CSE 218
Advanced Topics in Software Engineering
[Ubiquitous Computing]

Instructor: Prof. Nadir Weibel
Ass. Instructor: Dr. Ali Sarvghad

TAs: Yonatan Vaizman, Janet Johnson, Waqee Khalid
Who am I?

- Originally from Southern Switzerland (Ticino)
  - Languages: Italian (native), German, French, English and Spanish (basic)

- BSc. and MSc. in Computer Science and Engineering from ETH Zurich (Switzerland)

- PhD. in Computer Science (2009) from ETH Zurich

- Researcher and Lecturer at UCSD in Computer Science and Cognitive Science since 2009
UCSD

• Research Faculty in CSE

• Human-Centered and Ubiquitous Computing Lab (The Weibel Lab, HCC-Ubicomp)

• Affiliated Faculty with Calit2

• The Design Lab (http://designlab.ucsd.edu)

• Center for Wireless and Population Health Systems (http://cwphs.ucsd.edu)

• Research Health Science Specialist at VA San Diego
Ubiquitous Computing
Ubiquitous Computing

The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it.

Mark Weiser
Ubicomp

Ubicomp is an **interdisciplinary** field that includes technologies that **bridge the digital and physical worlds**, systems and **applications** that incorporate such technologies, **infrastructures** that support them, **human activities and experiences** these technologies facilitate, and **conceptual overviews** that help us understand – or challenge our understanding of – the impact of these technologies.
Themes, Applications

- Sensing (temperature, location, emotion, energy)
- Activity recognition (e.g., walking/driving)
- Context-awareness (e.g., smart homes)
- Ambient displays
- Security, privacy
- Social interaction, communication
- Health
- Education
- ICT4D (developing regions)
- Environment
Research Question

How do we best enable access to information in the right way, at the right time and for the right user and situation?
To develop technology that supports knowledge workers’ and end-user’s fluid interaction with information in hybrid physical/digital information spaces.
Chroma: A Wearable Augmented-Reality Solution for Color-Blindness

Presented at Ubicomp 2014, Seattle WA. Best Paper Award Nominee
Cocoon Cam (2014)

Breathe Easy With Our Technology
REVOLUTIONARY BABY MONITOR
Computer Scientists Develop Technology To Help Locked In Syndrome Patients Communicate Using Eye Tracking

10 August 2015, 9:34 am EDT  By Nicole Arce  Tech Times

Researchers at the University of California San Diego (UCSD) are developing various communication systems that use eye-tracking technologies that will help people with locked in syndrome communicate using the tiny movements they can make only with their eyes.

Locked in syndrome is a medical condition that can occur after a stroke that damages part of the brainstem, leading to the paralysis of the facial and body muscles but somehow leaving the eyes unaffected. Patients with locked in syndrome usually remain conscious of their surroundings but cannot move their bodies to or express themselves through facial expressions. Many of them can only communicate with the limited movements they can make with their eyes.

Researchers at the University of California San Diego receive $300,000 dollars from the Moxie Foundation to develop an eye tracking technology to help patients with locked in syndrome to communicate. (UCSD)
CSE 218 - Topics of the Week

- Week 01: Introduction to Ubicomp
- Week 02: Extrasensory
- Week 03: Context Awareness
- [Week 04: Mid-Term Presentations]
- Week 05: Tracking Body Movements
- Week 06: Software Engineering in Ubicomp
- Week 07: Design of Ubicomp Systems
- Week 08: Applications of Machine Learning to Ubicomp
- Week 09: Games for Ubicomp
The Course: Academic Preparation

- Directly engage the research literature
  - A good look at the future
- Participatory, loosely structured
  - Mold this course to your interests
  - Get out of it what you put in
- A peek at what research look like
  - Analytical thinking, communicating ideas, teamwork
  - Even if you’re not considering an academic career...
The Course: Inquiry-based learning

- Lecture on the technology of the week on Tuesdays
- Seminar style, roundtable discussion on Thursdays
  - You must come prepared for class to discuss
  - We will have some visitors give talks, demos
- Research project
  - 16 teams (6 people per team) across CSE 118 and 218
  - Experimental hybrid class undergrad/grad
  - Graduate students will additionally lead project management
- More on that on Thursday 2pm-3.20pm in CSE 2154
The Course: Logistics

