DTU Data Analysis and Visualization [Summer 2023]

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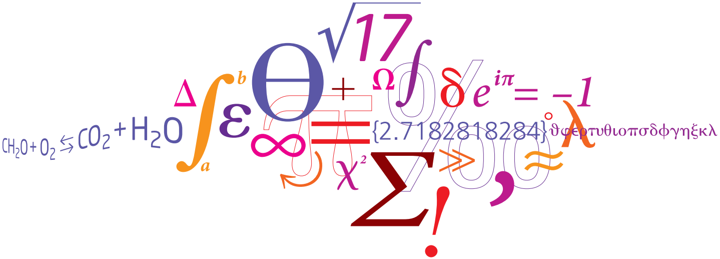
Group 10

Technical University of Denmark (DTU)



DTU Environment
Department of Environmental Engineering

Outline

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  - Task 1
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  - Task 3
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- Project 2: NASA Data Acquisition, Visualization, and Analysis
  - Task 1
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  - Task 3
  - Task 3
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Task 1: Understanding the Data

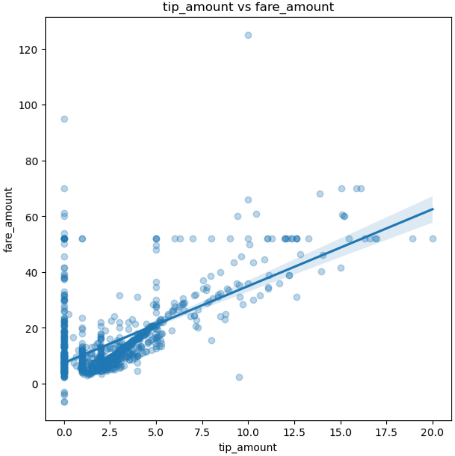
Important Data Given

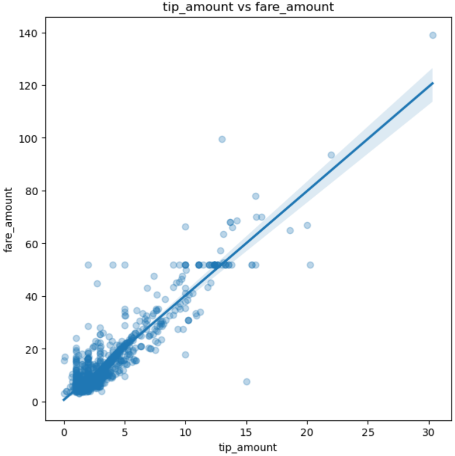
- Pickup/Dropoff Date and Time
- Pickup/Dropoff Location ID
- Passenger Count
- Trip Distance
- Fare Amount
- Tip Amount

