

Reconstructing 3D Faces from Video, Range, and Thermal Imagery (Poster)

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OUTLINE

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Introduction

Objective:

- Reconstruct dense textured 3D models of faces from video, range, and thermal images

Applications:

- Face recognition using both 3D geometry and multi-spectral images overcomes the problems of pose and illumination changes



Multi-modal Modeling System

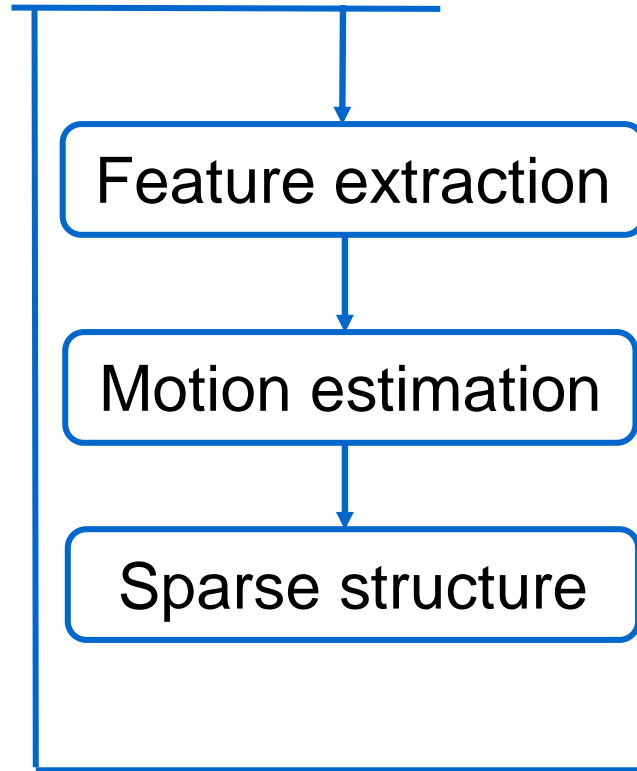
Approach:

- Fuse dense geometric information available in range with sparse features reconstructed from video and thermal data
- Use standard low-cost video and thermal input
- Employ both geometry and intensity information for recognition

