

Updated: April 2, 2020

University of Southern California

Affective Computing CSCI534

Spring 2020

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 illustrates 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 health, entertainment and pedagogical applications.

Instructor: [Jonathan Gratch](#)

TA: Emmanuel Johnson <emmanuej@usc.edu>

Date/Time: Mon, Wed 330-5:20, Room THH 210

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 (of approximately 4 students) 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
- Algorithms and tools that support the above methods
- Human-subjects experimental design and analysis
- Ethical issues in AI

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 (Mon, Jan13) 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
- **Homework 1: Emotion prediction (on blackboard):** Estimated time, 20-30 min, Due Friday Jan 17th, midnight
- Readings:
 - Are we now in the era of *affectivism*?
 - [OHAC, Chapter 1](#) (skim). Summarizes major topics in affective computing
- Optional background readings:
 - Are we now in the era of affectivism? – A position paper (available via blackboard)
 - [OHAC, Chapter 2](#). Entertaining retrospective on field of affective computing from founder of the field
- [Lecture slides](#)

Lecture 2 (Wed, Jan 15) Emotion Theory

- Define affective phenomena (emotion, mood, attitude/sentiment, personality)
- What is theory and why does it matter?
- Review alternative theoretical perspectives on emotion
- Readings
 - [OHAC, Chap 3](#). Short history of psychological perspectives on emotion
 - [Barrett video interview](#) (first 15min): Outlines alternative theories of emotion
- Optional background readings
 - [The science of 'Inside Out'](#): Short piece by Dacher Keltner and Paul Ekman about the Pixar movie
- [Lecture slides](#)

January 20: Martin Luther King's Birthday (no class)

Lecture 3 (Wed, Jan 22) Emotion Theory (continued)

- Dual-process theories of emotion
- Constructivist theories
- Appraisal theories (continued)
- Download and bring to class: [Stim1](#); [Stim2](#)
- **Homework 2 (Part 1): Complete short survey in advance of Lecture 4** (Due Sun Jan 26th, midnight)
- 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 (Mon, Jan 27) Experimental Design, Methodology and Analysis

- Guest Lectures by [Gale Lucas](#), USC ICT
- **Homework 2 (part 2): Experimental design and analysis** (Due Jan 31, midnight)

- Reading:
 - sparknotes reading on [Research Methods in Psychology](#), a good summary of research methods. You have to click through each section separately to read.
- [Lecture slides](#)

Lecture 5 (Wed, Jan 29) Giving Computers Emotion (part 1)

- Discuss ways to make machines “have” emotions
- Introduce Computational Appraisal Theory
- **Homework 3: Appraisal modeling** (Due Feb 5, midnight)
- Reading-
 - [Marsella and Gratch \(2009\)](#), sections 1.1, 1.2, 2 and 3: describes model of “the Bird”
- Optional reading:
 - [Emotional Calculator](#): a short description of how the Emotion Calculator (HW1) was created
 - [Emotion Analyst](#): a published paper describing how the emotion analyst works.
- [Lecture slides](#)

Lecture 6 (Mon, Feb 3) Giving Computers Emotion (part 2)

- Discussion of reinforcement learning based approaches to appraisal modeling
- Discuss framework for evaluating computational appraisal models
- **Homework 4 (part 1): Short decision-making survey** (Due Feb 4, midnight)
chance to earn some extra credit
- Reading
 - [Marsella, Gratch and Petta \(2010\)](#): reviews modeling research. Focus on pp. 31-40.
- Optional reading:
 - [Moerland et al. \(2018\)](#): Survey of Emotion in Reinforcement Learning
- [Lecture slides](#)

Lecture 7 (Wed, Feb 5) Emotion and Decision-making

- Review rational choice theory (decision theory)
- Contrast between rational models and human decision making
- **Homework 4 (part2): Decision modeling** (Due Feb 16, midnight)
- Reading:
 - [Lowenstein and Lerner 2003](#), p620-633. You should understand figure 31.1
- Strongly encouraged:
 - Watch NOVA’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 (Mon, Feb10) Emotion and the Brain

- 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
 - [Davidson et al. 2003](#): Reviews some neuroanatomy of emotion
 - [Arani et al., 2015](#): Example of using fNIRS for affective computing.

