



Robust Automated Face Modeling and Recognition Based on 3D Shape

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3D is a Productive Research Path

- Compare
3D SHAPE of faces instead of
2D PICTURES of faces
- Potential generational improvement
- Overcomes limitations due to
 - Viewpoint
 - Pose
 - Lighting



■ 3D Sensing

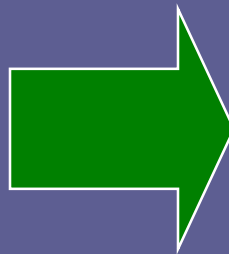
- ◆ Passive 3D sensing from images
- ◆ Low-cost COTS components
- ◆ High-res 2D images as baseline for direct 2D/3D comparison



Sensor



Lab Tool



Pilot Product



Works with Overhead Lighting, System Lighting **Off**



A



B



C



D



E



F



G

The system can handle wide variations, from 90 to 300 lux



Field Experiments – Outdoors

geometriX[®]

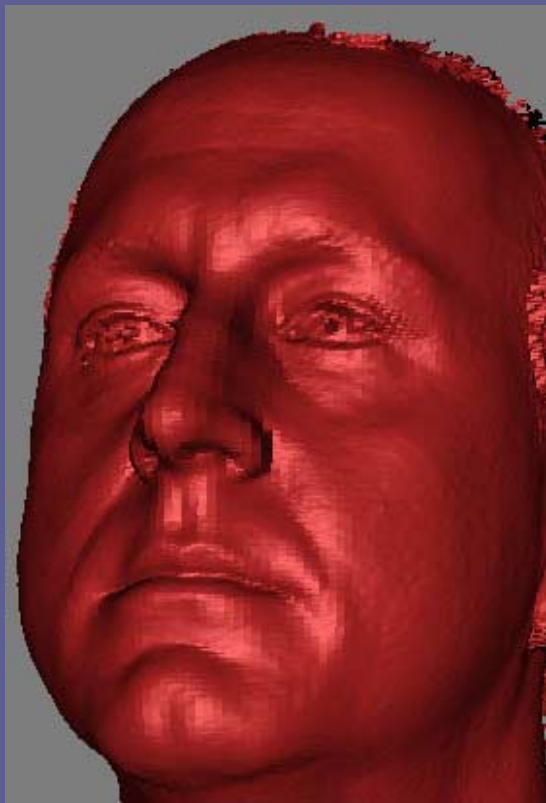
Exposure time 1.2 ms
80,000 lux



Even under such extreme conditions, we produce good models with the sun behind the subject, behind the camera, and to the side



Baseline Accuracy

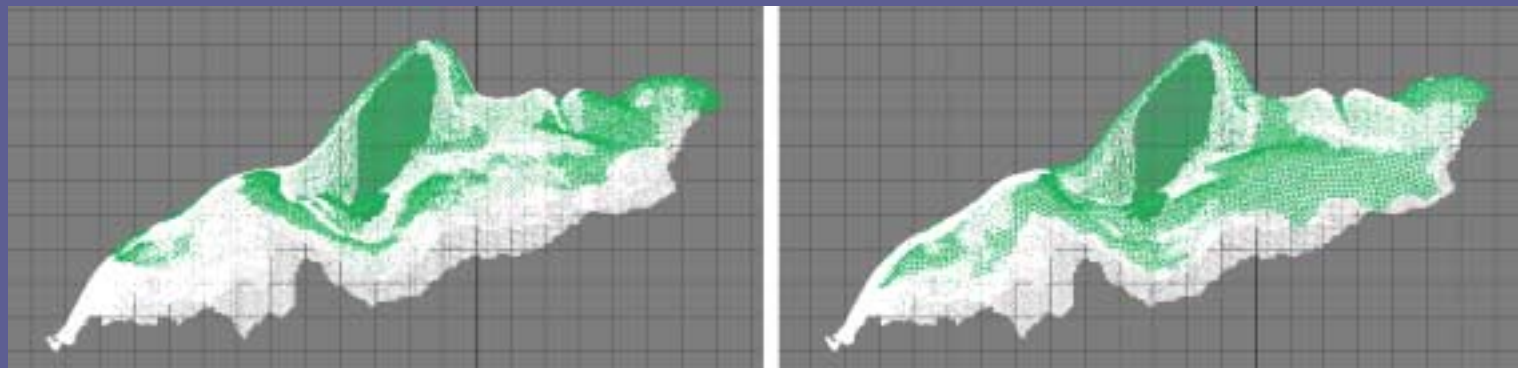


Cyberware



FaceVision

Baseline Accuracy



Example





Recognition



- Our 3-D recognition engine performs one-on-one comparison of a probe 3-D model
 - ◆ with a reference model for **verification**
 - ◆ with *all* existing reference models for **identification**
- The process:
 - ◆ automatically align the two meshes
 - ◆ classification based on the statistics of the difference



Validation



- ◆ tested on database of 100 subjects, each in 7 different poses within $\pm 20^\circ$ of frontal
- ◆ For comparison, input images were used as input to the Identix Facelt[®] 2-D recognition engine
- ◆ Our 3-D method yielded an equal error rate better than 2%, vs nearly 6% for the Identix Facelt[®] system

Note: Facelt[®] was rated one of the “top-three” in the FRVT2002 test



Authentication Performance

Test data is based on 100 people with 7 images per person

