Research of the Art Creation on the Virtual and Real Integration of Augmented Reality

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Abstract
In recent years, due to the rise of the metaverse, the virtual and real integration of argumental reality has gradually been applied in various industries. Among them, the art creations based on the image process technology have played an important role in virtual objects, which are integrated into the computer screen usually should be a sense of incongruity and inharmoniousness. This research proposes to use computer vision and image processing technology to identify the light source direction of the real scene first. Creating the virtual art creation complied with the light direction would significantly reduce the incongruity of the integrated pictures and achieve a better overall visual observation experience of the virtual and real integration. The research methodologies are described in the following: (a) to gather and classify the existing real scene pictures; (b) to convolute the image with the specific kernel filters to depict the direction of the light source; (c) to draw and paint the virtual art creations using image processing technology, however, based on sketching skills of hand-painted to make them more realistic. The results show that integrating virtual reality with real pictures allows artists to have more creative possibilities. The virtual objects in the augmented reality can be simulated in various situations, allowing the artists to grasp the overall situation. The way of presentation of the pictures, the integrated pictures of the real pictures, and the virtual realities could approach the reality of the immersive visual experiences.

Keywords: Augmented Reality, Art Creation, Metaverse, Immersive Visual Experiences

Introduction

Due to the rise of the metaverse, the virtual and real integration of augmented reality has gradually been applied in various industries. Among them, the art creations based on the image process technology have played an important role in virtual objects plugged into a real scene, which usually find a sense of incongruity and inharmoniousness. This research would first try to identify the light source direction of the real scene with computer vision and image processing technology. Creating the shadow of the virtual object complied with the light direction would significantly reduce the incongruity of the integrated pictures and achieve a better overall visual observation experience of the virtual and real integration. The research methodologies are described in the following: (a) to gather and classify the existing real scene pictures; (b) to create a virtual object and a simulated scene background established by 3D creation software; to observe the relation between the light source and shadow and compare to the sketching skills of the hand painting creation for them more realistic. (c) to convolute the image with specific kernel filters to find the direction of the light source; The virtual objects in augmented reality can be simulated in various situations, allowing the artists to more accurately grasp the overall situation. The way of presentation of the pictures, the integrated pictures of the real pictures, and the virtual realities could approach the reality of the immersive visual experiences.

Effect of the shadow

When a virtual object would plug into an actual scene image, the object's shadow would determines the harmoniousness of the augmented reality image. For digital painting technology, to achieve a comfortable viewing experience, how to make two images merge into one photo, the light direction, and the corresponding objects' shadow should be predicted and considered. The inharmoniousness will be highlighted in Fig. 1. When the shadow is not considered in Fig. 1(a), the virtual object is unexpected and unnatural, obviously. Oppositely, the object seems to comply with the scene, although the shadow would be added casually without the light direction prediction in detail in Fig.1(b). The fact shows that the shadow would affect the harmoniousness of the augmented reality image.

(a) (b)

Fig. 1: Synthesis of a real scene and a virtual object, (a) light and shadow are not considered; (b) the shadow of the object is added casually without the light direction prediction in detail.