Project 1: Analysis and Forecasting of NYC Taxi Rides

Task 2: Exploratory Data Analysis I

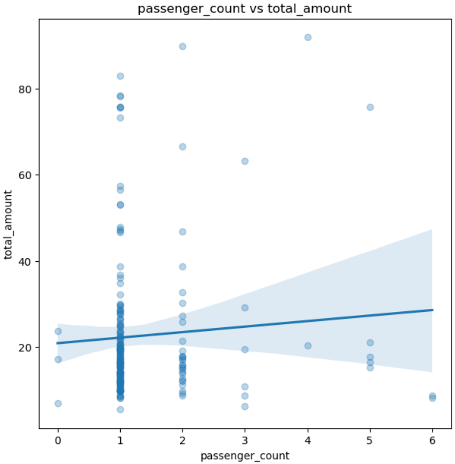
Exploring Tipping





Task 2: Exploratory Data Analysis II

Passenger Amount



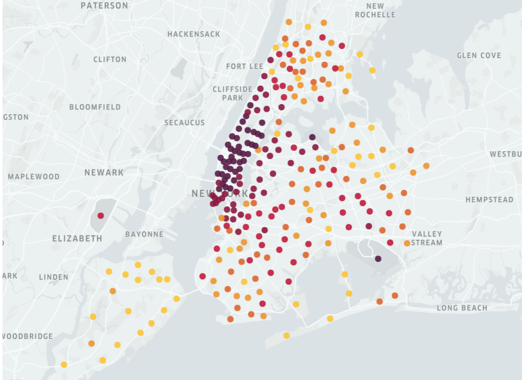
Task 2: Exploratory Data Analysis III

Other Curiosities

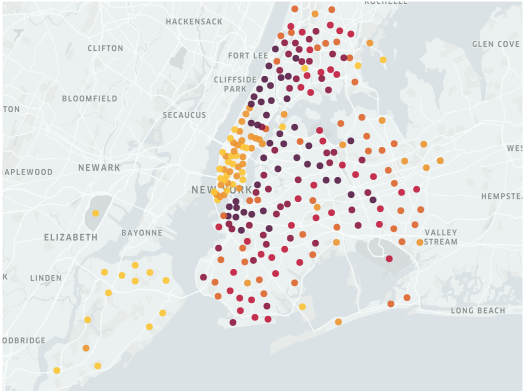
- Average Tip Amount (Yellow vs Green) = \$7.23 vs \$2.00
- Amount of Rides (Yellow vs Green) = 39,656,098 vs 840,402
- Average Distance (Yellow vs Green) = 5.96 miles vs 84.45 miles

Task 3: Spatial Analysis

Identifying PU/DO Hotspots using Kepler Maps



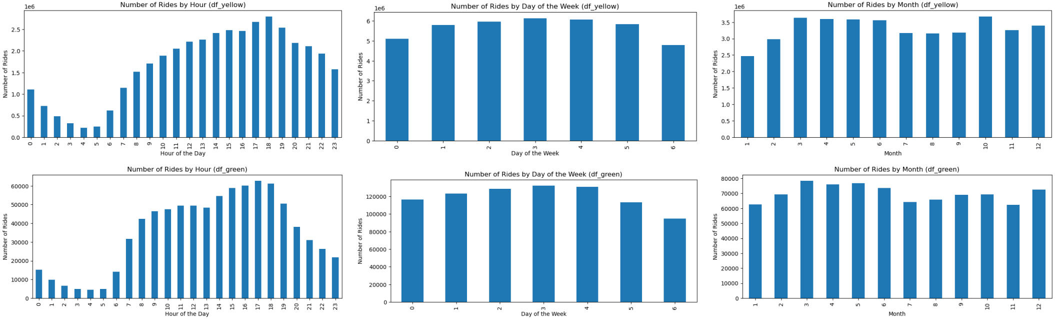
(a) Yellow Taxis



(b) Green Taxis

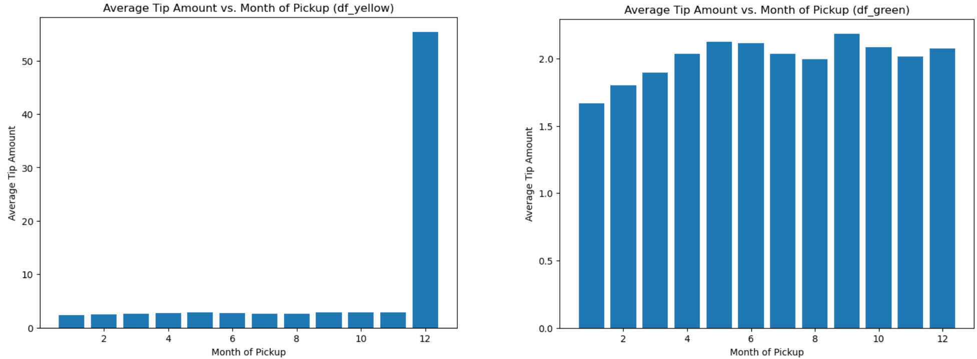
Task 4: Temporal Analysis I

Yellow vs Green Temporal



Task 4: Temporal Analysis II

Yellow vs Green (Month vs Tip Amount)

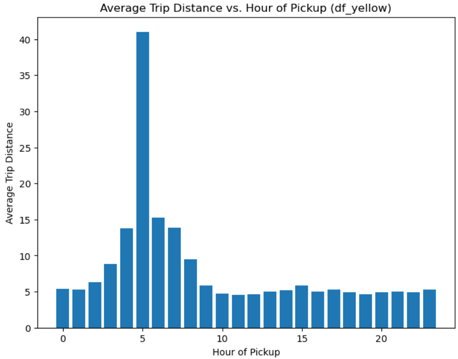


(a) Yellow

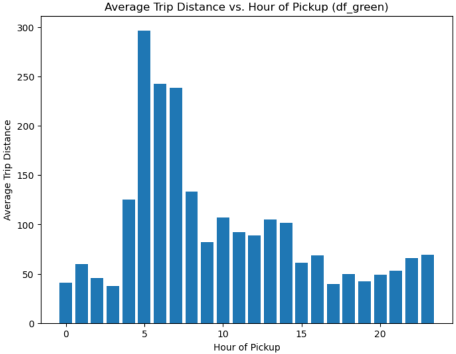
(b) Green

Task 4: Temporal Analysis III

Yellow vs Green (Distance vs Hour)



