
Python DeCal
Week 12

# Announcements

- Check-In Reports due WEDNESDAY 4/21
- Final Projects Presentations 26th and 28th of April! (Next week!)

- This is the last week of lectures!

- Ask for help if you need it! We are here for you

- Attendance: https://forms.gle/q6JiyTZ3cuZQRVmk9

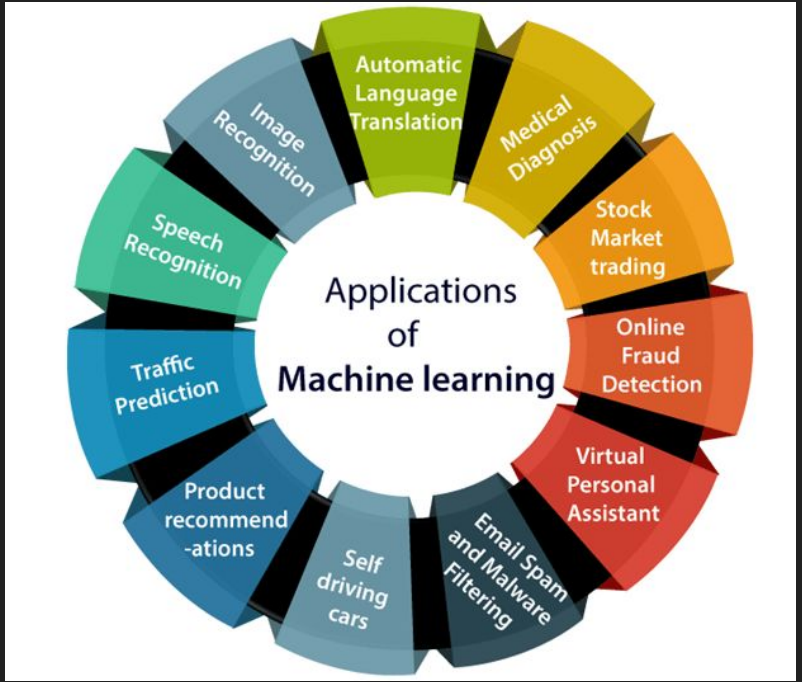
# Monday

# Breakout Rooms

- How are final projects going?
- What types of libraries, methods, or datasets have you been using?
- Any problems that you are running into?

# Machine Learning Applications

- Self-driving cars
- Netflix & Tiktok recommendations
- Siri & Alexa speech recognition
- Google Translate
- Medical diagnosis
- Face recognition

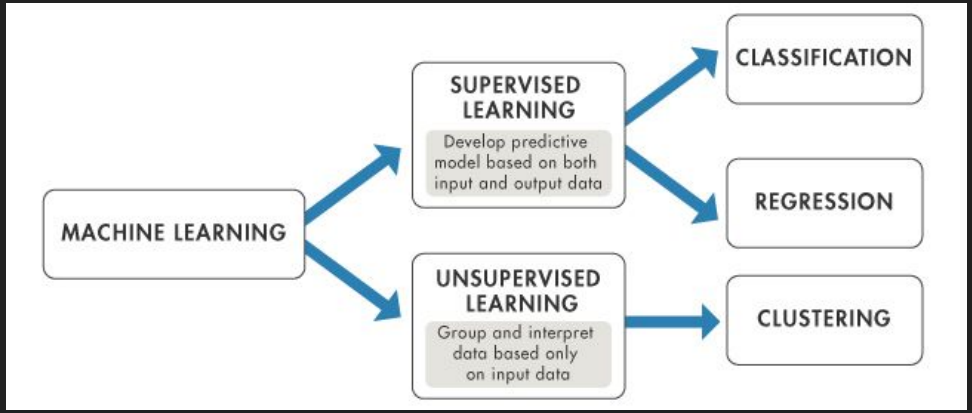


# Intro to Machine Learning

- Programming real-life applications is really hard!
  - Real life is not a perfect model
  - Too many factors to code

- What if we let the computer learn through examples and training rather than explicitly code everything?
  - CPU learns through experience and reward

