Virtual Lighting Using Stereo Images

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1. Introduction

Previous methods of Image-Based Modeling and Rendering (IBMR) that generate virtual lighting need many images as input; the quality of resultant images depends on the number of input images [Mukaigawa et al. 2000, Wong et al. 1997]. In this paper, we present a method of IBMR that generates the virtual lighting requiring less input images. We obtain the 3D coordinates of a target from 3 pairs of stereo images, restore the 3D object and then light the modeled 3D object. We take each pair of stereo images every 120 degrees.

2. Process

The following is the procedure of our method.
1. Obtain 3D coordinates of the feature points on the target and model the 3D object.
2. Remove a texture-illuminance of the target from an input image in order to obtain the appropriate texture.
3. Map the texture obtained in procedure 2 on the 3D object obtained in procedure 1.
4. Light the 3D object.

3. Obtain the 3D model

The 3D coordinates of the feature points, for instance the vertices of the target, in a pair of stereo images are obtained by applying triangular surveying to two corresponding points in the pair of images. When a point is specified in an image, the corresponding point is determined by searching in the other image with a template matching technique.
Once the feature points of the target have been obtained, we do texture mapping on the other parts.

4. Texture-illuminance removal method

Images taken in real space have illuminances from lights or the sun. In order to obtain the appropriate texture map, these illuminances must be removed.
Byong et al. [2001] assume that large-scale luminance variations are due to lighting, while small-scale details are due to the texture. We apply this assumption and make an additional one: the color of dim points has low saturation and brightness (see Figure 1).
Following these assumptions, we present a method for removing unwanted illuminances using the HSB color model that defines a color by hue, saturation and brightness.
The basic idea of our method is to control the lightness of each pixel through the saturation and brightness. The advantage of our method is that it maintains the object's hue. The following is our procedure for removing illumination.
To begin, we blur the input image with a Gaussian filter to remove the pattern of its surface. Then we obtain the hue, saturation and brightness of each pixel to determine the measure of lightness. Finally, we change the saturation and brightness of each pixel to the measured lightness value and get the resultant texture map.

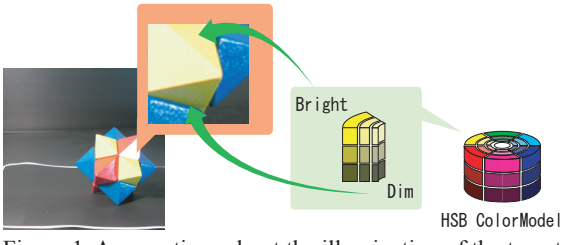

Figure 1. Assumptions about the illumination of the target.

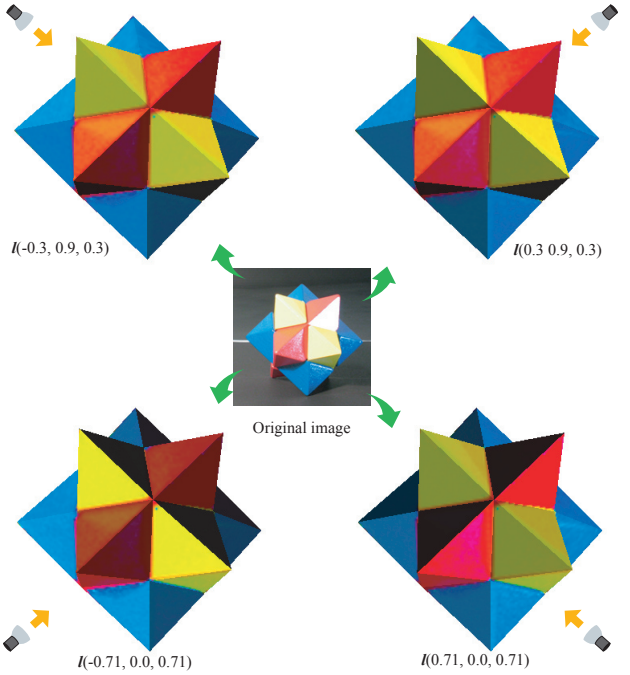

Figure 2. Resultant images illuminated by light located at several different positions. the vector ***l*** indicates the light direction. All images were rendered with OpenGL.

5. Results and Conclusion

In this paper, we presented a method of IBMR that generate virtual lighting with less input images. Figure 2 shows resultant images. Each image shows a different illumination. We succeeded in decreasing the required number of input image to the 6 images referred to in section 1.
We intend to improve our method by taking the target reflection into consideration.

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