Python for Artificial Intelligence
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Goal: The purpose of this course will be to give the students an introduction in working with Python as a data analysis tool. The world of data science has exploded exponentially in recent years and the need for understanding how to use code to analyze data is an imperative skill for students to learn as they develop their careers. In this course, students will walk away with a working knowledge of Python. Further, they will be able to load data into Python and write code to analyze said data. This includes being given some of the mathematical tools to work with data and time permitting the algorithms used to do more advanced analysis. They will be able to be given a data set and being thinking about how to frame their own questions of how to analyze said data.

Meetings: Sessions will be twice a week on **Saturdays and Wednesdays at 5:30 pm EST** for approximately **60 minutes** depending on the amount of material needed to be covered. This can include writing code tailored to sessions, working through students' code, answering questions, preparing material to hone in on specific topics or answer specific questions, handling hardware, etc.

Structure: The course will mostly consist of sessions via Zoom. The course will begin by presenting the first couple of weeks reviewing the basics of Python. This will include data types, data structures, simple algorithms, etc. It is important the students feel more comfortable with Python before they are able to do much computation with it. Assignments will be given based on the relevance of the lectures to challenge the students' understanding of the lecture. They will have weekly assignments and based on how motivated the students are, I will incorporate more nontrivial problems. Though the overall pace of this course will be set by the pace of the students, **this course is anticipated to take anywhere from 6-8 weeks, not including the project or application. It will come to 12 weeks in total.**

Material:
- Key Texts:
    - Python Data Science Handbook:
        - https://jakevdp.github.io/PythonDataScienceHandbook/
    - Fundamentals of Python:
        - This is the same textbook used by the intro python course at Harvard for undergraduates.
- We will be following the materials from these books as guidance for the course material.

I will be providing lessons through a mix of powerpoints and jupyter notebooks (python code meant to show the output of the code in line - often used as a teaching tool). The students will learn the fundamentals of Python as well as how to use Python for basic data analysis. This will build off the lessons done during the IGNITE program in which they will learn how to run some hypothesis tests in Python. They will learn more advanced statistical techniques using Python

packages (numpy, sci-kit learn, pandas) and how to visualize it. Time permitting and depending on how challenging they find this work, they will be introduced to some introductory machine learning topics.

- Topic 1 - Installing Python, packages, and command line
    - Overview of Python and its applications
    - Installing and setting up Python
- Topic 2 - Fundamentals in Python
    - Using Python in the command line and Jupyter notebooks
    - Basic Python syntax: data types, variables, operators, control structures, functions
- Topic 3 - Working with Data in Python
    - Introduction to file I/O
    - Loading in data
    - Working with directories and file paths
- Topic 4 - Data Structures and Algorithms
    - Working with lists, tuples, and dictionaries
    - Basic algorithms and data structures
    - Sorting and searching algorithms
- Topic 5 - Working with NumPy Arrays
    - Using NumPy for numerical computations
- Topic 6 - Plotting in Python/Visualization
    - Using Matplotlib for data visualization
- Topic 7 - Functions and Classes in Python
- Topic 8 - Artificial Intelligence - what is it? What is AI?
    - Overview of machine learning and deep learning
    - Supervised learning and unsupervised learning
    - Overview of neural networks
- Topic 10 - Supervised Learning
    - Linear Regression, Logistic Regression
- Topic 9 - Neural Networks - perceptron
    - Classification
    - Overall structure of an NN - 1-2 layers
- Topic 11 - Introduction to Pytorch
    - Building their own
- Topic 12 - Applications

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There will be a final project either to build their own neural network - a one to two layer MLP to solve some task of their choice. They will need to acquire the data and build the model to run a simple classification task.