create a work of art with Chinese characteristics.[7]

6 Conclusions

In short, AI technology is the future trend of cross-cultural digital art. As technology continues to advance, the boundaries of art creation will continue to expand.[8] However, there are still limitations in the works generated by AI algorithms, which are currently only limited to 'resemblance', and in the future, progress needs to be made in the integration of the creator's feelings to express the mood of the work, and to achieve 'divine resemblance', which will be a major difficulty in the development of digital art.

The future still needs to clarify several key directions. Interdisciplinary research will become an important way to promote the development of cross-cultural digital art. Technological innovation will continue to be the focus of research in the field of intercultural digital art, and educational innovation is also an important direction for future research. Designing innovative educational programs, such as cross-cultural digital art workshops, online courses, and international exchange programs, will help foster a new generation of artists and designers. These programs will not only provide hands-on opportunities but also promote cross-cultural exchange and collaboration. Research on policy recommendations is also essential. The government and relevant organizations need to formulate policies to support the development of cross-cultural digital art, including financial support, regulatory development, and international cooperation. This will provide artists with more creative freedom and resources, as well as help promote the healthy development of the art market.

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