Welcome to EECS16A!

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First Lecture Plan

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

- Worked at Microsoft Research AI (Artificial Intelligence) before starting the faculty job at Berkeley
- PhD and Masters at UC Berkeley
- SB degree at Massachusetts Institute of Technology (MIT)
- Teaching experience in Berkeley, Boston, Ghana (Accra) and India (Pune)

Prof. Gireeja Ranade
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565 Cory
OH: Tuesday after lecture
Today after lecture
Wednesday at homework party
Other Staff

Head GSIs:

eeecs16a@Berkeley.edu
We are here to help

- ~50+ course staff
- Lab staff
- Office hours staff
- Discussion staff
- Ed
Resources

- Student Technology Equity Program
- DSP --- student accommodations
- Let us know.
Some logistics

• EECS 16A. Read the syllabus. eecs16a.org

• Ed: a resource for you to help each other out
• Gradescope

• Lecture: Attend them all
• Lab: Attend section you signed up for
• Discussion: Attend any section. One on Monday, one on Wednesday
Homeworks

• Due Friday at 11:00 pm
  – HW 0 due Friday, Sep 1 at 11:00 pm
• HW Party: Wed 9-11 am and Fri 9-11 pm
• Self-grades due Mondays at midnight
How to succeed in 16A

• Get enough sleep
• Attend lecture and discussion and lab
• Actively read notes, mark what is challenging
• Try HW on your own, early on
• Discuss problems with study group and/or at HW Party
• Help others
• Write HW solution 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!
Course culture

• Positive and fun learning environment.
• Learning can be hard.
• Collaborate and help each other out.
• Build community. Get to know each other on Ed/HW Party/Study Groups.
• Encourage different perspectives --- this is built into the material, different types of problems, different types of material, different personalities.
Community in Computing

• Join EE 194-3
• Based on a well-received class for first-year and junior transfer students
• Develop study techniques, form study groups, navigate Berkeley and do your homework
• 1 unit
Let’s get started...
Early communications..

Telegraph ---
1830-1840

Laying of the transatlantic cable ---
- 1858
Current Era
The ChatGPT Era
Moore’s Law

Microprocessor Transistor Counts 1971-2011 & Moore’s Law

Transistor count

Date of introduction

Curve shows transistor count doubling every two years

Gordon Moore
Intel Cofounder

B.S. Cal 1950!
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 – information theory + how to implement logic out of EM switches
Design exercise

Sense

Process
Data
Make a model
Predict

Actuate i.e take action

External environment

16a

16b

External environment
16A Examples

Real World → Measurement → Processing

- **Imaging:**
  - Measurement circuits
  - Systems of linear equations
  - Matrix analysis

- **Touchscreens:**
  - Measurement circuits
  - Processing circuits

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

Take measurements.
Measurements are also called projections.

Sum of values along the line
Example: Tomography

Can we solve for the pixel values from projections?
Yes, with tomography.

What do pixel values represent?
e.g. density, absorption, etc.

\[
\begin{array}{cc}
  x_1 & x_2 \\
  x_3 & x_4 \\
\end{array}
\]
Imaging in general

Energy source

Subject

Energy detection

Imaging System
(electronics, control, computing, algorithms, visualization….)
Single-pixel camera

Can I create an image if I have just one detector?
Single-pixel camera

Patterned illumination

Subject

Single-pixel detector

Barniauk et al., Rice University.
Single-pixel camera

Can we recover the frog?

Measurement: Linear combination of the pixels

How many measurements do I need?

How should I choose illumination patterns?
Imaging Lab #1 Setup
Imaging Lab #1