**Abstract Summary**

**Project**: Big Data Processing

**Scholar**: Dean Robert Keithly

**Mentor**: Robert Sivilli

**Program**: Space Scholars

**School**: Cornell University

The goal of this work is to constrain a space object’s orbit and estimate object size with as few high uncertainty ground observations as possible.

I use a collection of two-line elements and state vectors from the Unified Data Library to aggregate probability distributions of Keplerian orbital elements and object characteristics.

With a single ground observation of an unknown object and orbit location constraints, I constrain the solution space of orbital element and object characteristics to arrive at object parameter posterior distributions.

Based on the location of the first observing ground station (simulated from the Unified Data Library) and statistical orbital parameters, I determine which set of ground station fields of regard (FoR) the object will enter next, when it will enter the FoR, and where it could be observed in the FoR.

By repeatedly simulating second observations based on the highest probability locations, we can determine the number of observations to make a second detection of the object.

Executing this process in Monte Carlo can produce a distribution of the average number of observations.

Supplanting general population inputs with known state vectors and simulated deviations enables us to determine when and where ground stations could statistically make future object detections.