

December 12, 2009

University of Southern California

Affective Computing CSCI534

Spring 2009 (Prior syllabus found [here](#))

Objective:

Affective Computing is computing that relates to, arises from, or deliberately influences emotions. This course will overview the theory of human emotion (how it arises from and influences cognition, the body and the social environment), techniques for recognizing and synthesizing emotional behavior, and illustrate how these can be applied to application design. The graduate Computer Science and Computer Engineering major will gain a strong background in the theory and practice in human-centered computing as it relates to games, immersive environments and pedagogical applications.

I Instructors: Stacy Marsella and Jonathan Gratch

Class Number/Units: 3

Date/Time: Thursday 2-4:50, KAP 158

Grades: Grades determined by class participation 10%, in-class quizzes 30%, mid-term project presentation 10%, homework 10%, final project presentation 15%, final project writeup 25%

Note: **Prior projects can be found [here](#)**

Software: Students will gain knowledge and/or hands-on experience with the following software tools related to affective computing:

- Emotion Recognition Techniques
 - Face (Watson, CERT, OKAO, other tools)
 - Speech (Shri, sentiment analysis)
 - Physiological signals
 - Gesture recognition
- Emotion Synthesis Techniques
 - Facial expressions (Smartbody)
 - Gestures (NVBG)
 - Gaze/Posture
- Machine Learning (Gesture toolkit)

Course Outline (Tentative)

Classes end may 1

Related readings (Coats, Feldman, & Philippot, 1999; Gifford, 1994; van Kleef, De Dreu, & Manstead, 2004)

Feb 19

How do we elicit emotion?

- Discuss how we can predictably elicit emotion from people for the purpose of entertainment or study (Guest lecture, Ning Wang)
- Play with “emotion-eliciting” games in class
- Project proposals presentations, comments

Feb 26

How is emotion displayed? ([Slides-Lee](#)) ([Slides-Lance](#))

Guest lecturers: Brent Lance and Jina Lee

- Discuss characteristics of emotional displays
- Discuss computational methods for animating emotional displays

READINGS:

Smartbody (Thiebaut, Marshall, Marsella, & Kallmann, 2008) ([PDF](#))

NVBG (Lee & Marsella, 2009) ([PDF](#))

Emotional Gaze (Lance & Marsella, 2008) ([PDF](#))

Mar 5

Emotion recognition ([Slides-Busso](#)) ([Slides-Gratch](#))

- Using speech analysis. Fuest lecture: Carlos Busso (USC Signal Analysis & Interpretation Lab)
- Applications of emotion recognition to building rapport

SUGGESTED READINGS:

(Gratch, Wang, Gerten, & Fast, 2007)

Chul Min Lee and Shrikanth Narayanan. Towards detecting emotions in spoken dialogs. IEEE Transactions on Speech and Audio Processing, 13(2):293–302, 2005.

<http://sail.usc.edu/publications/emotion-cml-journal.pdf>

Michael Grimm, Emily Mower, Kristian Kroschel, and Shrikanth Narayanan. Primitives based estimation and evaluation of emotions in speech. Speech Communication, 49:787–800, Nov 2007.

http://sail.usc.edu/publications/spcom_grimm.pdf

Carlos Busso, Sungbok Lee, and Shrikanth Narayanan. Using neutral speech models for emotional speech analysis. In Proceedings of InterSpeech ICSLP, Antwerp, Belgium, August 2007. URL:

http://sail.usc.edu/publications/busso_icslp07.pdf

Mar 12

Emotion recognition (continued)

- Using machine vision. Guest lecture (Morency)

Suggested Readings:

(Vinciarelli, M.Pantic, Bourlard, & Pentland, 2008) [\(PDF\)](#)

(Poppe, 2007) [\(PDF\)](#)

(Pantic & Bartlett, 2007) [\(PDF\)](#)

(Murphy-Chutorian & Trivedi, 2008) [\(PDF\)](#)

(Hansen & Ji, 2009) [\(PDF\)](#)

March 16-21 (spring break).