• Lecture (research topic)
  Tue 2:00pm 3:20pm, EBU3B (CSE) 2154

• Discussion (paper discussions in groups)
  Thu 2:00pm - 3:20pm, EBU3B 2154, 2109, 2217, 3109, 3217
  • Starting Week 2

• Tutorial (test discussion, tech intro)
  Thu 2:00pm-3:20pm

• 16ish Hybrid Project Teams (CSE 118/218)

• Web page: http://ubicomp.ucsd.edu/cse118-218

• Piazza: http://piazza.com/ucsd/fall2017/cse118cse218
  > Register today! (group discussions, team formation)
CSE 218  - Tuesday’s Lecture

• 2:00pm - 3.20pm in CSE 2154

• Presentations/Demo of the Ubicomp concept of the week by CSE 218 students

• Additional coverage of Software Engineering tools and methods by the instruction team
CSE 218 - Tuesday’s Presentations

- Every week, starting Week 3
- Pairs of CSE 218 students. Every pair only once for the whole quarter
- 3x 7min presentations (+3 min questions) per week on different aspects and technology related to the topic of the week
- Find a partner and signup for a slot this week (url to come)
- The Specific topics for the single presentations must be approved by the instructors to avoid duplicate presentations (you can already sign up and discuss the topic later on)
CSE 218 - Thursday’s Paper Discussion

- Follows the weekly theme / topic
- Before class: read and annotate 2-3 papers for class
  - Dig into background reading if need/want
  - Bring questions to class (more important than answers)
- Take notes
- In class: jump into discussion!
  - Volunteer when you’re ready, be polite but assertive
  - Show respect, encourage balanced participation
  - If you’re late, you can’t participate
CSE 218
Thursday’s weekly Assignments

• Read (and Annotate) 2-3 papers (How to read an Engineering Paper)

• Deadline: Thursday 2pm, before discussion

• Prepare a 1-pager essay on the topic of the week, based on personal thoughts, reflections, experiences, etc.
How to Read an Engineering Research Paper

William G. Griswold

with additions by Nadir Weibel

(based on some ideas from Ali Khayam)

CSE, UC San Diego

Reading research papers effectively is challenging. These papers are written in a very condensed style because of page limitations and the intended audience, which is assumed to already know the area well. Moreover, the reasons for writing the paper may be different than the reasons the paper has been assigned, meaning you have to work harder to find the content that you are interested in. Finally, your time is very limited, so you may not have time to read every word of the paper or read it several times to extract all the nuances. For all these reasons, reading a research paper can require a special approach.

To develop an effective reading style for research papers, it can help to know two things: what you should get out of the paper, and where that information is located in the paper. First, I’ll describe how a typical research paper is put together.

Despite a paper's condensed form, it is likely repetitive. The introduction will state not only the motivations behind the work, but also outline the solution. Often this may be all the expert requires from the paper. The body of the paper states the authors' solution to the problem in detail, and should also describe a detailed evaluation of the solution in terms of arguments or an experiment. Finally, the paper will conclude with a recap, including a discussion of the primary contributions. A paper will also discuss related work to some degree. Because of the repetition in these papers at different levels of detail and from different perspectives, it may be desirable, to read the paper “out of order” or to skip certain sections.
CSE 118/218 - Thursday’s Discussion

Logistics

- 5 groups, 5 classrooms, each one with a different instructor
- 18-20 students per room (grad+ugrad, CSE 118+218)
- Inner circle (9-10 students) discussion
- Outer circle observation
- More on this on Thursday, 2pm-3.20pm in CSE 2154
CSE 218 Thursday’s Discussion Evaluation

• How will we grade discussion?
  • quality, not quantity
  • ideas and critique supported by evidence
  • helping group perform at high level (teamwork)

• How to Read and Engineering Paper
  • Use reading rubric to frame your note-taking
  • Structure discussion around participation rubric

