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A Research on AI Generated 2D Image to 3D Modeling Technology

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Abstract

Advancements in generative AI are reshaping graphic and 3D content design landscapes, where AI not only enriches graphic design but extends its reach to 3D content creation. Though 3D texture mapping through AI is advancing, AI-generated 3D modeling technology in this realm remains nascent. This paper presents AI 2D image-driven 3D modeling techniques, assessing their viability in 3D content design by scrutinizing various algorithms. Initially, four OBJ model-exporting AI algorithms are screened, and two are further evaluated. Results indicate that while AI-generated 3D models may not be directly usable, they effectively capture reference object structures, offering substantial time savings and enhanced design efficiency through manual refinements. This endeavor pioneers new avenues for 3D content creators, anticipating a dynamic fusion of AI and 3D design.

Keywords: *AI Generated Technology, AI Painting, 3D Modelling, Generative Artificial Intelligence, 3D Content Design，Image 2D to 3D Model*

1. Introduction

1.1 Research Background

In recent years, artificial intelligence generated image technology has become a popular research direction in related fields. However, AI technology is not limited to generating 2D images, and various algorithms for AI image generation 3D models have also continued to appear in the field of AI. However, AI image generation 3D model algorithms vary in time and quality of 3D models generated by various algorithms as they are in the

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early stages of development, in which case it is necessary to test the use of different AI generation 3D image algorithms to find out the most suitable AI generation 3D image algorithm to use. Therefore, the focus of this paper is to test the use of different related algorithms for the technique of AI generation of 3D models through images, and to screen out the potential related algorithms through comparative analysis of 3D models generated by different algorithms, so as to provide guidance and insights for the application of AI-generated 3D image algorithms to the workflow in the field of 3D content design.

1.2 Research Purpose

The purpose of this study is to test the use of various AI image generation 3D model techniques, and to summarise the advantages and problems of various AI image generation techniques by analysing the characteristics of AI-generated 3D models. The aim of this study is to explore and analyse AI image generation 3D model algorithms applicable in the field of 3D content design by studying various AI image generation 3D model techniques.

2. Theoretical Background

2.1 Artificial Intelligence 2D Images to Generated 3D Models

Al Picture Generation 3D Model is the process of converting a 2D picture into a 3D model using Artificial Intelligence techniques. Currently, the development of A picture to generate 3D models has made impressive progress. In the traditional method, to generate a 3D model, tedious 3D scanning and modelling of the object is required. A Picture Generated 3D Model, on the other hand, can more quickly convert a 2D image into an accurate 3D model. This technology has a wide range of applications and can be used in movies, games, industrial design, etc.Al Image Generation 3D Modelling is based on the principle of using neural networks, which are learnt and trained on a large number of image samples, and then deep learning algorithms are used to predict the 3D structure of the target image.Al model recognises features such as shapes, textures, and details of an image, and then generates the corresponding 3D model.

Of course, there are still some limitations of the AI image generation 3D model technology. Currently, the technology still needs to be improved in recognising complex shapes and textures, and more training teachings are needed to improve the accuracy. In addition, the quality and level of detail of the 3D model depends on the quality and clarity of the input image.

3. AI Generated 3D Model Effect Comparison Process

The existing AI image generation 3D model algorithms are collected, and one image is selected to generate a model as a preliminary screening, and two AI algorithms are finally selected for comparative analysis based on the generation time and 3D model quality. Then, three object images with different structures, geometry, character portrait and character full-body portrait, are selected to generate corresponding 3D models using the two AI image generation 3D model algorithms. Finally, the structure and completeness of the generated 3D models are compared and analysed to explore how they can be integrated into the workflow of 3D content designers.

3.1 AI Generated 3D Model Algorithm Screening

In this study, we use four AI image generation 3D model algorithms, which are selected from the AI open source community hugging face. We select a robot with a size of 260 resolution as a test image, and generate the corresponding 3D model through an online website, in order to test and filter the final AI image generation 3D algorithms. The basic OBJ model was imported into the 3D software to compare and filter the final AI image generation 3D model algorithm.

As shown in Fig. 1, four 3D models of the robots were finally generated, in which the 3D models generated by the two techniques TripoSR and CRM were clearly constructed and did not differ much from the structure of the reference image, while the 3D models generated by the DreamGaussian and One-2-3-45 techniques did not have a clear structure, and differed more from the reference image. Therefore, the two AI algorithms, TripoSR and CRM, were chosen for the final comparative analysis.

