On-Site Real-Time 3D Match Move for MR-based Previsualization with Relighting

Ryosuke Ichikari,* Kaori Kikuchi, Wataru Toishita, Ryuhei Tenmoku, Fumihisa Shibata, Hideyuki Tamura
Ritsumeikan University

Figure 1: *Our method (left: Structure-from-motion, middle: Match move, right: Relighting)*

1 Introduction

We are developing a previsualization method called MR-PreViz, which utilizes mixed reality technology for filmmaking [Tenmoku et al. 2006]. To determine camera-work at the shooting site, estimating camera position and posture is required. In this paper, we introduce a method for on-site real-time 3D match move and relighting for MR-PreViz. To realize the match move, we developed a computer vision-based camera tracking method using natural feature tracking. This method is based on details about the site captured in advance. The method can automatically construct a feature landmark database (LMDB) using a fiducial marker. Moreover, the result of the method enables MR-PreViz to design lighting for the site using a relighting method. To add lighting effects to the real objects, the relighting method uses reflectance properties of the real objects and LMDB.

2 Flow of On-Site Match Move and Relighting

The proposed method realizes pre-visualizing a movie's scene without using specialized equipment as shown in the following steps.

Step 1 Preparation of CG Action Data
This step collects CG environment data and action data before making MR-PreViz movies. The action data are separately recorded, and their timings and positions are adjusted for building one-on-one fighting action. Moreover, we developed a method of adjusting the action displacement to fit into the motion area derived from the actual site.

Step 2 Gathering Geometrical and Photometrical Information of the Shooting Site (shown in the left image of Figure 1)
This step gathers geometrical information including the 3D positions of the feature points and reflectance property of the surfaces at the site for MR-PreViz shooting. This process is automatically realized by utilizing a fiducial marker.

Step 3 Compositing MR-PreViz Image Using Real-Time 3D Match Move and Relighting (shown in the middle/right image of Figure 1)
The geometrical information is used for real-time match move during the MR-PreViz shooting. The lighting condition of the MR-PreViz movie can be changed using the geometry and reflectance property gathered in Step 2.

*e-mail: ichikari@rm.is.ritsumei.ac.jp

3 Gathering Geometrical and Photometrical Information of the Shooting Site

In preparation for the MR-PreViz shooting, geometrical and photometrical information of the site is gathered by pre-shooting using markers. Geometry of the site is estimated using a Structure-From-Motion technique. In particular, the positions of feature points in 3D space are first estimated by using epipolar geometry on several frames in the video sequence. Secondly, 6DOFs of the camera and positions of new feature points are simultaneously calculated by tracking the feature points. Finally, the coordinates of the 3D points are transformed into world coordinates by recognizing a fiducial marker. The data of the feature points are entered into our LMDB.

For the relighting, the relationship between pixel value and illuminance is obtained as a reflectance property. Illuminance is automatically calculated under several lighting conditions by using a reference marker where the reflectance property of the marker is known.

4 Compositing MR-PreViz Images Using Real-Time 3D Match Move and Relighting

In this step, the fiducial marker is removed for MR-PreViz shooting. Match move is realized by correlating the 2D feature points in the images with the 3D points in the LMDB.

After compositing the MR-PreViz movie, lighting conditions of the MR-PreViz images are intentionally changed in according to the method described in [Ichikari et al. 2009]. In this case, the method uses the geometry and the reflectance property of the site captured in Step 2. Thus, our method realizes the interactive design capabilities of camera-work and lighting at the site in real-time for MR-based pre-visualization.

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