# Machine Learning

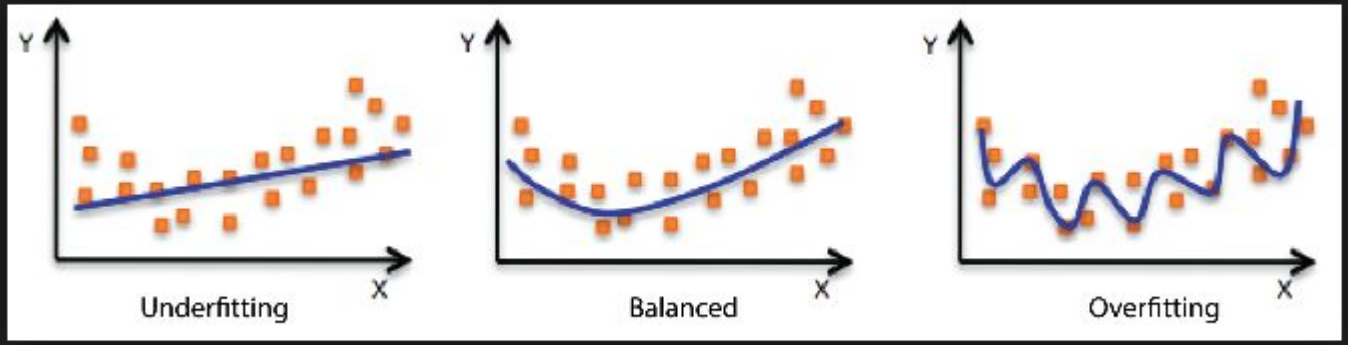



Two types of machine learning:

- Supervised: (gives data with correct labels)
  - Regression—includes basic linear regression! We have technically already applied machine learning in this course
  - Classification—is this image a person or a car?
- Unsupervised: (gives data and machine creates the labels)
  - Clustering—Netflix classifying movies as “irreverent thrillers”

# Regression

- Many different types of models—linear, polynomial, logistic
- Calculate the parameters that minimize the error given input data (x) and output labels (y)
  - Real data is never perfect! There will always be errors
- Important to consider simplicity versus overfitting
  - Use regularization, cross-validation, different loss models

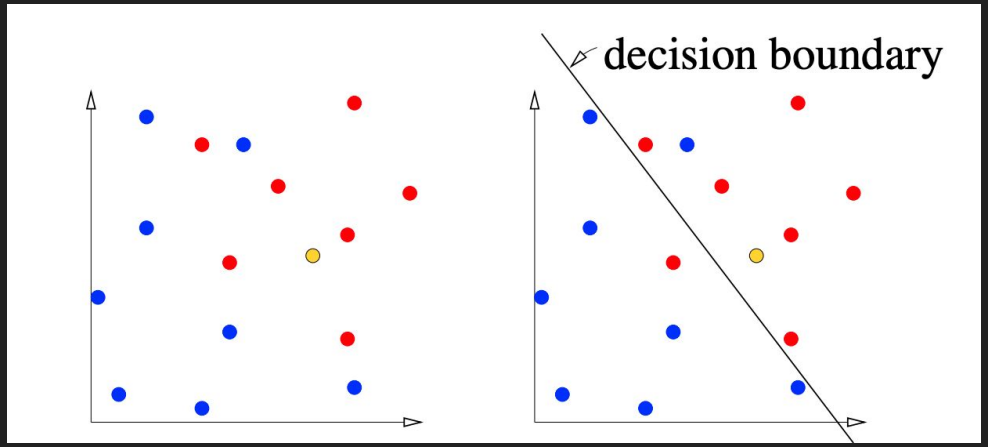


# Using Data

- Split the data into a training set and a test set
  - Use the training set to train the model
  - Use the test set to test the accuracy of the model on never before seen data
- Very important not to use test set as training data!! This is to avoid overfitting
- More important to have high test accuracy than training accuracy