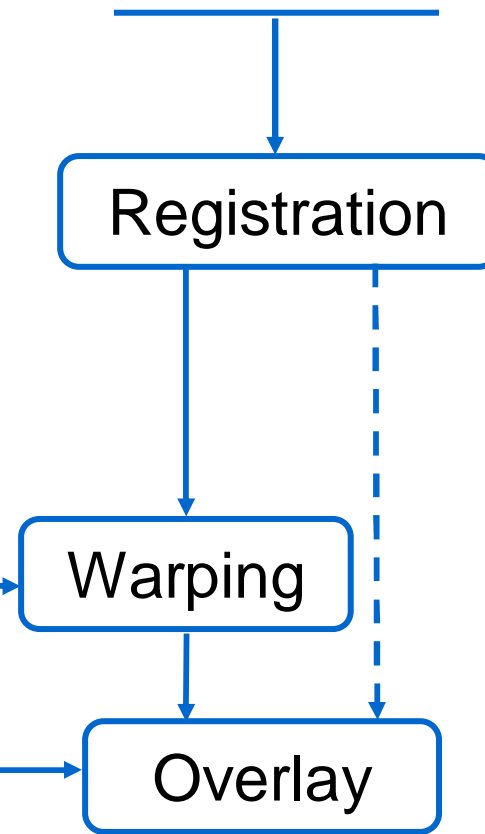


Overview

Color and Thermal images



Range maps



3D Textured Models



Related Work

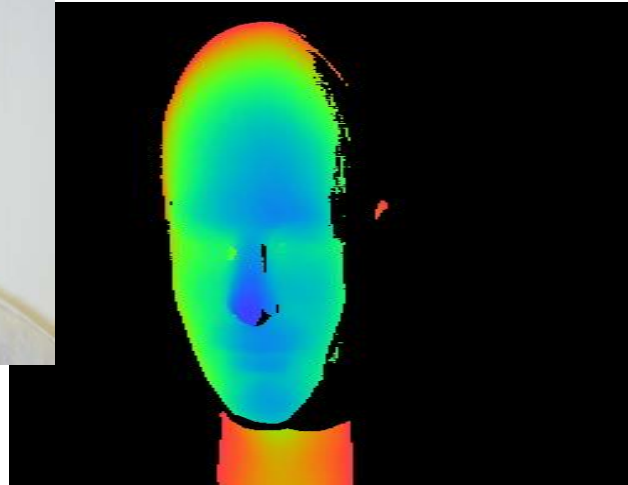
- C. Zhang and F. S. Cohen, “3D Face Structure Extraction and Recognition from Images using 3D Morphing and Distance Mapping”, IEEE Trans. Image Processing, 2002
- Chowdhury et al., “3D Face Reconstruction from Video Using a Generic Model”, IEEE International Conference on Multimedia 2002
- Hwang and Blanz, “Face Reconstruction from a Small Number of Feature-points”, ICPR 2000
- P. Fua, “Regularized Bundle-adjustment to Model Heads from Image Sequences without Calibration Data”, IJCV 2000



