Welcome to EECS16A!

Prof. Gireeja Ranade

August 24, 2023

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
ranade@eecs.berkeley.edu
565 Cory
OH: Tuesday after lecture
Today after lecture
Wednesday at homework party

Other Staff

Head GSIs:
eecs16a@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 in16A
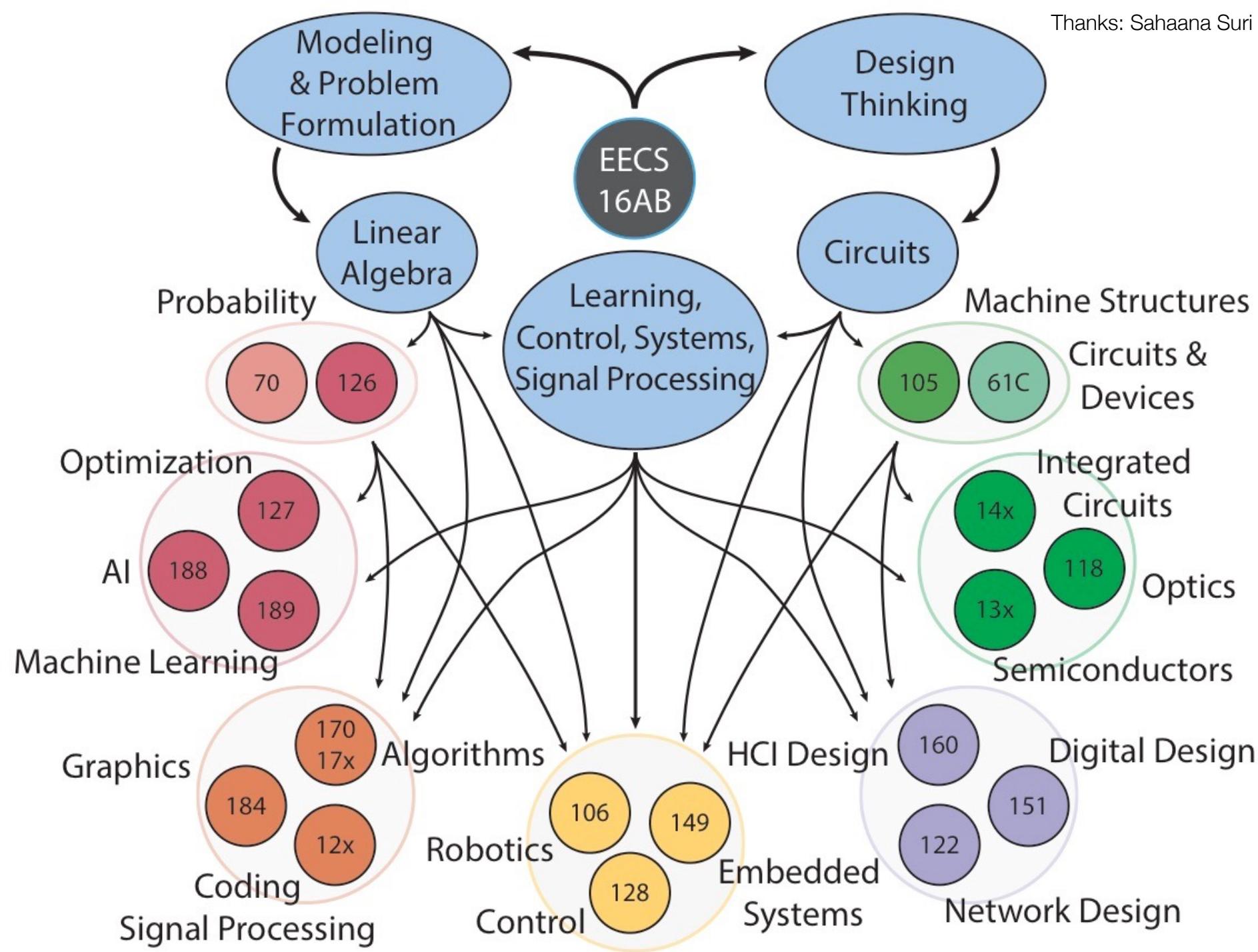
- Get enough sleep
- Attend lecture and discussion and lab
- Actively read notes, mark what is challenging
- Try HW on your own, early on
- Discuss problems with study group and/or at HW Party
- Help others
- Write HW solution on your own
- Reflect on solutions while self-grading
- Study with others 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.
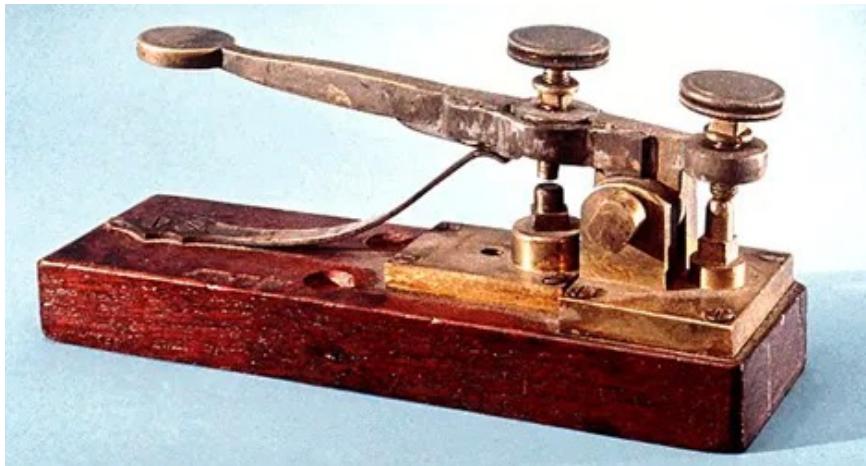
Community in Computing

