Welcome to EECS16A!

Gireeja Ranade and Bernhard Boser

August 29, 2019
First Lecture Plan

• Introductions
• Administrative Details (discussions, homework, etc.)
• Overview of 16A’s material and how it fits into EECS
• Start with module 1
Instructors

Prof. Gireeja Ranade
ranade@eecs.berkeley.edu
565 Cory
OH: After lecture

Prof. Bernhard Boser
boser@berkeley.edu
490 A Cory
GSIs and uGSIs

Head GSIs:
eecs16a@gmail.com

Email with:
- Questions not for Piazza
  - All conflicts
  - Any emergencies
- Administrative questions

Sam Weismann

Sarika Madhvapathy
Some logistics

• EECS 16A
http://inst.eecs.berkeley.edu/~ee16a/fa19/

• Piazza
http://piazza.com/

• Gradescope
Lots of you, but lots of us too!

• ~40 TAs
  • Lots of different research areas and interests represented (by design)

• Many Academic Student Employees…
  • Former 16A students just like you …

• The path to being on 16A staff
  • Do great in 16A
  • Become an Academic Student Employee
    • Grade homeworks, assist in labs, tutor and help out in OH, work on improving the notes …
    • Become a uGSI
    • Become faculty!
### Monday

<table>
<thead>
<tr>
<th>Time</th>
<th>Room/Name</th>
<th>Student/Teacher</th>
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<tbody>
<tr>
<td>9:00 AM</td>
<td>(207: Barrows 60): Ricky [CS Scholars]</td>
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<tr>
<td>11:00 AM</td>
<td>(208: Barrows 140): Nirmaan</td>
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<tr>
<td>12:00 PM</td>
<td>(204: Cory 241): Grace</td>
<td>(201: Wheeler 222): Alice</td>
</tr>
<tr>
<td>1:00 PM</td>
<td>(216: Barrows 60): Miyuki</td>
<td>(209: Barrows 140): Michelle</td>
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<tr>
<td>2:00 PM</td>
<td>(205: Cory 247): Ryan</td>
<td>(210: Cory 521): Deepshika</td>
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<td>3:00 PM</td>
<td>(215: Etcheverry 3113): Terry</td>
<td>(212: Cory 521): Jesse</td>
</tr>
<tr>
<td>4:00 PM</td>
<td>(203: Cory 521): Miyuki</td>
<td>(206: Etcheverry 3113): Jack</td>
</tr>
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<td>5:00 PM</td>
<td>(223: Barrows 140): Panos</td>
<td>(222: Barrows 56): Christos</td>
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### Wednesday

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<td>(222: Barrows 56): Christos</td>
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Course audience -- YOU

• Freshmen and incoming junior-transfers

• Sophomores who for some reason were unable to take the class their first year

• We assume no prior background in linear algebra or physics
Homeworks

• Due Friday at midnight
  – Except HW 0, due Wednesday, Sep 4 at 11:59 pm
• HW Party: Wed 2-4 pm and Thu 9-11 and 2-4 pm
• OH: See website
• Self-grades due Mondays at midnight
• Resubmissions due along with self-grades
Homework Submission

- Homework submitted on Gradescope (enroll if you haven’t been automatically: code 96KR6D)
  - You must select pages
  - You must submit printout of iPython code (see syllabus)

Unmatched Pages & Questions

ℹ️ You haven't matched all pages and questions.

Pages 1, and 2 don't have associated questions.

Questions 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 3.1, and 4.1 don't have associated pages.

You can still submit your assignment without these pages associated, however we recommend matching all pages so that graders can easily find your work.

Continue Matching  
Submit Assignment
Course policies

• Our goal: Learning
  • Policies are designed around this
  • Come to us when you need help
• Syllabus is on course website
  • Please read and follow all course policies listed.
• Grading is absolute (no curve)
  – You are not competing against one another
• Round tables
Course culture

• Positive and fun learning environment.
• Learning can be hard.
• Collaborate and help each other out.
• Build community. HW parties, discussion, lab are great places to make friends.
• Encourage different perspectives --- this is built into the material, different types of problems, different types of material, different personalities.
How to succeed in 16A

• Get enough sleep
• Attend lecture (freshmen and junior transfers)
• Actively read notes, mark what is challenging
• Attend discussion
• Try HW on your own, early on
• Discuss problems with study group and/or at HW Party
• Ask/Lurk and help others on Piazza
• Hand write HW on your own
• Reflect on solutions while self-grading
• Study with others as well as alone.
• Seek and offer help.
• We are here to help you and to have you succeed!
Let’s get started...
Did you know…

The same idea that allows touchscreens to detect touch,

Also allows an autonomous car drive in a straight line,

And lets search engines rank webpages,

And lets us train deep learning neural networks.

Feedback, eigenvalues and stability!
Also time travel
Other contributors to 16: Elad Alon, Anant Sahai, Laura Waller, Ali Niknejad, Claire Tomlin, Michel Maharbiz, Miki Lustig, Vivek Subramanian, Thomas Courtade, Babak Ayazifar
Did you know…

That the same idea that makes Shazam work

Also make the GPS on your phone work?

Cross-correlation!
Did you know...

A fundamental algorithm in machine learning and artificial intelligence

Is used to make predictions in biology, brain-machine interfaces, social sciences, imaging algorithms and more?

Least-squares!
Learning goals

Not a survey class --- rigorous and deep

16A
Module 1: Introduction to systems
    How do we build a model?
Module 2: Introduction to circuits and design
    How do we use a model to solve a problem?
Module 3: Introduction to Machine Learning
    How do we “learn” models from data?

16B
Module 4: Advanced circuit design
Module 5: Introduction to robotics
Module 6: Introduction to unsupervised learning
How to approach something unfamiliar and systematically build understanding

Linear Algebra: conceptual tools to model
Circuits: How to go from model to design, grounded in physical world

Intro to foundational concepts in Machine Learning
How Did We Get From This...

1837

1866

1876
To this?
Moore’s Law

Microprocessor Transistor Counts 1971-2011 & Moore’s Law

What is a transistor?

Gordon Moore
Intel Cofounder
B.S. Cal 1950!
Sense of Scale

Source: Mark Bohr, IDF14
Completing the puzzle …

- Ada Lovelace - wrote the first computer program
- Turing – invented the Turing machine – how to build a computer to execute programs – what is actually computable?
- Claude Shannon – info theory, + how to implement logic out of EM switches
Design of Information Devices and Systems

• Best when hardware and software work together
  • Best algorithms and best code written by understanding the sensing and compute mechanisms
  • Best devices designed understanding the physical limitations
16A Examples

**Real World**

- **Imaging:**
  - Imaging: EE16A

- **Touchscreens:**
  - Touchscreens:

- **Positioning:**
  - Positioning:

**Measurement**

- **Measurement circuits**

**Processing**

- **Systems of linear equations**
- **Matrix analysis**
- **Processing circuits**
- **Cross-correlation Optimization**
Module 1: Imaging
Medical imaging ... 1632
Seeing inside bodies: sans surgery...

All of these benefitted from the math/hardware design techniques you will learn in this class!
Tomography

‘tomo’ – slice
‘graphy’ – to write

Assume it is not desirable to slice open my brain. How does tomography ‘see’ inside?
Tomography

Many measurements

Take measurements.

Measurements are also called projections

Sum of values along the line

many measurements
Example: Tomography

What do pixel values represent?

e.g. density, absorption, etc.

Can we solve for the pixel values from projections?

Yes, with tomography.