# DTU Data Analysis and Visualization [Summer 2023]

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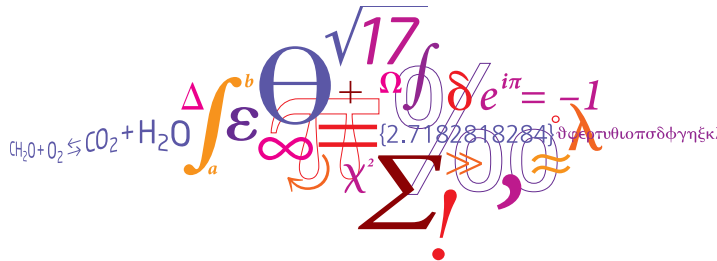


# Outline

- Project 1: Analysis and Forecasting of NYC Taxi Rides
  - Task 1
  - Task 2
  - Task 3
  - Task 4
  - Task 5
- Project 2: NASA Data Acquisition, Visualization, and Analysis
  - Task 1
  - Task 2
  - Task 3
  - Task 3
  - Task 3
  - Task 4
  - Task 5

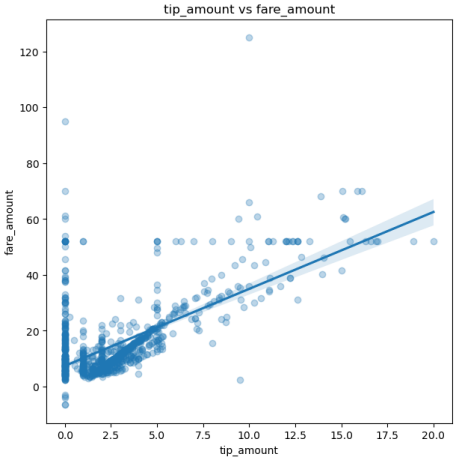
# Task 1: Understanding the Data

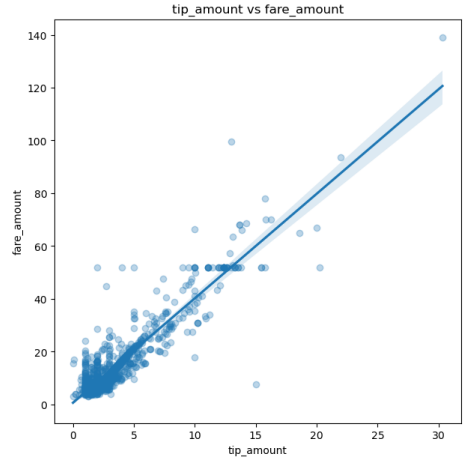
Important Data Given

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

# Task 2: Exploratory Data Analysis I

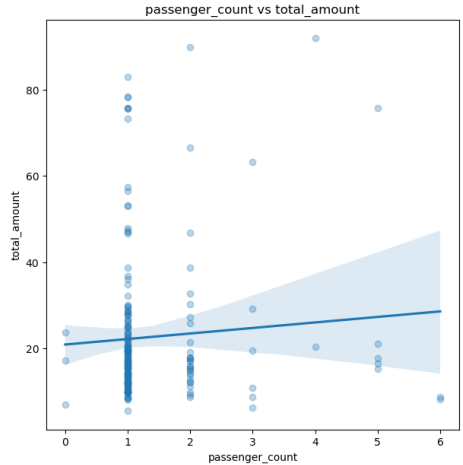
## Exploring Tipping



# Task 2: Exploratory Data Analysis II

## Passenger Amount



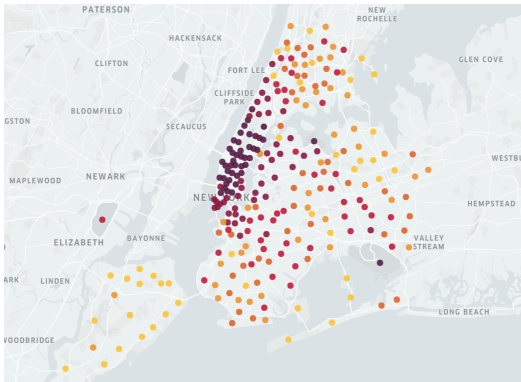
# Task 2: Exploratory Data Analysis III

## Other Curiosities

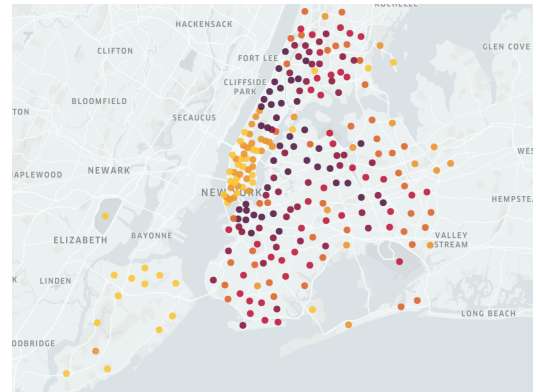
- Average Tip Amount (Yellow vs Green) = \$7.23 vs \$2.00
- Amount of Rides (Yellow vs Green) = 39,656,098 vs 840,402
- Average Distance (Yellow vs Green) = 5.96 miles vs 84.45 miles