(a) Yellow

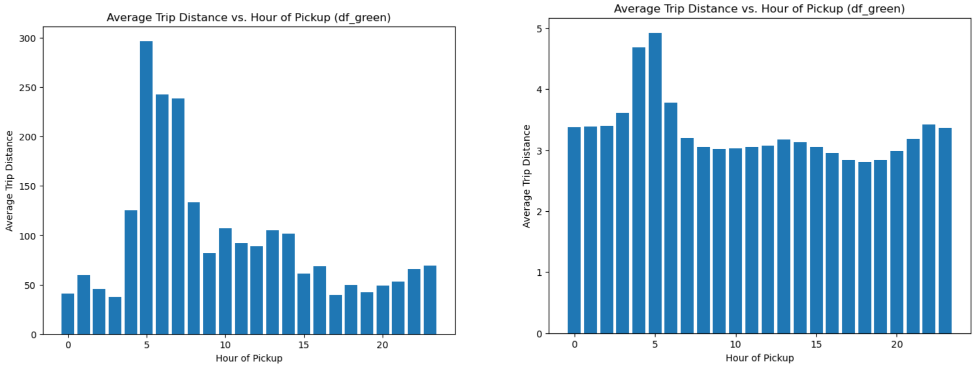


(b) Green

Project 1: Analysis and Forecasting of NYC Taxi Rides

Task 4: Temporal Analysis IV

Errors

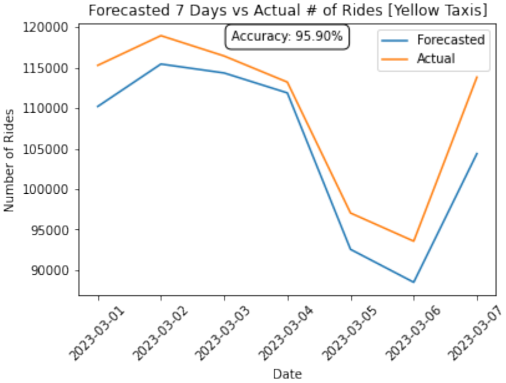


(a) Original

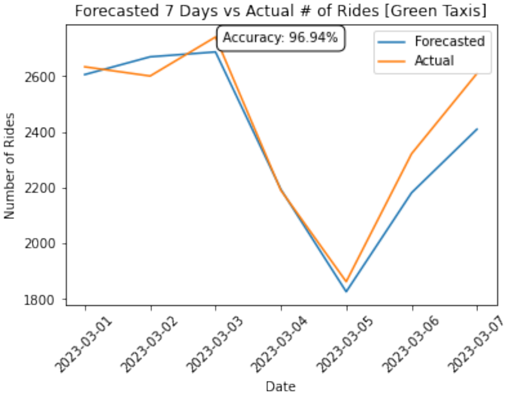
(b) Fixed

Task 5: Time Series Forecasting I

Forecasting 7 Days using Prophet trained on Jan/Feb 2023 data



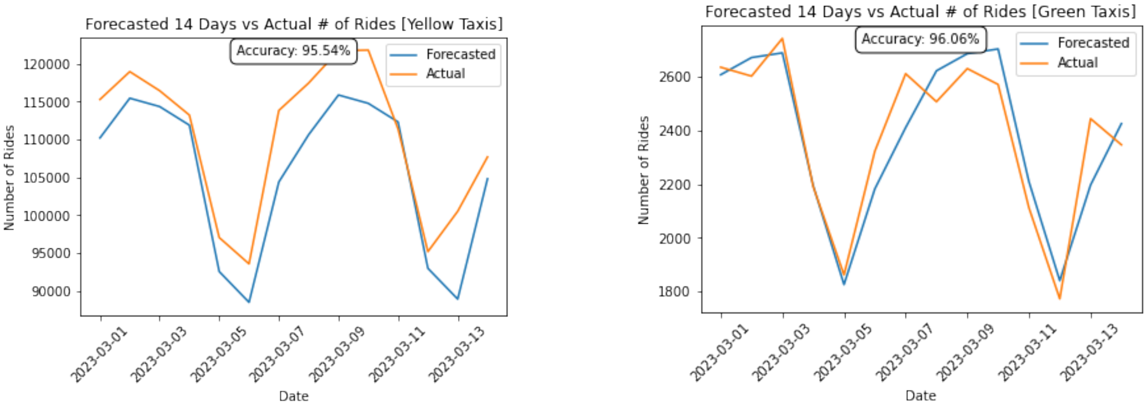
(a) Yellow Taxis



(b) Green Taxis

Task 5: Time Series Forecasting II

Forecasting 14 Days using Prophet trained on Jan/Feb 2023 data



(a) Yellow Taxis

(b) Green Taxis

Project 2

Project 2: NASA Data Acquisition, Visualization, and Analysis

Task 1 Understanding the NASA API and Data Collection

Data acquisition and Data analysis

- Fetched JSON data about Near Earth Objects (NEOs) using Python
- Cleaned up data by removing extra date in a "week" (8 days) of data, e.g. $neo\_df = neo\_df.drop\_duplicates()$
- Extracted and analyzed distinct data elements for each NEO via pd.json_normalize, e.g. $expanded\_neo\_df = pd.json\_normalize(neo, record\_path = neo\_entry\_date)$
- Converted extracted data into pd.DataFrame

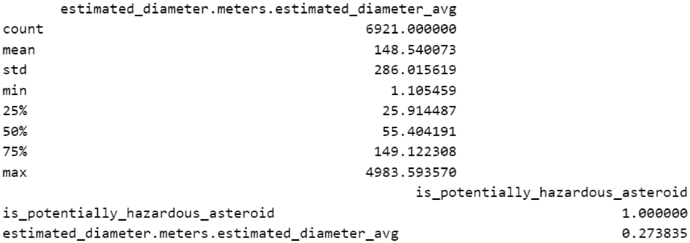
Task 2: Data Science and Analytics Works

Average size, hazards correlation, statistics

(a) The average size of the NEOs for each day

```
            average_size
2022-01-01    164.069506
