Appearance Sampling for Obtaining a Set of Basis Images for Variable Illumination

Imari Sato   Takahiro Okabe   Yoichi Sato   Katsushi Ikeuchi

Previous studies have demonstrated that the appearance of an object under varying illumination conditions can be represented by a low-dimensional linear subspace. A set of basis images spanning such a linear subspace can be obtained by applying the principal component analysis for a large number of images taken under different lighting conditions. Since little is known about how to sample the appearance of an object in order to obtain its basis images correctly, it has been a common practice to use as many input images as possible to ensure that the set of input images span a subspace entirely. In this study, we present a novel method for analytically obtaining a set of basis images of an object for arbitrary illumination from input images of the object taken under a point light source. The main contribution of our work is that we show that a set of lighting directions can be determined for sampling images of an object depending on the spectrum of the object's BRDF in the angular frequency domain such that a set of harmonic images can be obtained analytically based on the sampling theorem on spherical harmonics.

Publication


Image acquisition set-up

Synthesized images of objects under natural illumination