3D Scene Reconstruction by Stereo Methods for Analysis and Visualization of Sports Scenes

Margrit Gelautz, Michael Bleyer, Danijela Markovic, and Christoph Rhemann
Institute for Software Technology and Interactive Systems
Vienna University of Technology, Austria

The 3D reconstruction of image and video scenes by stereo analysis is an important topic in computer vision research. In this talk, we first present some principles of stereo algorithms and recent developments. We then demonstrate two applications of stereo reconstruction for the analysis and visualization of human movement: (a) We employ depth maps derived from sport scenes for novel view synthesis, and (b) we show how stereo processing can be used for expressive visualization of human motion in a comic-like style.

Figure 1 shows an original stereo image pair of a soccer game captured by two spatially displaced video cameras. We applied stereo analysis [1] to generate automatically a depth map of the scene, which is given in Figure 2 (left). Scene points with brighter gray values are closer to the camera than areas displayed in darker tones. The precise reconstruction of textureless regions and depth discontinuities arising along object borders present special challenges in the 3D reconstruction process. The depth map, in combination with the original images, is now employed to compute a virtual view of the soccer scene, as demonstrated in Figure 2 (right).

Figures 3 and 4 give an example of an image stylization that emphasizes human motion extracted from real stereo videos [2]. The original frame sequence can be seen in Figure 3. By using stereo analysis and tracking salient features, we compute a non-photorealistic rendering that relies on motion lines and multiple contours as stylization elements, in imitation of comics produced by hand.

[1] Bleyer, M. and M. Gelautz, Graph-cut Based Stereo Matching Using Image Segmentation with Symmetrical Treatment of Occlusions, *Signal Processing: Image Communication* (Special Issue on Three-dimensional Video and Television), vol. 22, issue 2, pp. 127-143, 2007.

[2] Markovic, D. and M. Gelautz, Comics-like Motion Depiction from Stereo, Proceedings of *WSCG 2006*, Plzen, Czech Republic, pp. 155-160, 2006.

Novel View Synthesis

Figure 1: Original stereo image pair (left and right view).

Figure 2: Stereo-derived depth map (left) and computed virtual view (right).
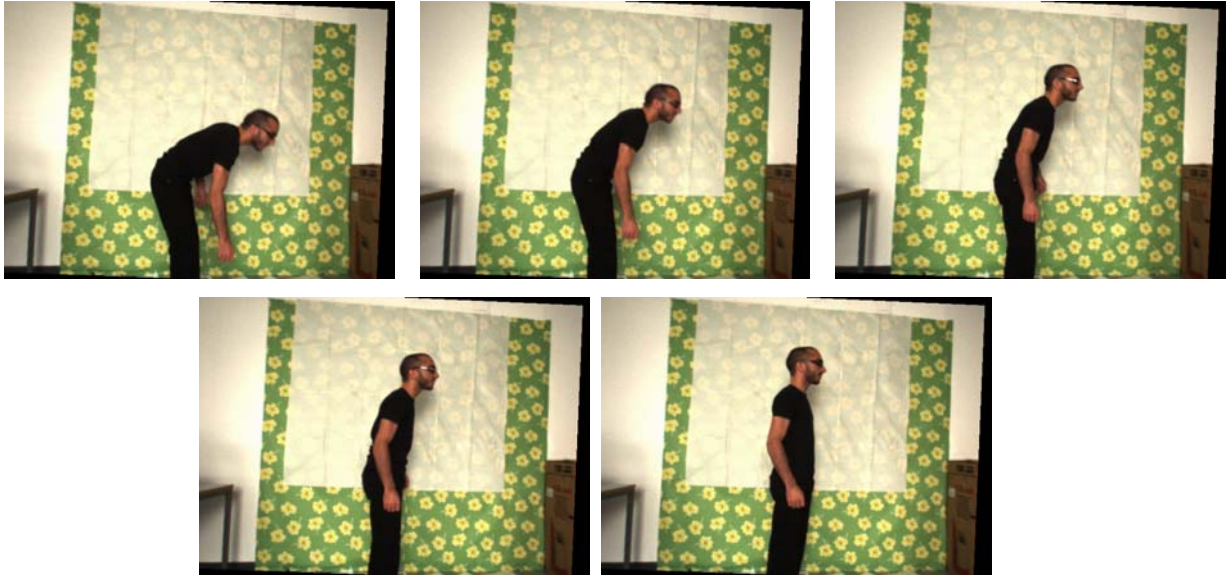
Stylization of Human Movement

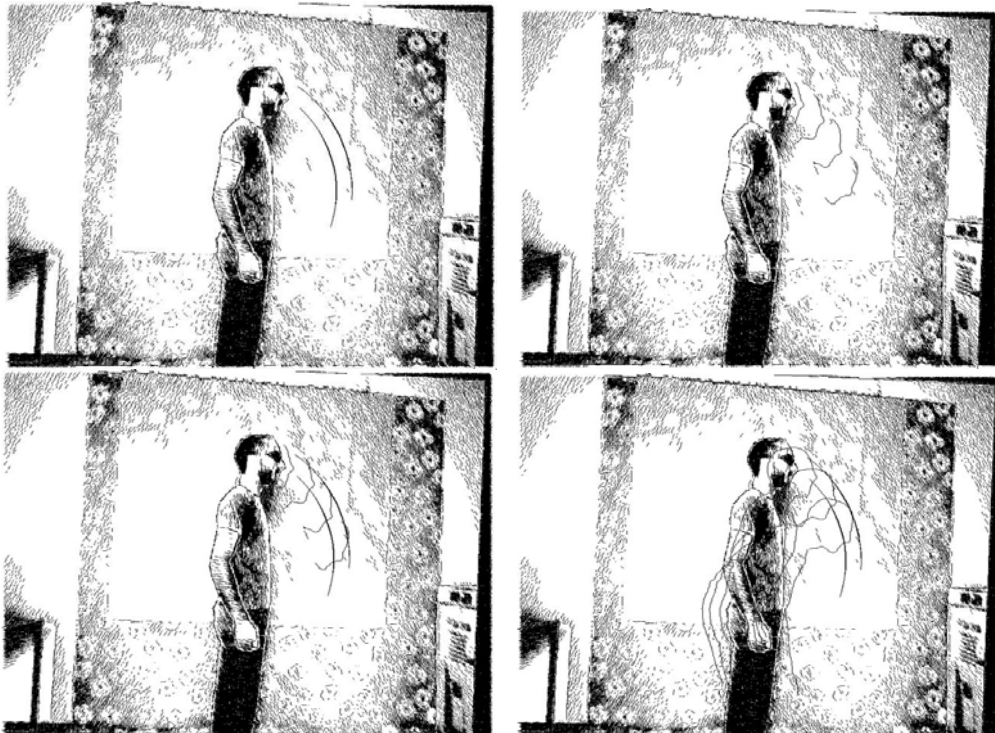
Figure 3: Frames of the original video sequence.

Figure 4: Stylization results – the motion is depicted in imitation of comics drawn by hand.