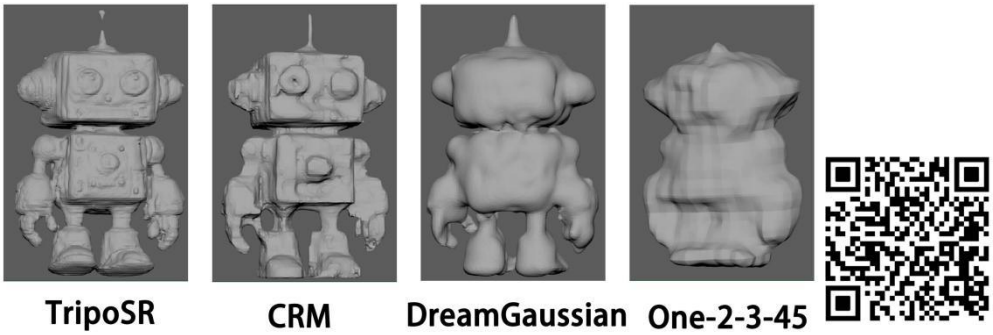

Figure 1. Four AI Algorithms Generate Comparisons

3.2 AI Generative Model Structure Analysis

In this study, we use three different structures of objects as the basic material for experimental testing, and generate corresponding 3D models through the AI 3D model generation algorithm, and analyse the structure of the generated 3D models from a variety of perspectives, in order to compare the advantages and disadvantages of the two AI image generation 3D model algorithms.

3.2.1 Geometry

As shown in Figure 2, the 3D models generated by these two AI algorithms do not have much structural difference, and both can correctly restore the 3D structure of the reference image, although the wiring of the 3D model is not standardised and can not be used directly in formal projects and works, but it can be used normally after a simple modification through the Dcc software. And it is more efficient than traditional 3D modelling.

Figure 2. Geometry 3D Model Comparison

3.2.1 Character Portraits

As shown in Figure 3, the CRM algorithm has better 3D spatial imagery than the TripoSR algorithm in the complex character portrait section, the CRM algorithm can correctly calculate the complete structure of the character including correctly restoring the structure on the back side of the 3D model, while the TripoSR algorithm only performs better on the front side of the character, correctly restoring the structure on the front side of the reference image with more details, but the back side of the 3D model as well as the 3D structure on the side of the side of the 3D model are miscalculated by the TripoSR algorithm.

Figure 3. Character Portraits 3D Model Comparison

3.2.2 Character Full Body

As shown in Figure 4, there is not much difference between the 3D model generated by CRM and TripoSR, both algorithms can restore the basic 3D structure of the whole body of the character correctly, and the structure of the back and side of the 3D model, the structure generated by AI is not much different from the reference picture, the whole 3D model has a relatively high degree of restoration, and it doesn't need extra time and effort

to enter the DCC software to deal with it. The TripoSR algorithm generates more details of the whole body structure of the character, and the 3D model is more rounded, but the overall structure is a bit tilted, on the contrary, although the CRM algorithm generates less details of the 3D model, but the overall 3D structure is closer to the original picture than the TripoSR calculation.

Figure 4. Character Full Body 3D Model Comparison

4. Conclusion

Through the comparative analysis of the above cases, it is concluded that the 3D model generated by AI technology through a photo can restore the correct 3D structure of the reference photo, but due to the low accuracy of its generated model, it can only restore the basic structure of the object, and after that, it is still necessary to go to manually go to the DCC software for modification. However, to a certain extent, it saves a lot of time and energy for 3D content designers.

This study introduces the AI 2D 3D model generation technology, and explores the potential and value of AI 3D model generation technology in the field of 3D content design through the comparative study of multiple AI 3D model generation algorithms as the research basis. The study shows that AI is valuable in the field of content design and can be integrated into the existing 3D image production process to continuously increase the breadth of application. With the continuous development of AI technology, it is believed that in the near future AI image generation 3D model technology will have a relatively large progress, in the relevant algorithms continue to upgrade the iterative situation, AI generated 3D model structure will be closer to the reference image, 3D structure will be more detailed, there will be more designers will be AI integration into the 3D image production process, the author is optimistic about this situation.

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