- 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

Thanks: Sahaana Suri

Let's get started…

Early communications..
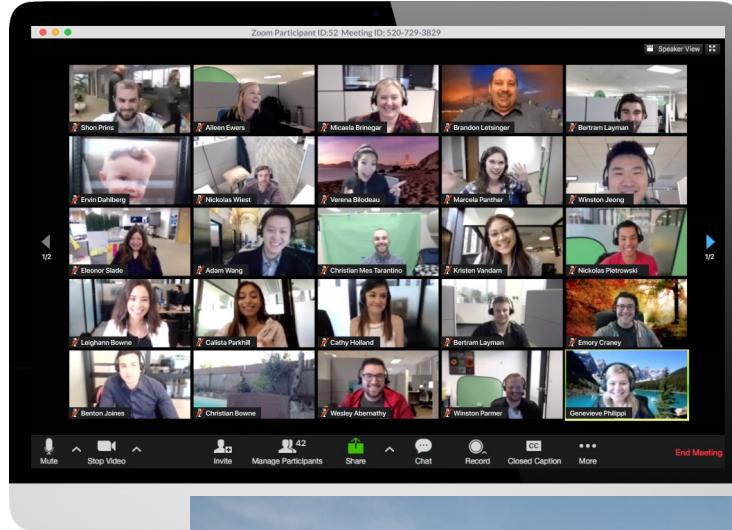
Telegraph ---
1830-1840

Laying of the transatlantic cable -
- 1858
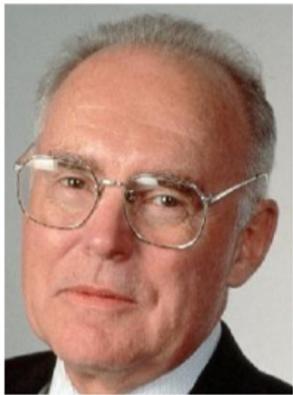
Currrent Era

The ChatGPT Era

Moore's Law
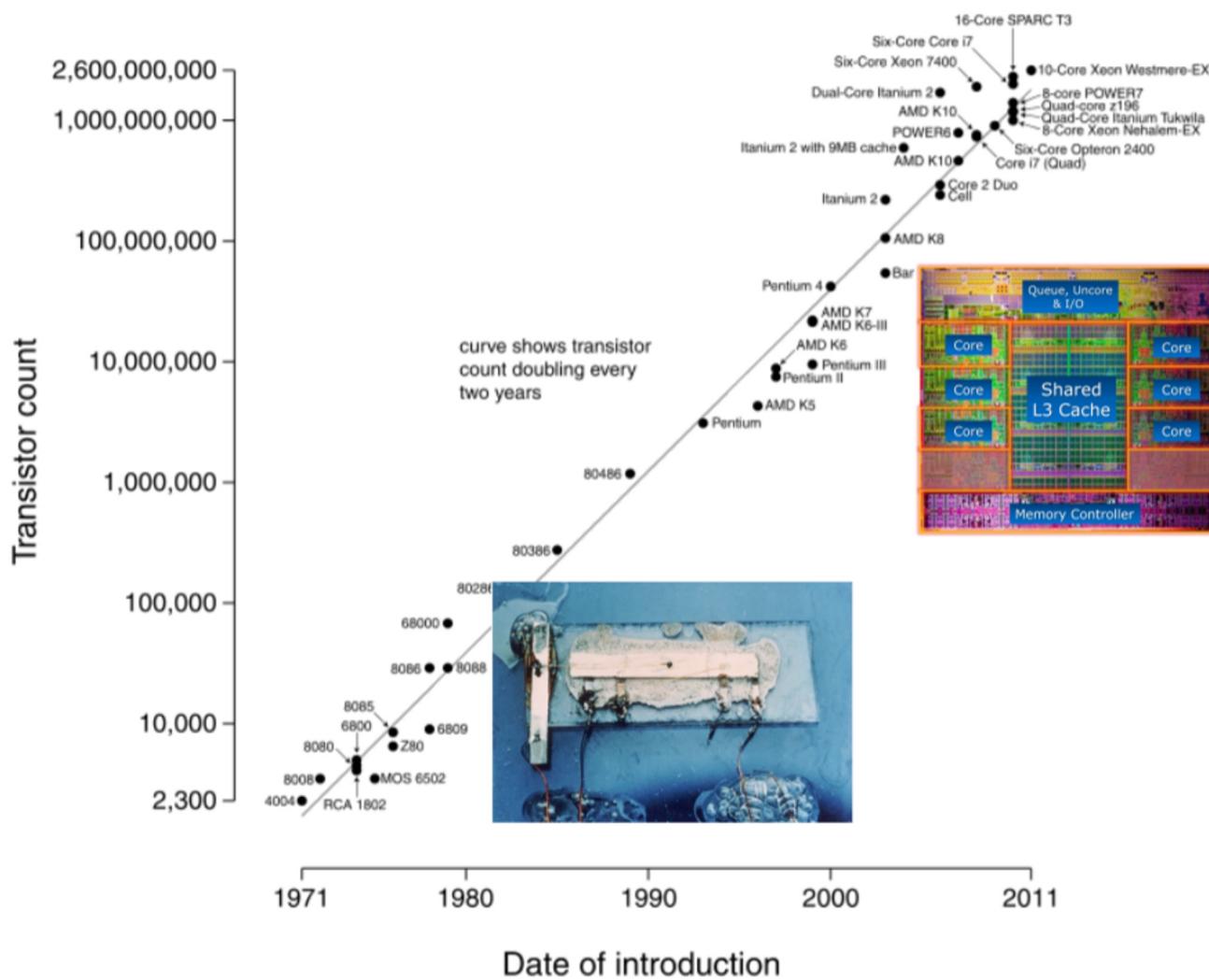
Microprocessor Transistor Counts 1971-2011 & Moore's Law
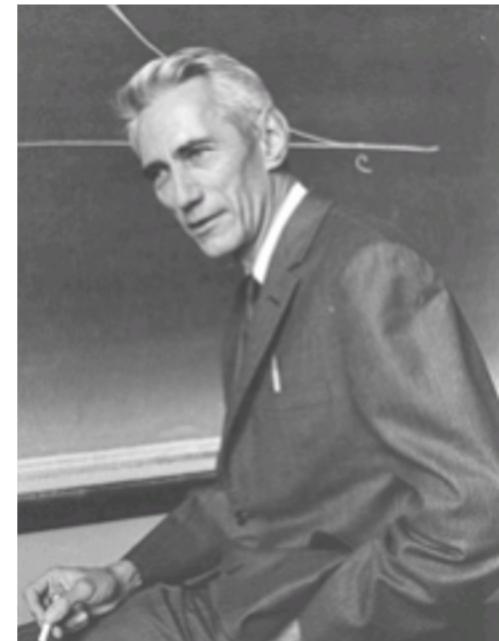
**Gordon Moore**