# Task 3: Spatial Analysis

## Identifying PU/DO Hotspots using Kepler Maps



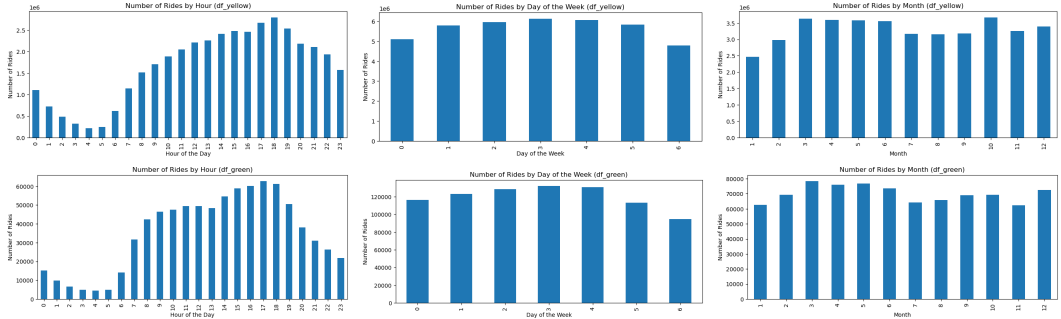

(a) Yellow Taxis




(b) Green Taxis

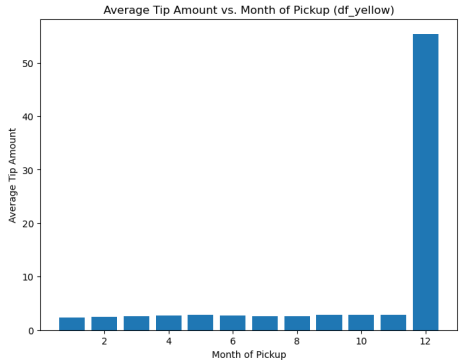
# Task 4: Temporal Analysis I

## Yellow vs Green Temporal

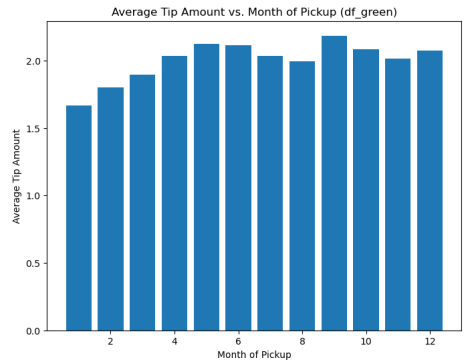


# Task 4: Temporal Analysis II

## Yellow vs Green (Month vs Tip Amount)



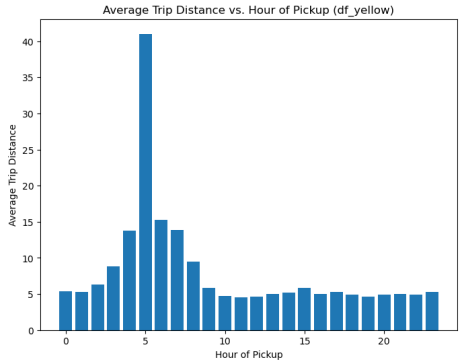

(a) Yellow



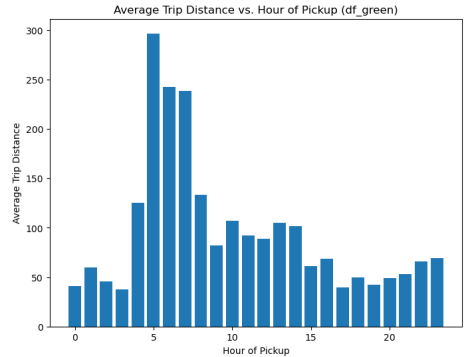

(b) Green

# Task 4: Temporal Analysis III

## Yellow vs Green (Distance vs Hour)



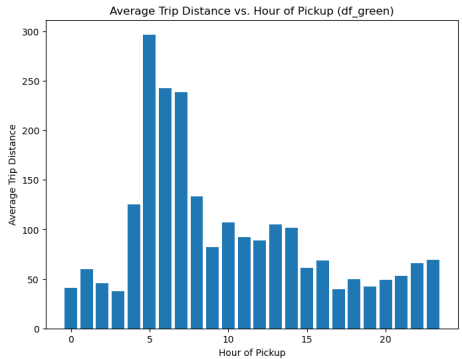

(a) Yellow



