
Image-Based Rendering

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Image-Based Rendering

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Abstract

Image-based rendering (IBR) is unique in that it requires computer graphics, computer vision, and image processing to join forces to solve a common goal, namely photorealistic rendering through the use of images. IBR as an area of research has been around for about ten years, and substantial progress has been achieved in effectively capturing, representing, and rendering scenes. In this article, we survey the techniques used in IBR. Our survey shows that representations and rendering techniques can differ radically, depending on design decisions related to ease of capture, use of geometry, accuracy of geometry (if used), number and distribution of source images, degrees of freedom for virtual navigation, and expected scene complexity.

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Introduction

One of the primary goals in computer graphics is photorealistic rendering. Much progress has been made over the years in graphics in a bid to attain this goal, with significant advancements in 3D representations and model acquisition, measurement and modeling of object surface properties such as the bidirectional reflectance distribution function (BRDF) and surface subscattering, illumination modeling, natural objects such as plants, and natural phenomena such as water, fog, smoke, snow, and fire. More sophisticated graphics hardware that permit very fast rendering, programmable vertex and pixel shading, larger caches and memory footprints, and floating-point pixel formats also help in the cause. In other words, a variety of well-established approaches and systems are available for rendering models. See the surveys on physically based rendering [78], global illumination methods [26], and photon mapping (an extension of ray tracing) [44].

Despite all the advancements in the more classical areas of computer graphics, it is still hard to compete with images of real scenes. The rendering quality of environments in animated movies such as *Shrek 2* and even games such as *Ghost Recon* for Xbox 360TM is excellent, but there are hints that these environments are synthetic. Websites such

2 Introduction

as <http://www.ignorancia.org/> showcase highly photorealistic images that were generated through ray tracing, which is computationally expensive. The special effects in high-budget movies blend seamlessly in real environments, but they typically involved many man-hours to create and refine. The observation that full photorealism is really hard to achieve with conventional 3D and model-based graphics has led researchers to take a “short-cut” by working directly with real images. This approach is called *image-based modeling and rendering*. Some of the special effects used in the movie industry were created using image-based rendering techniques described in this article.

Image-based modeling and rendering techniques have received a lot of attention as a powerful alternative to traditional geometry-based techniques for image synthesis. These techniques use images rather than geometry as the main primitives for rendering novel views. Previous surveys related to image-based rendering (IBR) have suggested characterizing a technique based on how image-centric or geometry-centric it is. This has resulted in the image-geometry continuum (or *IBR continuum*) of image-based representations [52, 46].

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