Welcome to EECS16A!

Prof. Gireeja Ranade

August 27, 2020

First Lecture Plan

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

Zoom logistics

- If you have a question you would like me to answer, please type into the Q&A
- If you want to chat with other students or ask a question other students can answer, please type in the chat (highly encouraged)
- If you would like to ask a question verbally, please use the raise hand feature

Instructors

- Designed EECS 16A in 2015
- 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
ranade@eecs.berkeley.edu
565 Cory
OH: After lecture

Other Staff

Head GSIs:
eecs16a@Berkeley.edu
Email with:
- Questions not for Piazza
- All conflicts
- Any emergencies
- Administrative questions


Amanda Jackson


Anika Ramchandran

Coursemanager
Accommodations for exams, homeworks etc.
Great resource for 1-1 concerns
Krystle@eecs.Berkeley.edu


Krystle Simon

We are here to help

- ~35 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, then Grad student… then prof!

Resources

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

Some logistics

- EECS 16A. Read the syllabus.

http://inst.eecs.berkeley.edu/~ee16a/fa20/

- Piazza: a resource for you to help each other out

http://piazza.com/

- Gradescope

- Exam proctoring via Zoom

Course audience -- YOU

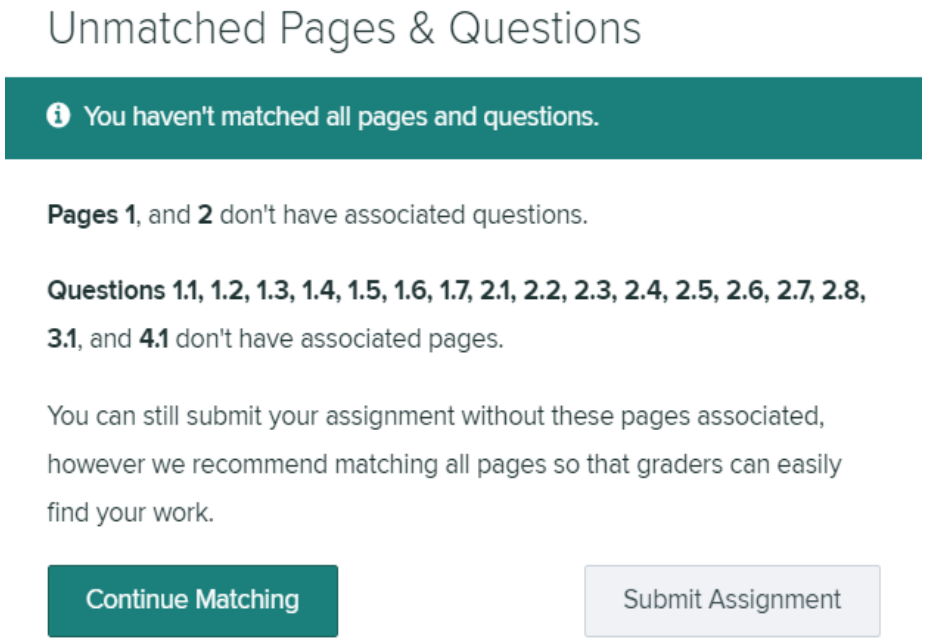
- Freshmen and incoming junior-transfers
- Sophomores who were unable to take the class their first year
- We assume no prior background in linear algebra or physics

Homeworks

- Due Friday at 11:59 pm
  - HW 1 due Friday, Sep 4 at 11:59 pm
- HW Party: Thu 9-11 am and 2-4 pm
- OH: Have them at various times for people in other timezones
- 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 98PY62.)
  - You must select pages
  - You must submit printout of iPython code (see syllabus)



Course policies

- Attend lecture (required)
- Attend discussion (required, one on Monday, one on Wednesday. Automatic participation points, submit checkoff if watching recording.)
- Attend lab (required, at your scheduled time, checkoff during your lab)
- Attend office hours and homework party (optional)
- Progress tracker on website

How to succeed in16A

- Get enough sleep
- Attend lecture and discussion (esp. Freshmen and Jr. Transfers)
- 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 on Piazza
- 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!

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 Piazza/HW Party/Study Groups.
- Encourage different perspectives --- this is built into the material, different types of problems, different types of material, different personalities.
- Great Piazza thread

Study groups!

- System to match you into study groups!
- Information form (timezones etc.) in HW1. You are required to fill this out.

- Chance to meet new friends and study buddies

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 allows search engines to rank webpages,

And trains deep learning neural networks.

Eigenvalues!

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
MARVEL STUDIOS
THE AVENGERS
Credit: Akshay Madhani

Did you know…

That the same idea that makes Shazam work

Also make the GPS on your phone work?

Cross-correlation!