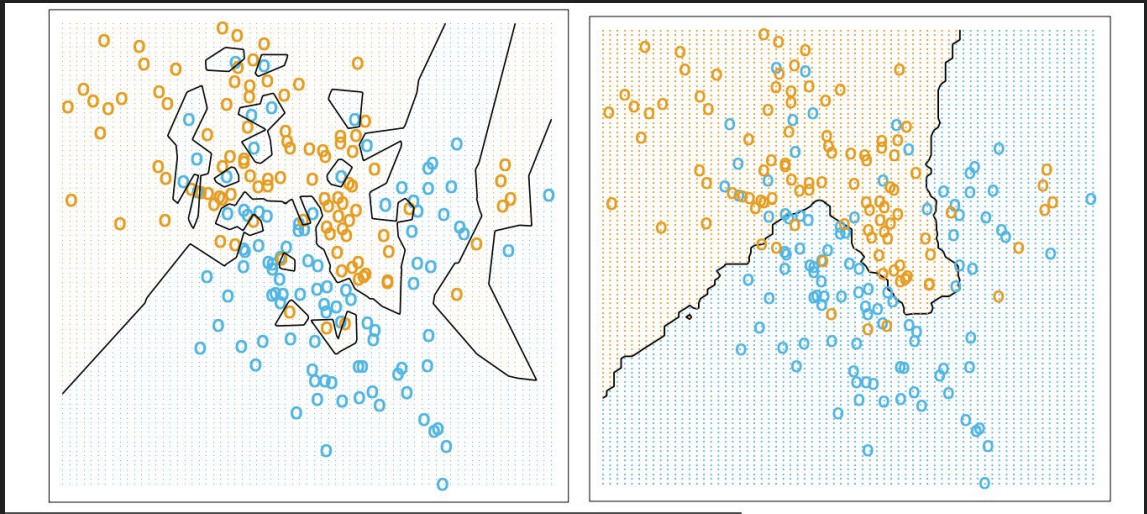
# Classification

- Given many data points with different class labels
- You are then asked to predict/classify new data points
- Define a decision boundary to split the data



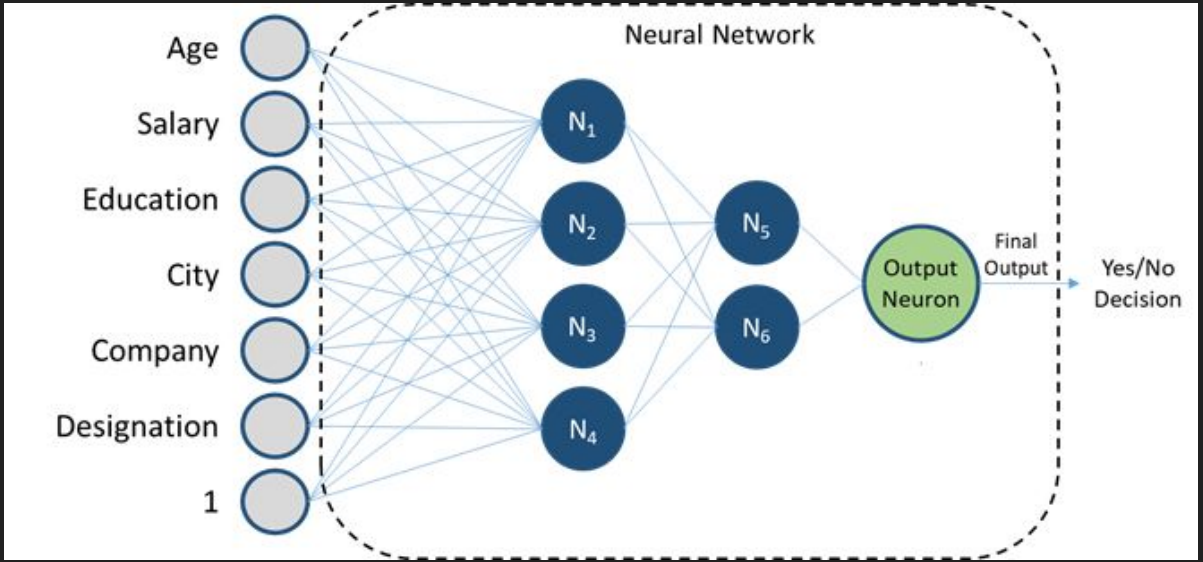
# Classification

- Often data is not easily splittable
- Need tradeoffs to balance future accuracy
- Model on the left has smaller error, but model on right is more general to future data



# Neural Networks

- Use layers of regression to model any function
- The nodes are called perceptrons which are interconnected
- Hidden layers and activation functions that turn linear weights into nonlinear functions