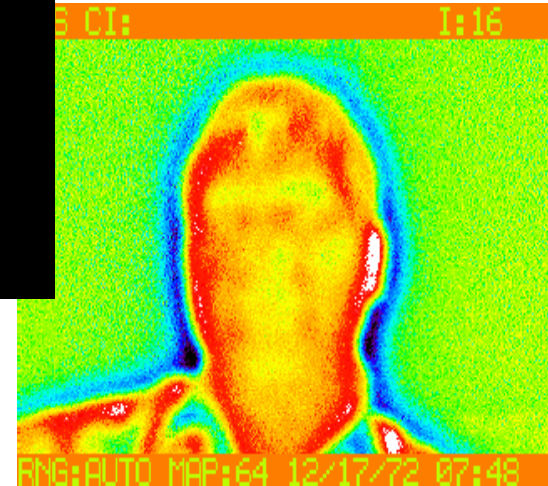
Imaging Modalities



Color

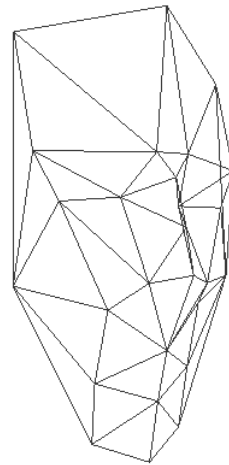


Range



Thermal

Motion and Shape



Reconstruction of few face features using Shape from Motion

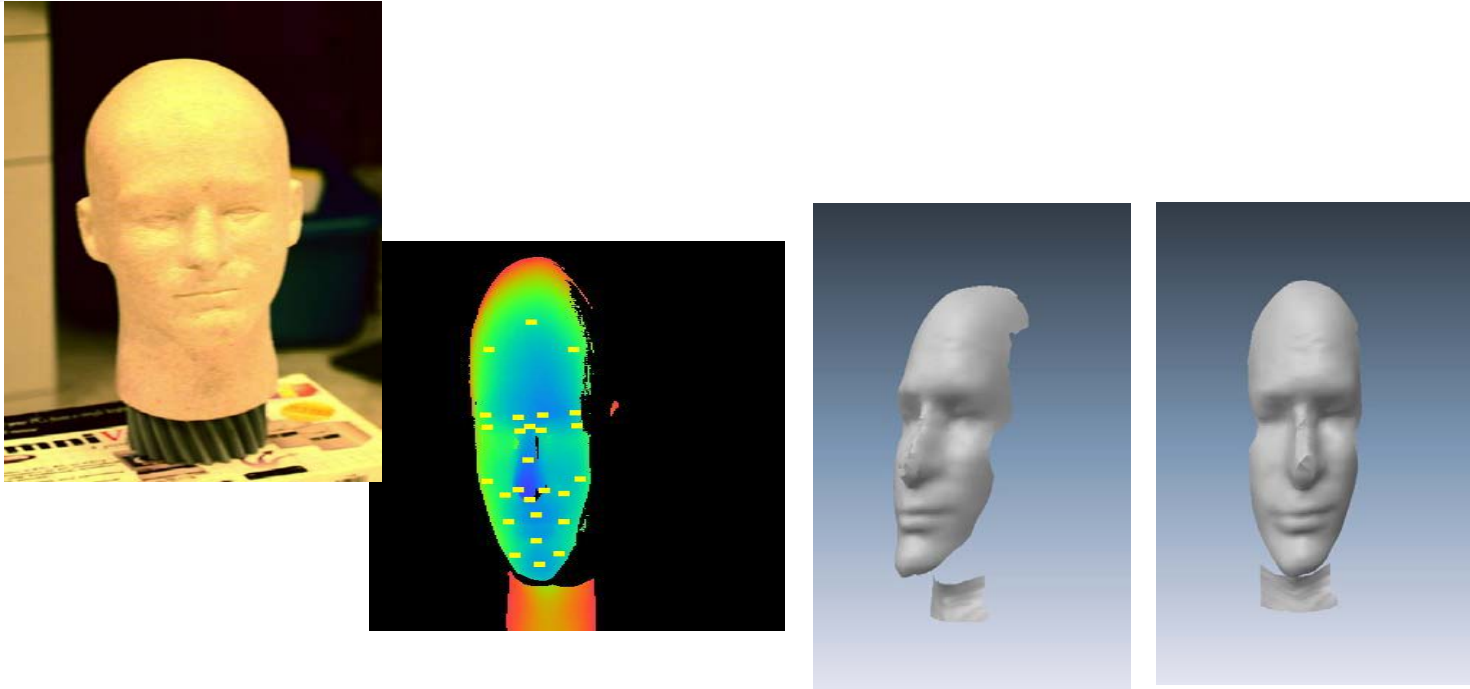


Feature Tracking

- R. Lanzarotti et al., “Robust Identification and Matching of Fiducial for the Reconstruction of Human Faces from Raw Video Sequences”, International Symposium on 3DPVT, 2002
- R.L Hsu et al., “Face Detection in Color Images”, TPAMI 2002

