Single Image Appearance Measurement

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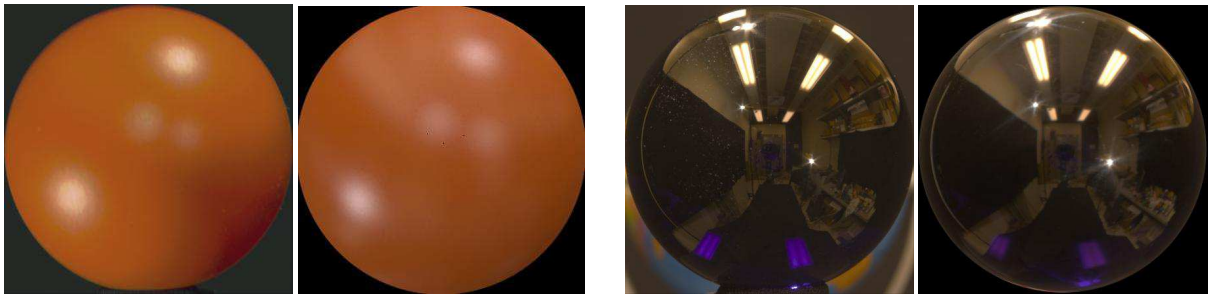

Figure 1: Rendering with recovered appearance model parameters. The image pair on the left is an image of a spray-painted plastic ball and a rendered version of a sphere using a Torrance-Sparrow BRDF with parameters recovered using our method. The right pair is if of a cobalt blue quartz sphere with the real image on the left and an image rendered with recovered parameters on the right.

Abstract

Creating realistic renderings in computer graphics depends on having knowledge of the reflectance properties of materials in the scene. For opaque materials the bi-directional reflectance function (BRDF) captures these properties. Full BRDFs can be measured using highly-accurate gonioreflectometers or more recently with techniques using digital cameras. These approaches sample the BRDF either densely and use simple interpolation for rendering with the BRDF or acquire data sparsely and fit to a BRDF. Previous methods require images from a number of camera positions with a variety of known light positions. We present a technique to recover appearance model parameters from a single image under arbitrary lighting. Using a single high dynamic range image of material sample of known geometry, an environment map, and an iterative rendering and optimization approach we can recover parameters for a wide variety of materials in short amount of time with less stringent experimental constraints as compared to previous techniques. Our technique in not limited to recovering BRDF parameters for opaque materials. We can fit parameters for any low parameter appearance model that is used in a typical renderer. We have measured a number of opaque and transparent materials and we present results showing comparisons of an image of a sample material and the rendered counterpart using the recovered parameters. We further use our optimization approach to recover BRDF model parameters from a single render image of a number of materials rendered from a data-driven BRDF model.

A copy of this technical report can be obtained by sending a request to njoshi@cs.ucsd.edu