2022-01-02    113.283811
2022-01-03     28.178929
2022-01-04     80.179344
```

(b) Statistical analysis + correl



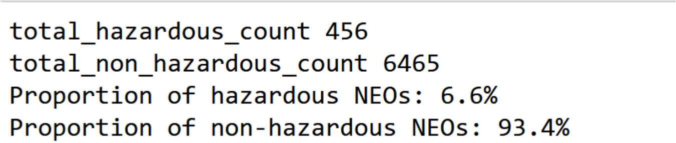
```
       estimated_diameter.meters.estimated_diameter_avg
count                                       6921.000000
mean                                         148.540073
std                                          286.015619
min                                            1.105459
25%                                           25.914487
50%                                           55.404191
75%                                          149.122308
max                                         4983.593570
                                                  is_potentially_hazardous_asteroid
is_potentially_hazardous_asteroid                                          1.000000
estimated_diameter.meters.estimated_diameter_avg                           0.273835
```

Project 2: NASA Data Acquisition, Visualization, and Analysis

Data Science and Analytics Works

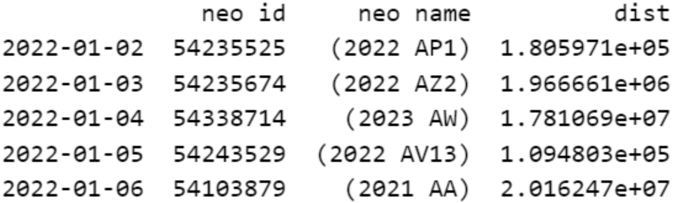
Closest approach size-potential hazard correlation.

(a) Proportion of NEOs that are potentially hazardous.



```
total_hazardous_count 456
total_non_hazardous_count 6465
Proportion of hazardous NEOs: 6.6%
Proportion of non-hazardous NEOs: 93.4%
```

(b) NEOs with the closest approach distance for each day.

