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

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• Introduction
• Multi-modal Modeling System
• Imaging Modalities
• Motion and Shape
• Geometric Warping
• Results
• Conclusions
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
  - Feature extraction
  - Motion estimation
  - Sparse structure

Range maps
  - Registration
  - Warping
  - Overlay

3D Textured Models
Related Work


• 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.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

3D warping: Thin-plate Splines

3D Reference points

Reconstructed Tracked points
Reconstructed Model

Reconstructed face geometry
3D Warping, Thin-plate Splines

- Thin-plate splines (Menguet 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.
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