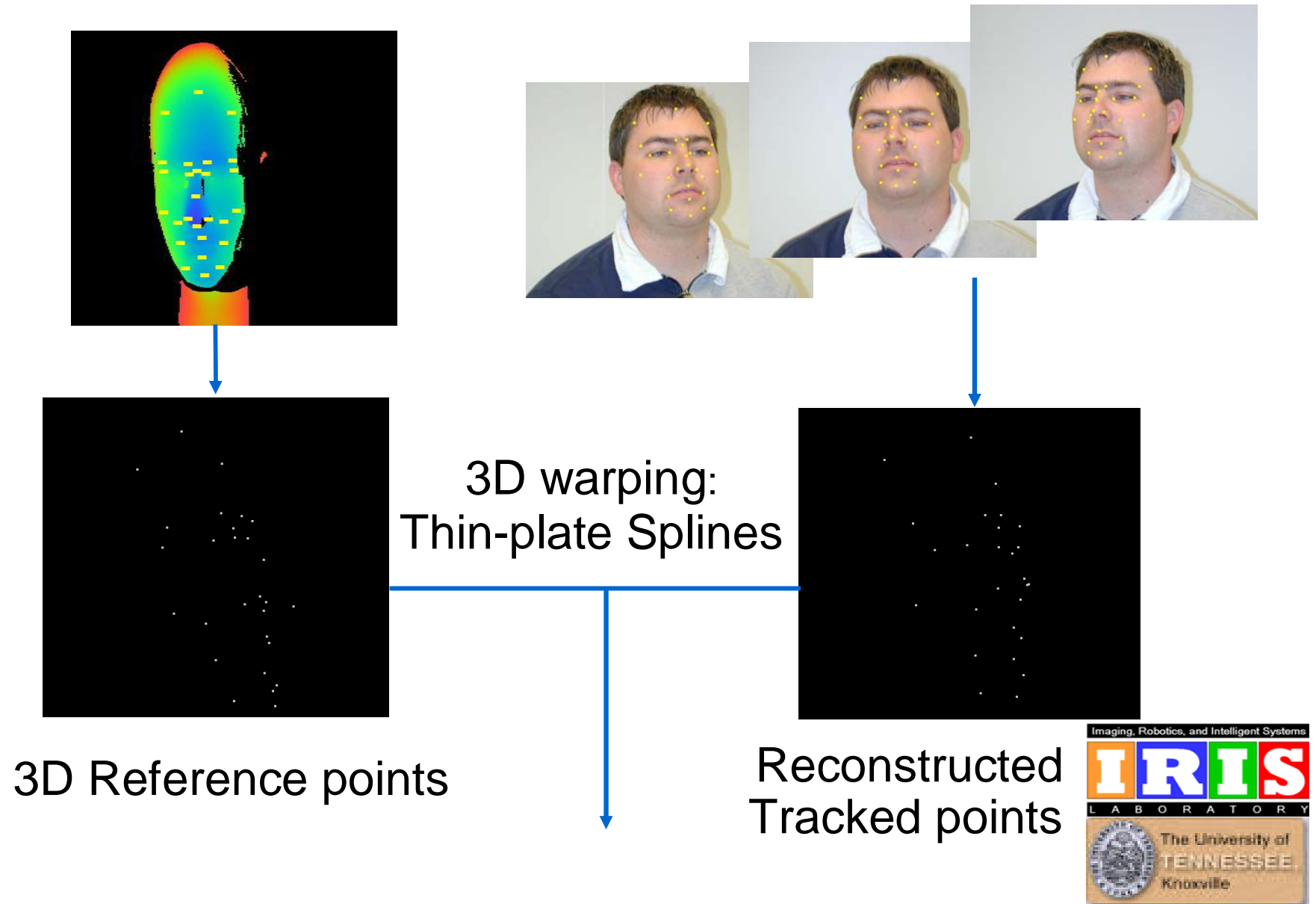


Range Data

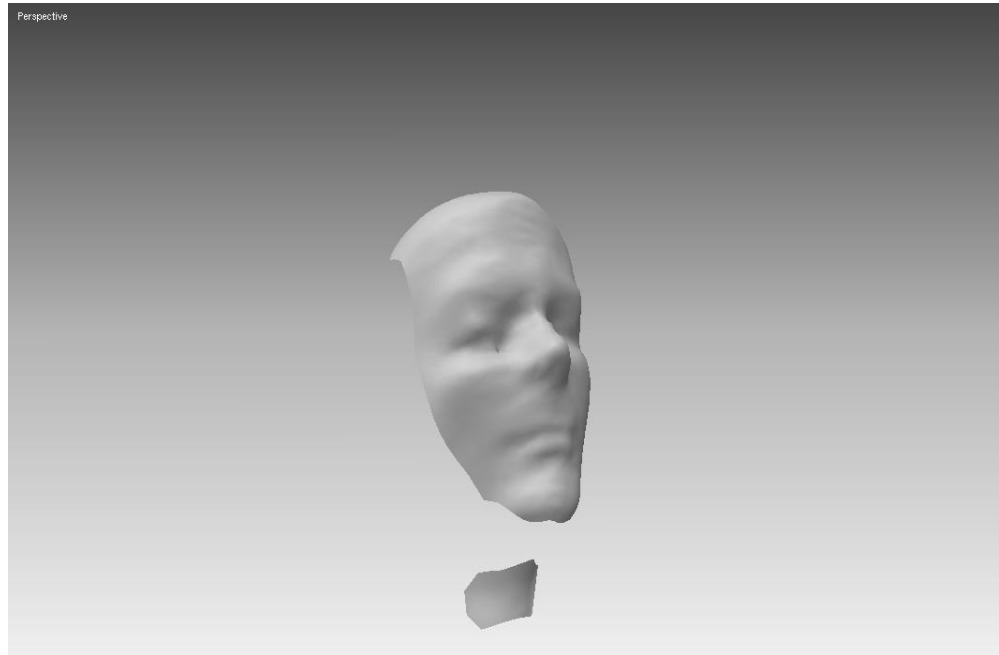


Range scan of a mannequin's head with landmark points and views of reconstructed generic model

