Color Alignment in Texturing 3D Geometric Model under General Lighting Condition

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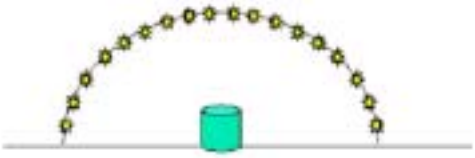
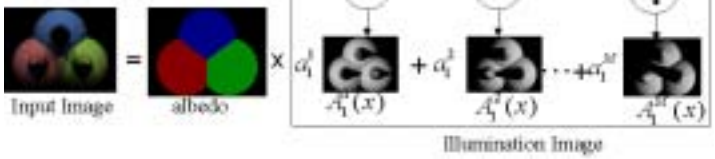
We propose a novel method for color alignment in texturing 3D geometric model by utilizing images measured by a digital camera. Our method eliminates the color discontinuities between input images. We approximate the illumination distribution on the scene by a series of distant point light sources on a sphere (illumination sphere). And by utilizing the fact that surface reflectance of the object is invariant to the illumination distribution, illumination images under two different illuminating conditions and pseudo-albedo images are estimated. By mapping the pseudo-albedo images onto the 3D geometric model, 3D model with color-consistent texture are generated.

Publication

1. H. Unten and K. Ikeuchi, "Color Alignment in Texture Mapping of Images under Point Light Source and General Lighting Condition," Proc. IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR'04), June 2004



Illumination distribution (illumination sphere)



$$I_1(x) = S(x)(a_1^1 A_1^1(x) + \cdots + a_1^m A_1^m(x) + \cdots + a_1^M A_1^M(x))$$

$$k(x) = \frac{I_1(x)}{I_2(x)} = \frac{a_1^1 A_1^1(x) + \cdots + a_1^m A_1^m(x) + \cdots + a_1^M A_1^M(x)}{a_2^1 A_2^1(x) + \cdots + a_2^m A_2^m(x) + \cdots + a_2^M A_2^M(x)}$$

Canceling albedo (ratio image)

$$\begin{pmatrix} A_1^1(x_1) & \cdots & A_1^M(x_1) & -k(x_1)A_2^1(x_1) & \cdots & -k(x_1)A_2^M(x_1) \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ A_1^1(x_l) & \cdots & A_1^M(x_l) & -k(x_l)A_2^1(x_l) & \cdots & -k(x_l)A_2^M(x_l) \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ A_1^1(x_L) & \cdots & A_1^M(x_L) & -k(x_L)A_2^1(x_L) & \cdots & -k(x_L)A_2^M(x_L) \end{pmatrix} \begin{pmatrix} a_1^1 \\ \vdots \\ a_1^M \\ a_2^1 \\ \vdots \\ a_2^M \end{pmatrix} = 0$$

$$Ta = 0$$

T: Known

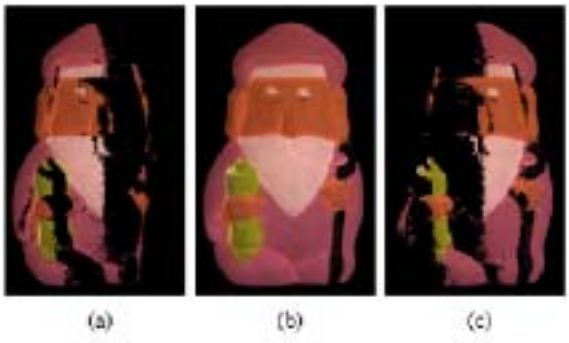
a:Unknown

→estimating *a*

→illumination distribution

→pseudo-albedo

Input Images and 3D geometric model.



Textured 3D geometrid model: (a) image1, (b)both, (c)image2.