Intel Cofounder

B.S. Cal 1950!
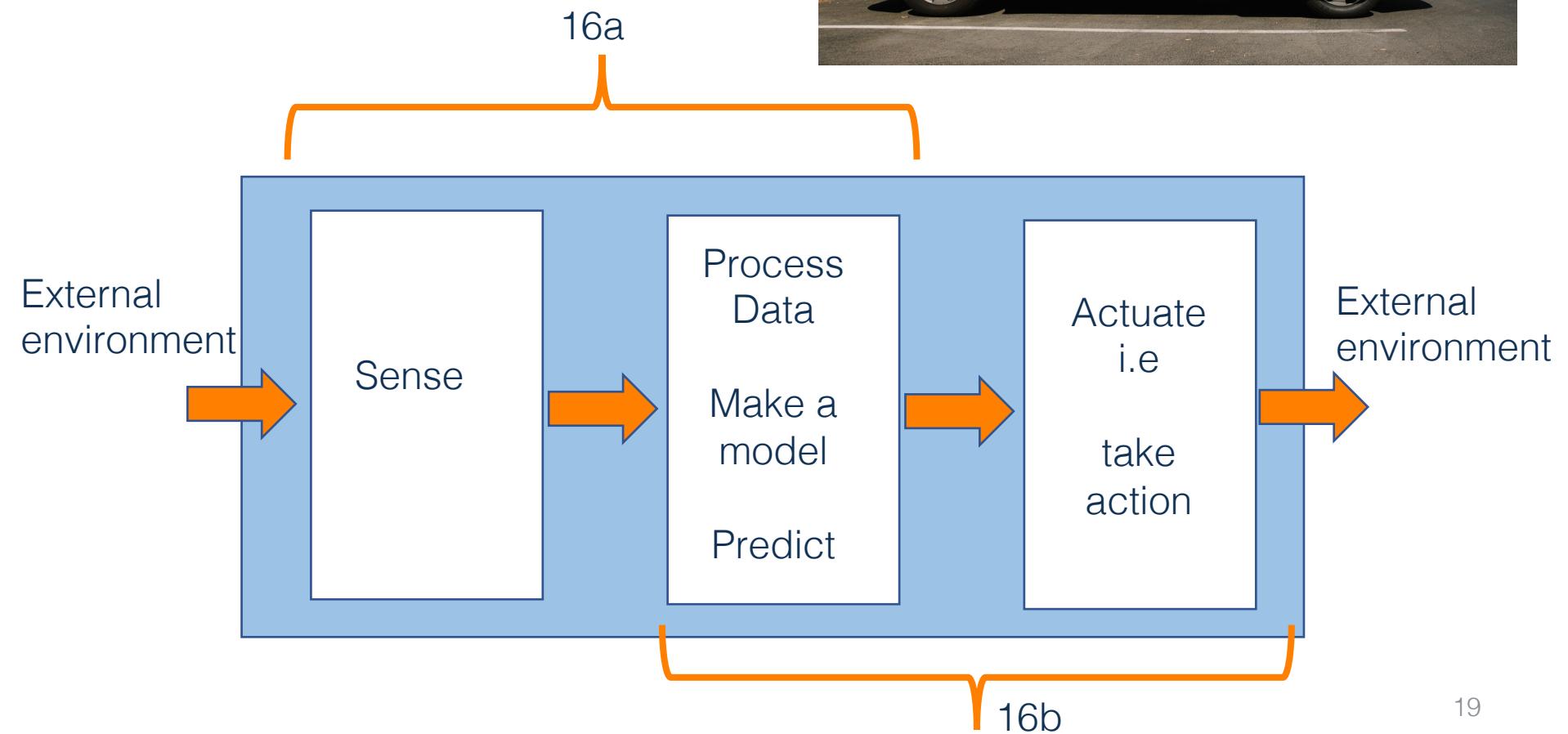
Completing the puzzle …
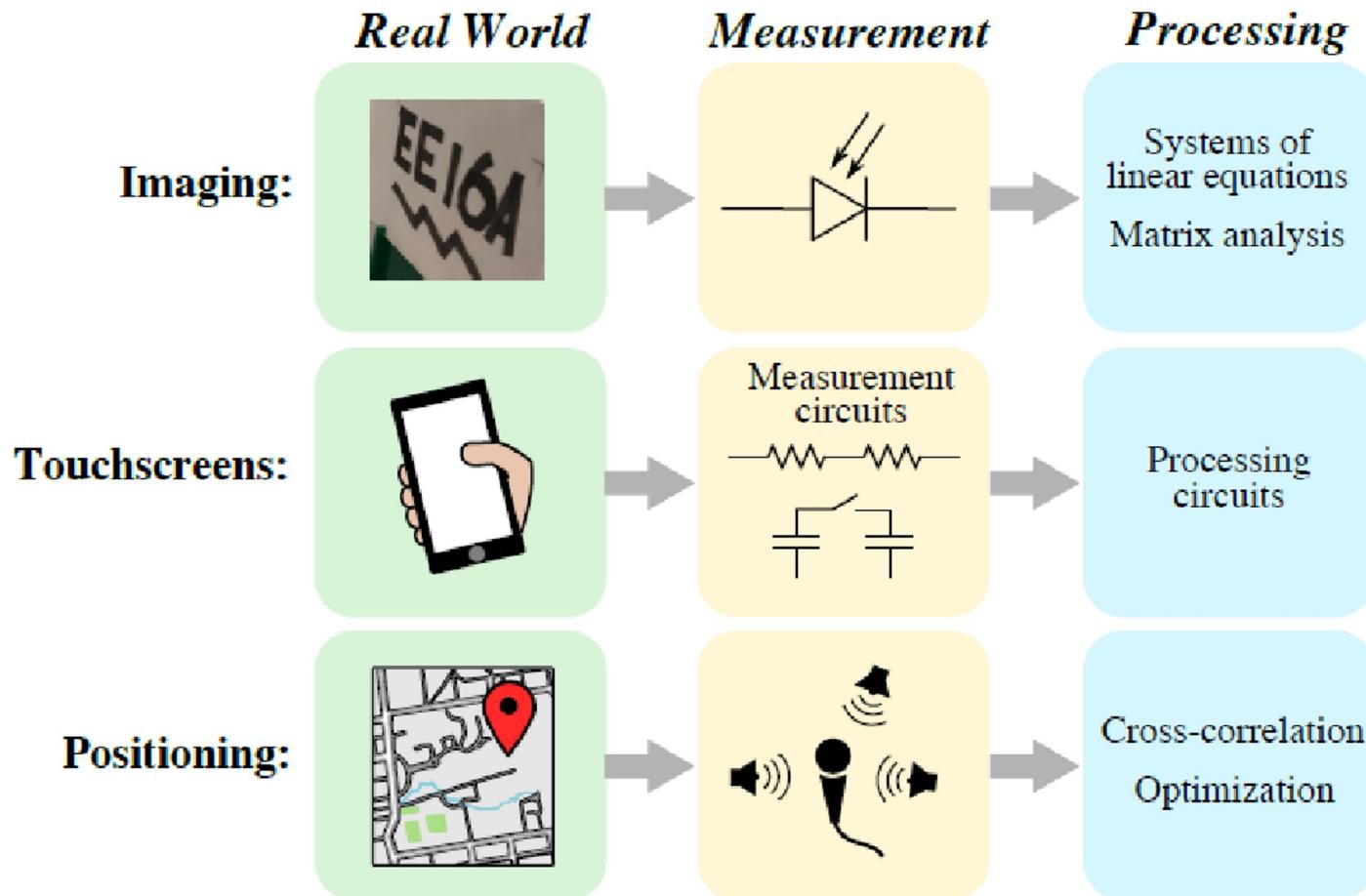
- Ada Lovelace - wrote the first computer program