- Outside resource: [Brain-Computer Interface Tutorial](#)
- [Lecture slides](#)

Lecture 9 (Wed, Feb 12) Group project discussion

- Discussion of group projects. Explore topics and tentative teams
 - Expect students to sit in tentative groups. Use class time to develop your ideas. I will circulate through class, expect short “pitches” and give feedback
- [Lecture slides](#)

February 17: President’s Day (no class)

- **Homework 5: Classifying physiological signals** (Due Feb 27, midnight)

Lecture 10 (Wed, Feb 19) Emotion and the Body

- 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](#)

Lecture 11 (Mon, Feb 24) Bodily Expression of Emotion

- Physical manifestation of peripheral psychophysiology
- Embodied theories of emotion
- Reading: [Niedenthal 2007](#): Discusses embodied approaches to emotion
- Optional Reading:
 - [Zacharatos et al. 2014](#). A survey of automatic emotion recognition based on body movement analysis
- [Lecture slides](#)

Lecture 12 (Wed, Feb 26) Group Project Proposal Presentations

- Students will give 5min presentations of their project
- **Homework 6 (part 1): Behavioral game theory** (Assigned Feb27; Due Mar 1, midnight)

Lecture 13 (Mon, Mar 2) Synthesis of Emotional Behavior

- Encoding-Decoding: realistic vs. communicative approaches
- Expression synthesis techniques
- Demonstration of virtual human toolkit (**Guest lecture**, Adam Reilly)
- **Homework 6 (part 1): Behavioral game theory** (Due Mar 9, 11:59pm)
- 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
 - [OHAC, Chapter 20](#); Emotional speech synthesis
 - [OHAC, Chapter 19](#); Gesture & postures synthesis

- [Lecture slides](#) , [Tutorial Slides](#)

Lecture 14 (Wed, Mar 4) Emotion and Social Interaction I

- 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
- Optional Reading:
 - Fund game about learning game theory: (<https://ncase.me/trust/>)
 - [Behavioral Game Theory](#) (from handbook on judgment and decision-making)
 - [Fehr and Schmidt](#) on other-regarding preferences
- [Lecture slides](#)

Lecture 15 (Mon, Mar 9) Emotion and Social Interaction II

- Theories of the social impact of emotion expressions
 - Emotion as contagion
 - Emotion as social information (Reverse Appraisal Theory)
- Computational Models: Affect Control Theory
- **Homework 7: Affect Control Theory** (Assigned Mar10; Due Mar 25, 11:59pm)
- 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 (Wed, Mar 11) 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](#), [webinar](#)

Spring Recess Sun-Sun March 15-22

Lecture 17 (Mon, Mar 23) Emotion and Social Interaction IV: Deception and Manipulation

- Negotiation as a challenge problem for affective computing
- Manipulative emotions
- Optional Reading:
 - [Okekalns2015](#): How emotions shape negotiation
 - [Gratch et al 2015](#): the misrepresentation game
- [Lecture slides](#), [webinar](#)

Lecture 18 (Mon, Mar 25) Personality and Culture

- **Homework 8: Facial expression analysis** (Due April 6, midnight)
- 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
- Optional Reading:
 - [Haidt and Graham 2007](#): review of moral foundation theory
 - [Vinciarelli and Mohammadi 2014](#): survey of personality computing
 - [Yee et al 2011](#): expression of personality in World of Warcraft
 - [Connelly and Ones 2010](#): Discusses limits of personality approach
- [Lecture slides](#), [webinar](#)

Lecture 19 (Mon, Mar 30) Rapport and entrainment

- **Short Homework 9: Text analysis (Due, April 1)**
- 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](#), [webinar](#)

Lecture 20 (Wed, Apr 1) Emotion Recognition I: Emotion in Text

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

Lecture 21 (Mon, Apr 6) Emotion Recognition II: Emotions in 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, webinar

Lecture 22 (Wed, Apr 8) Emotion Recognition IV: Emotion in speech

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

Lecture 23 (Mon, Apr 13) 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 25 (Wed, Apr 15) 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

Lecture 24 (Mon, Apr 20) Aesthetic Emotions

- Guest Lecture: Mohammad Soleymani (tentative)
- 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 26(?) (Wed, Apr 22) Additional lecture or final project presentations if needed

Lecture 27 (Mon, Apr 27) Final Project Presentations

Lecture 28 (Wed, Apr 29) Final Project Presentations

May 6: Final project writeup due