International Journal of Arts and Humanities Studies
ISSN: 2754-4311
DOI: 10.32996/ijahs
Journal Homepage: www.al-kindipublisher.com/index.php/Ijahs

IJAHS
AL-KINDI CENTER FOR RESEARCH AND DEVELOPMENT

| RESEARCH ARTICLE

Research on Cultural and Creative Design Based on AIGC

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| ABSTRACT

This paper briefly expounds on AIGC and its advantages in the application of cultural and creative design, and puts forward the general process of AIGC in cultural and creative design applications. Based on AIGC design platforms such as SD and Comfyui, after element extraction, attempts at cultural and creative design are carried out according to "text instructions" and "image instructions". Taking the design of fridge magnets as an example, this paper verifies the effectiveness of AIGC technology in generating cultural and creative design renderings. The research indicates that AIGC technology can provide creators with more creativity during the design stage of cultural and creative products, and shorten the product design cycle and improve the product design quality by rapidly generating renderings. In recent years, AIGC technology has witnessed rapid development, especially with the continuous updates of various related application platforms. Consequently, it has been extensively applied across various industries. Cultural and creative products play a crucial role in the tourism economy. However, currently, China's cultural and creative products are confronted with issues such as severe homogenization, weak design sense, and shoddy production. The author posits that by better leveraging AIGC technology in the cultural and creative industry, more design inspirations can be furnished for cultural and creative product design, thereby enhancing the quality of product design.

| KEYWORDS

Cultural and creative products, Route, AIGC,design,Software,Future Prospects, Concept of AIGC

| ARTICLE INFORMATION

ACCEPTED: 10 December 2025 **PUBLISHED:** 25 December 2025 **DOI:** 10.32996/Ijahs.2025.5.5.4

1. The Concept of AIGC Technology

AIGC pertains to the automatic generation of content by means of artificial intelligence technology. AIGC is regarded as a novel content creation approach following professional-generated content (PGC) and user-generated content (UGC). It can fully capitalize on technological advantages in aspects such as creativity, expressiveness, iteration, dissemination, and personalization. AIGC technology functions by training deep learning models to enable them to comprehend and imitate the human creative process, thereby generating content that meets specific requirements. The operational principle of AIGC technology encompasses three principal processes: data collection, model training, and content generation. AIGC technology finds extensive applications in numerous domains, including text content, image content, and audio content.

2. SWOT Analysis of AIGC Technology

Strengths: AIGC technology is advancing at a rapid pace, and related applications are updated and iterated swiftly. AIGC technology can significantly boost product design efficiency and reduce manual labor. It can better fulfill users' personalized needs and inspire new creativity and inspiration.

Weaknesses: AIGC technology remains in an immature stage of development, and its design capabilities are still insufficient. It is prone to drawbacks such as multiple fingers, incomplete fingers, lack of aesthetics, unsmooth lines, and rigid design effects.

Opportunities: On one hand, AIGC can greatly enhance production efficiency and quality, liberating manual labor, and serving as an important means to achieve economic development and enhance the overall national competitiveness. On the other hand, it can expand the boundaries of creative design and increase the forms of expression of design works.

Challenges: Products produced using AIGC technology often exhibit inconsistent quality. Due to the randomness of AIGC technology, ensuring the stability, accuracy, rationality, and creativity of its design poses a major challenge in its application. Additionally, AIGC technology faces ethical and legal challenges, and relevant laws are required to regulate its application and better address issues such as copyright, intellectual property rights, and privacy protection.

In the traditional design process of cultural and creative products, owing to diverse customer demands, multiple rounds of modeling, model modification, and rendering are frequently necessary, which undoubtedly consumes a substantial amount of manual labor. In contrast, AIGC technology can repeatedly generate, edit, and modify products, thereby streamlining the design process, broadening design perspectives, enhancing efficiency, and saving time.

3.The general process of AIGC cultural and creative product design

AIGC technology can not only rapidly produce multiple renderings but also further modify and edit them as required. It offers designers multiple ideas and shortens the product design cycle, significantly improving design efficiency. Currently, AIGC technology has not been widely adopted in the design of cultural and creative products. Based on the general application process of AIGC technology in other fields, this paper summarizes its general process in the design of cultural and creative products.