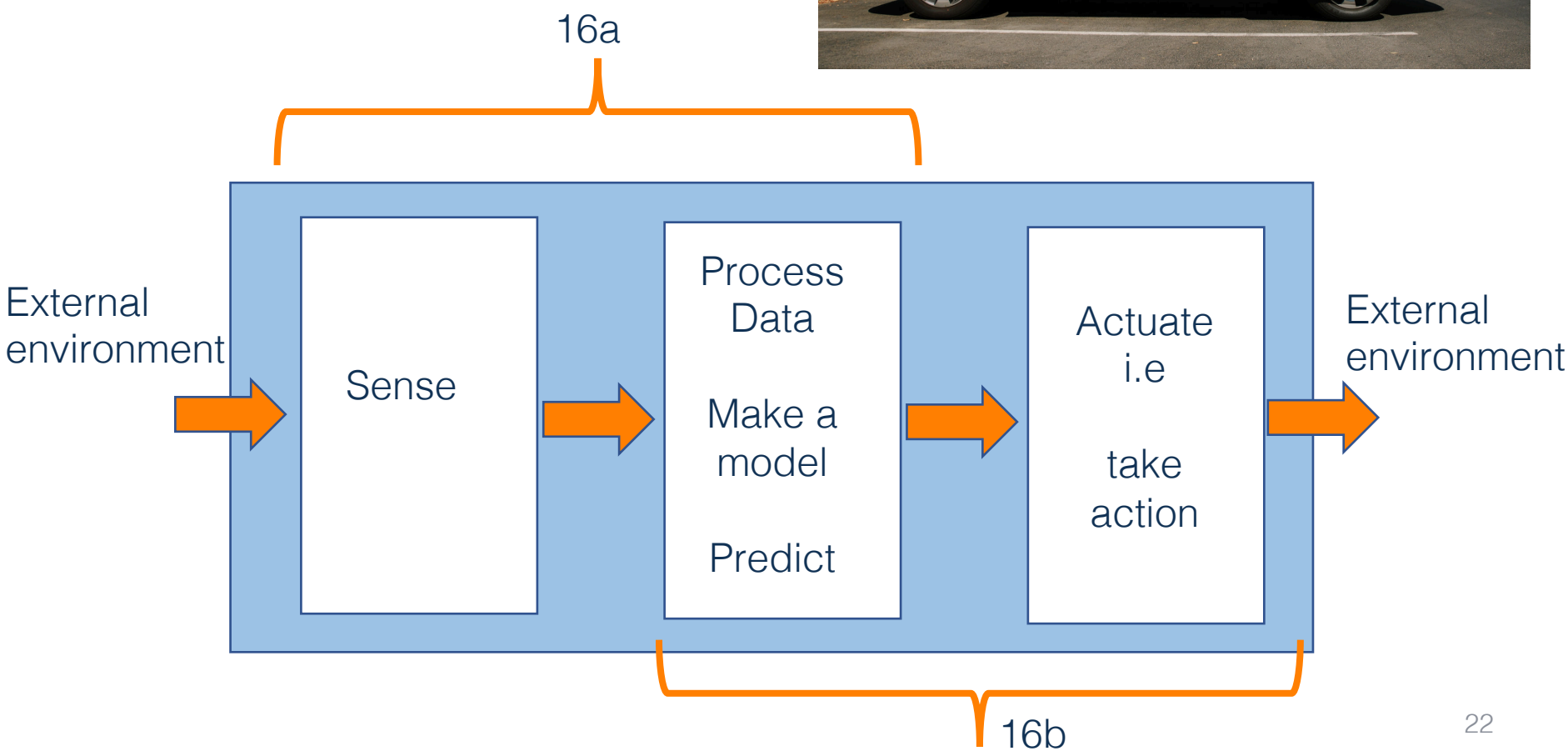
Did you know…

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!

Design exercise



Learning goals

Not a survey class --- rigorous and deep

16A

Module 1: Introduction to systems

How can we collect data? 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

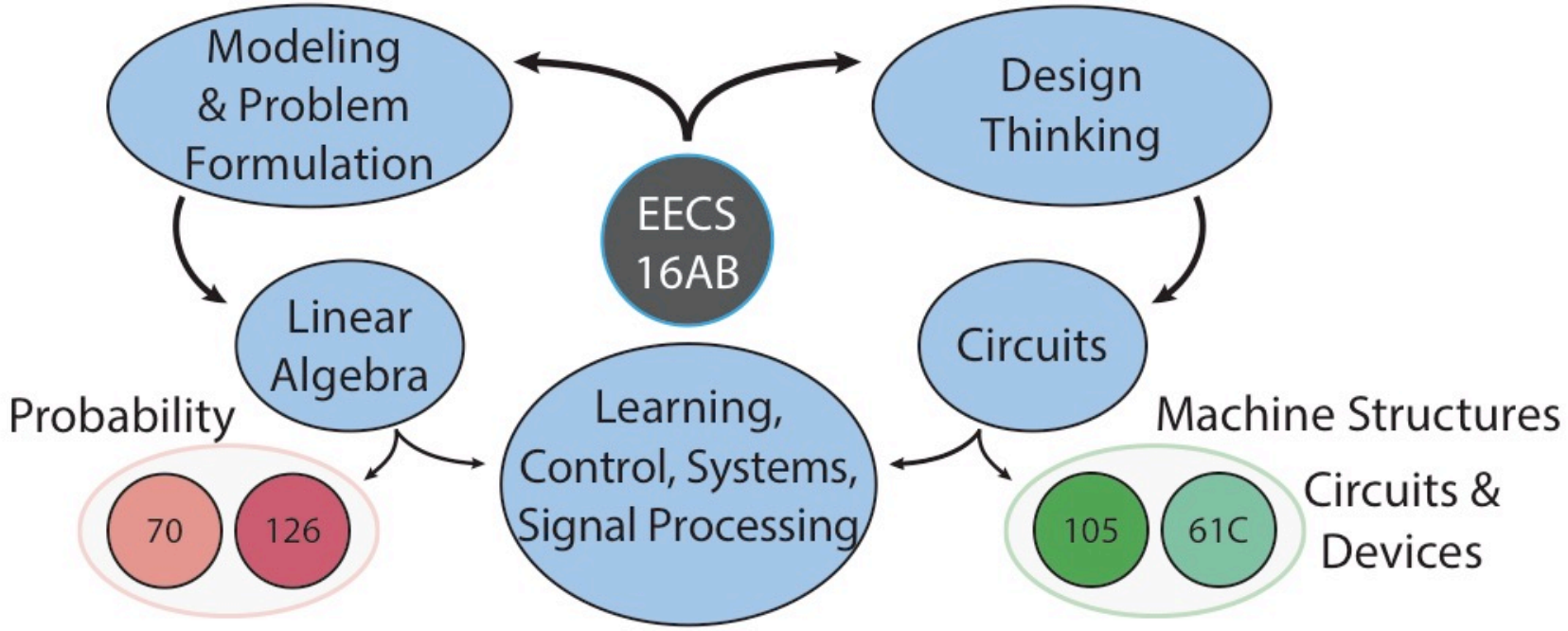
How do we “learn” models from data? How do we make predictions?

