CMPSCI 590AC: Introduction to Affective Computing
(20969)

Course Information & Syllabus

Course Dates: July 11, 2016 – August 19, 2016

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COURSE DESCRIPTION:
Affective computing represents a broad, interdisciplinary research and practice area focusing on a range of topics, including: affect-adaptive human-computer interaction, affective user modeling, computational models of emotion, cognitive-affective agent architectures; emotion sensing and recognition; and emotion expression. The course will also explore applications of affective computing in a variety of contexts, including intelligent tutoring, affect-adaptive user interfaces, affective gaming, and intelligent social robots and virtual agents.

Introduction to affective computing will be provided through a combination of lectures, student presentations of selected literature, projects and class discussion. The course content and format will be appropriate for graduate and advanced undergraduate students in computer science, cognitive science, psychology, human factors, and industrial engineering, as well as students in the arts, digital media, gaming, and those interested in the use of technology in education and healthcare.

Learning Objectives:
This course will enable the participants to make informed decisions about the appropriateness of incorporating emotion in specific applications involving human-computer interaction, including affect-adaptive user interaction in intelligent tutoring, gaming, and interaction with robots and virtual characters. The course will provide the necessary background for selecting the relevant emotion theories, empirical data, and techniques and methods for sensing, recognition, modeling and expression of emotions, across a variety of contexts.

Prerequisites:
Graduate or Senior level in Computer Science or Engineering, or permission of instructor. Computer Science students should be familiar with a high-level
programming language. Familiarity with AI, and HCI is desirable, including familiarity with knowledge representation formalisms and symbolic reasoning. Three credits.

**COURSE ORGANIZATION:**

The course will taught via a combination of lectures (primarily), class discussion, presentations of selected readings by students, and final project presentations.

*Student Presentations:*
Reading material summaries and student projects will be presented using PPT or similar. Each presentation should include a summary, outlining the salient points, discussion of related work, and a critical evaluation of the benefits and shortcomings of the content.
ASSESSMENT:

Student knowledge of the course material will be assessed as follows: formal exam (midterm), paper presentations, class participation, and a final project. When taught in an on-line format, established protocol will be followed to ensure that the students comply with the honor code.

Projects:

There will be one project, due at the end of the semester. This may be one of the following:

(a) Research paper on a specific theoretical or applied topic
(b) Critical literature review of a particular topic
(c) Development of a computational model of some aspect of affective processing, an affective user model, or an affective agent architecture. Students may use existing systems / agents and augment these with the affective modules (e.g., augment an existing robot or a game NPC with a model of emotion generation).
(d) Development of an emotion sensing and recognition system, or an affective expression capability (e.g., augment an existing virtual character with the ability to display some of the basic emotions)

Grading:

Midterm: 35%
Paper presentations: 10%
Homeworks: 15%
Class participation: 5%
Final project: 35%

Late Work Policy:

Late work without a valid prior reason will automatically lose 10% of the possible points. Work that is turned in up to a week late will be penalized 10%. Work that is turned in more than one week late will be penalized 25%. Work that is turned in more than two weeks late will be penalized 50%. Work that is turned in more than three weeks after due date will not be graded.
WEEK-BY-WEEK OUTLINE:

**Week 1:**
Overview of course structure; Overview of affective computing;
Background on emotion research from psychology and neuroscience & its relevance
to affective computing

**Week 2:**
Emotion sensing and recognition; Emotion expression

**Week 3:**
Emotion modeling – overview; Research vs. applied models;
Models of emotion generation; Models of emotion effects on cognition and behavior

**Week 4:**
Design guidelines for emotion models; Cognitive-affective agent architectures;
Affect-adaptive HCI; Affective user modeling;

**Week 5:** (Lecture & Student Presentations)
Applications in affective virtual agents & social robotics

**Week 6:** (Lecture & Student Presentations)
Affective gaming; Ethical considerations; Future trends & challenges
# SUMMARY OF CLASS SCHEDULE & LECTURE FILES & HOMEWORKS