- 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

Design exercise

16a

External environment →

| Sense | Process Data · Make a model · Predict | Actuate i.e take action |

→ External environment

16b

16A Examples

	Real World	Measurement	Processing
Imaging:	EE16A		Systems of linear equations / Matrix analysis
Touchscreens:		Measurement circuits	Processing circuits
Positioning:			Cross-correlation / Optimization
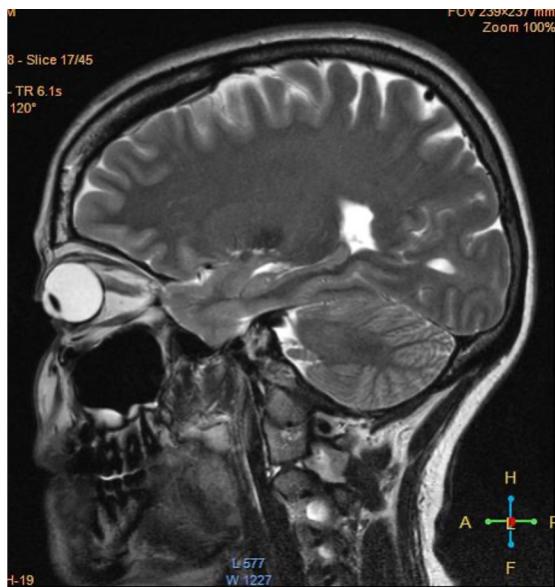
Module 1: Imaging

Medical imaging ... 1632

Seeing inside bodies: sans surgery…

MRI

X-Ray

CT
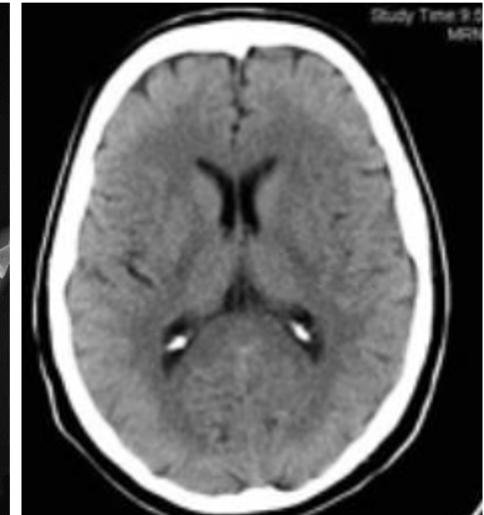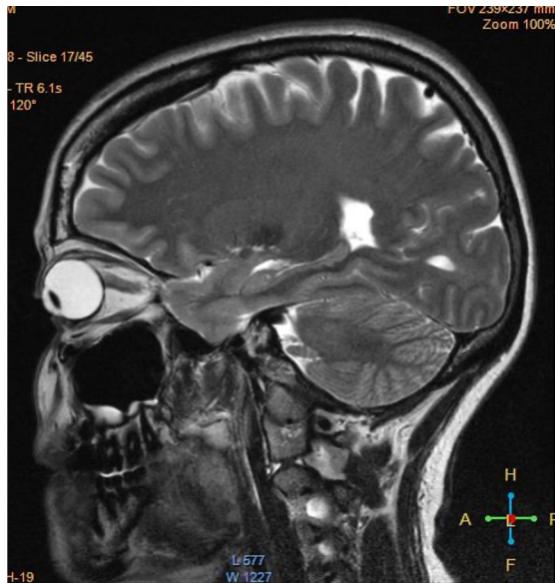
Ultrasound

