

Psychophysical Evaluation of Computer Graphics Renderings of Paint Surfaces

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Abstract

Digital images of materials (or scenes) are projections onto a two-dimensional plane. The geometric properties of the light source, object, and observer determine the material's appearance. An object's bidirectional reflectance distribution function, BRDF, combined with computer graphics enables dynamic images, approximating the real viewing experience and more importantly, eliminating the need to define a single representation of a material in a specific geometric condition. In practice, it is desirable to approximate the actual BRDF with a limited set of measurements and a reflection model.

The Phong and Torrance-Sparrow models are two common and effective light reflection models. The principal advantages of these two models are their mathematical simplicity and small number of parameters. Compared with other complex models, they will reduce data storage and rendering time when used to render objects such as artwork. However, there is one issue that should be explored: whether the simple models result in severe visual artifacts. The goal of this research was to evaluate the visual accuracy of the Phong and Torrance-Sparrow models for rendering art paintings. The images of a painted sample with brush marks were captured by a Nikon D1 CCD camera under twenty-two different illuminant angles. Then the parameters of both specular and diffuse components were estimated using non-linear optimization. Using the estimated parameters, the images of the painted sample were reproduced under arbitrary illumination angles. At the visual estimation stage, paired-comparison experiments were performed to determine preferred models for any illuminant angle. The experiment is in progress and the results will be given at the conference.

Reference

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Author Biography

Ying Chen received her MS degree in Optical Engineering Department at Zhejiang University in China (2005). Now she is the master student in Munsell Color Science Laboratory at Rochester Institute of Technology. Her research mainly focuses on the evaluation of BRDF models for rendering art paintings and simplifying the goniospectrophotometer.