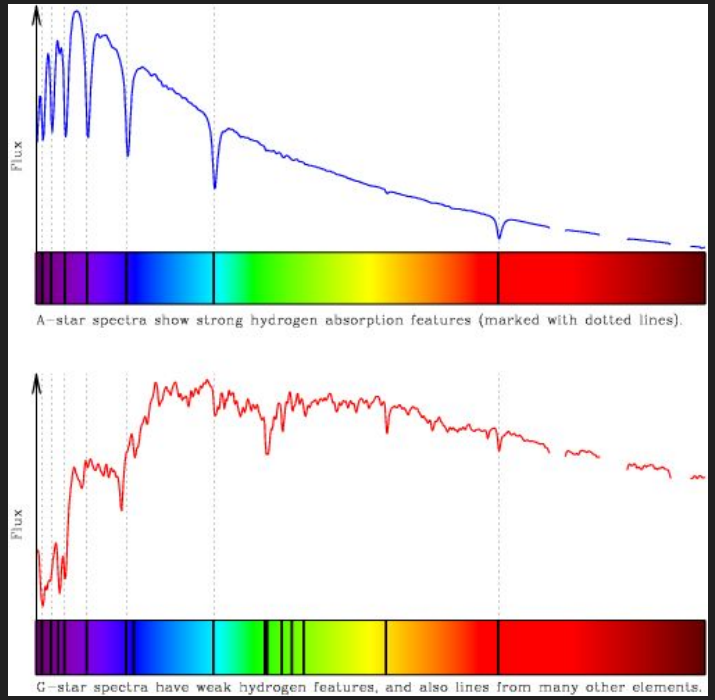


# Machine Learning in Astronomy

- With so much incoming data, astronomers need better tools like machine learning to model and classify data
- Examples:
  - Inferring stellar parameters from spectra (regression)
  - Detecting supernova (classification)
  - Galaxy type classification (classification)
  - Spatial clustering of dark matter halos (clustering)