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<th>Date</th>
<th>Topics</th>
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<tr>
<td>July 11</td>
<td><strong>Week 1 (Lectures)</strong></td>
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<td>Course overview &amp; Administrivia</td>
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<td>590AC_WK1_Lec_0_Overview_Admin.ppt</td>
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<td></td>
<td>Overview and history of Affective Computing</td>
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<tr>
<td>July 13</td>
<td>Emotion research in psychology &amp; affective neuroscience &amp; its relevance for Affective Computing</td>
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<td>July 15</td>
<td>Emotion research in psychology &amp; affective neuroscience &amp; its relevance for Affective Computing (cont.)</td>
<td>590AC_WK1_Lec_2&amp;3_Emotion_Research.ppt (cont.)</td>
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<td>July 18</td>
<td><strong>Week 2 (Lectures)</strong></td>
<td>Homework #3: Due 7-25</td>
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<td>Emotion sensing &amp; recognition (Part 1)</td>
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<td>July 20</td>
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<td>July 22</td>
<td>Emotion expression</td>
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<td>July 25</td>
<td><strong>Week 3 (Lectures)</strong></td>
<td>Homework #4: Due 8-1</td>
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<td>Emotion modeling - overview; Research vs. Applied models</td>
<td>590AC_WK3_Lec_1_Overview_Emotion_Modeling.ppt</td>
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<td>July 27</td>
<td>Models of emotion generation via cognitive appraisal</td>
<td>590AC_WK3_Lec_2_Modeling_Emotion_Generation.ppt</td>
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<td>July 29</td>
<td>Models of emotion effects on cognition &amp; behavior</td>
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<td>July 31</td>
<td>Midterm – take home (emailed out)</td>
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<td>August 1</td>
<td><strong>Week 4 (Lectures)</strong></td>
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<td>Guidelines for designing emotion models</td>
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<td>August 3</td>
<td>Cognitive-affective agent architectures</td>
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<td>August 5</td>
<td>Affect-Adaptive HCI &amp; Affective User Modeling</td>
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<td>August 8</td>
<td><strong>Week 5 (Lectures &amp; student presentations)</strong></td>
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<td>Midterm due – August 8 (8am)</td>
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<td>August 8</td>
<td>Social Agents &amp; Robots &amp; Believability</td>
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<td>590AC_WK5_Lec_1_Social_Agents_Robots_Believability.ppt</td>
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<td>August 10</td>
<td>Affective Virtual Agents and Social Robots</td>
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<td>August 12</td>
<td>Applications of Virtual Agents &amp; Social Robots (student summaries &amp; presentations) (No lecture)</td>
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<td>August 15</td>
<td>Week 6 (Lectures &amp; student presentations)</td>
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<td>August 15</td>
<td>Affective Gaming</td>
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<td>590AC_WK6_Lec_1_Affective_Gaming.ppt</td>
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<td>August 17</td>
<td>Ethical considerations</td>
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<td>August 19</td>
<td>Future trends &amp; challenges (student presentations)</td>
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<td>August 23</td>
<td><strong>Final Project Due (paper &amp; presentation slides)</strong></td>
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DETAILED CLASS SCHEDULE & READINGS

WEEK 1: JULY 11 - 15

July 11: Course overview & administrivia (Lecture 1-0)

July 11: Overview and history of Affective Computing (Lecture 1-1)

Hudlicka, forthcoming. Chapter 1 (posted on Blackboard)
(Skip sections 1.2 and 1.3; you can also skip 1.8 and 1.9, as this will be covered in the next lectures in more detail)

Intro to affective computing
Picard. 1997. Introduction, Chapter 1, Chapter 3

Affective computing: Challenges and skeptical views (posted on Blackboard – 2 files)

Hollnagel. 2003. IJHCS + Hudlicka (response) + McNeese (response))
Picard. 2003. IJHCS

July 13 & 15: Emotion research in psychology (Lecture 1-2 & 1-3)

Hudlicka, forthcoming. Chapter 3 (posted on Blackboard)
(This is a long chapter. I encourage you to read the entire chapter by the end of the course, but for now, feel free to skim it to elaborate on the material covered in the lecture, or to cover topics that you are particularly interested in.)

