Research Project „Dynamic Light Fields“

An exciting and interdisciplinary research topic in computer graphics and computer vision is image-based rendering (IBR), where image synthesis is based on previously obtained samples of the lightfield of the scene. Previous research for IBR required static scenes or technically complex 2D camera fields, or, used geometric models requiring global optimization, as e.g. with human characters. The model assumptions in this case either strongly restricted the objects in the scene or the lighting and the reflection properties of object surfaces.

This research project investigates further approaches in the field of time varying, geometry based lightfields, exploring variable reflection properties and lighting, for large volume acquisition, dynamic forms of representation, and efficient rendering techniques. Thus, rather sparse spatio-temporal subsets of the lightfield data are collected, instead of measuring lightfield data exhaustively. The time-dependent lightfield is scanned by a 2D movable multi-camera-rig with 25 cameras, at a base-width of 2.5m, acquiring data at 30 frames per second. Moreover, estimates of the scene geometry are provided by multiple depth-cameras (ToF/Kinect).
The central hypothesis is that the sparse acquisition of dynamic light-field data in the form of space-time-sections is sufficient for fast and high-quality light-field reconstruction. Two core methods are examined: The use of local optimization methods, will enable rapid, robust accumulation of dynamic light-field data, using the range data to estimate reflectance and lighting parameters. Secondly, a hybrid image- and model-based representation of the light-field information enables efficient storage of data, including light-field dynamics. In this way the range of application scenarios of dynamic light-fields is extended to, e.g., content generation for free-viewpoint-television and auto-stereoscopic displays. For this, highly efficient new approaches have to be developed for representation, analysis, accumulation and rendering.

The project is being conducted in collaboration with the research group of Prof. Dr. Reinhard Koch from the University of Kiel, whose focus is the acquisition of light-field data, while the research group Kolb focuses on the image synthesis. The efficient optimization and representation of dynamic light-fields is processed in collaboration.

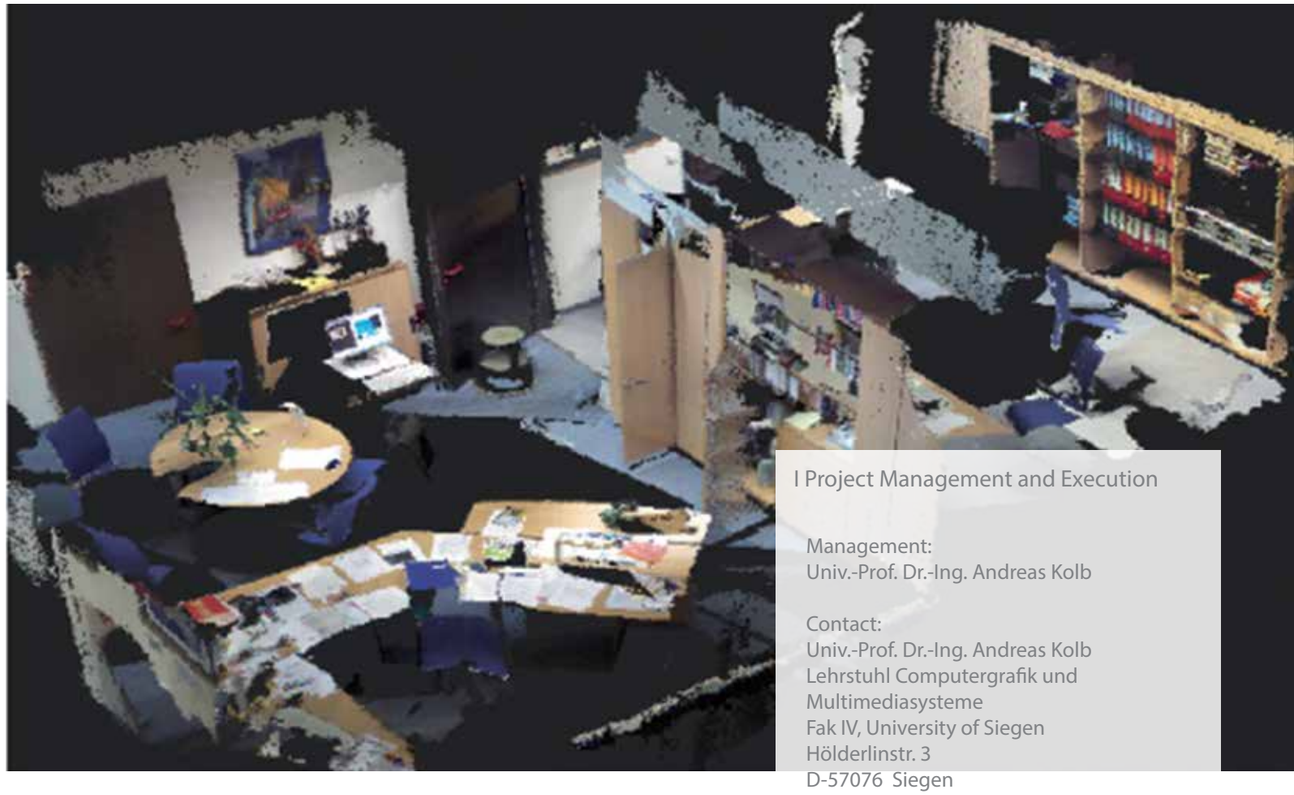

Fig1:
Acquisition of a large, static scenery with diffuse material properties only. The goal is to additionally encode the reflective properties for dynamic scenes, while sticking to the online processing paradigm.

I Project Management and Execution

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