Affective Computing CSCI534
Spring 2021

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. Students 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: Su Lei <slei@ict.usc.edu>
Date/Time: Mon, Wed 200-3:50, Online
Grades: Grades determined by class participation 10%, mid-term project presentation 15%, homework 40%, final project presentation 15%, final project writeup 20%

Class participation is expected and part of the grade. As this is a zoom-based course, students are expected to attend live, with video, and participate in in-class exercises and discussion.

The course is largely project based. Students are expected to work in teams (of approximately 4 students) to develop, execute and present a research project. Students are encouraged to build on existing tools. A list of some 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.


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

Note to Instructors: Other instructors are welcome to use these course materials. Please acknowledge the original source in footer of slides. Note some slides have been borrowed from other instructors as noted in the footers of presentation material.

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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 (Wed, Jan 20) 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 (posted on blackboard): Estimated time, 20-30 min, Due Sunday Jan 24th, midnight
• Readings:
  o Gratch 2021: The field of Affective Computing: An interdisciplinary Perspective
• Optional background readings:
  o OHAC, Chapter 1. Summarizes major topics in affective computing
  o Are we now in the era of affectivism? Draft article illustrating the growing importance of affective science
• Lecture slides, webinar

Lecture 2 (Mon, Jan 25) Emotion Theory

• Define affective phenomena (emotion, mood, attitude/sentiment, personality)
• What is theory and why does it matter?
• Review alternative theoretical perspectives on emotion
• Suggested Reading:
  o OHAC, Chap 3. Short history of psychological perspectives on emotion
• Optional background readings
  o The science of ‘Inside Out’: Short piece by Dacher Keltner and Paul Ekman about the Pixar movie
• Lecture slides, webinar

Lecture 3 (Wed, Jan 27) Emotion Theory (continued)

• Dual-process theories of emotion
• Constructivist theories
• Appraisal theories (continued)
• Homework 2 (part 1): Appraisal modeling (short online survey, Due Jan 31, 11:59pm)
• Optional Readings
  o Ellsworth and Scherer 2003: review of appraisal theories
  o Smith and Lazarus 1990: description of their appraisal and coping theory
• Lecture slides, webinar

Lecture 4 (Mon, Feb 1) Giving Computers Emotion (part 1)

• Discuss ways to make machines “have” emotions
• Introduce Computational Appraisal Theory
• Homework 2 (part 2): Appraisal modeling (Due Feb 5, 11:59pm)
• Reading:
  o Marsella and Gratch (2009), sections 1.1, 1.2, 2 and 3: describes model of “the Bird”
• Optional reading:

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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, webinar

Lecture 5 (Wed, Feb 3) Giving Computers Emotion (part 2)
Discussion of reinforcement learning based approaches to appraisal modeling
Discuss framework for evaluating computational appraisal models
Homework 3 (part 1): Short decision-making survey (Due Feb 7, midnight)
*chance to earn some extra credit*
Reading
Optional reading:
Moerland et al. (2018): Survey of Emotion in Reinforcement Learning
Lecture slides, webinar

Lecture 6 (Monday, Feb 8) Emotion and Decision-making
Review rational choice theory (decision theory)
Contrast between rational models and human decision making
Homework 3 (part 2): Decision modeling (Due Feb 17, midnight)
Homework 4 (Part 1): Complete short survey in advance of Lecture 4 (Due Feb 9, 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: A model of how emotions shape decisions – we will discuss in class
Lecture slides, webinar

Lecture 7 (Wed, Feb 10) Experimental Design, Methodology and Analysis
Guest Lectures by Gale Lucas, USC ICT
Homework 4 (part 2): Skipping this one due to schedule snafu (may add HW at end)
Reading:
SparkNotes reading on Research Methods in Psychology, a good summary of research methods. You have to click through each section separately to read.
Recommended Reading
Its only a computer: This study will be discussed as part of lecture
Lecture slides, webinar

February 15: President’s Day (no class)