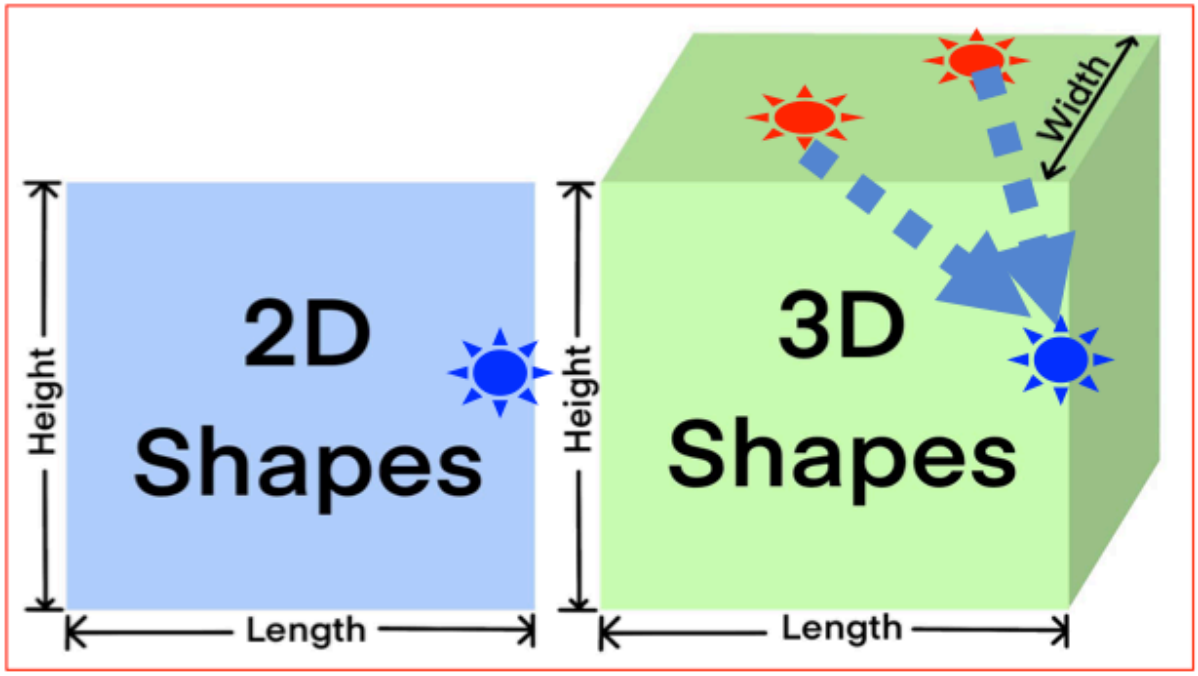

Fig. 2: Different light sources may have the same shadow in the 2D image

Handed painting is quite intuitive for the basics and beginners. When choosing one type of painting for the beginning learners, required minimal and cheap tools have been readily available for several centuries. Of course, well-trained handed painting is recognized and considered to transfer to digital painting easily. However, there are existed expensive special tools, pigments, and consumables for advanced learners. For beginning learners, there is a long trip for learning. Furthermore, difficult preservation of works from moisture, loss, fire, and aging would decrease the progress of learning and douse the enthusiasm of learners. For digital painting, there are seemingly simple tools, a digital pen, and an electric drawing board correspondingly, in the beginning stage of the handed painting learners. The advantages would not possess quick creation and easy modification only, but also could be preserved, transmitted, duplicated, and reappeared achievedly. In addition, complicated digital image processes and effects are possible. On the other hand, trained digital painting is not necessarily to be able to transfer to handed painting. For artists, it may not be easy that digital painting software needs to be selective and well-familiar.

Fusion of modeling drawing and virtual objects

In the past, composite images required manual retouching by experienced and aesthetic artists to make the images softer when superimposed. However, those experiences are sometimes quite complicated. For example, different light source positions in a real scene may produce the same shadows' location in a 2D image, as shown in Fig. 2. Furthermore, because most natural light sources belong to non-parallel lights, the shadows at different positions would be shown the different situations. This will increase the difficulty of deriving light direction and shadows from 2D images. Therefore, this study proposed to use commercially available 3D modeling software such as Sculptris, Blender, and 3Ds Max to perform calculations to restore the environment at that time. With today's technology, this 3D modeling will quickly obtain the corresponding 2D image. The operating software can restore and simulate the light source environment when taking the photo, giving creators a reference, as shown in Fig.3. Moreover, this method could quickly set the color of the light source, the contrast, and the surface

material of the object. It would make the scene restore quickly and realistically the scene at that time and harmonize and add the virtual objects artists need.

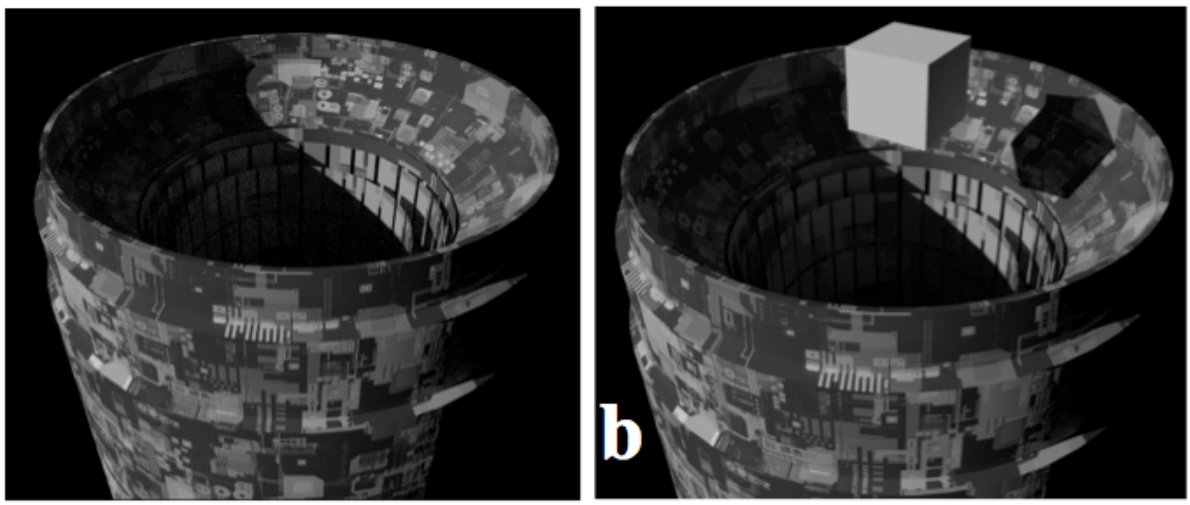

Fig. 3: (a) modeling drawings and known light sources; (b) synthesis of required virtual objects and known light sources

Calculation method of light and shadow of 2D pictures

After the simulation mentioned above, the 2D image needs to realize as a 3D scene. We could construct a physics engine to perform illumination calculations and drawings. The engine would be designed as specific kernel filters which could convolute the 2D image to estimate the direction of the light source and possible shadows' location. The following would show the process steps: choosing a trained photo as shown in Fig. 4, expanding into three-dimensional space, grabbing specific features, and convoluting the image with the filter to calculate the light position of the 3D scene. The collected data is then integrated into the image to be synthesized.

Fig. 4: The red points show the light source in the actual 3D position estimated after the operation from the 2D image

Conclusion

Most of today's image processing techniques can be fine-tuned through software, but the sense of inconsistency generated by synthesis still needs to be operated by experienced artists. The use of 3D modeling package can be very helpful in restoring lighting and

environment, but only inexperienced data can be provided as an aid. How to convert 2D pictures into 3D models by themselves is a big issue. There is a difference between the results after engineering calculations and the pictures synthesized by human experience, whether it should be aesthetic or reasonable.

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