INTEGRATED MEDIA SYSTEMS CENTER
A National Science Foundation
Engineering Research Center at the
UNIVERSITY OF SOUTHERN CALIFORNIA

PRINCIPAL INVESTIGATOR

Dr. Ulrich Neumann
uneumann@imsc.usc.edu

OTHER IMSC RESEARCHERS

Dr. Reyes Enciso, Dr. Albert Rizzo

USC STUDENTS, DEGREES

Tae-Yong Kim, Jun Yong Noh, Doug Fidaleo (Ph.D.)

FACIAL ANIMATION FOR 3D TELE-IMMERSION:

Modeling, Sensing, and Animation of Humans

Tracked features are shown as green points in video images (left), producing animations that include deformations and skin wrinkles (right) created by volume morphing and appearance classification.

BRIEF DESCRIPTION OF DEMONSTRATION

3D teleconferencing is done with avatars or models of people. Head models are created. Video of real people is analyzed, feature points are tracked, and textures are classified. Feature motions and texture classification states are transmitted over a network to animate the models (avatars). Geometry and textures are animated. Results are evaluated for perceptual quality and validity.

DISTINGUISHING CHARACTERISTICS RELATIVE TO STATE-OF-THE-ART

Improved modeling of hair, eyes, and skin coloring eliminate or minimize manual touch-up. Sense feature motions and texture changes. Reconstruct geometry by volume morphing to avoid need for muscles or other abstract animation parameters. Texture animation reproduces skin wrinkles, eye blinks, etc. Bandwidth required reduced by several orders of magnitude to ~1-10 kb/s.

UNDERLYING TECHNOLOGIES

- 3D deformation & animation
- Texture classification & animation
- Real-time networking & computing
- Stereo image reconstruction
- Model fitting
- Immersive audio
- Expression perception

APPLICATIONS

For 3D immersive teleconferencing, animation methods and reconstruction are essential for very high compression rates. Modeling and animation is useful for entertainment systems with personal avatars.

RECENT HIGHLIGHTS, LEVEL OF DEVELOPMENT, UPCOMING MILESTONES

Head modeling is hard and our system does it well. Fitting is interactive and the use of texture classification and volume morphing is unique to IMSC.

BRIEF DESCRIPTION OF UNDERLYING TECHNOLOGIES

- 3D deformation & animation – based on volume morphing. We track arbitrary points on face and move them in our model. All other points are smoothly interpolated by morphing. Added constraints in our model maintain plausible face structure and shape.

- Texture classification & animation -- textures of facial regions are matched to templates stored in database. The best interpolated match determines the appearance of the facial region (wrinkles, eye blink, etc). The encoded appearance triggers a smooth reconstruction of the appearance on the avatar by interpolating among a library of possible textures.

- Real-time networking and computing – use multiple CPUs on the SGI Onyx or multiple Pentium CPUs in PCs. All processes are networked for distributed system architecture.

- Stereo image reconstruction – Stereo pairs based on projected textures produce partial-face models. Multiple partial models are combined to form a complete head model with high quality texture.

- Model fitting –Complete head model with texture is fit to generic animation model. Textures and head shape are transferred so that animation model takes on specific person's appearance. Fitting is done interactively (only once) with volume morphing.
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LIST OF PUBLICATIONS, REFERENCES, URLs

D. Fidaleo, J-Y. Noh, T. Kim, R. Enciso, and U.Neumann, "Classification and Volume Morphing for Performance-Driven Facial Animation," *International Workshop on Digital and Computational Video (DCV'99)*, December 1999.
R. Enciso, J. Li, D. Fidaleo, T-Y. Kim, J-Y. Noh, and U. Neumann, "Synthesis of 3D Faces," *International Workshop on Digital and Computational Video (DCV'99)*, December 1999.
Jun-yong Noh, Ulrich Neumann. "Talking Faces," accepted by IEEE International Conference on Multimedia and Expo 2000, August 2000

www.usc.edu/dept/CGIT (lab web page)

For additional information, please contact the Principal Investigator listed above via email, or contact

Isaac Maya, Ph.D., P.E. 213-740-2592
Director, Industry and Technology Transfer Programs imaya@imsc.usc.edu

Ann Spurgeon 213-740-4877
Associate Director of Industry Programs aspurgeo@imsc.usc.edu

Integrated Media Systems Center
3740 McClintock Avenue, Suite 131
Los Angeles, CA 90089-2561
213-740-8931 (fax)
For additional information on the Integrated Media Systems Center (IMSC), please visit our Web site at http://imsc.usc.edu