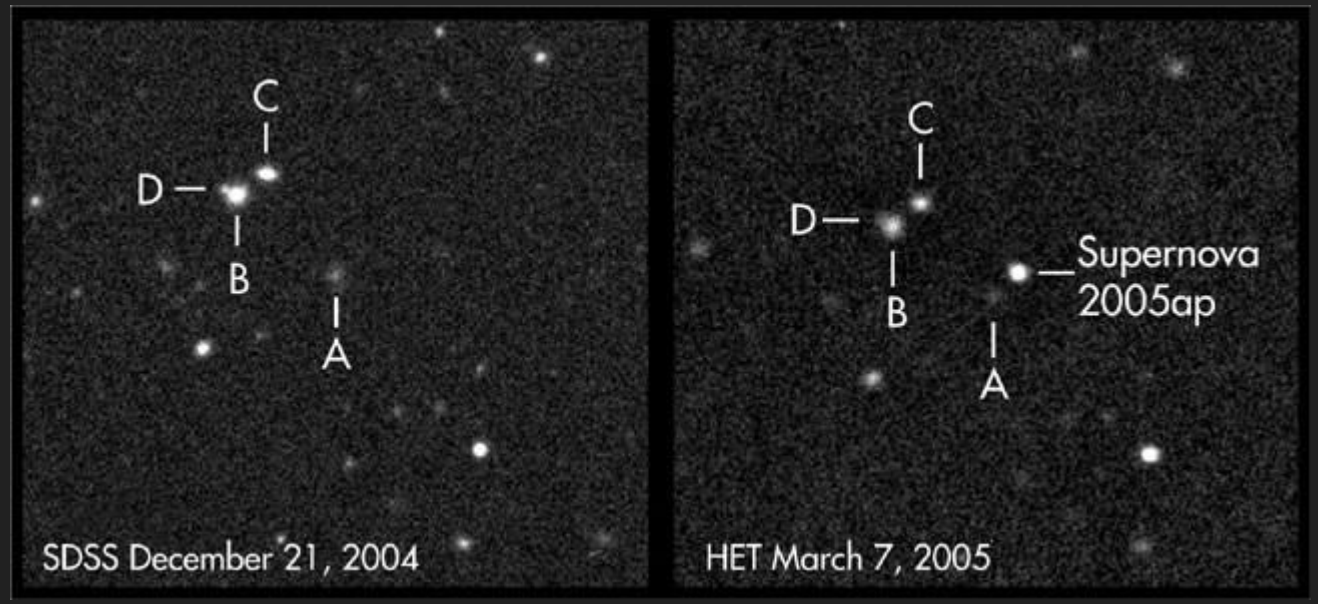
# Machine Learning in Astronomy

Inferring stellar parameters from spectra



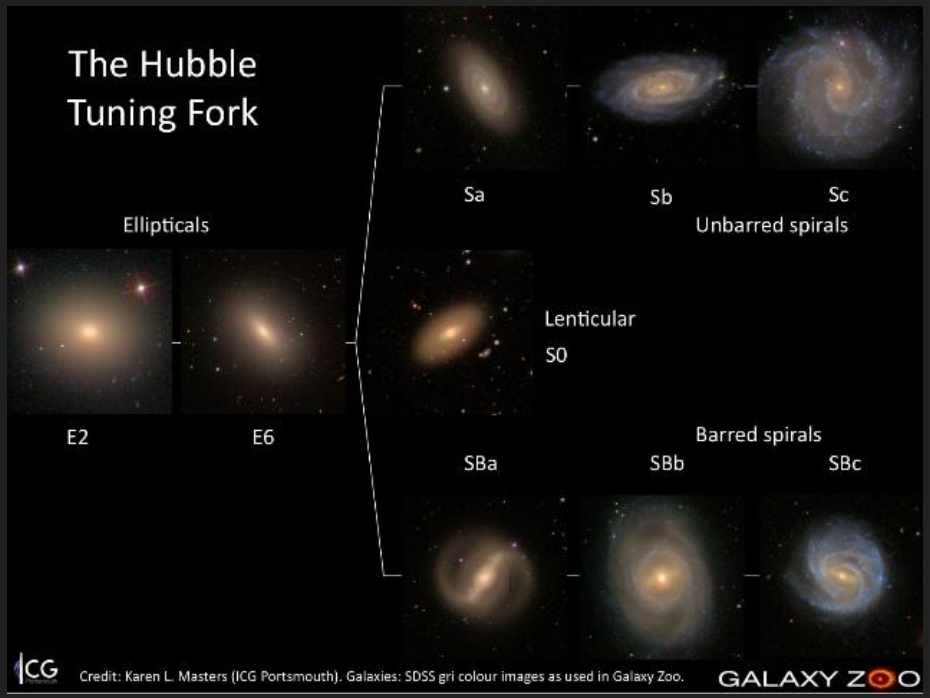
# Machine Learning in Astronomy

Detecting supernova



# Machine Learning in Astronomy

Galaxy type classification



# Helpful Links

- https://towardsdatascience.com/5-beginner-friendly-steps-to-learn-machine-learning-and-data-science-with-python-bf69e211ade5
- Check out past lectures and assignments from courses like Data8 (Intro to data science), Data100 (More advanced data science techniques), CS188 (Artificial intelligence), CS189(Machine learning)
  - https://inst.eecs.berkeley.edu/classes-eecs.html

# DEMO

# Wednesday

# Announcements

- Check-In Reports due Just now, do it ASAP if you haven't!
- FINAL PROJECTS ARE DUE MONDAY (4/26) BEFORE LECTURE! (5:00 pm PST)
- Final Projects Presentations 26th and 28th of April! (Next week!)

- This is the last lecture!
- Ask for help if you need it! We are here for you
- No attendance form today

# Congratulations!

# What you've learned!

- All the Python Basics!
    - Data Types, Functions, Recursion, Conditionals, Loops, Object Oriented Programming, etc...

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    - File I/o, subplots, imshow, plot real and model data, modifiers, curve fitting, animation