16B

Module 4: Advanced circuit design

Module 5: Introduction to robotics

Module 6: Introduction to unsupervised learning

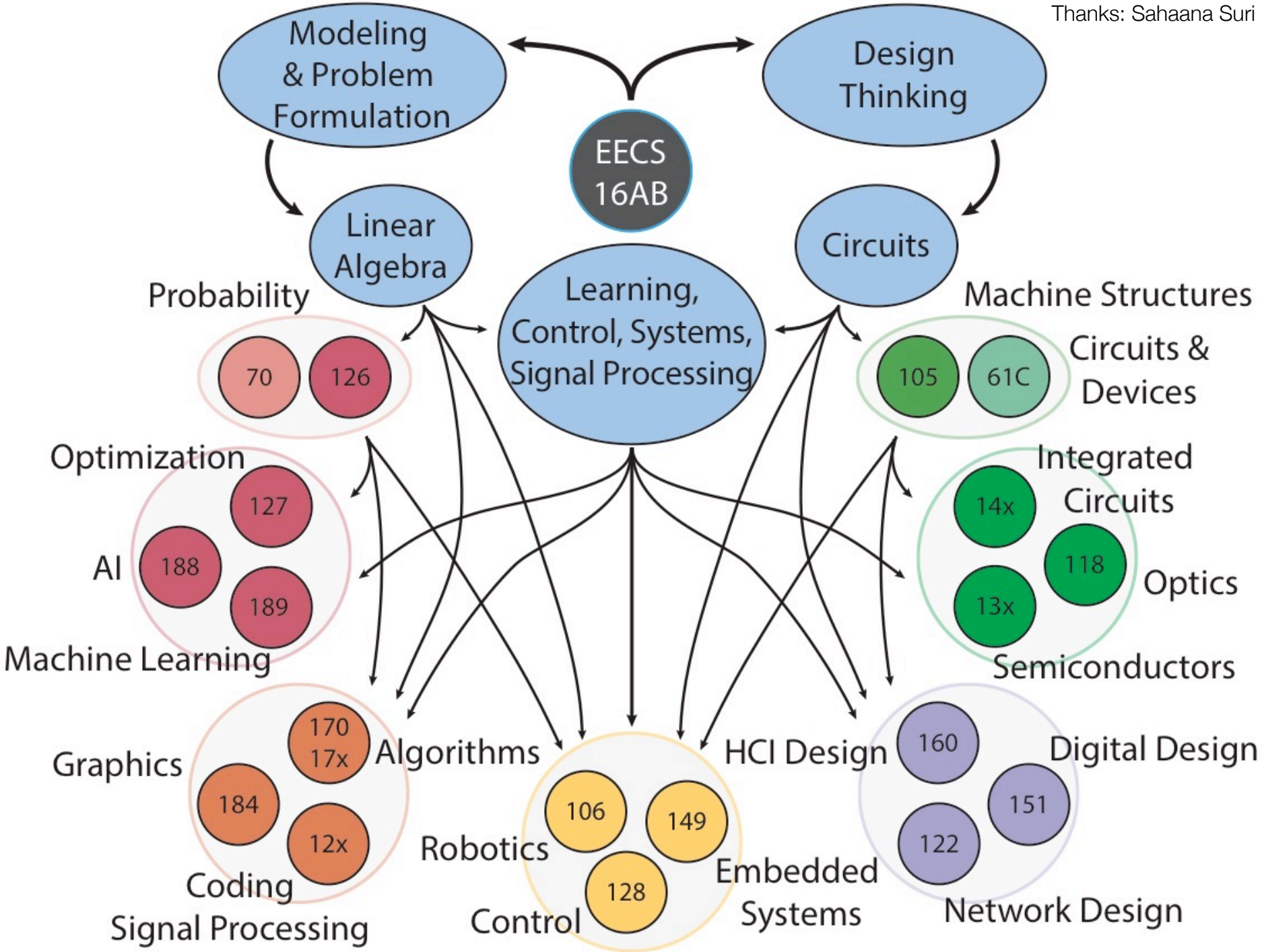


How to approach something unfamiliar and systematically build understanding

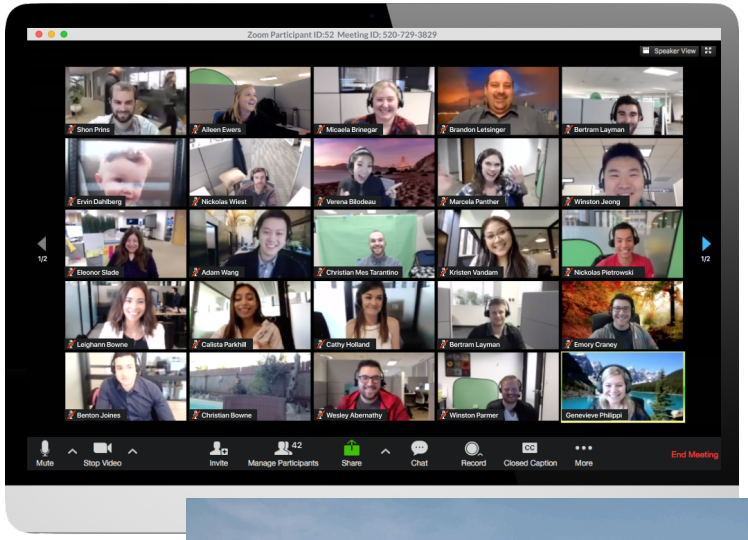
Linear Algebra: conceptual tools to model
Circuits: How to go from model to design, grounded in physical world

