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University of Southern California

Affective Computing CSCI534

Fall 2018

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.

Instructor: [Jonathan Gratch](#)

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Date/Time: Mon, Wed 330-5:20, THH 116

Grades: Grades determined by class participation 10%, mid-term project presentation 15%, homework 40%, final project presentation 15%, final project writeup 20%

The course is largely project based. Students are expected to work in teams to develop, executed and present a research project. Students are encouraged to build on existing tools. A complete list of pre-existing software tools available to students, and summaries of some prior student projects build with these tools can be found [HERE](#) . Project guidelines can be found [HERE](#)

Source book: [Oxford Handbook of Affective Computing](#) (OHAC): useful but not required

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

Course Outline

(**WARNING: Below will evolve somewhat throughout the semester**). Most current version will be [HERE](#). Don't get more than 1 week ahead on readings. The same topics will be presented but some changes to reading lists may occur. Homework will be added)

Lecture 1 (Aug20) Course Overview. Introduction to Affective Computing

- Review structure of course
- What is affective computing?
- Broadly overview functions of affect and why of interest to computer science
- Overview applications that take advantage of these perspective
- Readings:
 - [OHAC, Chapter 1](#) (skim). Summarizes major topics in affective computing
- Optional Readings:
 - [OHAC, Chapter 2](#). Entertaining retrospective on field of affective computing from founder of the field
- [Lecture slides](#)

Lecture 2 (Aug 22) Emotion Theory

- Define affective phenomena (emotion, mood, attitude/sentiment, personality)
- What is theory and why does it matter?
- Review alternative theoretical perspectives on emotion
- **Homework Exercise 1:** (Estimated time, 15min) Due Aug 26, midnight
- Readings
 - [OHAC, Chap 3](#). Short history of psychological perspectives on emotion
 - [Barrett video interview](#) (first 15min): Outlines alternative theories of emotion
- Optional readings
 - [Scherer\(2010\)](#), p10-19: Another take on alternative theories of emotion
 - [LeDoux 2012](#): Neuroanatomy take on the meaning of emotion
 - [The science of 'Inside Out'](#)
- [Lecture slides](#)

Lecture 3 (Aug 27) Emotion Theory (continued)

- Dual-process theories of emotion
- Constructivist theories
- Appraisal theories (continued)
- Download and bring to class: [Stim1](#); [Stim2](#)
- Optional Readings
 - [Ellsworth and Scherer 2003](#): review of appraisal theories
 - [Smith and Lazarus 1990](#): description of their appraisal and coping theory
- [Lecture slides](#)

Lecture 4 (Aug 29) Giving Computers Emotion (part 1)

- **Homework 2** (Due Sep 5, midnight): Appraisal modeling (assigned Thursday 30)
- Discuss ways to make machines "have" emotions
- Introduce Computational Appraisal Theory
 - Discuss plan-based approaches (EMA)
 - Discuss reinforcement learning based approaches
 - Introduce component framework
- Reading- [Marsella, Gratch and Petta \(2010\)](#): reviews modeling research

- Reading- [Marsella and Gratch \(2009\)](#), sections 1.1, 1.2, 2 and 3: describes model of “the Bird”
- Optional reading: [Moerland et al. \(in press\)](#): Survey of Emotion in Reinforcement Learning
- [Lecture slides](#)

Sep 3: Labor Day (NO CLASS)

Lecture 5 (Sep 5) Experimental Design, Methodology and Analysis

- Guest Lectures by [Gale Lucas](#), USC ICT
- Reading:
 - sparknotes reading on [Research Methods in Psychology](#), a good summary of research methods. You have to click through each section separately to read. Or, if you pay Barnes and Noble \$5 you can get a “clean” version w/o ads [here](#)
- **Homework 3** (Due **Sep 16**, midnight): Experimental design and analysis (I initially had wrong date on the syllabus)
- [Lecture slides](#)

Lecture 6 (Sep 10) Giving Computers Emotion (part 2)

- Discussion of reinforcement learning based approaches to appraisal modeling
- Framework for evaluating computational models
- [Lecture slides](#)