3.1 Generation of Cultural and Creative Concepts

Cultural and creative products are designed around cultural cores, drawing inspiration from cultural anchors such as historical relics, traditional craftsmanship, regional folk customs, literary intellectual properties (IPs), and intangible cultural heritage symbols to meet contemporary consumer demands. Consequently, the generation of cultural and creative concepts holds significant importance. A key component of these concepts involves the identification and extraction of cultural elements. The conceptualization process further requires defining the core objectives, application contexts, target audiences, and cost constraints of the design, thereby enabling precise product positioning. Upon completing this positioning, AIGC technologies can be leveraged to assist in the extraction of relevant cultural elements. Once extracted, these elements can be transformed into structured four-dimensional instructions in the format of "scene description + element requirements + style limitations + parameter constraints."

As illustrated in Table 1, the author employed the instruction: "Generate a bat-pattern fridge magnet design incorporating traditional bat motifs and auspicious cloud elements, in a 'Cyberpunk' style, with a pink-dominant color palette, 4K resolution, and seamless repeated pattern arrangement," to generate sample images using AIGC software. It is evident that the outputs generated solely based on textual instructions tend to appear rigid and often fail to fully satisfy design requirements. As such, these results are best utilized as preliminary design references rather than final deliverables.

The core design elements selected for this case are bats and auspicious clouds. Unlike bats in Western culture, bat motifs in Chinese tradition carry distinct cultural connotations. Due to the homophonic relationship between the Chinese word for "bat" (蝠, fú) and "fortune" (福, fú), ancient Chinese people regarded the bat motif as a symbol of good luck and happiness. Consequently, numerous auspicious patterns incorporating bats have emerged, such as "Five Blessings Arrive at the Door" (五蝠临门), "Boundless Fortune" (洪蝠齐天), and "Hundred Blessings in the Flowing Clouds" (流云百蝠). The auspicious cloud pattern, like the bat motif, carries a cultural meaning of auspiciousness in China. However, given the inherent complexity of traditional bat patterns, the author conducted prior simplification to develop mage2E, thereby enhancing visual clarity and ensuring greater adaptability for contemporary design applications.

As can be seen from Table 2, when the same instructions were used to generate the effect pictures in the three software programs with Picture 2e, the effect designed by Doubao software was relatively better. Therefore, the author only used Doubao software to generate the subsequent case pictures.

3.2 Utilizing AIGC Software for Assisted Design

The process of utilizing AIGC software to support design is illustrated in Figure 1 and consists of five distinct steps.

The First Step involves the preparation of data and the selection of appropriate software and models. Data Set Collection and Construction is very important.

The data set collection encompasses cultural and creative text instructions and associated images. Text instructions enable AIGC to generate images with greater precision. The collection of common promotional terms can enhance the efficiency of design. Additionally, relevant promotional terms can be generated using AIGC software according to specific requirements. When generating images from existing images, collecting relevant images is essential for achieving style transfer and precise design. Moreover, a substantial number of images are required for subsequent model training.

The construction of the data set is categorized into two types: "basic data set" and "customized data set". The basic data set can utilize publicly available cultural and creative design material libraries, such as the open cultural pattern library of the Palace Museum and the cultural and creative template library of Adobe Stock. The customized data set necessitates the supplementation of exclusive data for specific cultural themes. The collected data should be converted into vector graphics or labeled data that can be recognized by AI to prevent the model from generating biased content due to "insufficient cultural data".

Data preprocessing involves optimizing data quality through techniques such as image denoising, color calibration, and element segmentation. For instance, it includes super-resolution restoration of blurry photos of cultural relics and "subject-background" segmentation of complex patterns to ensure that AI can accurately capture the core element features. At the same time, a "cultural compliance check" is required to remove potentially controversial or sensitive content, such as religious symbols of Buddhism and Taoism, and elements considered inauspicious in traditional Chinese culture.

Software and model selection is a crucial part of image generation. Currently, common AIGC software in the market includes SD, MidJourney, ComfyUI, DouBao, JiMeng, DeepSeek, etc. You can choose the software based on your application habits and needs. Select the appropriate AIGC model according to the design type.

For visual design, such as patterns, IP images, and posters, Diffusion models such as Stable Diffusion, MidJourney, and Nano Banana are preferred. These models demonstrate superior performance in terms of image generation details and style controllability. Different AI models have a profound impact on the style of designed products; thus, model selection is of particular significance. Common models in the market include LLM and Lora. Given the high cost of training large models, small models can be trained as needed to act on different parts of the large model, and then the large model can be modified to meet design requirements.

