Maneuver Detection

Chosen Method: Machine Learning (ML)

1. **Complex Pattern Recognition**: Machine learning models are capable of identifying the complex variation in the SMA.
2. **Higher Accuracy**: When we train the machine learning model with sufficient and relevant data , it can achieve higher accuracy in detecting maneuvers.
3. **Handling Large Datasets**: Orbital data typically involves large volumes of data. Machine learning models are well-equipped to handle and analyze such datasets efficiently.

Assumptions :

1. Semi-major axis (SMA) data is used for Maneuver detection.
2. The threshold is set at three times the standard deviation of the SMA changes .

Methodology:

1. **Data Preprocessing**: The raw data is cleaned, normalized, and sorted by date and time.
2. **Feature Extraction**: Features such as SMA changes, absolute changes, and change rates are extracted.
3. **Maneuver Detection**: A RandomForestClassifier is used to detect maneuvers based on the extracted features.
4. **Result Visualization**: Detected maneuvers are visualized on a plot of SMA over time.

Results and Analysis

Detected Maneuvers

Maneuver Dates
2018-05-03 12:01:31
2018-10-11 13:37:05
2019-03-26 04:53:33
2019-03-27 04:34:36
2019-03-27 20:25:38
2019-05-15 10:44:37

The ML-based approach effectively detects orbital maneuvers.