Lecture 7 (Sep 12) Emotion and Decision-making

- Review rational choice theory (decision theory)
- Emotion and decision making
- Contrast between human and rational decisions (e.g. prospect theory)
- Reading: [Lowenstein and Lerner 2003](#), p620-633. You should understand figure 31.1
- Reading: Watch PBS’s “[Mind over Money](#)”
- Optional Reading:
 - [Lerner video interview](#): Outlines alternative theories of emotion
 - [Mellers et al 1999](#): Emotion-based choice
- [Lecture slides](#)

Lecture 8 (Sep 17) Emotion and the Brain

- **Homework 4**: Decision modeling (Due Midnight Monday Sep 24)
- Overview of physiological and brain Computing
- Focus on some affective computing approaches to brain measurement
- Reading (Sep24): [Fairclough 2009](#) – Fundamentals of physiological computing
- Optional Reading: [OHAC, Chap 15](#): Discusses affective brain-computer interfaces
- Optional Reading: [Davidson et al. 2003](#): Reviews some neuroanatomy of emotion
- Optional Reading: [Arani et al., 2015](#): Example of using fNIRS for affective computing.
- Outside resource (Sep24): [Brain-Computer Interface Tutorial](#)
- [Lecture slides](#)

Lecture 9 (Sep 19) Group project discussion

- Discussion of group projects. Explore topics and tentative teams

Lecture 10 (Sep 24) Emotion and the Body

- **Homework exercise 5** (Due Oct 3, midnight): Classifying physiological signals
- Overview psychophysiological impacts of emotion
 - Review biopsychosocial model of challenge / threat
 - Review physiological manifestation of coping responses

- Discuss cardiovascular measures of emotion and coping
- Reading: [Blascovich & Mendes 2010](#): Reviews psychophysiological findings. Only required to read following sections:
 - Neurophysiological systems, advantages & Indices (p199-203)
 - Uses [affect, attitudes, emotion] (p 210-215)
- Optional Reading: [OHAC, Chap 14](#): Reviews physiological sensing of emotion
- [Lecture slides](#)

Sep 26: NO CLASS

- Watch [Lecture10 Part 2](#)
- Watch [Cuddy body language TED Talk](#)
- [Lecture slides](#)

Lecture 11 (Oct 1) Bodily Expression of Emotion

- Physical manifestation of peripheral psychophysiology
- Embodied theories of emotion
- Reading: [Niedenthal 2007](#): Discusses embodied approaches to emotion
- [Lecture slides](#)

Lecture 12 (Oct 3) Group Project Proposal Presentations

- Students will give 5min presentations of their project

Lecture 13 (Oct 8) Synthesis of Emotional Behavior

- Encoding-Decoding: realistic vs. communicative approaches
- Expression synthesis techniques
- Demonstration of virtual human toolkit (Guest lecture, Arnold Hartholt and group)
- Reading: [OHAC, Chapter 18](#), Section 2 only; Digital expression synthesis
- Reading: [OHAC, Chapter 21](#), Section 3 only; Robotic expression synthesis
- Optional Reading: [Parkinson2008](#): Emotions in social interactions
- Optional Reading: [OHAC, Chapter 20](#); Emotional speech synthesis
- Optional Reading: [OHAC, Chapter 19](#); Gesture & postures synthesis
- [Lecture slides](#) , [Tutorial Slides](#)

Lecture 14 (Oct 10) Emotion and Social Interaction I

- **Homework 6:** Behavioral game theory (assigned tue; Due Midnight Sunday Oct 14th; 10% bonus for completing before class on Oct 10)
- Review rational choice theory (game theory)
- Review of behavioral game theory
 - Other-regarding preferences
- Psychological Distance and Mind perception theory
- Reading: [Game Theory Introduction](#), p1-11
- Reading: [Gray & Wegner 2012](#): Discusses mind-perception theory and uncanny valley
- Optional Reading: [Behavioral Game Theory](#) (from handbook on judgment and decision-making)
- Optional Reading: [Fehr and Schmidt](#) on other-regarding preferences
- [Lecture slides](#)

Lecture 15 (Oct 15) Emotion and Social Interaction II

- **Homework 7:** Affect Control Theory
- Theories of the social impact of emotion expressions
 - Emotion as contagion

