Augmented Reality

Transfer of the Lighting Situation to Synthetic Objects

Graduate

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Definition of Task: The aim of this study is to develop methods for estimating the lighting conditions and camera position of a real scene. With this information, a virtual object will be integrated into the scene using augmented reality. The virtual object should appear natural within the real environment. Various techniques are employed and compared to acquire information about the real scene.

Approach: For estimating the camera position, detection patterns like chessboard and ArUco are utilized. Using the Python library OpenCV and one of these detection patterns, the camera's rotation and translation are estimated.

The determination of the lighting conditions is achieved through a procedure involving a 360-degree camera and a neural network.

The obtained information is then passed to the ray-tracing program POV-Ray, which generates the image of the virtual object. The virtual image is presented within the real scene using alpha blending.

Result: The estimation of the camera position using ArUco markers provides precise orientations of the object. In contrast, chessboard patterns exhibit certain inaccuracies and only allow for a 180-degree rotation of the object. Both detection patterns show slight deviations concerning the camera's position.

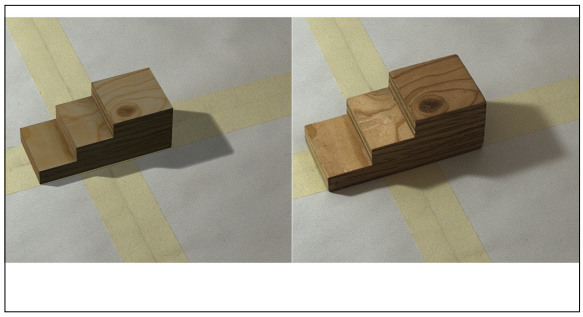
Detecting the light's position through a 360-degree camera yields plausible results. Nevertheless, this method is confined to estimating the light's position solely from the perspective of the 360-degree camera. The use of a neural network allows for only specific camera positions to be employed, yet they do not return satisfactory results.

It turns out that the estimation and application of the lighting situation are most successful when using a combination of ArUco markers and a 360-degree camera.

Experimental setup with a camera and a lamp
Own presentment

Image taken with the 360-degree camera of the environment
Own presentment

Comparison between a virtual object (left) and a real object (right)
Own presentment



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Subject Area
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