Intro to foundational concepts in Machine Learning

Thanks: Sahaana Suri



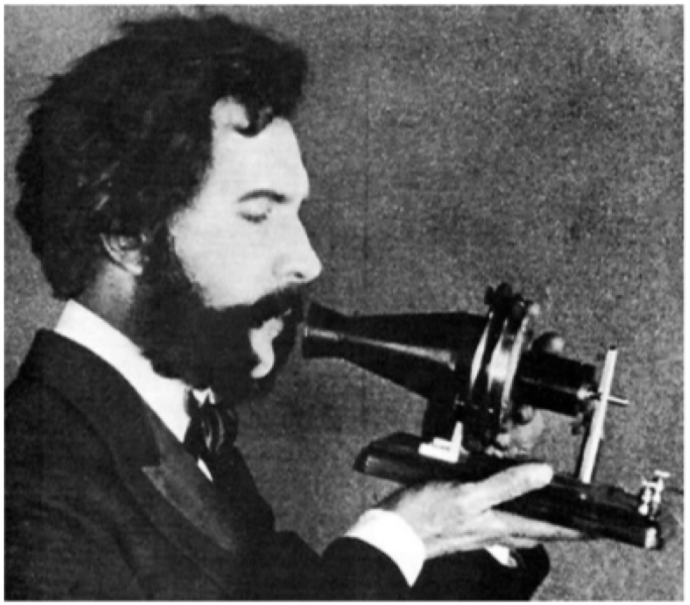
Currrent Era



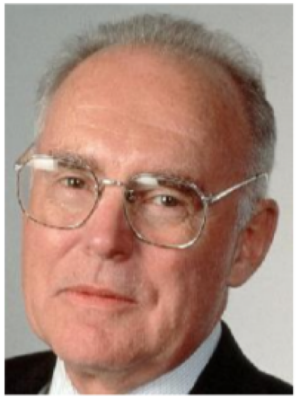
1837

1866

1876



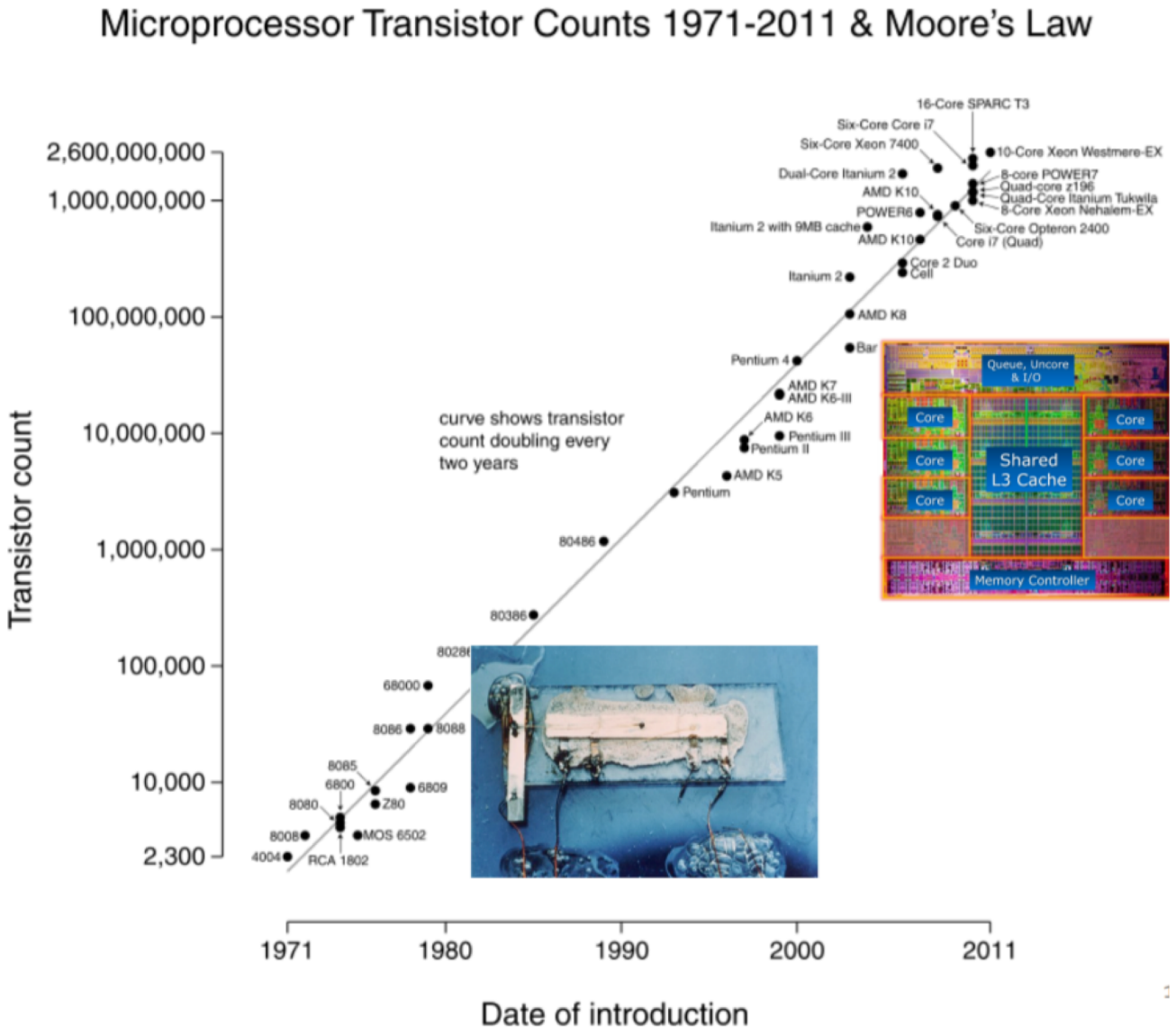
Moore's Law



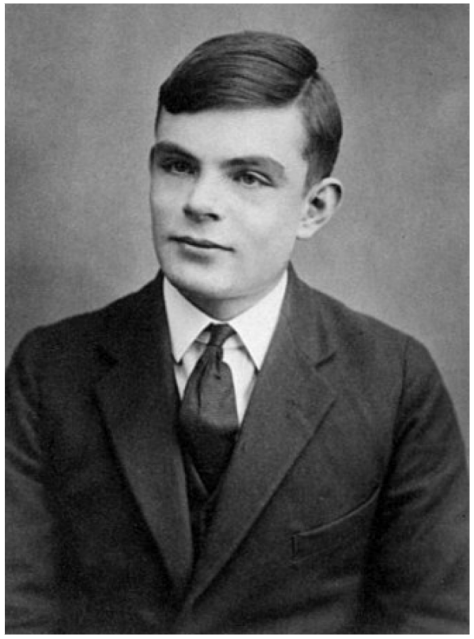
Gordon Moore

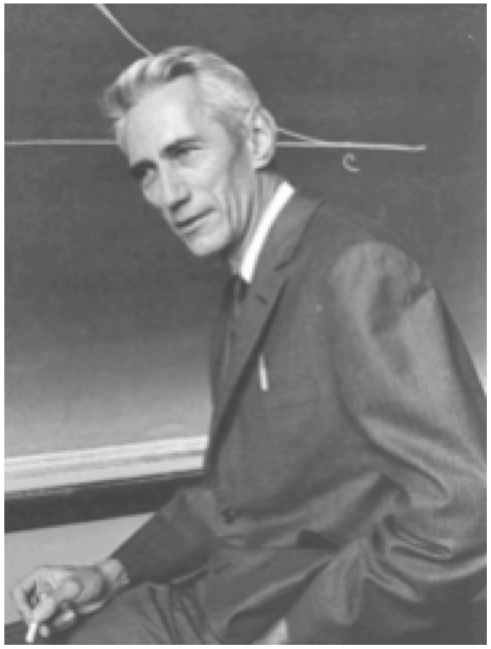
Intel Cofounder

B.S. Cal 1950!