For text design, such as cultural and creative product copywriting and IP story scripts, large language models such as GPT- 4 and Wenxin Yiyan are suitable. These models can generate context - appropriate copy based on cultural backgrounds.

For multimodal design, such as digital cultural and creative products with interactive functions, cross-modal models such as DALL -E3 and Xunfei Xinghuo Multimodal Edition can be selected. These models support the joint generation of "text - image - audio".

The second step involves creative generation and multiple iterations. The initial generation refers to inputting the structured instructions and preprocessed data into the selected model to generate 3 to 5 sets of differentiated schemes. For instance, in the fridge magnet project, Stable Diffusion generates 3 sets of pattern schemes based on the instructions, among which 1 sets focus on "Cyberpunk style", 1 sets on "abstraction of elements", and 1 set attempts "fusion of elements". During the generation process, "generation parameters" need to be set, such as the number of iteration steps, sampling method, and CFG Scale value.

The process of scheme screening and feedback involves evaluating the images generated by AI from aspects such as cultural accuracy, creativity, aesthetics, and feasibility. A review panel composed of designers, cultural experts, and marketing personnel will score the images based on three dimensions: "cultural accuracy" (For example, whether the elements conform to the characteristics of cultural relics), "creativity" (For example, whether it breaks through traditional design thinking), and "practicality" (For example, whether it is suitable for printing processes). Two to three potential schemes will be selected. After identifying the images that meet the requirements, issues with those that do not can be recorded for improvement in subsequent steps. Based on the evaluation results, the selected images will be optimized. This can be achieved by adjusting the prompt words, such as adding or modifying certain detail requirements, and having the AI regenerate the images.

Alternatively, the results generated by AI can be manually edited and modified. For example, detailed adjustments can be made to the AI - generated images in image - editing software.

Instruction optimization and secondary generation refer to the iterative process of supplementing "optimization instructions" for the selected schemes. For instance, the optimization instruction for Image 2A in the above figure is: "Replace the circles in the figure with clouds." Through 1-3 rounds of iteration, the final optimal scheme is determined. This step can enhance the design efficiency.

As shown in Table 2[i], the effects of the first generation and instruction optimization and secondary generation on Image1E are respectively presented.

The third step is manual verification and cultural correction.

The main tasks are cultural compliance verification and manual detail optimization. Cultural compliance verification involves inviting cultural scholars or museum experts to check if the plan contains any cultural misinterpretations. For instance, in this case, Image2C has a cultural misinterpretation, as the black bat with devil horns is a typical Western bat pattern. Detail optimization refers to correcting the "unreasonable details" generated by AI, such as the discontinuity at the pattern junctions, the inharmonious color matching, and the imbalance of element proportions. Process adaptation adjustment: Based on the actual production process, the feasibility of the plan is optimized. For example, if the fridge magnet uses digital printing technology, the "gradual color" generated by AI should be adjusted to "distinct color blocks" to avoid color blurring during printing; if embroidery is involved, the "complex lines" generated by AI should be simplified to ensure the embroidery precision is achievable.

The fourth step is prototype development and user testing. Prototype development refers to choosing the prototype type based on the design carrier. Physical products need to produce samples, while digital cultural products (such as digital collectibles, AR effects) need to develop demo versions.

Table 3[ii] presents prototype demonstrations designed in various styles with the assistance of AIGC software.

User testing involves inviting target users for small-scale testing, collecting feedback through questionnaires and interviews, and focusing on "cultural recognition", "usage experience", and "purchase intention". Based on user feedback, designers adjust relevant parameters again to ensure the final product meets user expectations.

The fifth step is mass production and iterative optimization. This is the end of the design process and the starting point of the next round of design. The core task is to achieve large-scale implementation and continuous optimization. Data accumulation and process optimization: The "instruction templates", "data sets", and "optimization experiences" in the design are accumulated as enterprise assets. The cultural element data sets, pain points in the process, and optimization technical solutions in the project are sorted and summarized, which can improve the efficiency of the next round of design.

