Surface Estimation of Glossy Object using Sparse Depths and Specular Cues

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We propose a novel surface reconstruction method that takes sparse 3-D points and specular measurements. The proposed method is particularly useful for reconstructing glossy surfaces where obtaining stable correspondences is difficult. To efficiently reconstruct a surface from such sparse measurements, our method represents a local surface shape by polynomial surfaces and determines the shape by finding the optimal polynomial coefficients that fit both the sparse 3-D points and specular observations. The local polynomial surfaces are finally integrated to obtain the whole surface. The effectiveness of the proposed method is demonstrated using both synthetic and realworld examples.

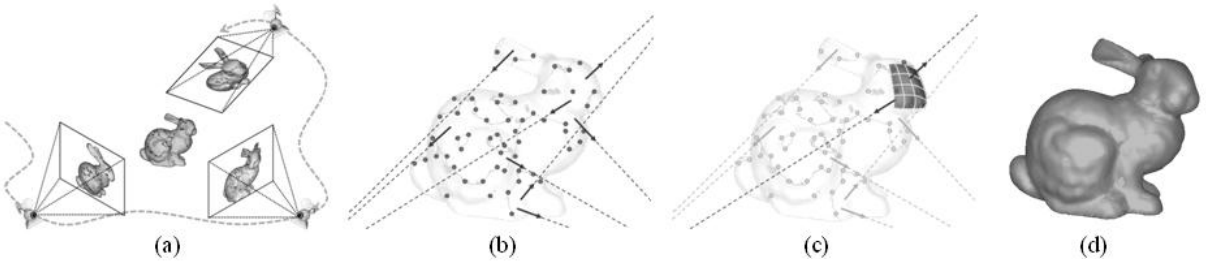

Fig. 1 Outline of process flow. (a) An object is captured from multiple viewpoints. As a light source is co-located at each camera position, specular highlights are observed at positions where their normals direct to the camera position. (b) Position of feature points are obtained by SfM. Normal vector and their corresponding specular cues are also computed. (c) Estimate a local surface as a polynomial using both sparse 3D points and specular cues. (d) Integrate all local surfaces to form a whole surface.

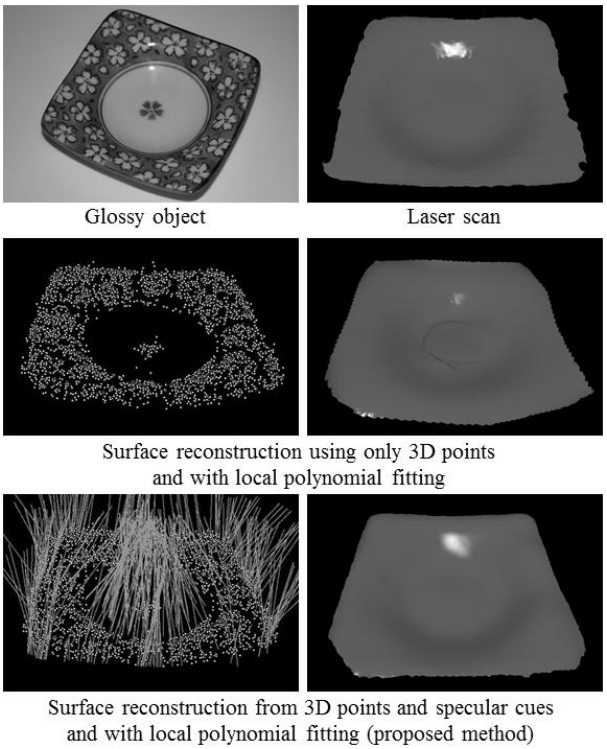

Fig. 2 Surface reconstruction of a plate. Top: The laser scanned surface is obtained by putting diffuse powder on the dish. Middle: Surface reconsturction by SfM. Bottom: Our method is able to recover an accurate shape of glossy surfaces using specular cues in addition to 3D point estimates.