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

Tomography

Siemens
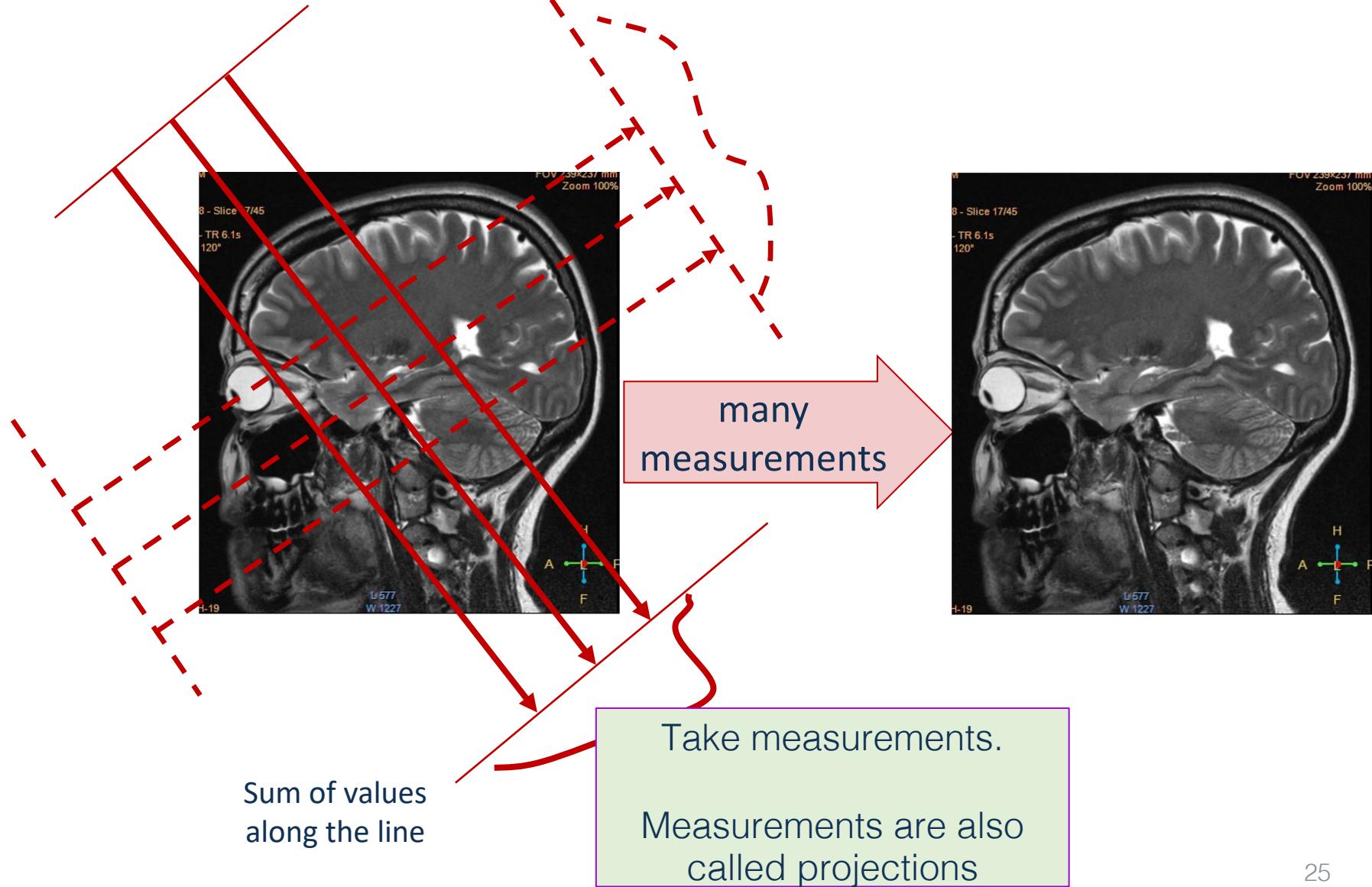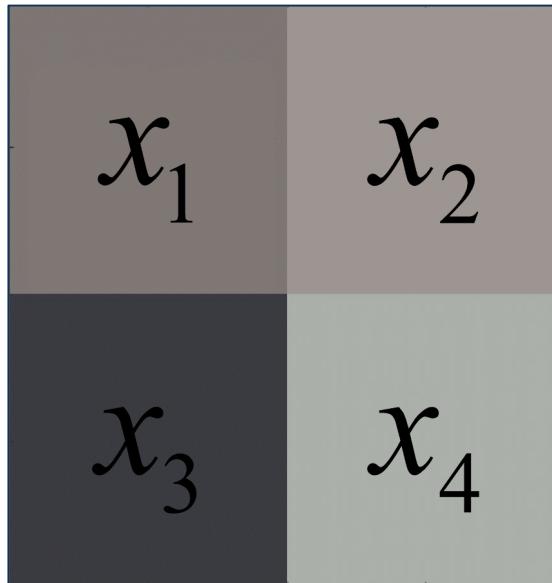
'tomo' – slice