Lecture 8 (Wed, Feb 17) Emotion and the Brain
Overview of physiological and brain Computing
Focus on some affective computing approaches to brain measurement
Homework 5: Classifying physiological signals (Due Feb 28, midnight)
Reading (Sep24):
Fairclough 2009 – Fundamentals of physiological computing
Optional Reading:
 Lecture 9 (Mon, Feb 22) 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 10 (Wed, Feb 24) 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
    Project descriptions: 1 paragraph tentative project description and team list (Due Feb 25, 11:59pm)
  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, webinar

 Lecture 11 (Mon, Mar 1) 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, webinar

 Lecture 12 (Wed, Mar 3) Group Project Proposal Presentations
  Students will give 5min presentations of their project
  webinar

 Lecture 13 (Mon, Mar 8) Synthesis of Emotional Behavior
  Homework 6 (part 1): Behavioral game theory (Due Mar 10, before class)
  Encoding-Decoding: realistic vs. communicative approaches
  Expression synthesis techniques
  Demonstration of virtual human toolkit (Guest lecture, Arno Hartholt)
  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
Lecture 14 (Wed, Mar 10) Emotion and Social Interaction I
- completing before class on Oct 10
- Review of rational choice theory (game theory)
  - Other-regarding preferences
- Review of behavioral game theory
  - Psychological Distance and Mind perception theory
- Homework 7: Affect Control Theory (Due Mar 17, 11:59pm)
  - Reading: Game Theory Introduction, p1-11
  - Optional Reading:
    - Fund game about learning game theory: [https://ncase.me/trust/](https://ncase.me/trust/)
    - Behavioral Game Theory (from handbook on judgment and decision-making)
    - Fehr and Schmidt on other-regarding preferences

Lecture slides, webinar

Lecture 15 (Mon, Mar 15) 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
- 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 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
- Homework 6 (part 2): Behavior game theory and emotional manipulation (Due March 24, 11:59p)
- 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 (Mon, Mar 22) 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

Lecture 18 (Wed, Mar 24) Personality and Culture
- Homework 8 (part 1): Recognizing emotion from text (Due Mar 29, midnight)
- Personality computing
  - Review Lens model

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Discuss automatic personality recognition, perception, synthesis

• Personality (and motivation) in computer games
• Limitations of personality computing approach
• Sacred values and Moral decision making

**Homework 8 (part 1): Recognizing emotion from text** (Due Mar 29, midnight)

- 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

**Lecture 19 (Mon, Mar 29) Rapport and entrainment**

- **Homework 8 (part 2): Recognizing emotion from text** (Due Apr 5, midnight)
- Emotional feedback and attunement
- Optional Reading: [Parkinson 2014](#): reviews theories of social emotions
- Optional Reading: [Tutorials on nonlinear methods](#)
- Lecture slides

**Lecture 20 (Wed, Mar 31) Emotion Recognition I: Emotion in Text**

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

**Lecture 21 (Mon, Apr 5) Emotion Recognition II: Emotions in the face**

- Impact of context in emotion recognition
- **Homework 9: Recognizing facial expressions** (Due Apr 16)
- 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

April 7: Wellness Day (no class)

**Lecture 22 (Mon, Apr 12) Emotion Recognition IV: Emotion in speech**

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

**Lecture 23 (Wed, Apr 14) 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, webinar

**Lecture 24 (Mon, Apr 19) Bias and Ethics of Affective Computing**

- **Homework 10 (Due April 21, 11:59pm)**

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- Discuss theories of how social machines might help or hinder human social interactions
- Potential for Bias
- Discuss ethical frameworks
- 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, webinar

**Lecture 25 (Wed, Apr 21) Aesthetic Emotions**
- 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 webinar

**Lecture 26 (Mon, Apr 26) Final Project Presentations**
- Lecture slides

**Lecture 27 (Wed, Apr 28) Final Project Presentations**

**May 7: Final project writeup due**