4. Future Prospects of AIGC in Cultural and Creative Design Applications

4.1 Enhancing Design Efficiency and Quality

AIGC can substitute human labor in completing repetitive and fundamental design tasks. It is anticipated that in the future, with the continuous advancement of AIGC technology, its speed and quality in handling design tasks will be further improved. This will enable designers to more rapidly transform their creative ideas into design plans while ensuring high precision and quality.

4.2 Promoting Creative Diversification and Personalization

AIGC can generate a rich variety of creative concepts and design plans by analyzing a substantial amount of cultural data and creative cases, thereby providing more possibilities for cultural and creative design. Moreover, it can generate personalized cultural and creative products based on the diverse needs and preferences of different users, meeting the increasingly diversified and personalized demands of consumers.

4.3 Achieving Multimodal Interaction and Immersive Experience

In the future, AIGC can be deeply integrated with multimodal interaction technology, enabling it to simultaneously process multiple forms of information, including text, images, sounds, and videos. For example, users can convey their cultural and creative design ideas to AIGC through natural interaction methods such as voice and gestures. AIGC will then generate corresponding visual effects or audio content in real time, offering users a more immersive creative experience and interactive sensations.

4.4 Facilitating the Development of Virtual Humans and Digital Assets

AIGC will drive the extensive application of virtual humans in cultural and creative design. Virtual humans can serve as image spokespersons, virtual hosts, or participate in the creation of cultural and creative content, injecting new vitality and allure into the cultural and creative industry. Simultaneously, digital assets based on blockchain technology will be combined with the cultural and creative content generated by AIGC, endowing cultural and creative products with higher copyright value and collection value, and promoting the digitalization and assetization development of the cultural and creative industry.

4.5 Optimizing Intelligent Content Distribution

AIGC can analyze user behavior and preferences to achieve more precise intelligent distribution of cultural and creative content. It can recommend suitable cultural and creative products to users who are most likely to be interested, thereby enhancing the dissemination efficiency and market conversion rate of cultural and creative products. This will assist cultural and creative enterprises in better understanding market demands, optimizing product strategies, and improving economic benefits.

4.6 Facilitating Cross - Cultural Communication and Innovation

AIGC can integrate and innovate various cultural elements by learning and understanding different cultures, creating cultural and creative products with cross-cultural characteristics. This helps promote the exchange and dissemination between different cultures, drive the development of global cultural diversity, and also provides new opportunities for cultural and creative enterprises to expand into international markets.

Figure1 Alt Text for illustration :The process of utilizing AIGC software to support design.

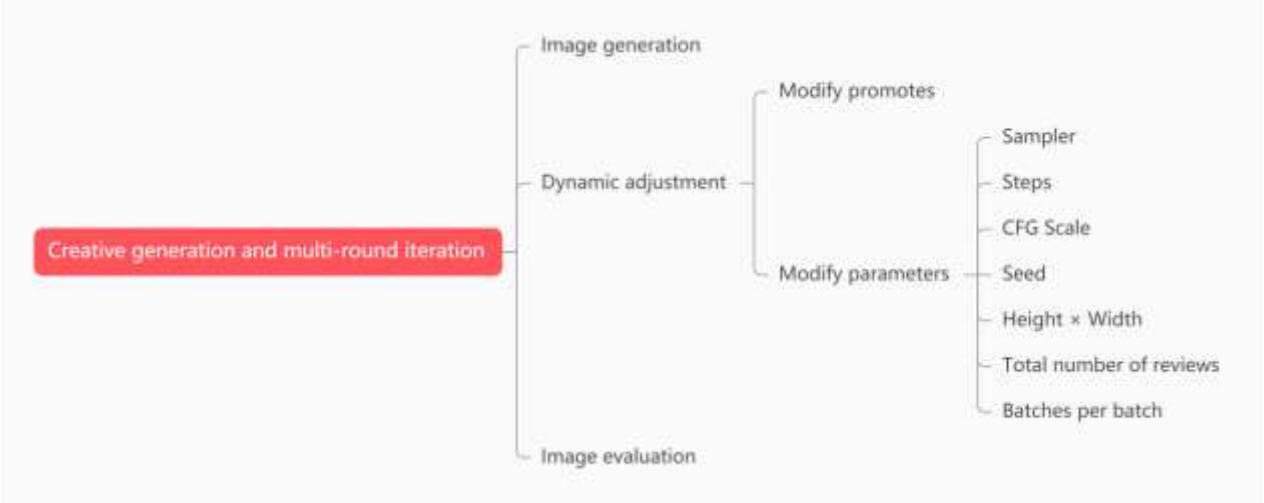


TABLE1:The effect images of AI command generation by different software.