'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

$$x_1 \quad x_2$$

$$x_3 \quad x_4$$
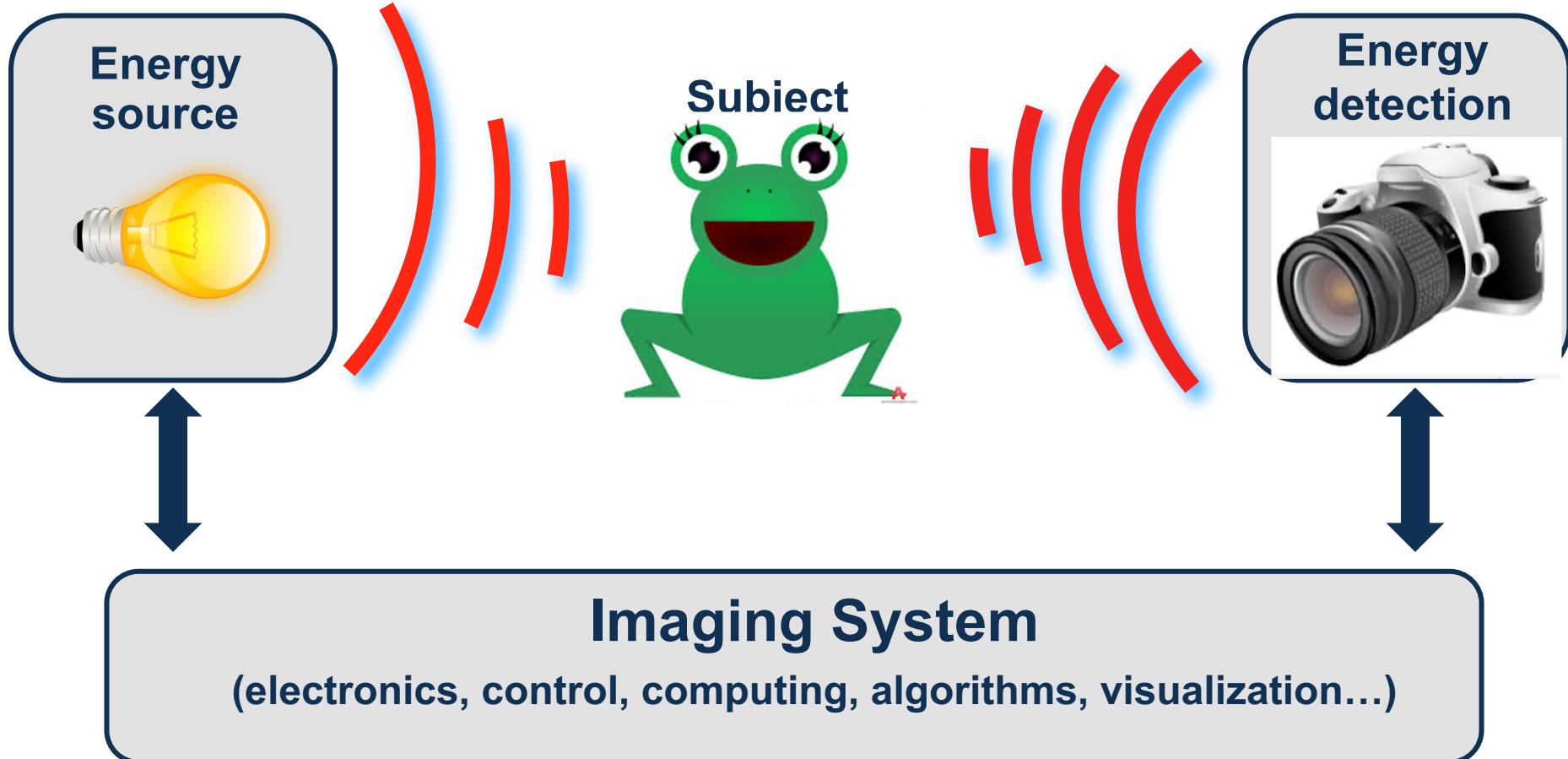
What do pixel values represent?

e.g. density, absorption, etc.
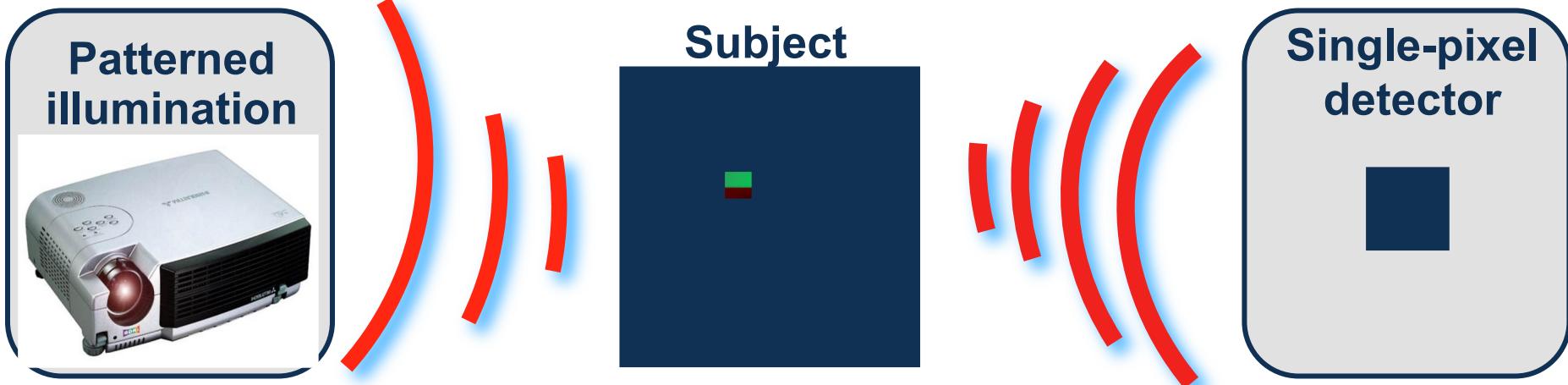
Can we solve for the pixel values from projections?