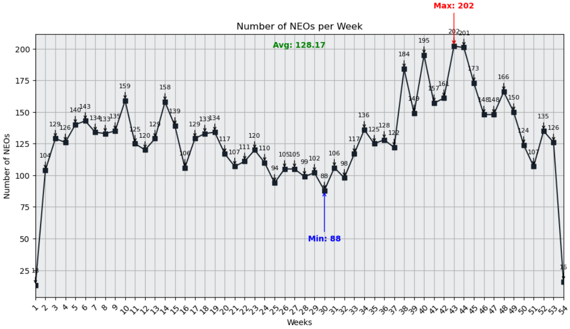


```
              neo id     neo name          dist
2022-01-02  54235525   (2022 AP1)  1.805971e+05
2022-01-03  54235674   (2022 AZ2)  1.966661e+06
2022-01-04  54338714    (2023 AW)  1.781069e+07
2022-01-05  54243529  (2022 AV13)  1.094803e+05
2022-01-06  54103879    (2021 AA)  2.016247e+07
```

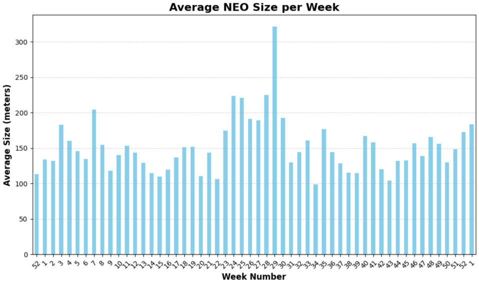
Project 2: NASA Data Acquisition, Visualization, and Analysis

Task 3: Data Visualization Part A (I)

line plot (count/week), bar plot (avg. size)



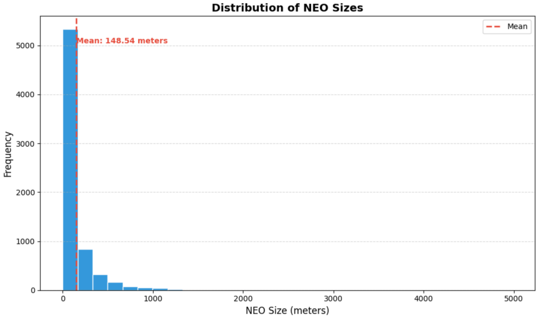
(a) line plot of the number of NEOs per week



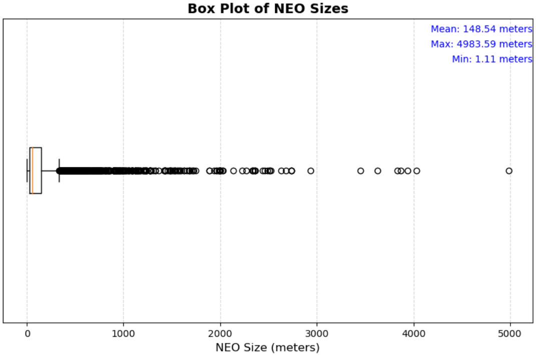
(b) bar plot of the average NEO size per week

Task 3: Data Visualization Part A (II)

Histogram (NEOs size),Seaborn box plot (NEO sizes)



(a) Histogram of the distribution of NEO sizes

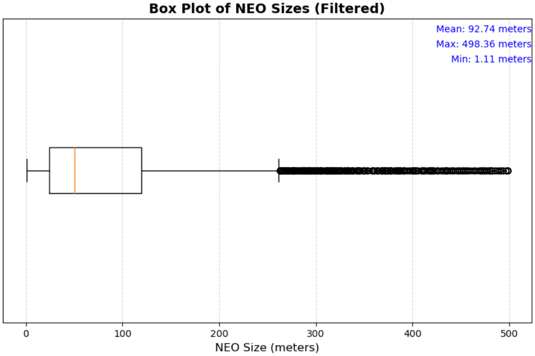


(b) box plot of the NEO sizes

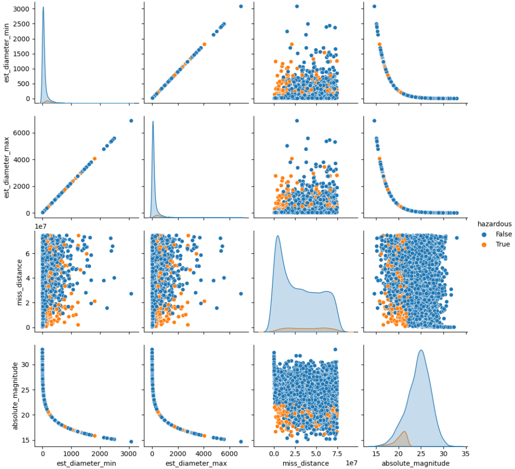
Project 2: NASA Data Acquisition, Visualization, and Analysis