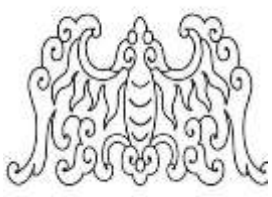
Legend	The image was generated by Doubao software.[iii]	The image was generated by the Liblib.art software.[iv]	The image was generated by Keling Software[v]
Image1A 	Image1 B 	Image1 C 	Image1 D 

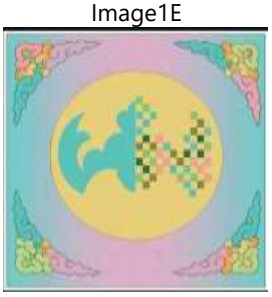
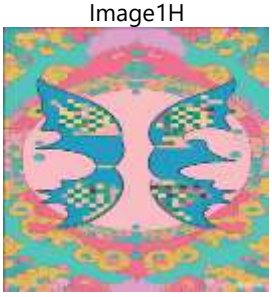
Image1E	Image1F	Image1G	Image1H
			

TABLE2:The effects of the first generation and the second generation with instruction optimization on Image1E are respectively presented.

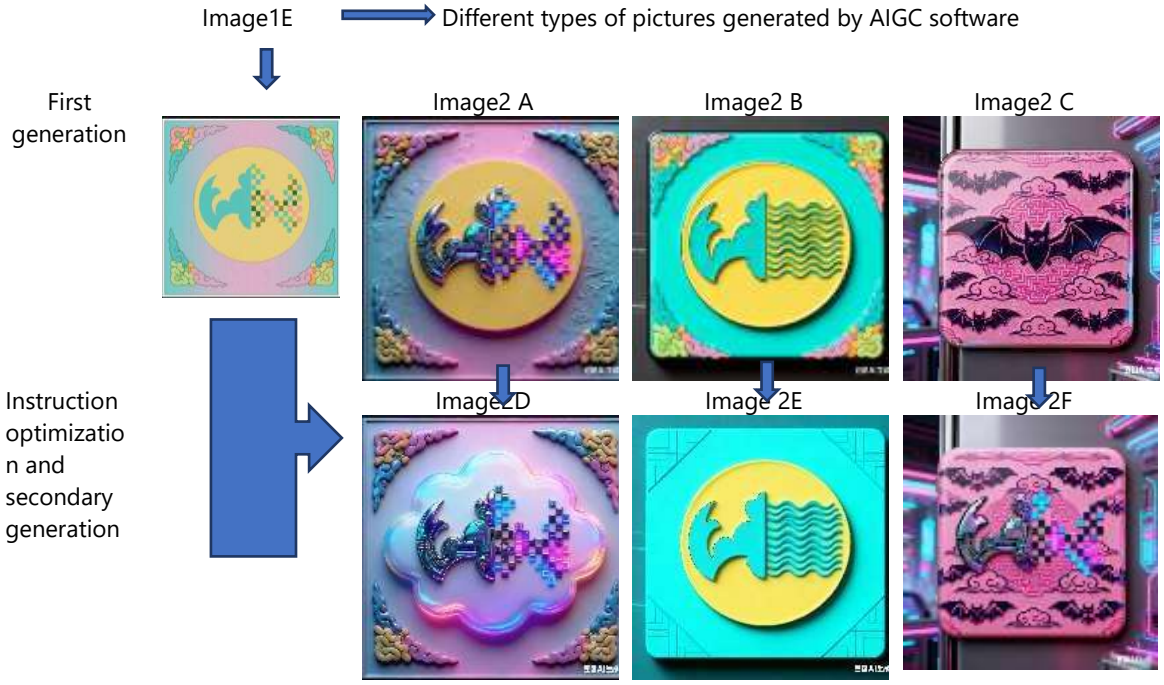
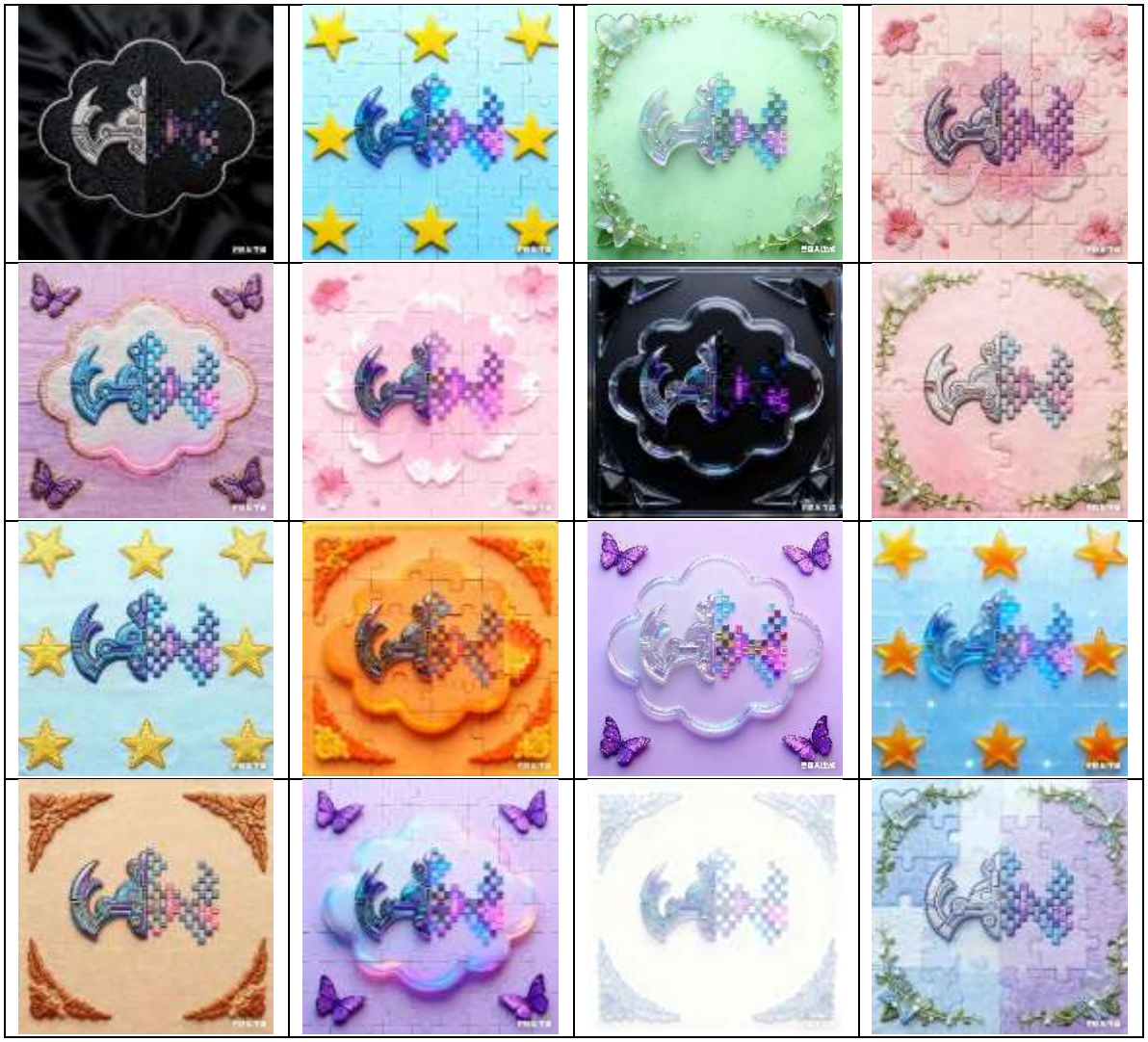


TABLE3: It presents a range of prototype demonstrations in diverse styles, developed with the support of AIGC software.

Embroidery style	Puzzle style	Acrylic style	Embroidery style and Puzzle style and Acrylic style
			



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[i] The AIGC software used in this case is DouBao, version: 10.5.0.
[ii] The AIGC software used in this case is DouBao, version: 10.5.0.
[iii] [iii]The AIGC software used in this case is DouBao, version: 10.5.0.
[iv] The AIGC software used in this case is liblib.ar, https://www.liblib.art/
[v] The AIGC software used in this case is l version2.7.40.205.