CSE 218
Advanced Topics in Software Engineering (Ubicomp)

Instructor: Prof. Nadir Weibel

TAs: Danilo Gasques Rodrigues, Janet Johnson, Scott Lim, Yuanyuan Feng
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
Danilo Gasques Rodrigues
CSE Ph.D. Student

Janet Johnson
CSE Ph.D. Student

Scott Lim
CSE MS Student

Yuanyuan Feng
UMBC PhD Students
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)
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?
Research Aims

To develop technology that supports knowledge workers’ and end-user’s fluid interaction with information in hybrid physical/digital information spaces
Chroma (2013)

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
COCOON CAM
Vitals sensing camera
## Our Products

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<tr>
<th>Standard</th>
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<tr>
<td>Buy Now</td>
<td>Camera &amp; Stand</td>
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![Image](image1.png)
EyeHome (2015)
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.
CSE 218 - Topics of the Week

- Week 01: Introduction to Ubicomp
- Week 02: Depth Cameras and Computer Vision
- Week 03: Augmented, Virtual and Mixed Reality
- Week 04: Physiological Sensors
- Week 05: Programming in Unity
- Week 06: Design of Ubicomp Systems
- Week 07: Software Engineering in Ubicomp
- Week 08: Privacy and Ethics
- Week 09: -
- Week 10: -
- Finals: Final Demos/Presentations
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 grad school and the industry could be like, and a preparation for it
  • Analytical thinking, communicating ideas, teamwork
The Course: Inquiry-based learning

- Lecture on Ubicomp and Software Engineering Concepts (theme of the week) on Tuesdays

- Seminar style, roundtable discussion on Thursdays afternoon (118+218, starts on week 2)
  - You must come prepared for class to discuss

- Labs on Thursday morning (118 + videos for 218)

- Research project
  - 16 teams (4 people per team) across CSE 118 and 218
  - Hybrid class undergrad/grad
  - Graduate students will additionally lead project management
  - More on that on Thursday 12.30pm-1.500pm in CSE 2154
The Course: Logistics

- Lecture (research topic)
  Tue 12:30pm - 1:50pm, EBU3B (CSE) 2154

- Discussion (paper discussions in groups, starts on week 2)
  Thu 12:30pm - 1:50pm, EBU3B 2154, 2109, 2217, 3217, 4217

- Labs (tech intro) —> For CSE 218 attendance it is optional
  (viewing the recorded video is required)
  Thu 11am-12:20pm

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

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

- Piazza: http://piazza.com/ucsd/fall2018/cse118cse218
  > Register today! (group discussions, team formation)
CSE 218 - Tuesday’s Lecture

- 12:30am - 1.50pm 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 HoloLens, etc.)
CSE 218 - Tuesday’s Presentations

- Week 2-5, starting Week 2
- 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

- Every week a new theme / topic
- Before class: read and annotate 2 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 won’t be able to participate effectively
CSE 218 - Thursday’s Discussion Preparation

• Read and Annotate 2 papers (see “How to read an Engineering Paper”)
  • 1x technical paper
  • 1x design paper
• Prepare a 1-pager essay on the topic of the week, based on personal thoughts, reflections, experiences, etc.
• Deadline: Thursday 12.30pm, online
How to Read an Engineering Research Paper

William G. Griswold
with additions by Nadir Welbel
(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 (CSE 118+218)

• Inner circle (9-10 students) discussion

• Outer circle observation

• More on this on Thursday, 12.30pm-1.50pm 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
Research Projects
The Course: Research Projects

- Combine a variety of Ubiquitous Computing Devices
  - Microsoft HoloLens
  - Oculus Rift
  - The eye-tribe remote eye-tracker
  - Toby EyeX
  - MS Kinect
  - Google Glass
  - Myo EMG gesture controller
  - …?
- Your own innovative idea
Microsoft HoloLens

https://www.microsoft.com/microsoft-hololens/en-us
The EyeTribe Eye-Tracking

http://theeyetribe.com/
Google Glass

https://developers.google.com/glass/
Oculus Rift

Projects

• 4 Topic Areas
  • Healthcare
  • Education
  • ICT for Development (ICT4D)
  • Automation
  • Human Augmentation
Research Projects
Prototyping, Design, Devices and Project Proposal

• Week 1-2: Form teams (2 grad + 2 undergrads)
• Week 2-5: Check-out devices and explore their capabilities
• Week 2-5: Design and Prototype with PrototipAR
• End of Week 5: Proposed Project and devices
• Week 6-10: Development of your proposed Application/System
• Weekly progress reports
• More on Thursday, 11am-12.20pm in CSE 2154
PrototipAR

- PrototipAR is an Augmented Reality (AR) prototyping tool that enables designers to create AR experiences embedded in the world. Users can sketch interfaces and objects, add behaviors and interactions, and experience everything live without writing a single line of code.

What You Sketch Is What You Get:
Quick and Easy
Augmented Reality Prototyping
with PintAR
Research Projects
Teams and Ideas

- Define a team project (2 undergrads, 2 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, Ubicomp or DIS Conferences
The Course: Living it

- Live the UbiComp lifestyle
  - Go mobile: laptop, tablet, smart phone, smart watch…
  - Use social media and apps
  - Equip yourself of wearable sensors (Fitbit, etc.)
  - Put a small “public display” up at home
- Read about it
  - Subscribe to an RSS feed, mailing list, or magazine
  - ACM TechNews: http://www.acm.org/technews/
  - Wired: http://www.wired.com
- Observe it, talk about it, bring it into discussion
- It’s everywhere around you
CSE 218 Grading

• This course is graded on three elements:
  • Discussion, preparation and participation (25%)
  • Research Presentation (15%)
  • Project (60%)

• 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 smartphones, Arduino boards with 802.11b 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 and the industry. 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

During the first half of the quarter (weeks 1-5) we will introduce a new ubiquitous computing concept 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 and engage in prototyping and design activities towards the development of a ubiquitous computing technology.