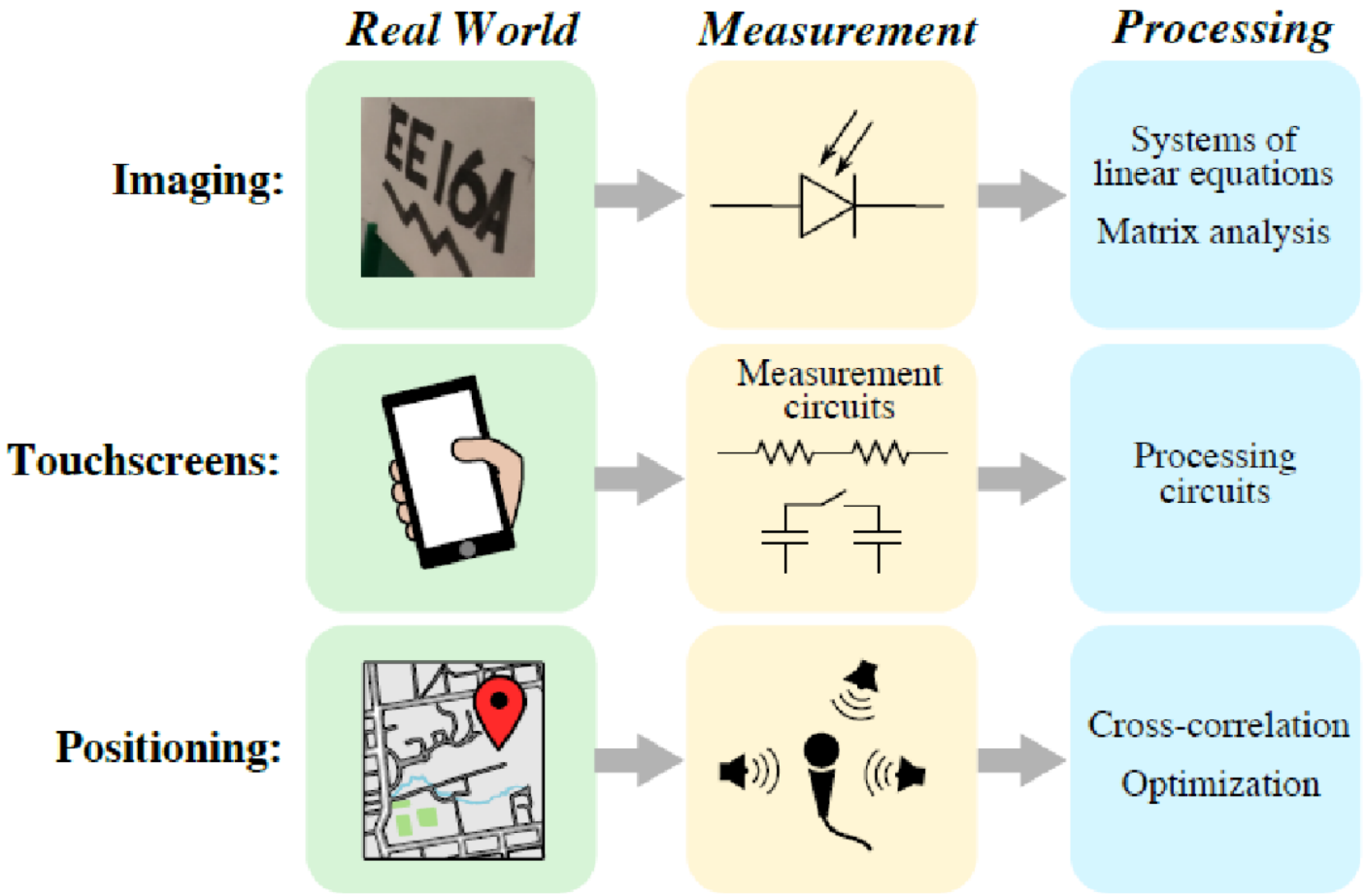
Completing the puzzle …





- 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

16A Examples

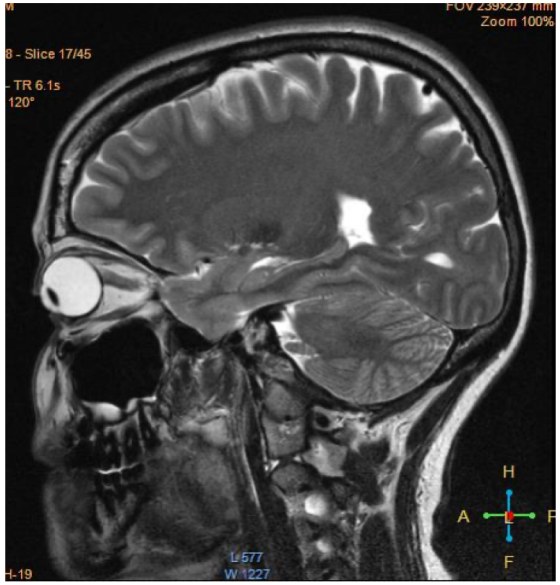


Module 1: Imaging

Medical imaging … 1632

Seeing inside bodies: sans surgery…

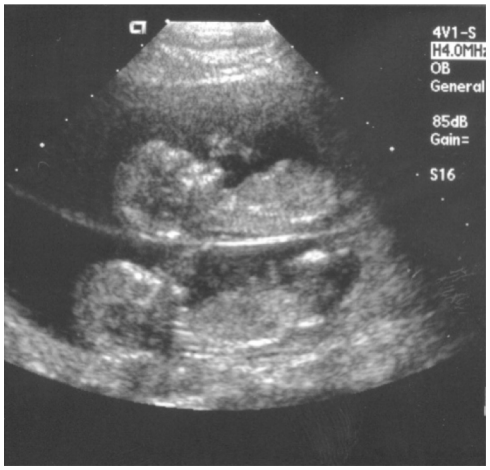
MRI



X-Ray

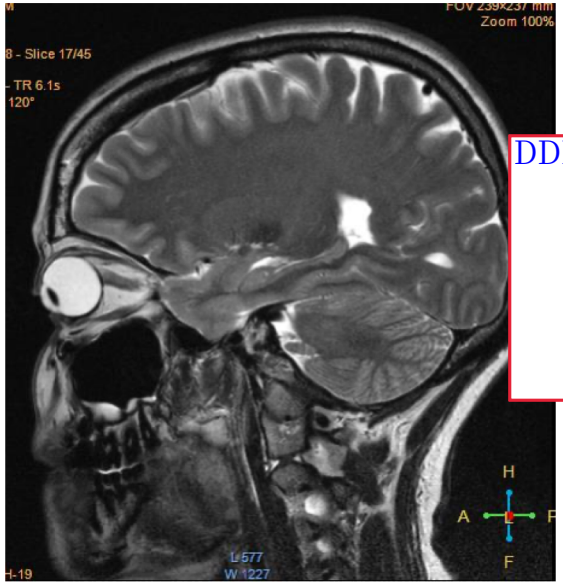
CT

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



Ultrasound

