Shape Recovery of Book Surface Using Two Shade Images Under Perspective Condition

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抄録

A shape recovery problem of book surface using two shade images under the fully perspective environments is discussed. In order to simplify the problem, the whole recovery process is divided into three sequential and explicit steps: preprocessing, apparent shape recovery, and generation of ortho-image. The separation of albedo and shading with reduced effect of interreflections is done in preprocessing step by applying image processing and a phenomena-based model. Implicit equations governing the shading and observation have been transformed into explicit ones having minimized number of unknown parameter. A direct and unique recovery become possible by combining the transformed ones and the recurrence relation. A feed-back recovery process is implemented as a practical algorithm which overcomes self-shadows. The results of simulations and real experiments show the properness and acceptability of the proposed approach and the implemented algorithms.
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Since the first shape-from-shading (SFS) technique was developed by Horn in the early 1970s, many different approaches have emerged. In this paper, six well-known
SFS algorithms are implemented and compared. The performance of the algorithms was analyzed on synthetic images using mean and standard deviation of depth error, mean of surface gradient $(p, q)$ error, and CPU timing. Each algorithm works well for certain images, but performs poorly for others. In general, minimization approaches are more robust, while the other approaches are faster. With just two stereo pairs of images taken under two different illumination conditions, a stereo pair of ratio images can be produced, one for the ratio of left-hand images and one for the ratio of right-hand images. We demonstrate how the photometric ratios composing these images can be used for accurate correspondence of object points. A divide-and-conquer strategy in shape from shading problem under fully perspective conditions is proposed for the information recovery of book surfaces. The whole recovery process is composed of three sequential steps: preprocessing, apparent shape recovery, and ortho-image generation. A strategy in solving the shape from shading problem for the shape and albedo recovery of book surfaces under the fully perspective environment is proposed. The whole recovery process is composed of... A feed-back recovery process using pure shade images is implemented as a practical algorithm in order to overcome self-shadows. Results of simulations and real experiments show the properness and acceptability of the proposed strategy and the implemented algorithms. Keywords. Shape Recovery Perspective Environment Photometric Stereo Iteration Error Apparent Shape. These keywords were added by machine and not by the authors. This process is experimental and the keywords may be updated as the learning algorithm improves.