- Emotion as social information (Reverse Appraisal Theory)
- Computational Models: Affect Control Theory
- Reading: [de Melo et al 2014](#), introduction, exp1, and general discussion: describes “reverse appraisal”
- Optional Reading: [Affect Control Theory](#)
- Optional Reading: [Keltner and Haidt 1999](#): discusses social functions of emotions
- [Lecture slides](#)

Lecture 16 (Oct 17) Emotion and Social Interaction III

- Fridlund vs. Ekman: Are expressions basic emotions or social motives?
- Emotional Labor
- Role of affective computing in emotional labor
- Optional Reading: [Scarantino, in press](#): Gives nice review of theories of facial expressions and proposed model of emotion displays as “speech acts”
- [Lecture slides](#)

Lecture 17 (Oct 22) Personality and Culture

- Guest Lecture by [Gale Lucas](#), USC ICT
- Personality computing
 - Review Lens model
 - Discuss automatic personality recognition, perception, synthesis
- Personality (and motivation) in computer games
- Limitations of personality computing approach
- Sacred values and Moral decision making
- Need for Cognition Experiment
- Optional Reading: [Haidt and Graham 2007](#): review of moral foundation theory
- Optional Reading: [Vinciarelli and Mohammadi 2014](#): survey of personality computing
- Optional Reading: [Yee et al 2011](#): expression of personality in World of Warcraft
- Optional Reading: [Connelly and Ones 2010](#): Discusses limits of personality approach
- [Lecture slides](#)

Lecture 18 (Oct 24) Emotion and Negotiation

- Negotiation as a challenge problem for affective computing
- Strategic emotions: Misrepresentation game
- Optional Reading: [Gratch et al 2015](#): the misrepresentation game
- [Lecture slides](#)

Lecture 19 (Oct 29) Rapport and attunement

- **Homework 8: Facial expression analysis**
- Emotional feedback and attunement
- Rapport agent. Review learning approaches.
- Optional Reading: [Parkinson 2014](#): reviews theories of social emotions
- Optional Reading: [Tutorials on nonlinear methods](#)
- [Lecture slides](#)

Lecture 20 (Oct 31) Emotion Recognition I: Emotion in Text

- Word embeddings?
- Reading: [OHAC, Chapter 13](#); Recognizing affect from text
- [Lecture slides](#)

Lecture 21 (Nov 5) Emotion Recognition II:

- Emotion and the face
- Impact of context in emotion recognition
- Reading: [OHAC, Chapter 10](#); Face expressions
- Optional Reading: Bin Lu, [Web Data Mining Chap11](#)
- Optional Reading: [Barrett et al 2011](#); Contextual influences on emotion perception
- [Lecture slides](#)

Lecture 22 (Nov 7) Emotion Recognition IV: Emotion in speech

- Emotion in speech
- Reading: [OHAC, Chapter 12](#); recognizing affect from speech
- [Lecture slides](#)

Lecture 23 (Nov 12) Emotion Recognition III: Learning representations and multimodal

- **Guest Lecture Mohammad Soleymani:**
- Multimodal techniques and machine learning
- Recommended Reading: [Baltrušaitis et al 2018](#): Survey of Multimodal ML approaches
- Optional Reading: [D'Melo et al 2015](#): Another survey of MM ML approaches
- [Lecture slides](#)

Lecture 24 (Nov 14) Aesthetic Emotions

- Guest Lecture: Mohammad Soleymani
- Discuss techniques to classify the “emotion” of music. Recommender systems
- Optional Reading: [Juslin 2013](#): Unified theory of musical emotions
- Optional Reading: [Yang and Chen 2012](#): Review of emotion recognition in music
- Optional Reading: [Renfrow et al 2011](#): Five-factor labeling scheme for music
- [Lecture slides](#)

Lecture 25 (Nov 19) Ethics

- **Homework 10**
- Discuss theories of how social machines might help or hinder human social interactions
- Discuss ethical frameworks
- Identity and mind perception
- Reading: [OHAC, Chapter 14](#)
- Optional Reading: [Robot sex](#): discusses ethics of building robots that have relations with people
- Optional Reading: [Turkle 2010](#): Discussion of robot companions
- [Lecture slides](#)

Thanksgiving

Lecture 27 (Nov 26) Final Project Presentations

Lecture 28 (Nov 28) Final Project Presentations

Dec 5: Final project writeup due