The second part of the quarter (weeks 6-10) will focus on the development, testing and evaluation of the ubicomp application that teams designed and prototyped in the first half of the quarter. This phase will culminate in a final project demonstration that will be evaluated and graded based on its completeness and actual working state.

The projects will involve the design and implementation of a ubiquitous computing application based on the combination of multiple devices (which will be made available to students). Project teams will span CSE 218 graduate students and CSE 118 undergraduates. While both graduate and undergraduate students will work on the design and development of the applications, graduate students will take an additional leadership and management role in the project.

SCHEDULE

Lecture
CSE 118: Tuesdays, 11am-12.20pm
CSE 218: Tuesdays, 12.30pm-1.50pm
Room: EBU3B (CSE Building) 2154

Labs
Thursdays 11.00am-12.20pm
Room: EBU3B (CSE Building) 2154
Online: TBD

Group Discussions
CSE 118+218: Thursdays 12.30-1.50pm
Rooms:
Group A: EBU3B (CSE Building) 2154
Group B: EBU3B (CSE Building) 2109
Group C: EBU3B (CSE Building) 2217
Group D: EBU3B (CSE Building) 3217
Group E: EBU3B (CSE Building) 4217
(see 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 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 into two moments.

TUESDAY’S LECTURE AND RESEARCH PRESENTATIONS

During the first 5 weeks, every Tuesday we will spend the first time of the lecture addressing specific elements of Software Engineering related to Ubiquitous Computing either at a general level or with regards of the specific topic of the week.

The second part of the Tuesday lecture will see pairs of students present the weekly topic focusing on one of the presented technologies.

Every student will be asked to present one specific technology that will fit within the weekly topic throughout the quarter in collaboration with another student. We will have 4 presentations (weeks 2, 3, 4, and 5), each one presented by two students. Their duration will be 7 min only (where both students are required to present) with an additional 3 minutes for questions. Presentations will have to be prepared either using MS Powerpoint or Apple Keynote. Students should submit their presentation by end of the day before their presentation day through Gradescope.

Students will be able to choose who to pair with. Slots can be booked at this link (please enter names and student IDs of both students):

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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>
<th>Slot #4</th>
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<tbody>
<tr>
<td>Week 02 - Oct 9</td>
<td>Depth Cameras / Computer Vision</td>
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<td>Week 03 - Oct 16</td>
<td>Augmented, Virtual and Mixed Reality</td>
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<td>Week 04 - Oct 23</td>
<td>Physiological Sensors</td>
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<td>Week 05 - Oct 30</td>
<td>Unity Programming</td>
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THURSDAY’S LABS

Thursday morning (11am–12:25pm) the TAs will offer a Lab. Labs will cover specific methods, introduce APIs and SDKs for the technologies discussed in Tuesday’s lessons. Code samples will be used to walk students through setup and use of the specific technology. Students who are available (the ones who don’t have another class at that time) are welcome to attend in person. For everyone, labs will also be video-recorded and made available online for later studying. Students are required to either attend labs or watch the recording.

http://ubicomp.ucsd.edu/cse118-218/course-details-218
# Schedule

## CSE 118/218: Ubiquitous Computing - Fall 2018

### Schedule

<table>
<thead>
<tr>
<th>WEEK</th>
<th>DATE</th>
<th>TOPIC</th>
<th>READINGS</th>
<th>ASSIGNMENTS</th>
<th>NOTES</th>
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<tbody>
<tr>
<td>1</td>
<td>Tue 02</td>
<td>Introduction to the Course and Introduction to Ubicomp.</td>
<td>1. &quot;How to Read an Engineering Paper&quot;</td>
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<td>CSE 118 - 11a-12.20p in CSE 2154</td>
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<td>CSE 218 - 12.30p-1.50p in CSE 2154</td>
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<td>1</td>
<td>Thu 04</td>
<td>Group Discussions, Projects, Policies, and Team Formation</td>
<td>Ubicomp Papers</td>
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<td>CSE 118 - 11a-12.20p in CSE 2154</td>
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<td>To download papers free of charge you need to be on UCSD's network (either on campus or using a VPN)</td>
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<td>2</td>
<td>Tue 09</td>
<td>Depth Cameras and Computer Vision</td>
<td>Depth Cameras and Computer Vision Papers</td>
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<td>CSE 118 - In-class Mini-Quiz (Week 1)</td>
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<td>1. TBD</td>
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<td>CSE 218 - Submit a 1-page essay (Week 1)</td>
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<td>--&gt; Deadline 2pm</td>
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<td>Notice: need to declare your teams on Piazza by Tuesday, October 9 at 11:59 pm!</td>
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Next

- Papers to read
  - V. Bush, "As We May Think", Atlantic Monthly, July 1945
- Thursday 12.30pm-1.50pm CSE 2154: Logistics on Discussions, Projects, and Team Formation
Group Formation

- Start NOW to talk with your peers about common interests and cool ideas
  - Deadline to form a team is Tuesday of next week!
- 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!