Geometric Warping



Reconstructed Model



Reconstructed face geometry



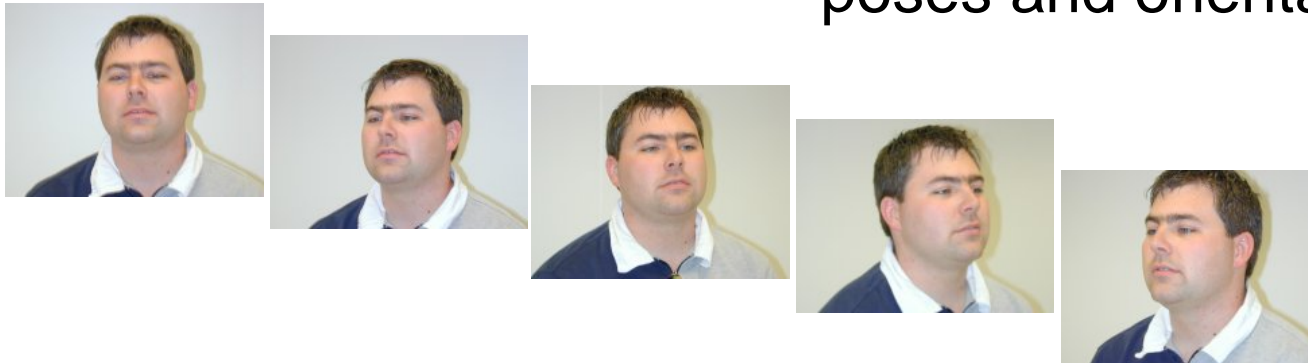
3D Warping, Thin-plate Splines

- Thin-plate splines (Menguét 84, Bookstein 89), belong to a class of interpolation techniques based on radial basis functions
- Thin-plate splines are commonly used for warping and non-rigid image registration
- Thin-plate splines emphasize local shape information

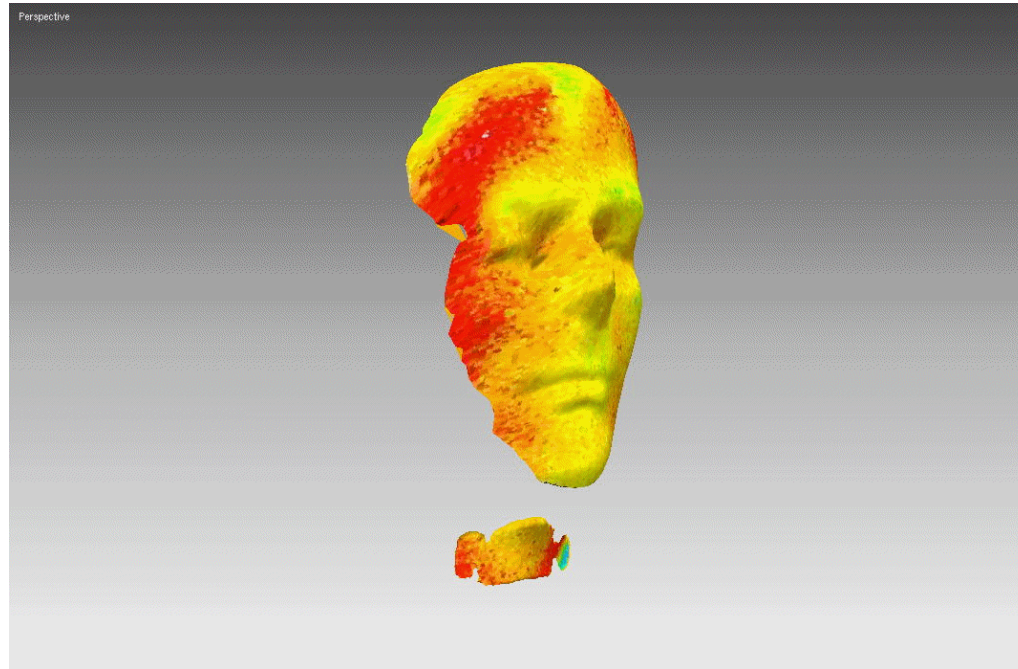
Textured Models



3D model of a face with color overlay, such model will permit the recognition of faces in images from various poses and orientations



Textured Models



Adding thermal texture will help overcome illumination changes in recognition



Conclusion

- Combining a dense generic 3D model, Shape from Motion, and Thin-plate splines warping techniques allows for the recovery of accurate face models using only few feature-points
- Modeling system fuses efficiently range and color data at intensity and geometry levels
- Unlike most systems based on deformable models no iterative fitting is required
- Recognition rates will be enhanced by the use of registered geometry and multi-spectral images