Tomography



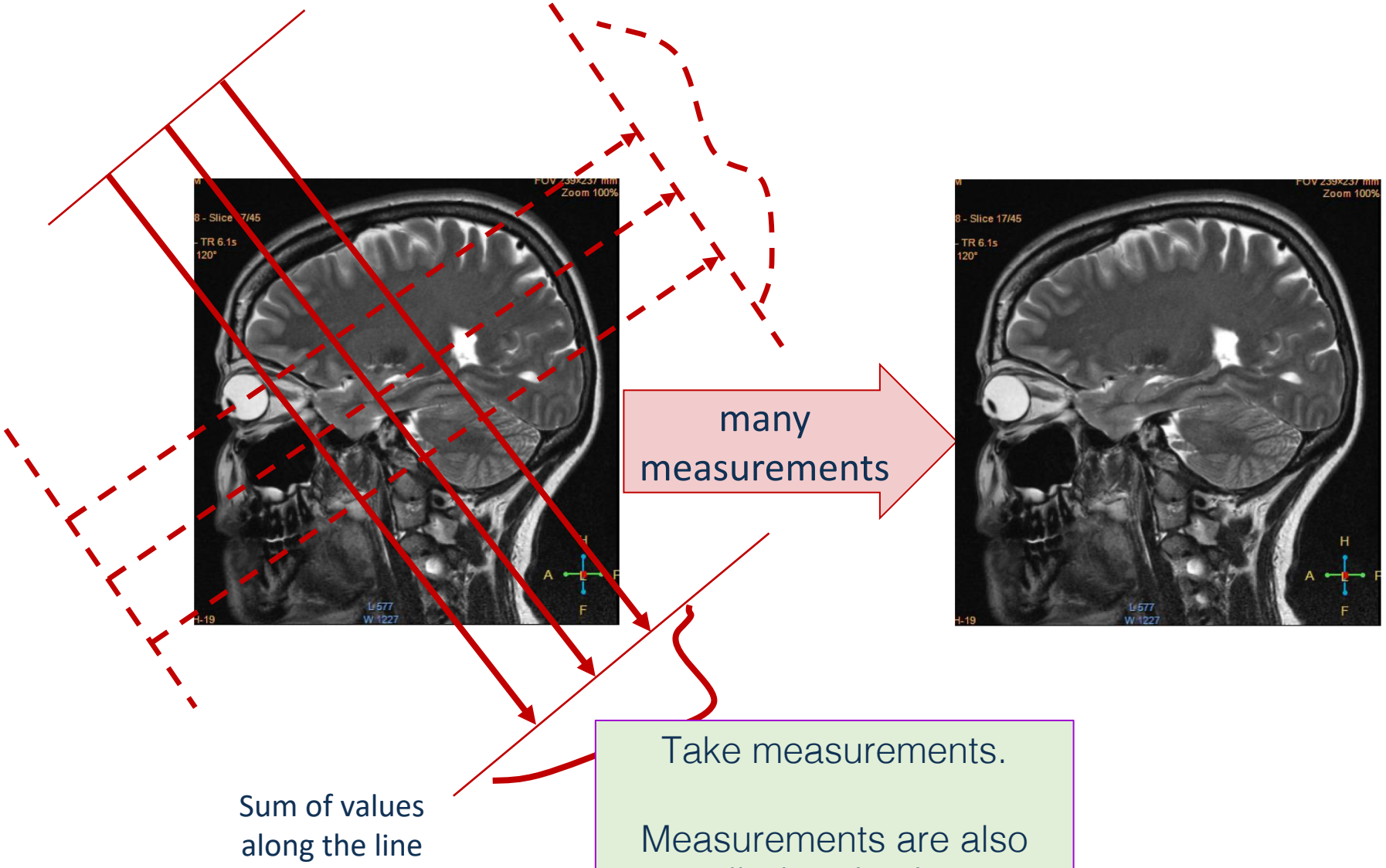
DDDDDD

tomo' – slice

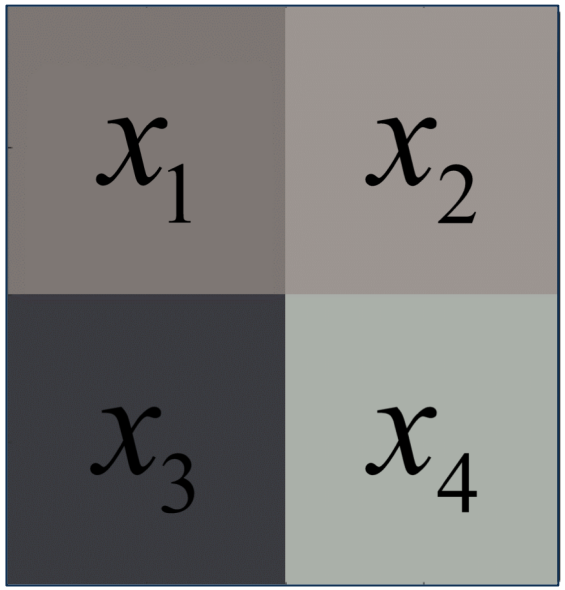
graphy' – to write

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

Tomography


many measurements
Sum of values along the line
Take measurements.
Measurements are also called projections

Example: Tomography



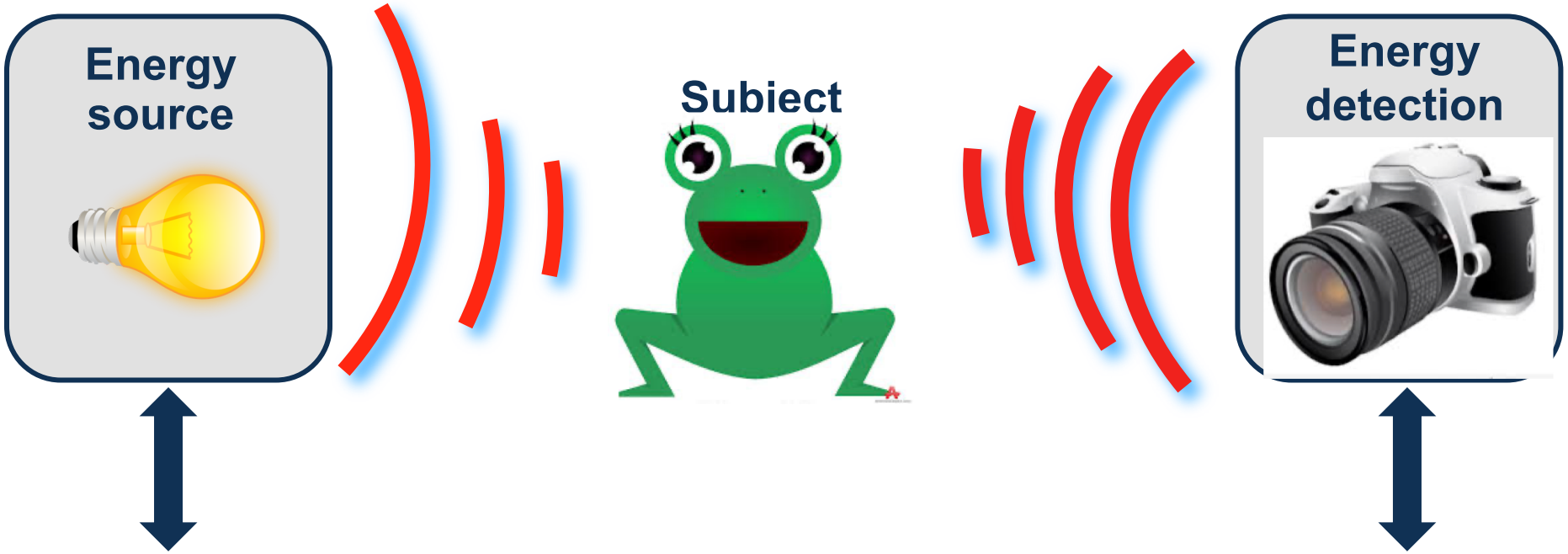
What do pixel values represent?

e.g. density, absorption, etc.