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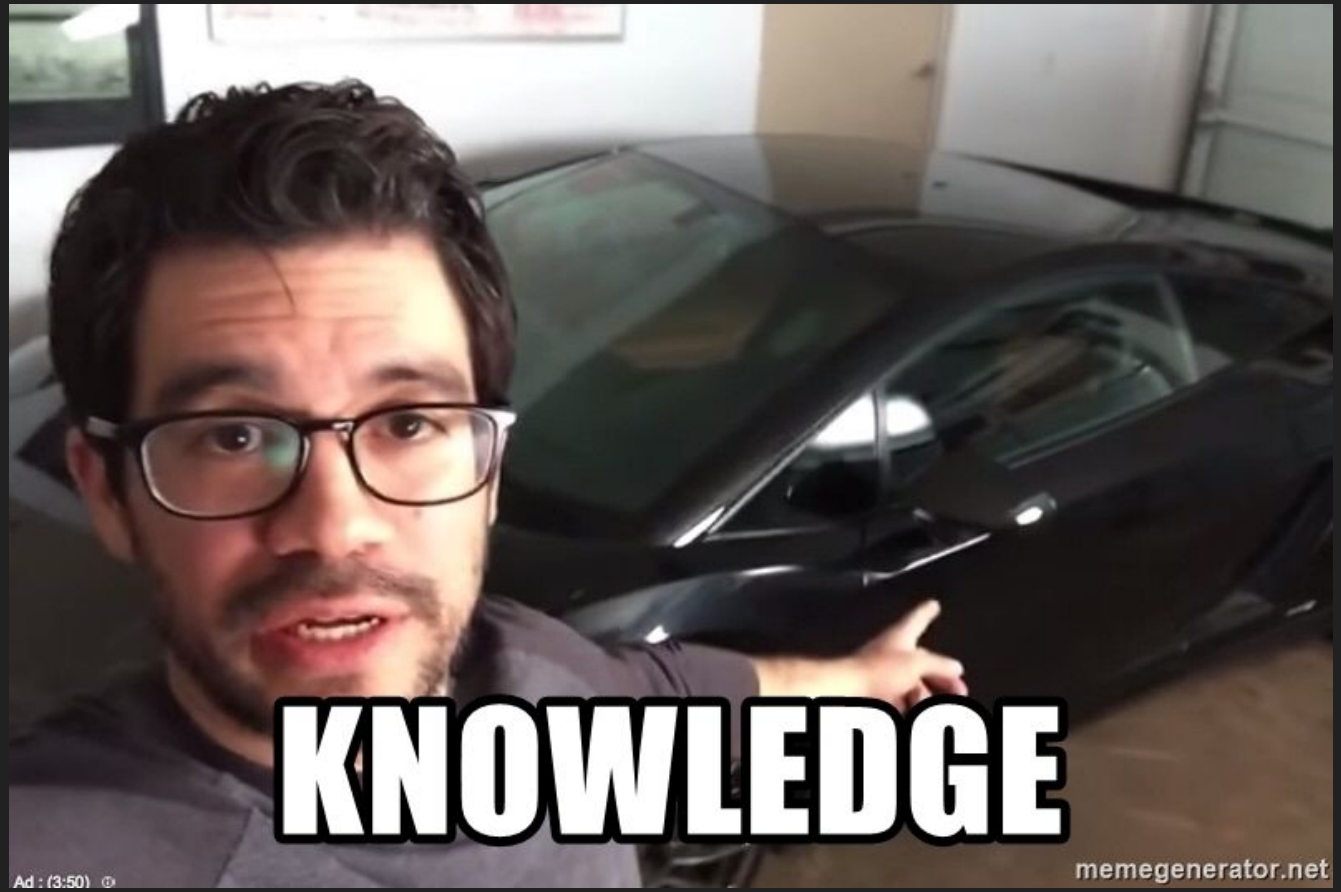
- Professional Development
    - Intro to research, CVs, personal professional websites, LaTex/Overleaf, GitHub, etc...


KNOWLEDGE
memegenerator.net

# What’s next?

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1. Apply to research! Send a thoughtful cold email to professors whose work you find interesting + go to symposiums and colloquiums. You are very ready for it now!
    i. Every good cold email must be thoughtful and non-general.
    ii. "Read" a research paper you find interesting from them and talk about it a little
    iii. Send an academic summary "unofficial transcript" + your CV and the link to your Personal Research Cite!

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2. Wanna learn more coding skills??? Here are some options
    i. Take Physics 77/88
    ii. Take Data 8 + Data 100 (or maybe even minor lol)
    iii. Physics 188 (Intro to Bayesian Analysis + Machine Learning)
    iv. Astro 128 Data Lab
    v. CS 61A if you want some rigorous programming experience! (check out those sick CS classes)

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3. Help teach the Python DeCal in the future?
    i. Come talk to me about it and we can make something happen!

# Class Photo!


# Course Evaluations

https://forms.gle/ZctGXNeBD5u2gLFf6

Thank you everyone for coming!
Good luck next week!