Project Proposal

Analysis of NASA Near-Earth Objects and Close Approaches

Team Members

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Need

Comets and asteroids are valuable entities to scientists. These objects are mostly preserved from the creation of the solar system. An analysis on asteroids can provide important insight into astronomical history. Another important reason to study near-earth objects is the resources that they provide. Asteroid mining, therefore, is a growing area of interest for academia and industry. By analyzing a dataset of NEOs, a model can be generated of when and where the nearest asteroids be for future mining missions. Finally, monitoring asteroids near earth is important to earth safety. Some of the near-earth object are classified as potentially hazardous and need to be tracked in order to prepare for an impact. There are several needs for an organized analysis of near-earth objects, and we plan to explore these opportunities.

Dataset

The dataset we chose is a collection of NEOs (Near-Earth Objects) provided by NASA. The dataset has several columns. The first column is the name of the object. The second is the Close-Approach Date, meaning when the object is expected to be closest to the earth; this column is a datetime. The next two columns relate to the Close Approach Distance, the first is the most likely (nominal) distance and the other is the minimum possible distance during the close approach. Both columns have values in Lunar and Astronomical Distance units. The next two columns relate to the velocity of the object at its close approach. The first velocity column gives the velocity relative to Earth, while the second gives the velocity relative to a massless Earth. Both columns are in kilometers per second. The next column is related to the absolute magnitude of asteroids. The last column is the class of the object, including Near-Earth Asteroids, Near-Earth Comets and Potentially Hazardous Asteroids.

The dates range from late December 1899 to January of 2201. This provides over 300,000 rows of data. We have limited the data to objects with a nominal distance of less than or equal to .5 Astronomical Units. All of the data are available on NASA's Near Earth Object Program website. The URL for the close approach data tables is http://neo.jpl.nasa.gov/cgi-bin/neo_ca.

This is the only dataset that we are considering for the project at this time. The size of the dataset may make it difficult to process, but it presents an opportunity for classification.

Data Science Toolkit

Below is a list the tools we will use for data preprocessing and possible tools we will use for data visualization.

- Pandas - Data Preprocessing
- Tableau - Data Visualization
- Chart.js - Data Visualization
- D3.js - Data Visualization

We are open to expanding our toolkit as the project progresses and as we are introduced to new tools.

Preliminary Sketch of What We Hope to Build

Currently, we are planning on creating an animated and/or interactive visualization charting out the kinds of objects floating nearby earth. We will focus on the object's velocity, mass, and distance to earth. At this point, we foresee a frame, for lack of a better term, to be similar to this graphic on Wikimedia detailing the closest stars to our Solar System:

https://upload.wikimedia.org/wikipedia/commons/e/e9/Near-stars-past-future-en.svg

We are also looking into setting up a classification system for how close different types of objects get to Earth. At this point, we have no idea as to how accurate such a classification could be, as we do not know if there are any correlations in the data.