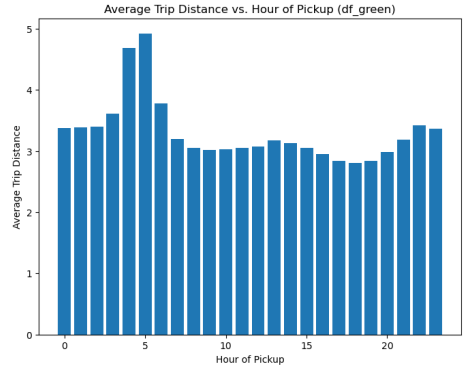

(b) Green

# Task 4: Temporal Analysis IV

## Errors



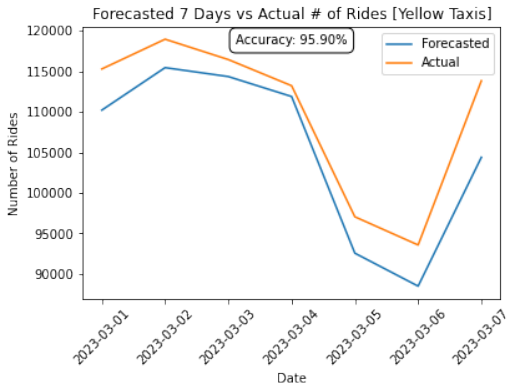

(a) Original



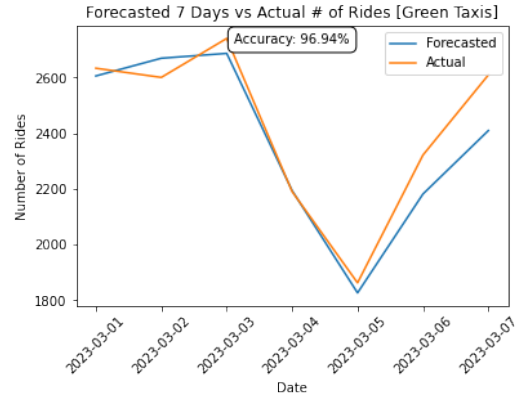

(b) Fixed

# Task 5: Time Series Forecasting I

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



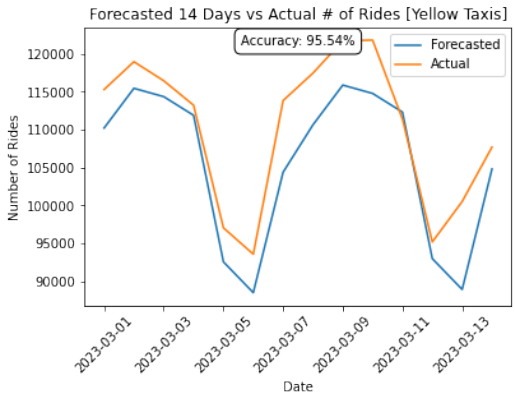

(a) Yellow Taxis



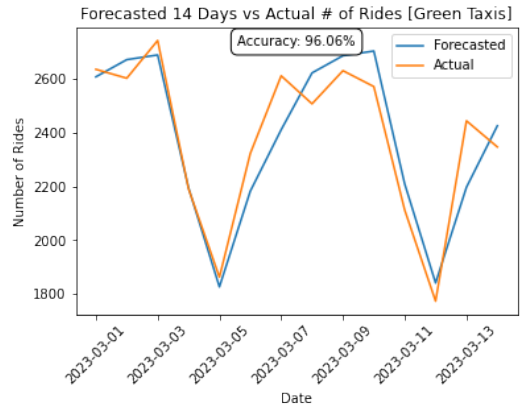

(b) Green Taxis

# 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 |

## Closest approach size-potential hazard correlation.

(a) Proportion of NEOs that are potentially hazardous.