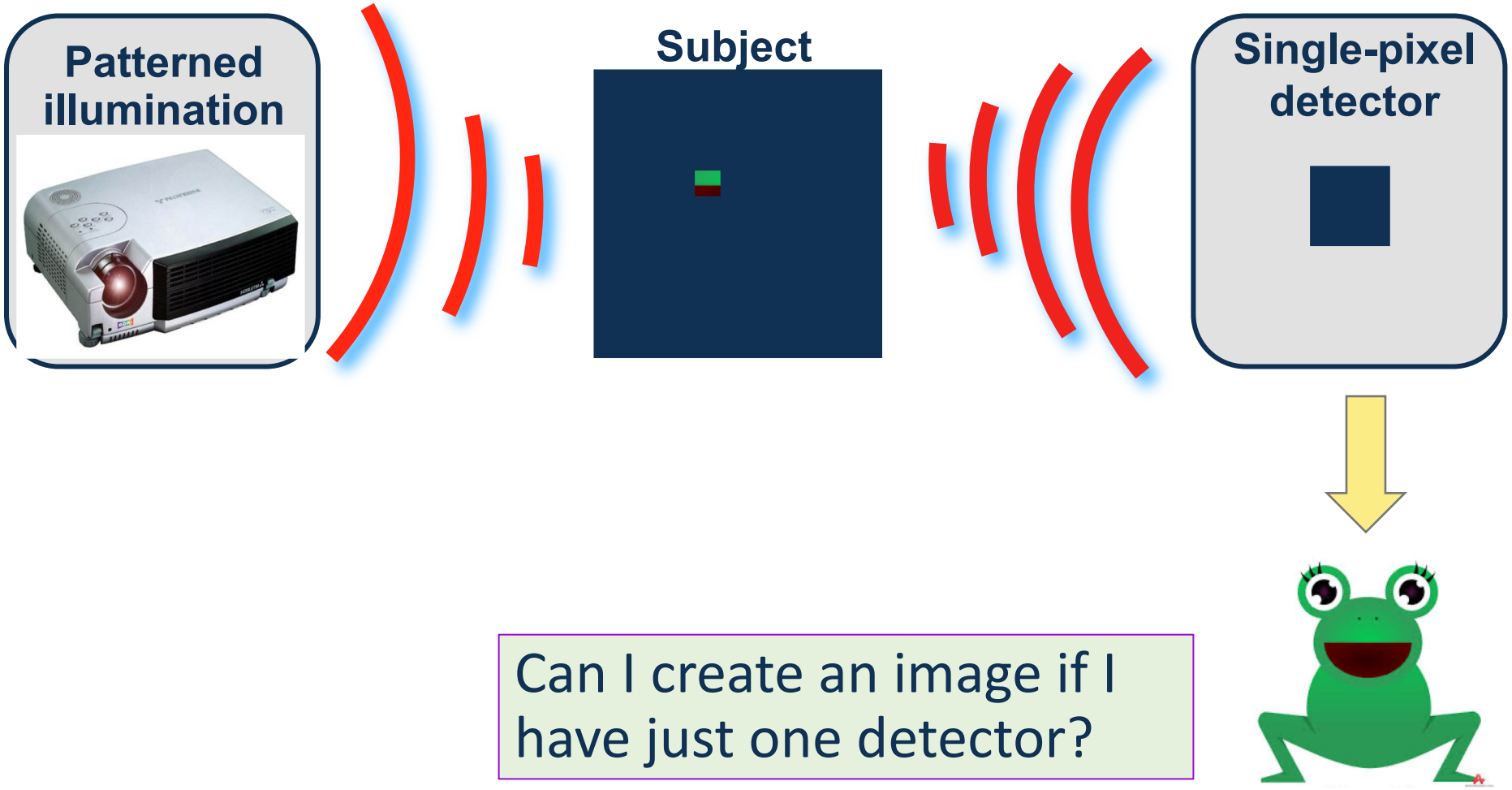
Can we solve for the pixel values from projections?

Yes, with tomography.