• Evaluation is based on the available discussion rubrics
| Participation Rubric for Group Discussion of Engineering Research Papers - Self Evaluation |
|---|---|---|
| **Masterful Participation** | **Competent Participation** | **Developing Participation** |
| communicates clearly using language of discipline | speaks clearly or uses language of discipline, but not both | simplistic, incoherent, or inaudible communication |
| communicates succinctly | speaks at length or laconically | runs on or speaks in fragments |
| stays on topic | digresses | raises irrelevant subjects |
| constructively builds on contributions of others | naively restates what others says or contradicts others without evidence | ignores what others say |
| brings others into conversation according to perceived level of participation or subject expertise | participates while leaving room in conversation for others | interrupts others, dominates conversation, or doesn’t participate |
| consistent eye contact/gestures | some eye contact and gestures | looks down a lot, little gesture |
| contributions energize others | contributions are worked into conversation | contributions cannot be engaged |
| uses humor in on-topic way | uses humor | does not use humor |
| starts new avenues of inquiry after previous topic has run its course | abruptly changes subject | always lets others take the lead |
| asks valuable, sincere questions | asks questions | asks insincere questions, or doesn’t ask questions |
| introduces creative or provocative ideas | introduces ideas | does not introduce ideas |
| makes salient points, good answers | makes points or answers | does not make points or offer answers |
| draws own conclusions by applying a rationale supported by evidence or logical inference | draws conclusions supported by only iconic reference to paper | offers opinions or accepts conclusions of paper as facts |
| draws on content in other papers, specific personal experience, or details of current events | makes vague or iconic reference to other papers, personal experiences, or current events | does not draw on outside sources, engages the paper only on its own terms |
| incisively summarizes paper or points of others in own words | summarizes clumsily | repeats what others say or incorrectly summarizes |
| engaged people problem | Notable questions, points, ideas, team work (see back for more) | |
| engaged technical problem | | |
| engaged proposed solution | | |
| engaged evaluation | | |
| engaged future directions | | |
| engaged conclusion / take-aways | | |
| engaged meta topics | | |

**Week:**
**Topic:**
**Date:**
**Student:**
Research Projects
The Course: Research Projects

- ExtraSensory Dataset and Mobile App
  - [http://extrasensory.ucsd.edu](http://extrasensory.ucsd.edu)
  - Black-box for automatic context recognition
  - Array of 50+ recognizable behaviors with assigned confidence (%)
- Android Device
  - Question: how many people do NOT have android?
- Your own innovative idea
ExtraSensory

Next Week, Tue 10/3 - Yonatan Vaizman
Research Projects
Teams and Project Proposal

• Week 1-2: Explore ExtraSensory, Install ExtraSensory App

• By Week 3: Form a team (3 undergrads + 3 grads) and decide on a project
  • What does your application do?
  • Who are its potential users?
  • When will it be used?
  • Why would anyone use it?
Research Projects
Teams and Ideas

• Define a team project (3 undergrads, 3 grads) to explore ubiquitous computing
  • Usefulness, scalability, cost, how, effects…
  • Not necessarily big, but insightful or useful
• Come up with own idea or build on existing work
• Goal: having a working prototype by the end of the quarter
  • something that you can demo!
• The best project will participate to the CHI or Ubicomp Conferences
CSE 218 Grading

• This course is graded on three elements:
  • Discussion, preparation and participation (25%)
  • Research Presentation (25%)
  • Project (50%)

• Details on the web page
BACKGROUND AND INTRODUCTION
The advent of affordable sensors and interaction devices (e.g., webcams, mobile phone-based sensors, digital pens, Microsoft SenseCam, Microsoft Kinect, Google glasses, portable eye-tracking, HoloLens, Oculus Rift, etc.) and wireless mobile computing devices (e.g., mobile smart phones, Arduino boards with 632.11b wireless connectivity, etc.) has created boundless opportunities for in-the-world computing applications that can transform our lives.

This course explores these opportunities in the form of both a project-based class and a preparatory course for graduate school. On the one hand we will focus on the development of specific applications and interaction techniques based on those devices. On the other hand, we will learn how to read, present, and discuss research papers from the literature of ubiquitous computing, pervasive computing, and human-computer interaction.

OVERALL PLAN
Every week a new ubiquitous computing concept will be introduced as the topic of the week. We will discuss the technology behind it, and how it has been used in research (i.e. reading and discussing technical and research papers). In addition we will form teams to undertake small research projects.

