# FACIAL GESTURE ANALYSIS:
# Sensing and Portrayal of Expressive Faces


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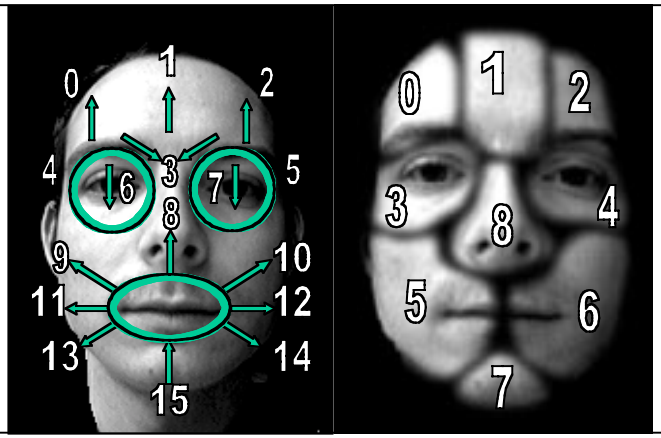
0. Frontalis L
1. Frontalis C
2. Frontalis R
3. Corrugator
4. Orbicularis Occuli L
5. Orbicularis Occuli R
6. Levator Palpebrae L
7. Levator Palpebrae R
8. Levator Nasii
9. Zygomatic Major L
10. Zygomatic Major R
11. Risorius L
12. Risorius R
13. Triangularis L
14. Triangularis R
15. Mentalis




| 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 |

(left) List of analyzed muscle groups and their locations and directions of contraction. (right) Labeled coarticulation regions and list of contributing muscles.

## USC STUDENTS, DEGREES

Doug Fidaleo (Ph.D.)

## BRIEF DESCRIPTION OF DEMONSTRATION

Analysis of facial images is demonstrated for expression recognition and animation of 2D characters. Facial motion is decomposed into muscle actuations by analyzing nine regions of potential change called *co-articulation regions*. The result is a general analysis framework whose features (muscles) are amenable to a wide variety of uses, from expression recognition to facial animation. Facial animation can be realized with either cartoon style 2D avatars or more realistic interpolated 3D models.

## UNIQUE OR DISTINGUISHING CHARACTERISTICS RELATIVE TO STATE-OF-THE-ART

Computer analysis of speech is the subject of extensive research, but non-speech facial gestures have received less attention. The fact that face-to-face meetings remain important in this age of ubiquitous cell phones is indication that non-speech gestures are important. Our mid-level analysis of the textural appearance of co-articulation regions appears to be a unique approach to this problem.

## APPLICATIONS

- Expression recognition, 2D and 3D avatars, facial animation.

## RECENT HIGHLIGHTS, LEVEL OF DEVELOPMENT, UPCOMING MILESTONES

. The system currently assumes a single muscle/gesture is active in a region at a given time. An interesting structure of the co-articulation region feature space has recently been discovered. A future goal is to exploit this structure to assist in training data acquisition/labeling and interpretation of co-articulated muscle states.

**UNDERLYING TECHNOLOGIES**

- Co-articulation regions are analyzed into schematic muscle actuations using independent component analysis. Tools for facial tracking and gesture classification tasks have been developed.

**LIST OF PUBLICATIONS, REFERENCES, URLs**


- J-Y. Noh, D. Fidaleo, U. Neumann, Emotion Driven Facial Animation, IMSC/CGIT Internal Report, 2002.
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- R. Enciso, J. Li, DA Fidaleo, T-Y. Kim, J-Y. Noh and U. Neumann, Synthesis of 3D Faces, Proceedings Digital and Computational Video 1999.
- D. Fidaleo, J-Y. Noh, T-Y Kim, R. Enciso, and U. Neumann, Classification and Volume Morphing for Performance-Driven Facial Animation, Proceedings Digital and Computational Video 1999.
- http://graphics.usc.edu/cgit/ (lab web page)


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