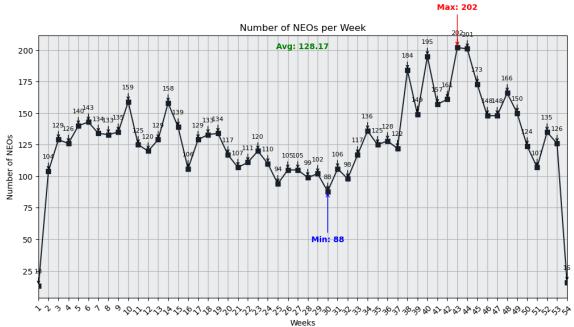
```
total_hazardous_count 456
total_non_hazardous_count 6465
Proportion of hazardous NEOs: 6.6%
Proportion of non-hazardous NEOs: 93.4%
```

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

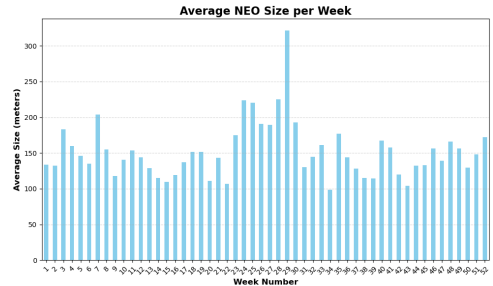
| | neo id | neo name | dist |
|---|---|---|---|
| 2022-01-02 | 54235525 | (2022 AP1) | 1.805971e+05 |
| 2022-01-03 | 54235674 | (2022 AZ2) | 1.966661e+06 |
| 2022-01-04 | 54338714 | (2023 AW) | 1.781069e+07 |
| 2022-01-05 | 54243529 | (2022 AV13) | 1.094803e+05 |
| 2022-01-06 | 54103879 | (2021 AA)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