Yes, with tomography.

Imaging in general

Energy source

Subject

Energy detection

Imaging System
(electronics, control, computing, algorithms, visualization…)

Single-pixel camera

Patterned illumination
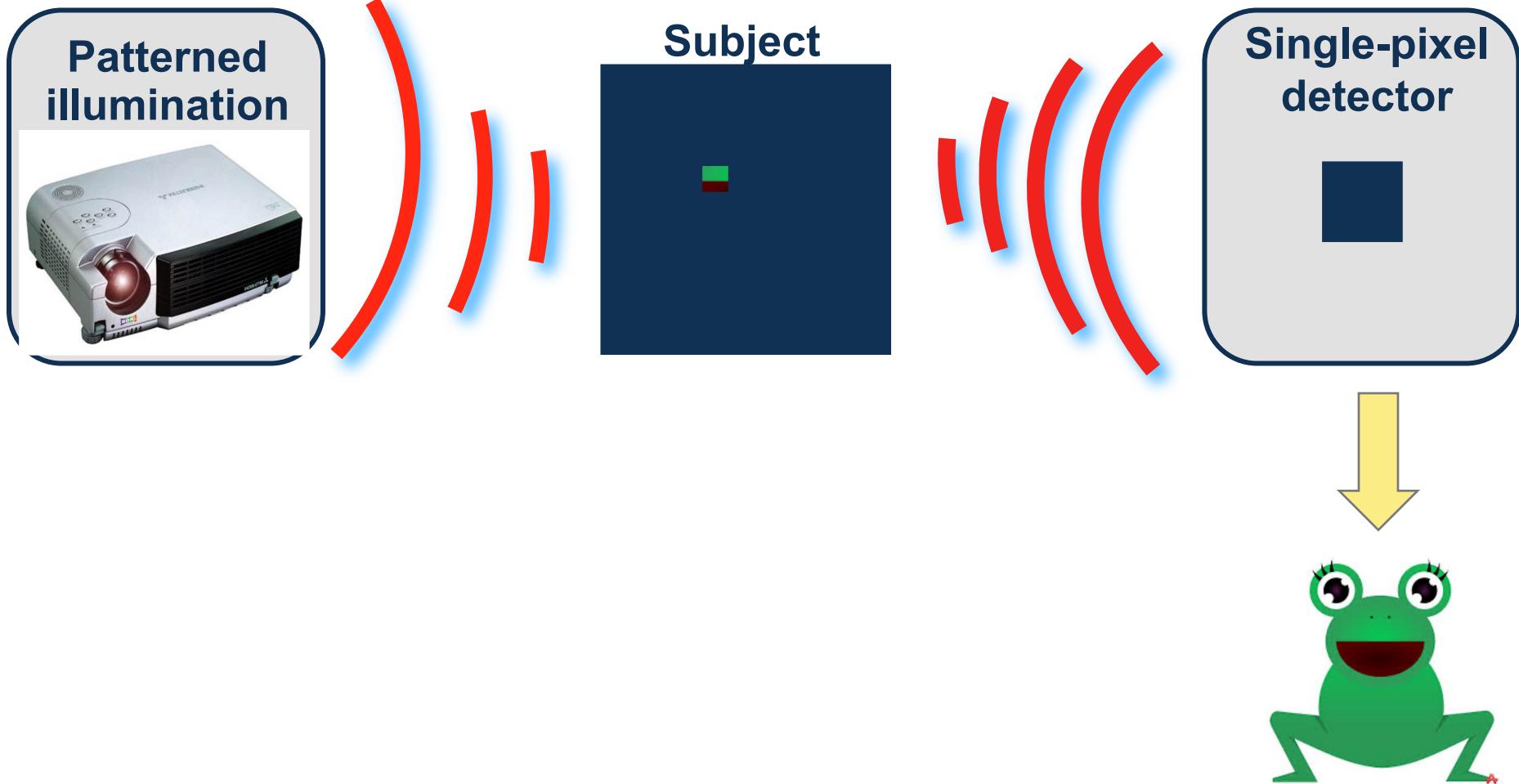
Subject

Single-pixel detector

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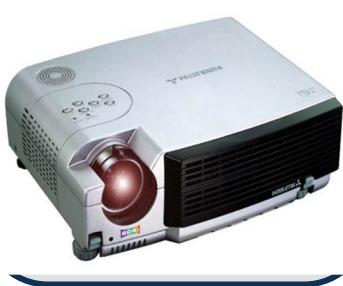
Single-pixel camera

Patterned illumination

Subject

Single-pixel detector
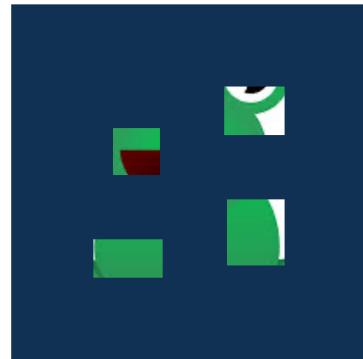
Single-pixel camera
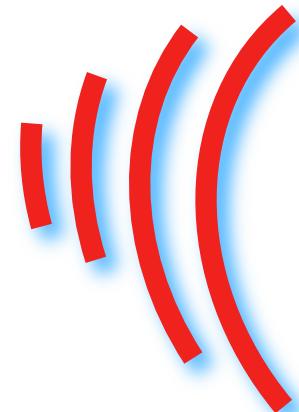
Patterned illumination

