Astronomical Data-modelling and Interpretation

Progress Report

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Github Repository

Milestones

- Finished reading the resource for Basics of Python
- Completed the assignment
- Completed the course: Data-driven Astronomy
- Completed the course: Basics of Digital Imaging

Week 0: Basic Python

A week of learning basic Python syntax and familiarising with Python libraries such as NumPy and MatPlotlib

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Week 1: Assignment based on basic Python

a. Plotting a histogram of randomly rolling a pair of dice
b. Thought-provoking question
c. Sorting a given list

Week 2-4: Data-driven Astronomy

Week-1:

a. Description of Pulsars
b. Introduction to packages such as Astropy and SciPy
c. Reading NumPy arrays from a CSV file
d. Calculating mean of datasets
e. Working with FITS files
f. Plotting FITS images and finding the mean of a set of FITS files

Week-2

a. Role of Supermassive Black Holes

b. Median is more robust than Mean
c. Time and Memory usage difference in NumPy and Python arrays
d. Binapprox Algorithm
e. Equitorial Coordinates
f. k-d trees

Week-3

a. Habitability of Exoplanets
b. Introduction to SQL
c. SQL queries

Week-4

a. The lifecycle of stars
b. Setting up my own database in SQL
c. Combining SQL and Python using the psycopg2 module
d. SQL vs Python

Week-5

a. Understanding cosmological distances
b. Decision Tree Regressors
c. k-fold Cross-Validation

Week-6

a. Factors in the classification of galaxies
b. Decision Tree Classifiers
c. Random forest Classification

Week 5-6: Basics of Digital Imaging

Lesson-1

a. Definitions of pixels and pixel values
b. Adjustment Layers (Brightness and Contrast)
c. Non-destructive Cropping
d. Different formats for saving the final image
e. Converting colour images to black and white (Black & White Adjustment Layer)

Lesson-2

a. Bit depth
b. Differences between 8-bit and 16-bit images
c. Histograms
d. Adjusting levels or Histogram stretching

Lesson-3

a. Different definitions of Image Integrity for journalists and scientists
b. Tools to repair blemishes
    1. Pencil tool
    2. Paintbrush tool
    3. Clone Stamp tool
    4. Healing Brush

c. Manually creating mosaics
   Using a layer mask and paintbrush tool

Lesson-4

a. Light levels in space
b. Definitions of exposure and aperture
c. Problems with overexposing and underexposing
d. Different surface reflectances of celestial objects

Lesson-5

a. Different file formats
b. How does data compression work?

Lesson-6

a. Importance of resampling
b. Pixel dimensions and aspect ratios

Lesson-7

a. Different ways in which mission images are shared with the public
b. Where to find all these different formats?
