UC Berkeley EECS
Lecturer
Michael Ball

Computational Structures in Data Science

Review and Wrap Up

1

Computing In the News

- AI Can Turn Spoken Language Into Photorealistic Sign Language Videos
- New Scientist | Chris Stokel-Walker | November 27, 2020
- Researchers at the U.K.'s University of Surrey employed a neural network to render spoken language as sign language, and to map the signs onto a three-dimensional model of the human skeleton. Surrey's Ben Saunders and colleagues also trained the SignGAN system on videos of sign language interpreters, educating it to generate a photorealistic video of anyone signing based on an image of them. The artificial intelligence (AI) combines video and skeletal images to convert spoken words into sign language. Because interpreters' hands in the training videos could sometimes be blurry, the Surrey team used an existing AI that could estimate hand poses from a small area around the middle knuckle. When 10-second clips of the videos were shown to 46 people, about 25% of whom were signers, all favored SignGAN over other AI models.

2

Announcements

- Final Exam, Tuesday 7-10pm slot
  - Alternate 8am Wednesday
  - We will email those with alternates/accommodations soon.
- Don't forget Ants Project is due tomorrow!
  - You may use slip days
- The grading info is all based on points you earned
  - Sum everything up! (Everything except lecture self-checks are in Okpy.)
    - » Almost everyone is getting 20/20 on the lecture self-checks. That's the point. ☺
- 190 points is a pass! You don't need to take the final exam.

3

Head Teaching Assistants

Brian M
Office Hours:
bm@berkeley.edu

Hello! I'm a 4th year CS major from Indiana. In my free time, I really enjoy playing tennis and badminton. This is now my fourth semester teaching CS88, and I'm excited for this unique semester! Let me know if there's anything I can help with. Looking forward to meeting as many of you as possible!

Shreya Kannan
Office Hours:
shreyakannan@berkeley.edu

Hey everyone! I'm super excited to meet and work with y'all this semester! In no particular order, I prefer musicals over concerts, cold over warm weather, dancing over singing, and sushi over tacos. Feel free to talk to me about great restaurants, cool study spots, and of course, CS 88 :)

Teaching Assistants

Jeff Chen
Office Hours:
jeffrey_chen984@berkeley.edu

Hi! I'm a 4th year CS major from NY. I'm on the Cal Ice Hockey team, but outside of that I enjoy hanging out with friends and I'm also currently trying to learn to cook. Looking forward to meeting y'all!

Nicholas Ng
Office Hours:
nicking589@berkeley.edu

Hi! I'm Nicholas, and I'm a third year Computer Science Major from the San Gabriel Valley. I like playing video games (I probably spent too much of my summer playing Valorant), and every once in a while I'll go outside for a run (but not really though). I look forward to meeting everyone!

Vandana Ganesh
Office Hours:
vandanag@berkeley.edu

Hi everyone! I am a third-year EECS major from near Dallas, Texas. In my free time, I love binging a variety of TV shows, making desserts (and eating them :p), and working on a bunch of different fine arts hobbies (dancing, violin). Feel free to email me if have any questions or just want to talk. This is my third semester on 88 course staff (2nd time as a TA) and I am super excited to meet you all virtually!

4

THANK YOU!

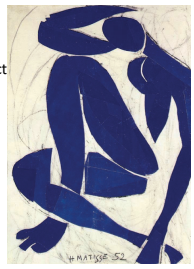
5

The One Big Thing...

6

Abstraction

- Detail removal
  "The act of leaving out of consideration one or more properties of a complex object so as to attend to others."
- Generalization
  "The process of formulating general concepts by abstracting common properties of instances"
- Technical terms: Compression, Quantization, Clustering, Unsupervised Learning



Henri Matisse *"Naked Blue IV"*

8

The Power of Abstraction, Everywhere!

- **Examples:**
  - **Functions (e.g., sin x)**
  - **Hiring contractors**
  - **Application Programming Interfaces (APIs)**
  - **Technology (e.g., cars)**
- **Amazing things are built when these layer**
  - **And the abstraction layers are getting deeper by the day!**

We only need to worry about the interface, or specification, or contract NOT how (or by whom) it's built

Above the abstraction line

Abstraction Barrier (Interface)
(the interface, or specification, or contract)

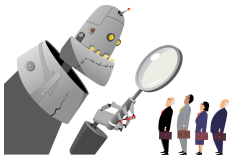
Below the abstraction line

This is where / how / when / by whom it is actually built, which is done according to the interface, specification, or contract.

9

Abstraction: Pitfalls

- **Abstraction is not universal without loss of information (mathematically provable). This means, in the end, the complexity can only be "moved around"**
- **Abstraction makes us forget how things actually work and can therefore hide bias. Example: AI and hiring decisions.**



- **Abstraction makes things special and that creates dependencies. Dependencies grow longer and longer over time and can become unmanageable.**

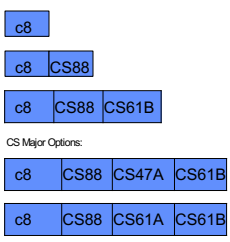
10

Computational Concepts Toolbox

Python Tools:
- Data type: values, literals, operations,
- Expressions, Call expression
- Variables
- Assignment Statement, Tuple assignment
- Sequences: tuple, list
- Dictionaries
- Function Definition Statement
- Conditional Statement
- Iteration: list comp, for, while
- Lambda function expr.
- Higher Order Functions
  - Functions as Values
  - Functions with functions as argument
  - Assignment of function values
  - Function factories – create and return functions
- Higher order function patterns
  - Map, Filter, Reduce
- Recursion
- Abstract Data Types
- Mutation
- Class & Inheritance
- Exceptions
- Iterators & Generators
- SQL / Declarative Programming

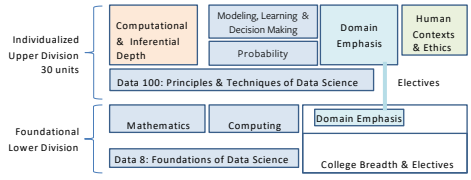
11

Where to go from here?



12

The Data Science Major



Data Science Info: https://data.berkeley.edu/2020-cal-week (Recordings)
There's also a minor!

13

Ask Is Anything!

14

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THANK YOU!

(Again!)

15