

## 4D Capture using Passive Stereo Photogrammetry

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### Abstract

Dimensional Imaging has developed a 4D capture system that is capable of capturing colour textured 3D models sequences of dynamically deforming surfaces. The use of passive stereo photogrammetry allows the simultaneous capture of both 3D shape and colour texture from multiple viewpoints.

### 1 Introduction

Several systems have now been reported that are able to capture 3D model sequences of dynamically deforming surfaces [1], [2]. However previously reported systems use either pattern projection or active stereo photogrammetry to recover 3D shape, which makes it difficult to derive “clean” images either for use as texture maps or for temporal point tracking. Our use of passive stereo photogrammetry elegantly addresses this issue.

### 2 Image Capture

The current 4D Image Capture Rig comprises six synchronised off-the-shelf 1.4 mega pixel digital video cameras and a standard continuous video lighting system. The cameras are arranged into two banks of three cameras, with each bank comprising two monochrome cameras (top and bottom) and one colour camera (middle). The two banks of cameras are arranged to capture the left and right sides of a human subject’s face. The current system is capable of capturing 20s sequences at 25fps.

### 3 Image Processing

For each time instant in the captured sequence, the top and bottom monochrome images from each bank of cameras are formed into stereo pairs, and processed to derive range maps.

Each range map is first re-projected onto the image coordinates its associated colour image. The two re-projected range maps are then merged into a single 3D point cloud, and polygonised. The two colour images are processed to balance the colours at the join and then applied as a texture map onto the polygonised 3D model.

### References

- [1] L. Zhang, et al.. Spacetime Faces: High-resolution capture for modeling and animation. In ACM SIGGRAPH Proceedings, Los Angeles, CA, Aug., 2004.
- [2] D. MacVicar, et al., 3D Performance Capture for Facial Animation. In 3DPVT Proceedings, Thessaloniki, Greece, 2004.



Figure 1: 4D Image Capture Rig and captured images.

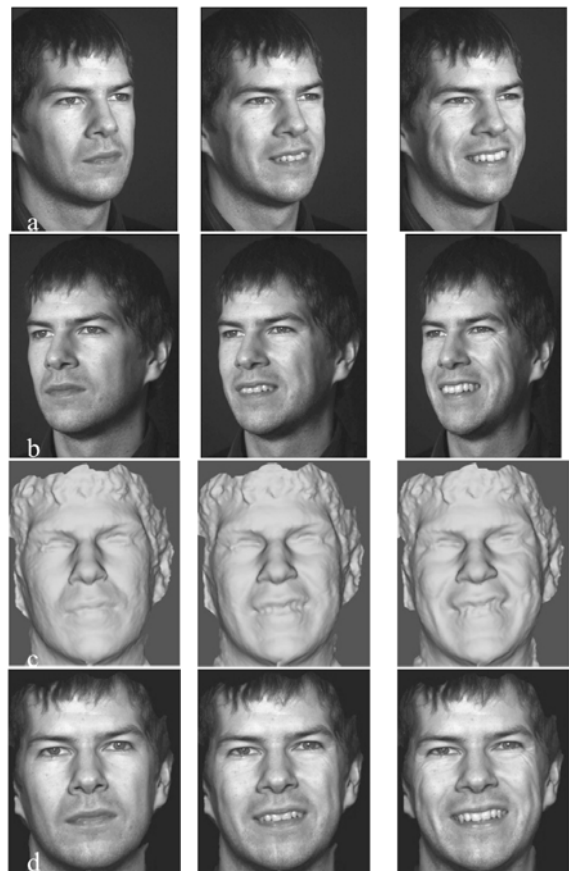


Figure 2: Three consecutive frames from a captured sequence: a) left colour images, b) right colour images, c) final merged 3D models, d) 3D models with texture mapping.