Fellous, 2004. From human emotions to robot emotions. AAAI Spring Symposium – Architectures for Modeling Emotions

Optional Supplemental Readings & References:


Distinctions among affective factors: emotions, moods, temperament (traits)
Ekman & Davidson. 1994. Question #2 (pp. 51 – 96)


**WEEK 2: JULY 18 – 22**

**July 18: Emotion sensing and recognition (Lecture 2-1)**

*Overview of affective signals and systems*

*Techniques for emotion sensing & recognition, synthesis and expression*

Framework for organizing techniques for machine emotion sensing, recognition and expression


**Optional Supplemental Readings:**


**July 20: Emotion sensing and recognition (Lecture 2-2)**

Continue reading the materials listed above.

**July 22: Emotion expression (Lecture 2-3)**

Refer back to the two readings from last week for an overview & organizing framework:
*Techniques for emotion sensing & recognition, synthesis and expression*
Picard. 1997. Chapters 6

Framework for organizing techniques for machine emotion sensing, recognition and expression

Optional Supplemental Readings:


*EmotionML – an upcoming standard for representing emotions and related states.* In 
Proceedings of Affective Computing and Intelligent Interaction, Memphis, TN, US.

Systems.


WEEK 3: JULY 25 - 29

July 25: Emotion Modeling; Research vs. Applied Models (Lecture 3-1)

(On B’board)

Optional Supplemental Readings:
Cooper & Fox, 2002; Modeling Cognition (On B’board)
Canamero, 2002: Designing Emotions for Activity Selection in Autonomous Agents (On 
B’board)

July 27: Models of emotion generation (Lecture 3-2)

Sections: 11.0 – 11.4, 11.6, 11.8 (On B’board)

July 29: Models of emotion effects on cognition and behavior (Lecture 3-3)

Hudlicka, 2004; Two Sides of Appraisal, AAAI (On B’board)

(On B’board)
Optional Supplemental Readings:
Hudlicka, 2008; Modeling the Mechanisms of Emotion Effects on Cognition (On B’board)

WEEK 4: AUGUST 1 - AUGUST 5

August 1: Guidelines for designing emotion models (Lecture 4-1)
Hudlicka, 2011. Guidelines for Designing Computational Models of Emotion; Sections 4 & 5. IJSE. (On B’board)

August 3: Cognitive-Affective Agent Architectures (Lecture 4-2)


Optional Supplemental Readings:

July 5: Affect-Adaptive HCI & Affective User Modeling (Lecture 4-3 & 4-4)

Overview of Emotions and Affective HCI
Hudlicka. 2003. To Feel or Not to Feel: The role of affect in human-computer interaction. IJHCS. (on B’board)

Hudlicka, forthcoming. Chapter 1 (posted on Blackboard under “Week 1 – Readings”) (Re-read section 1.4.3 – Affective User Modeling)


Optional Supplemental Readings:


WEEK 5: AUGUST 8 – AUGUST 12

August 8: Social Agents & Robots & Believability


Optional Supplemental Readings:


Overview of synthetic avatar development

August 10: Affective Virtual Agents and Social Robots


August 12: Applications – Student Summaries & Presentations (No lecture)

Papers to be announced based on student selections
WEEK 6: AUGUST 15 – 19

August 15: Affective Gaming

Hudlicka, E. 2008; Affective Computing for Game Design

Hudlicka, E. and Broekens, J. 2009. Foundations for Modelling Emotions in Game Characters

Hudlicka, E. 2009; Affective Game Engines: Motivation and Requirements

Optional Supplemental Readings:


August 17: Ethical Considerations


August 19: Future Trends and Challenges in Affective Computing

Papers to be announced based on student selections
REQUIRED TEXTS:


• A reader consisting of papers from the current literature

RECOMMENDED TEXTS:


Supplemental Texts / References:

