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University of Southern California

Affective Computing CSCI534

Fall 2011

Objective:

Affective Computing is computing that relates to, arises from, or deliberately influences emotions. This course overviews 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.

Instructors: Stacy Marsella and Jonathan Gratch

Class Number/Units: 3

Date/Time: Thursday 2-4:50

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%

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

- Emotion Recognition Techniques
- Emotion Synthesis Techniques
- Cognitive and Emotional Modeling
- Machine Learning algorithms that support the above methods

A complete list of pre-existing software tools available to students, and summaries of prior student projects build with these tools can be found [here](#)

Course Outline (Tentative)

- Aug 25 **Introduction and Course Overview ([SLIDES](#))**
- Overview structure of the course
 - Discuss what emotion is and why it is of interest to computation.
 - Overview applications that utilize emotion
 - Overview the modeling of emotion
- READING: ([Gratch & Marsella, 2005](#))
- Sep 1 **Psychological perspectives on human emotion ([SLIDES](#)) ([SLIDES-Pt2](#))**
- Present psychological theories of how emotions arise from an appraisal of the relationship between external events and internal beliefs, desires and intentions.
 - Discuss value of computationally modeling these processes
 - Discuss computational models and applications influenced by this view
- READING: ([Marsella, Gratch & Petta, 2010](#)) only through page 13
HOMEWORK (due 9/8): [Homework 1](#)
OPTIONAL: [Definition of emotional terms](#)
(Scherer, 2010) ([PDF](#))
[Emotion Misattribution](#)
- Sep 8 **Psychological perspectives on human emotion II ([SLIDES](#))** - partial
- No additional reading
- OPTIONAL: [Essay on complexity of computational models](#)
- Sep 15 **Guest Lecture on Theory of Mind Reasoning ([SLIDES](#))**
- Present PsychSim architecture for theory of mind reasoning
 - Show how social appraisals can be represented in such a system
- READING: ([Pynadath et al., forthcoming](#))
- Sep 22 **Emotion as social signal ([SLIDES](#))**

- Discuss how emotional behaviors are social signals that influence behavior of others
- Discuss how emotions arise from the perception of emotion's in others and interactive processes such as social contagion, empathy, rapport.
- Overview applications that exploit these social cues for teaching and persuasion

READINGS: None

OPTIONAL:

(Keltner & Haidt, 1999) ([PDF](#))

(de Melo, Gratch, & Carnevale, 2011) ([PDF](#))

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

Sep 29

Nonverbal behavior generation ([SLIDES](#))

- Discuss Nonverbal behavior generation
- Discuss and present a variety of tools for recognizing, modeling, and synthesizing affect
- In-class time to discuss/plan project proposals

OPTIONAL READINGS:

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

[NVBG](#) (Lee & Marsella, 2006,2009)

READINGS: None

Oct 6

Short Project proposals & TBD

Project proposals presentations, comments

Oct 13

Bottom Up emotional processes ([SLIDES](#))

- Continue project presentations

- Oct 20 **Culture & Emotion recognition from speech** ([Culture-Slides](#)) ([Speech-Slides](#))
- Guest lecture on emotion and culture (Dehghani)
 - Guest lecture on emotion recognition from speech (SAIL Lab)
- Suggested Readings:
 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
- Oct 27 **Emotion, Learning and the Brain** ([Tutoring](#)) ([Brain](#))
- Lecturing on emotion and tutoring
 - Lecture on emotion and the brain
- Suggested readings:
- Baker, R., D'Mello, S., Rodrigo, M., Graesser, A. (2010). **Better to be frustrated than bored: The incidence and persistence of affect during interactions with three different computer-based learning environments.** International Journal of Human-Computer Studies, 68 (4), 223-241.
[\[PDF\]](#) PRE PRINT DRAFT
 - [Computational modeling of emotion: Explorations through the anatomy and physiology of fear conditioning](#) (Armony, Servan-Schreiber, Cohen, & LeDoux, 1997)
- Nov 3 **Emotion Recognition from Vision** ([Intro](#)) ([Lecture](#))
- Nov 10 **Tour ICT (Tentative)**
- Nov 17 **Emotion in the Brain (continued); Emotion in the Arts**
- Guest Lecture: Neuroscience: [Lin Xiao](#) – Brain and Creativity Institute
 - Guest Lecture: Theatrical behavior: Tentative Guest lecture on artistic theatrical systems: [Sharon Carnicke](#) – Associate Dean, School of Theater
- Nov 24 **Thanksgiving**

Dec 1

Final project presentations

Bibliography

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- Bechara, A., Damasio, H., AntonioDamasio, & 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.
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- de Melo, C., Gratch, J., & Carnevale, P. J. (2011). *Reverse Appraisal: Inferring from Emotion Displays who is the Cooperator and the Competitor in a Social Dilemma*. Paper presented at the Cognitive Science Conference.
- Keltner, D., & Haidt, J. (1999). Social Functions of Emotions at Four Levels of Analysis. *Cognition and Emotion*, 13(5), 505-521.
- Scherer, K. R. (2010). Emotion and emotional competence: conceptual and theoretical issues for modelling agents. In K. R. Scherer, T. Bänziger & E. Roesch (Eds.), *A blueprint for affective computing: A sourcebook and manual*. New York: Oxford University Press.