**Subject**

Single-pixel detector

Can we recover the frog?
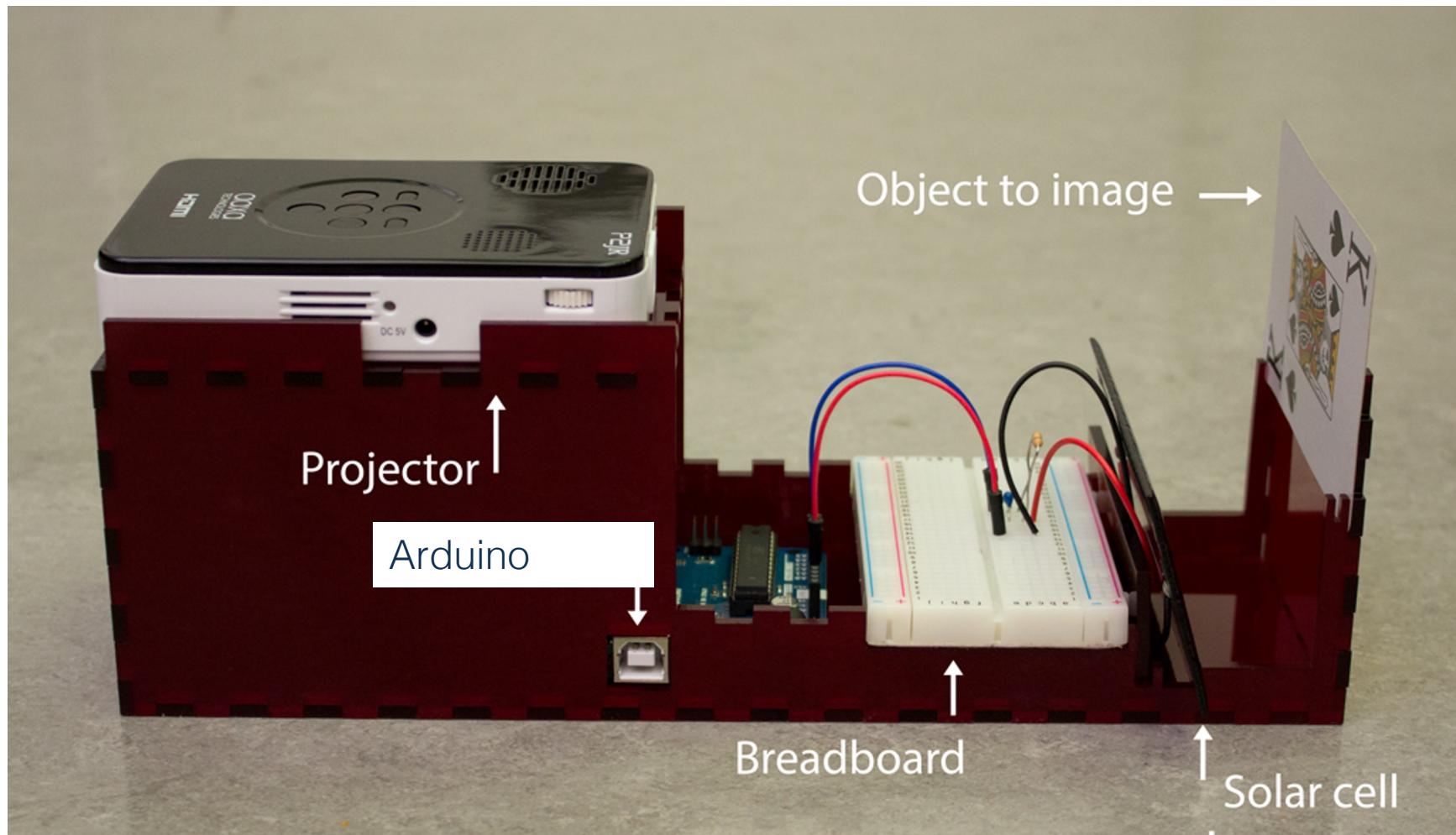
Measurement: Linear combination of the pixels

How many measurements do I need?
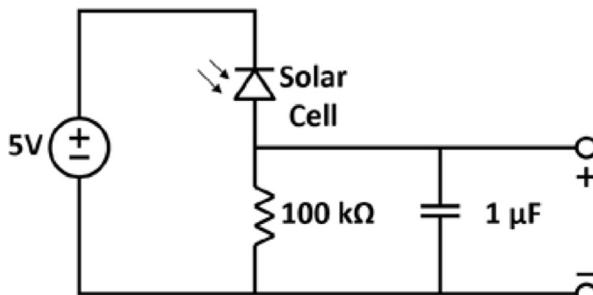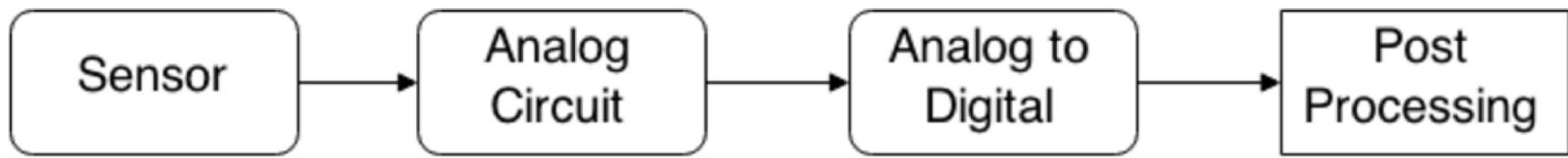
How should I choose illumination patterns?

Imaging Lab #1 Setup

Object to image →

Projector

Arduino

Breadboard

Solar cell

Imaging Lab #1