Task 3: Data Visualization Part A (III)

Pairwise Relationships and Hazardousness in NEO Data



(a) Histogram of the distribution of NEO sizes

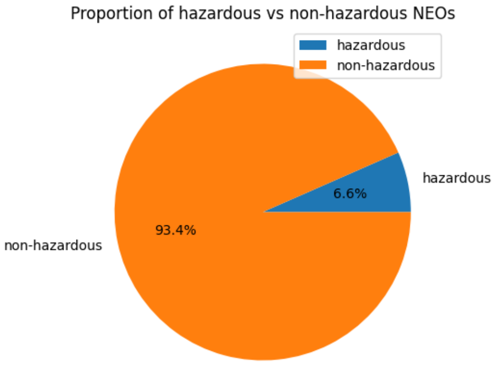


(b) Pair plot that visualizes the relationships between different variables

Task 4: Data Visualization Part B

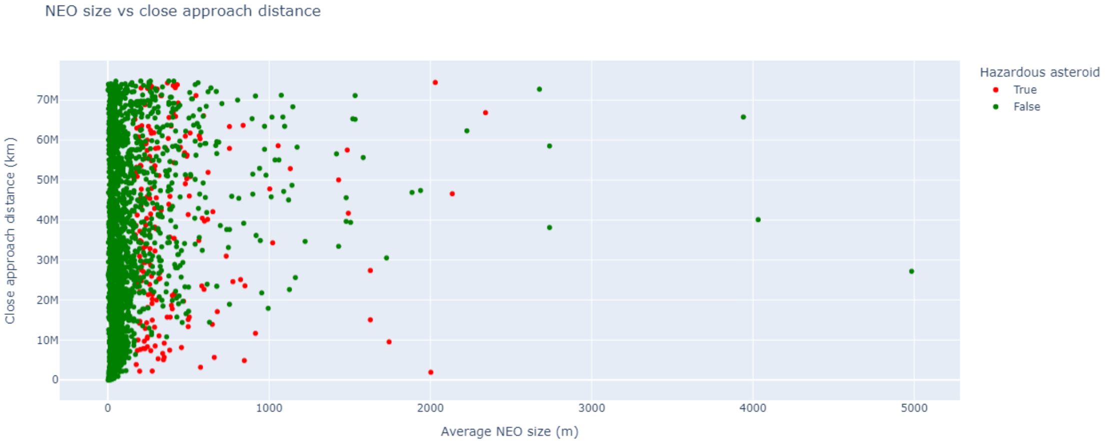
Pie chart: Hazardous vs. non-hazardous NEOs