# Task 3: Data Visualization Part A (I)

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



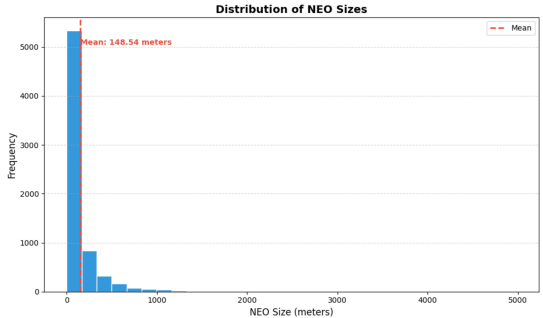

(a) line plot of the number of NEOs per week



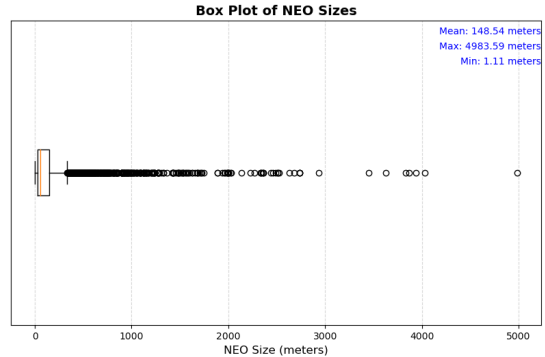

(b) bar plot of the average NEO size per week

# Task 3: Data Visualization Part A (II)

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



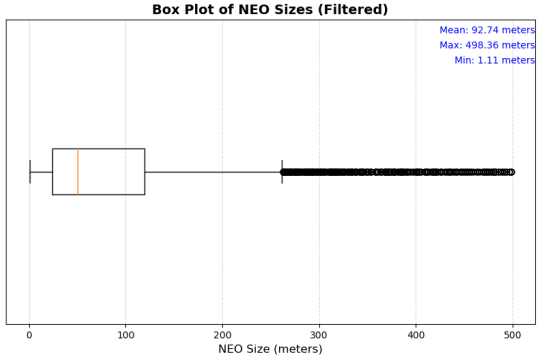

(a) Histogram of the distribution of NEO sizes



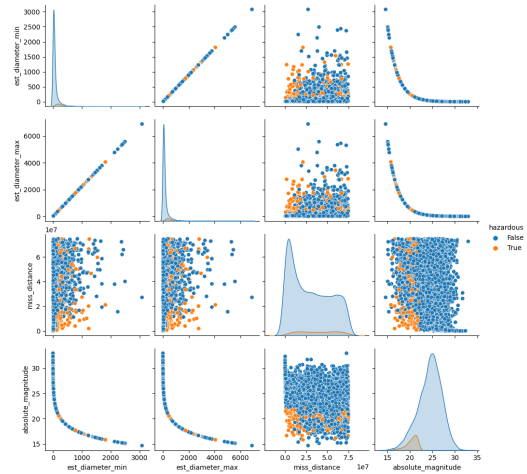

(b) box plot of the NEO sizes

# Task 3: Data Visualization Part A (III)

## Pairwise Relationships and Hazardousness in NEO Data




(a) Histogram of the distribution of NEO sizes

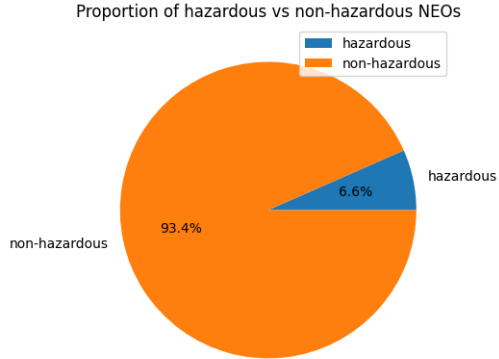



(b) Pair plot that visualizes the relationships between different variables

# Task 4: Data Visualization Part B

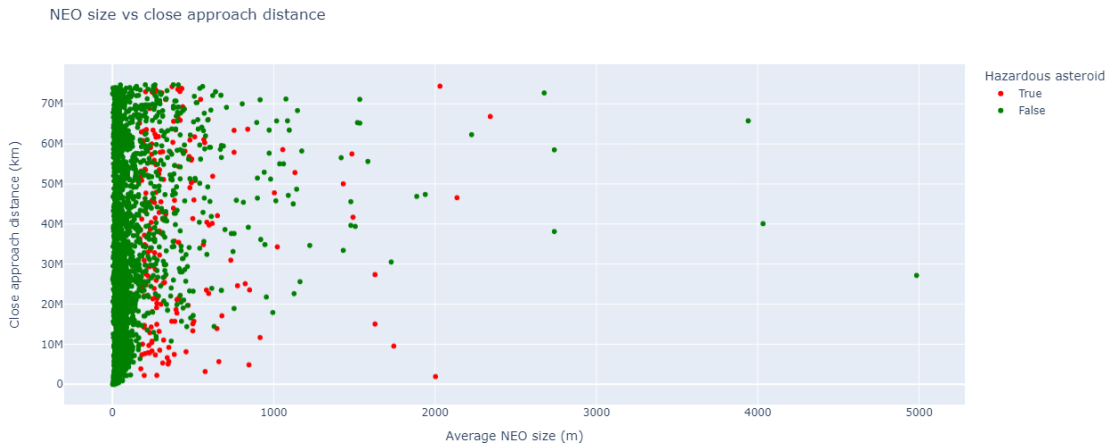
## Pie chart: Hazardous vs. non-hazardous NEOs