Imaging in general

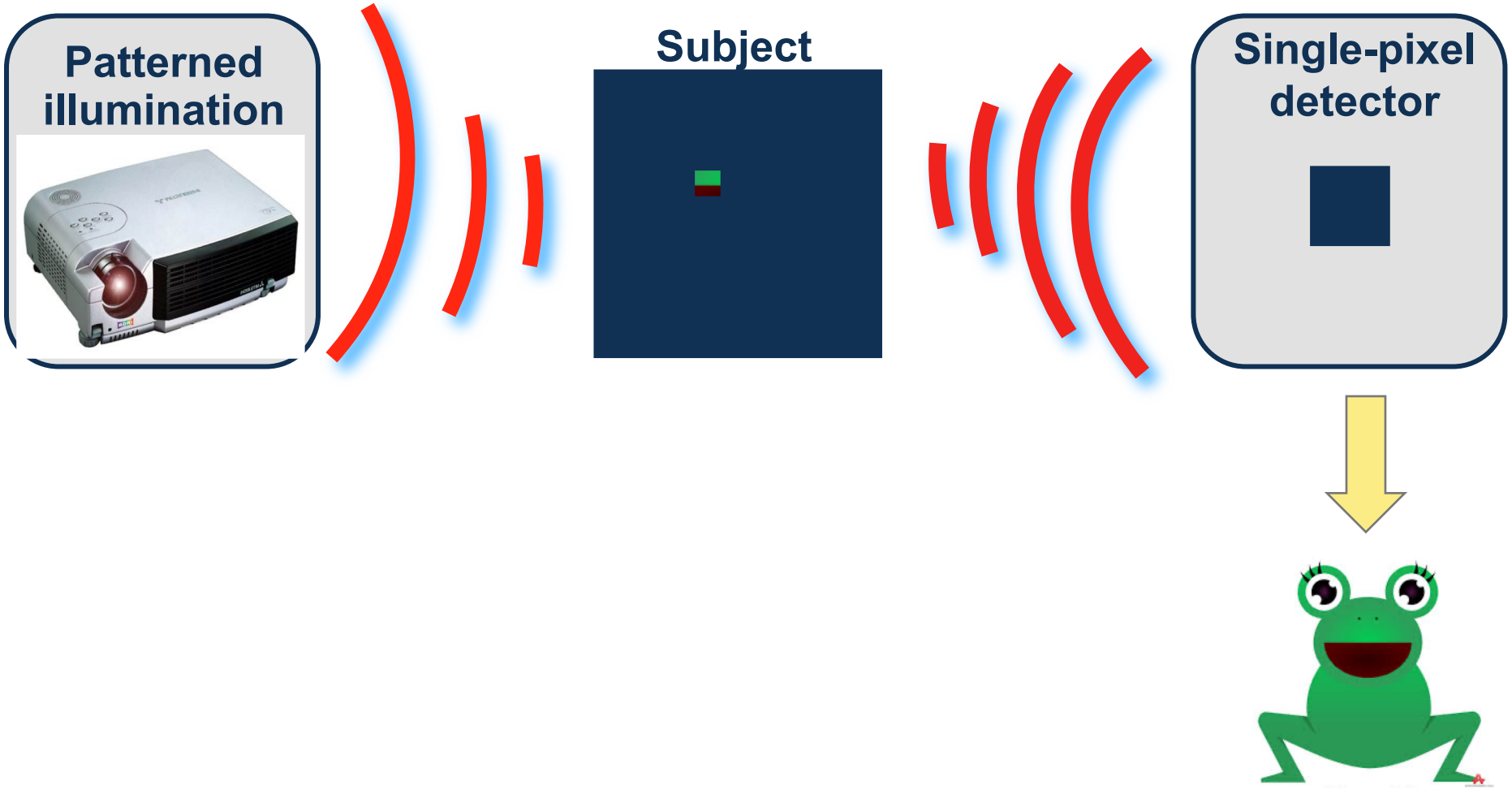


Single-pixel camera

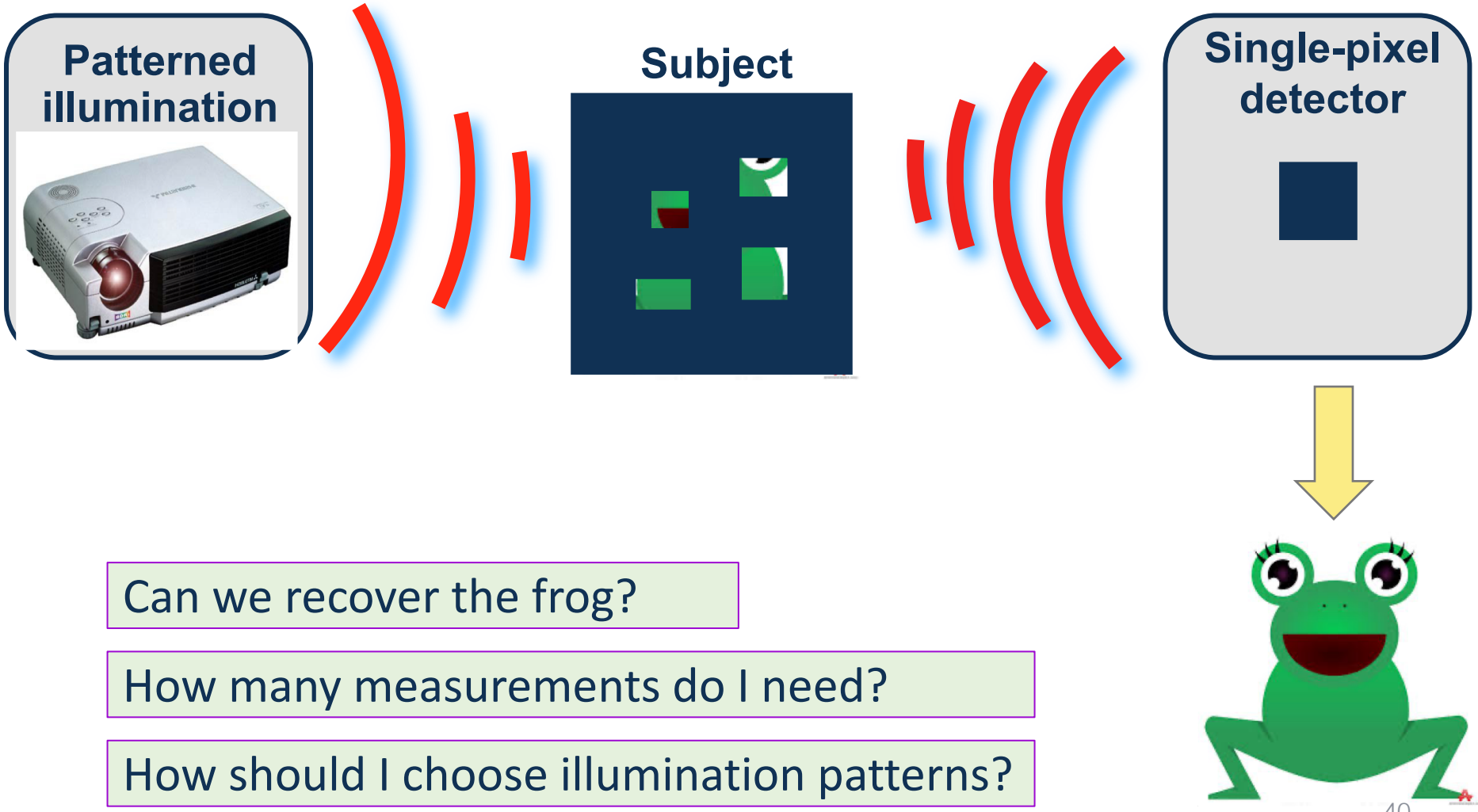


Can I create an image if I have just one detector?

Single-pixel camera



Single-pixel camera

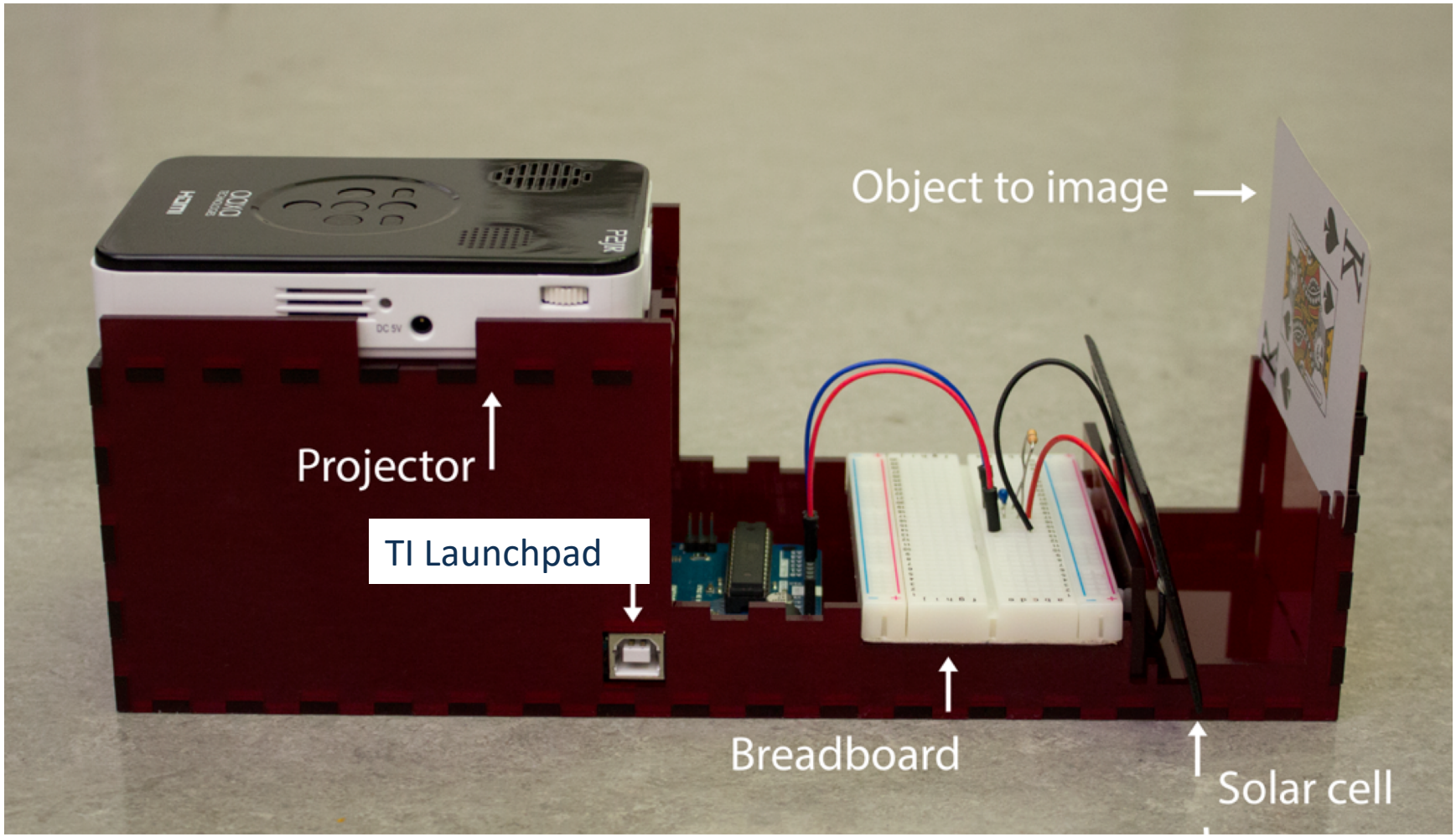


Can we recover the frog?

How many measurements do I need?

How should I choose illumination patterns?

Imaging Lab #1 Setup



Imaging Lab #1