Automated, Precise 3D Reconstruction with High-Resolution Projector-Camera Systems

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Digitalization of objects has a vast field of application including conservation of cultural heritage, quality control and reverse engineering. Many different acquisition techniques have emerged during the last decades [1] that can roughly be categorized into active and passive methods. Active systems like laser- or structured light scanners emit light into the scenery. Passive systems use cameras or detectors only. Most of those systems exclusively focus on geometry acquisition. However, for a visually complete reconstruction that can be rendered in a photorealistic way the diffuse object color and its reflectance properties must also be provided. An active acquisition system for capturing this data usually consists of cameras, a pattern projection unit and light sources. Our research aims to solve usability problems of such a system, in a way that reconstructions can be computed without much user interaction for a large variety of objects. The typical work flow for acquiring a reconstruction is a.) scanner calibration b.) image acquisition c.) data reconstruction and d.) outlier removal. Especially the first and the last stage still require a considerable amount of user interaction. Camera and camera-projector systems often need to be calibrated manually [2]. While self calibration methods for cameras do exist, they cannot be applied when the object to be reconstructed has no visual features. For reflectance acquisition, light sources must be included into the calibration process. The reconstructed datasets are often outlier afflicted, thus cannot be used immediately. Existing methods for outlier removal often rely on user interaction [3]. A solution of the aforementioned problems will leave users to place the object inside the scanner. A successful reconstruction is then acquired automatically.

References

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