Facial Expression: Analysis and Synthesis

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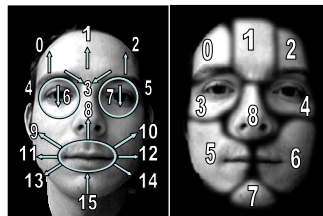
Research Goals

• Automatically record and analyze human facial expressions and synthesize corresponding facial animation
• Include both speech and non-speech gestures
• Abstract parameters between the control signal and the animated character allows model and animation independence

Role in IMSC

Human-centric interfaces and interactions are part of IMSC's vision of Immersipresence. Such interfaces will require both the identification and processing of human facial gestures, and the synthesis of facial animation. This project focuses on facial expression processing; the Data-Driven Facial Modeling and Animation project explores a data-driven approach to the synthesis problem.

0. Frontalis L.
1. Frontalis C.
2. Frontalis R.
3. Corrugator
4. Orbicularis Occuli L.
5. Orbicularis Occuli R.
6. Levator Palpebrae L.
7. Levator Palpebrae R.
8. Levator Nasii
9. Zygomatic Major L.
10. Zygomatic Major R.
11. Risorius L.
12. Risorius R.
13. Triangularis L.
14. Triangularis R.
15. Mentalis

| CR	Muscles
0	0
1	1, 3
2	2
3	4, 6
4	5, 7
5	9, 11, 13
6	10, 12,14
7	15
8	8
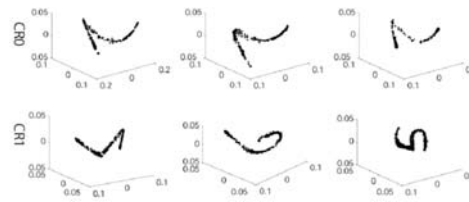
Gesture Manifolds

Research Approach

The face is partitioned into local regions of change called *coarticulation (CoArt) regions.* Each region is influenced by a limited number of underlying facial muscles, and little coupling to other CoArt regions.

Gesture Polynomial Reduction (GPR) introduces an explicit "manifold" model of facial gesture movement, allowing robust classification of gesture intensity.

Accomplishments

• D. Fidaleo and U. Neumann, Analysis of Coarticulation Regions for Performance Driven Facial Animation, *Journal of Visualization and Computer Animation*, 2003.
• J-Y. Noh, D. Fidaleo, U. Neumann, Gesture Driven Facial Animation, USC Technical Report 02-761, 2002.
• D. Fidaleo and U. Neumann, CoArt: Co-Articulation Region Analysis for Control of 2D/3D Characters, *Computer Animation* 2002.
• D. Fidaleo and U. Neumann, Gesture Polynomial Reduction: Manifold Analysis of Facial Gestures for Perceptual User Interfaces, *submitted for review*, 2003.
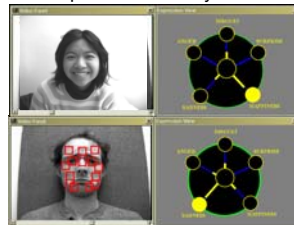
Muscle Morphing and CoArt Animation

Gesture Driven Facial Animation

Expression Analysis
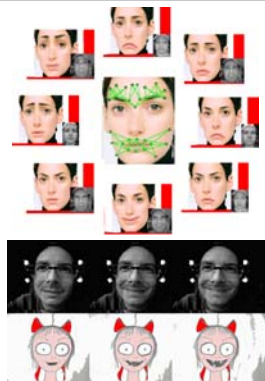
D. Fidaleo, U. Neumann, *CoArt: Coarticulation Region Analysis for Control of 2D Characters*. Proceedings Computer Animation, 2002.
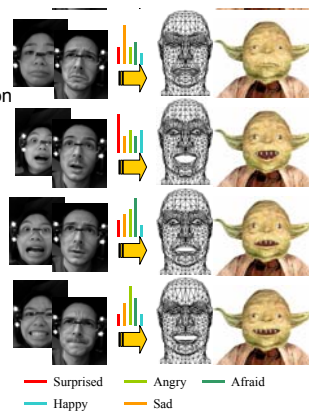
02/26/02 news release from Teradata

Nationally broadcasted E-motions video news release with NCR/Teradata.

— Surprised   — Angry   — Afraid
— Happy   — Sad

Uniqueness & Related Work

Face tracking and recognition are popular research topics at present (IEEE F&GR is a conference devoted to these topics). Our work is distinguished in several ways:

• In addition to facial motion due to speech, non-speech facial gestures such as a "furled brow" are targeted,

• We adopt a region-based and "textural" level of analysis that avoids the combinatorial complexity of a whole-face approach.

Comfort Control

Comfort Control art installation: Freedom from restraints obtained by computer reacting to subject's facial expressions.

Lindhurst Gallery: Oct 2001
Raid Projects: April 2002

5-Year Plan
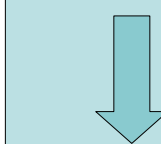
Milestone Chart		
2002-2004	2004-2006	2006-2008
- Analysis of emotive gestures and speech	- Integration with aural speech analysis	- Extensions to body poses and gaits
- Analysis driving realistic 3D avatar animations		

research areas

ucs   si   im   mc   mie   arp

user-centered sciences | sensory interfaces | information management | media communications | media immersion environment systems architecture | application research projects