Mar 26 **Beyond human emotion (Emotions in art, theater, games)**

- Theatrical behavior: Guest lecture on artistic theatrical systems (Sharon Carnicke, Associate Dean, USC Theater School)
- Emotions in game design: Tentative guest lecture (Tracy Fullerton)

April 2 **Tour of ICT. Presentation of demo systems** (stacy out)

April 9 **Beyond human emotion (continued)** (jon out)

April 16 **Emotional applications** (jon out)

April 23 **Final project presentations**

April 30 **Final project presentations**

Bibliography

Bechara, A., & Damasio, A. R. (2005). The somatic marker hypothesis: a neural theory of economic decision. *Games and Economic Behavior*, 52, 336-372.

Bechara, A., Damasio, H., Antonio Damasio, & Lee, G. (1999). Different Contributions of the Human Amygdala and Ventromedial Prefrontal Cortex to Decision-Making. *Journal of Neuroscience*, 19(13), 5473-5481.

Coats, E. J., Feldman, R. S., & Philippot, P. (1999). The influence of television on children's nonverbal behavior. In P. Philippot, R. S. Feldman & E. J. Coats (Eds.), *The social context of nonverbal behavior* (pp. 156-181). Paris: Cambridge University Press.

Gifford, R. (1994). A Lens-Mapping Framework for Understanding the Encoding and Decoding of Interpersonal Dispositions in Nonverbal Behavior. *Journal of Personality and Social Psychology*, 66(2), 398-412.

Gratch, J., & Marsella, S. (2005). Lessons from Emotion Psychology for the Design of Lifelike Characters. *Applied Artificial Intelligence*, 19(3-4), 215-233.

Gratch, J., Marsella, S., & Petta, P. (2009). Modeling the Antecedents and Consequences of Emotion. *Journal of Cognitive Systems Research*, 10(1), 1-5.

- Gratch, J., Wang, N., Gerten, J., & Fast, E. (2007). *Creating Rapport with Virtual Agents*. Paper presented at the 7th International Conference on Intelligent Virtual Agents.
- Hansen, D. W., & Ji, Q. (2009). In the Eye of the Beholder: A Survey of Models for Eyes and Gaze. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 99(1).
- Lance, B., & Marsella, S. (2008). *A Model of Gaze for the Purpose of Emotional Expression in Virtual Embodied Agents*. Paper presented at the 7th Int. Conf. on Autonomous Agents and Multiagent Systems.
- LeDoux, J. (1996). *The Emotional Brain: The Mysterious Underpinnings of Emotional Life*. New York, NY: Simon & Schuster.
- Lee, J., & Marsella, S. (2009). *Learning a Model of Speaker Head Nods using Gesture Corpora*. Paper presented at the 7th International Conference on Autonomous Agents and Multi-Agent Systems, Budapest, Hungary.
- Marsella, S., & Gratch, J. (2009). EMA: A Model of Emotional Dynamics. *Journal of Cognitive Systems Research*, 10(1), 70-90.
- Murphy-Chutorian, E., & Trivedi, M. M. (2008). Head Pose Estimation in Computer Vision: A Survey. *IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI)*.
- Panskepp, J. (1998). *Affective Neuroscience: The Foundations of Human and Animal Emotions*. New York: Oxford University Press.
- Pantic, M., & Bartlett, M. (2007). Machine analysis of facial expressions. In K. Delac & M. Grgic (Eds.), *Handbook of Face Recognition* (pp. 377–416): I-Tech Education and Publishing.
- Poppe, R. (2007). Vision-based human motion analysis: An overview. *Computer Vision and Image Understanding*, 108(1-2), 4-18.
- Thiebaut, M., Marshall, A., Marsella, S., & Kallmann, M. (2008). *SmartBody: Behavior Realization for Embodied Conversational Agents*. Paper presented at the International Conference on Autonomous Agents and Multi-Agent Systems.
- van Kleef, G. A., De Dreu, C. K. W., & Manstead, A. S. R. (2004). The interpersonal effects of anger and happiness in negotiations. *Journal of Personality and Social Psychology*, 86(1), 57-76.
- Vinciarelli, A., M.Pantic, Bourlard, H., & Pentland, A. (2008). *Social signal processing: state-of-the-art and future perspectives of an emerging domain*. Paper presented at the 16th ACM international conference on Multimedia.