- Created a pie chart of the proportion of hazardous vs non-hazardous NEOs



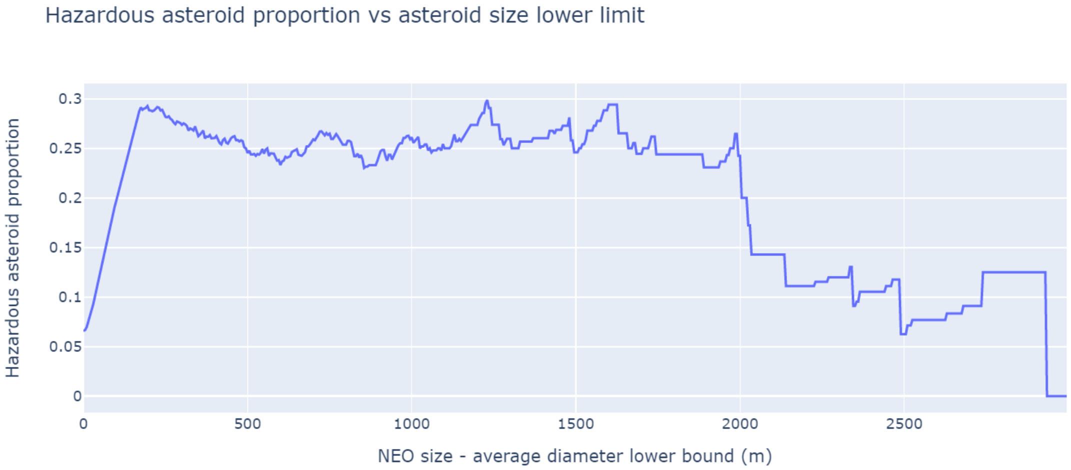
Task 4: Data Visualization Part B

Scatter plot with hover functionality for NEO data using Plotly



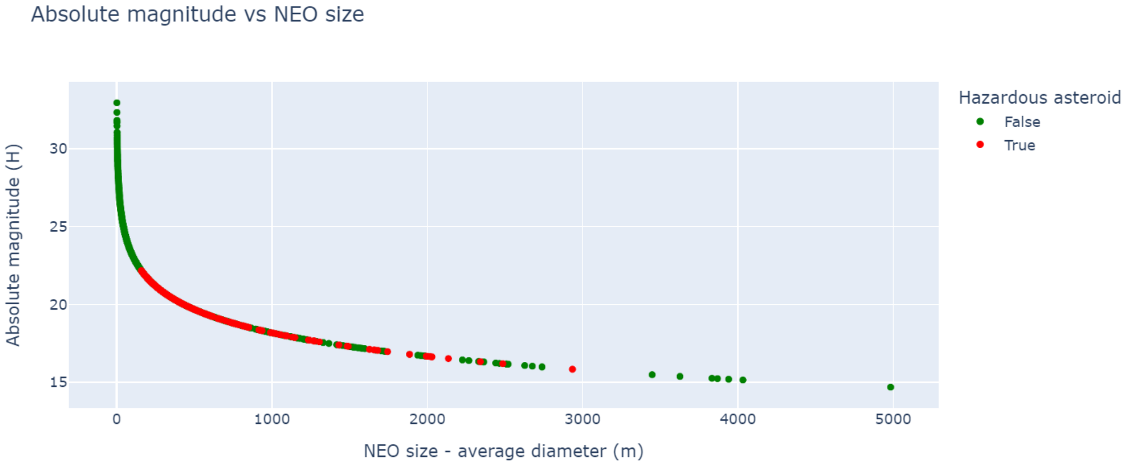
Task 4: Data Visualization Part B

Line chart: Hazardous asteroid proportion vs. NEO size's lower limit



Task 4: Data Visualization Part B

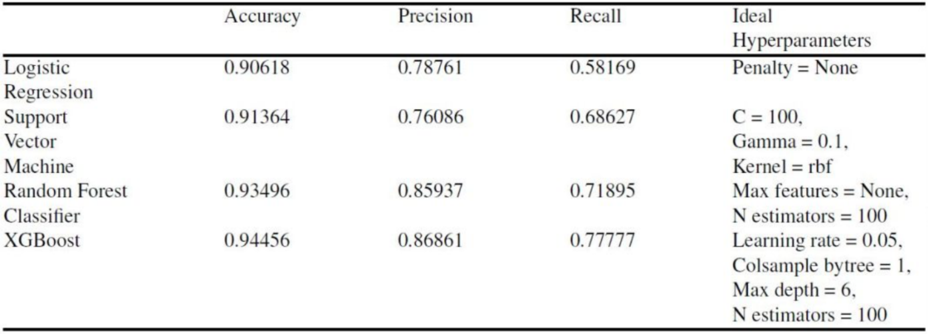
Interesting finding - Scatter plot: Absolute magnitude vs. NEO size



Task 5

Findings from NASA data visualizations to make predictions or recommendations

Classifying Hazardous and Non-Hazardous Asteroids Using Machine Learning



	Accuracy	Precision	Recall	Ideal Hyperparameters
Logistic Regression	0.90618	0.78761	0.58169	Penalty = None

Support Vector Machine	0.91364	0.76086	0.68627	C = 100,
				Gamma = 0.1,
				Kernel = rbf

Random Forest Classifier	0.93496	0.85937	0.71895	Max features = None, N estimators = 100
XGBoost	0.94456	0.86861	0.77777	Learning rate = 0.05, Colsample bytree = 1, Max depth = 6, N estimators = 100

Table 1* | *Results on the Test Set

Source for scientific paper.(NJS)