The projects will involve the design and implementation of a ubiquitous computing application. This year (Fall 2017) the class projects will use the Exsensory App, a mobile phone application for behavioral context recognition. This app was previously used to collect the Exsensory Datafile (http://exsensory.ucsd.edu), and class projects will use it as a black-box tool for automatic context recognition of activities (e.g., walking, eating, shower), environments (e.g., at home, at work, in a meeting), and more. Projects will have to exploit these predicted behaviors and work on a novel application.

Teams will span CSE 218 graduate students and CSE 118 undergraduates. While both graduate and undergraduate students will work on the development of the applications, graduate students will take an additional leadership and management role in the project.

SCHEDULE
Lectures
CSE 118: Tuesdays, 11am-12:20pm
CSE 218: Tuesdays, 2pm-3:20pm
Rooms: EBUS (CSE Building) 2154

Group Discussions
CSE 118+218: Thursdays 2pm-3:20pm
Rooms:
Group A: EBUS (CSE Building) 2154
Group B: EBUS (CSE Building) 2109
Group C: EBUS (CSE Building) 2217
Group D: EBUS (CSE Building) 3109
Group E: EBUS (CSE Building) 4719

(email separate page for group assignments)

TEACHING TEAM
Prof. Nadir Weibel
Email: weibel@ucsd.edu
Office: CSE 3224
Office Hours: By Appointment

http://ubicomp.ucsd.edu/cse118-218/
CSE 218 - Course Details

Every week we will introduce a new ubiquitous concept (with the exception of week 1, when we will introduce Ubicomp). In addition, all students will be assigned 2-3 papers on the topic of the week and they will be required to read them. Readings are key to be able to participate in discussion.

We will divide the discussion in two moments.

1) TUESDAY'S LECTURE AND RESEARCH PRESENTATIONS

We will spend the first time of the lecture on Tuesday to address specific elements of Software Engineering, related to Ubiquitous Computing in general, or the topic of the week in particular.

During the second part of the lecture, pairs (or groups) of students will present the weekly topic taking two different perspectives: (a) the technical perspective (what is the specific concept that we are covering, is there any specific technology that goes with it, if it does, how does it work?) and (b) the research perspective (how has this concept been applied in research, what results have been achieved?).

-Every student will be asked to present one specific concept that will fit within the weekly topic throughout the quarter in collaboration with one another student. Every week we will have 3 presentations, each one presented by two students in pairs.
-Oral presentations will be 7min, (both students will be required to present) with additional 3 minutes of questions. Presentations will have to be prepared either using MS Powerpoint or Apple Keynote. Submit presentation by end of the day before your presentation.

http://ubicomp.ucsd.edu/cse218/submit/presentation/

-Students will be able to choose who to pair with. Slots can be booked at this link (please ente names and student IDs of both students): https://cse218.youcanbook.me/

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<thead>
<tr>
<th>Week - Date</th>
<th>Topic</th>
<th>Slot #1</th>
<th>Slot #2</th>
<th>Slot #3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 03 - Oct 17</td>
<td>Context Awareness</td>
<td>1. Student #1</td>
<td>1. Student #1</td>
<td>1. Student #1</td>
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<td>2. Student #2</td>
<td>2. Student #2</td>
<td>2. Student #2</td>
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<tr>
<td>Week 05 - Oct 31</td>
<td>Tracking Body movements</td>
<td>1. Student #1</td>
<td>1. Student #1</td>
<td>1. Student #1</td>
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http://ubicomp.ucsd.edu/cse118-218/course-details-218
Ubicomp at Xerox PARC

Xerox Parc, 1991

https://www.youtube.com/watch?v=blw9_cob_zw
• Papers to read
  • V. Bush, "As We May Think", Atlantic Monthly, July 1945

• Thursday 2pm-3.20pm: Paper Discussions, Projects, and Team Formation
Group Formation

- Start NOW to talk with your peers about common interests and cool ideas
- Groups can be heterogeneous, not everybody needs to do hardcore programming, but groups need also designers, managers, etc. Some of you are from outside CSE
- Use Piazza, remember that groups will have to be across CSE 118 and CSE 218
- If you have a good idea, send me a short description and perhaps a sketch I will present it next week during class
- Look on the web for what other people already did (as inspiration only: you should do something new)
For Thursday

• Register on Piazza and start discussion on groups and projects
• Read course website, especially:
  • How to read an engineering paper
  • Structured form for reading a paper
  • Note taking rubric
  • Participation rubric
Thank you!