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



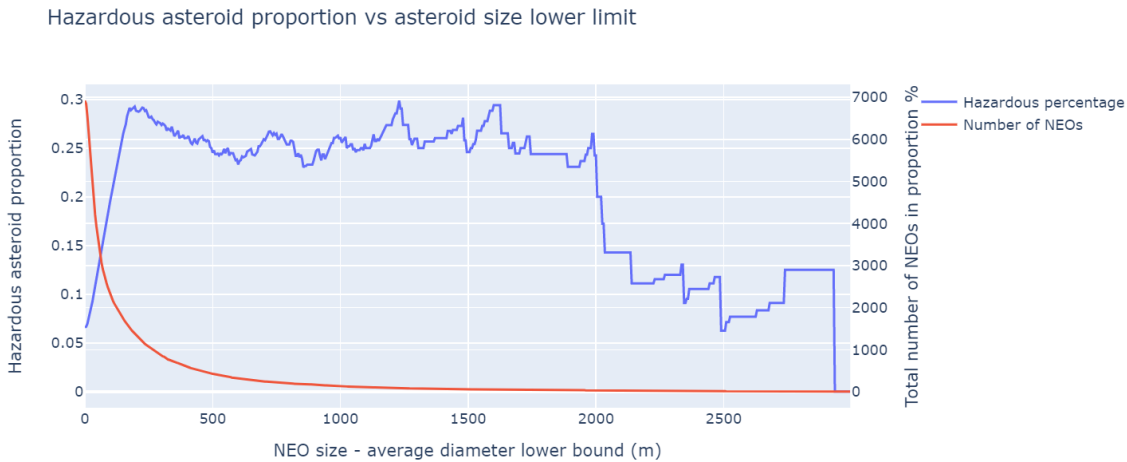
# Task 4: Data Visualization Part B

## Scatter plot with hover functionality for NEO data using Plotly



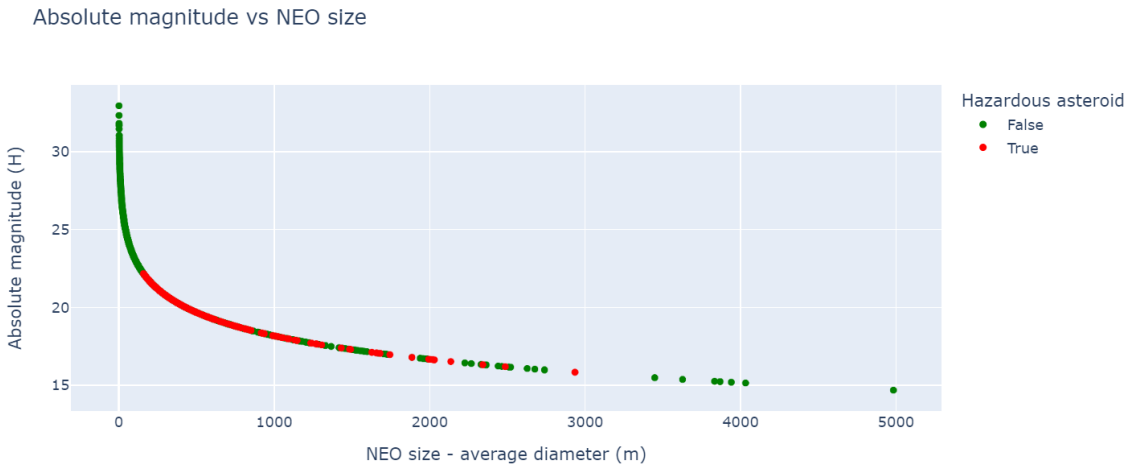
# Task 4: Data Visualization Part B

## 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)