IAF SYMPOSIUM ON INTEGRATED APPLICATIONS (B5)
Integrated Applications End-to-End Solutions (2)

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WATCHERCATCHER: A REAL-TIME FUNCTION OF SPACEMAP TO PREDICT SPY SATELLITES IN TIMELINE

Abstract

Space is busy and will be busier in the New Space Age. One of the phenomena is mega-constellations such as Starlink, OneWeb, Planet Labs, Capella Space, etc. with applications of internet communication, imagery, earth and space observations, and so on. Suppose that you want to predict satellites which can take your picture tomorrow while you are located at a target location. Planet Labs might be a candidate. Or suppose that you want to predict the satellites in a communication constellation, such as Starlink or OneWeb, which can uplink and downlink with your data terminal. *SpaceMap* can produce a real-time report of the solutions to these problems in a foreseeable future, say within a few days, provided with a set of system parameters or constraints such as a prediction time window, a field-of-view, threshold distance, etc. Obviously, the longer the prediction, the more error. SpaceMap can handle this query for multiple target locations in near real-time. This is because SpaceMap is running on AWS and takes full advantage of elastic compute cloud and auto scaling features where the speed for handling each target location is close to real-time. In addition, the SpaceMap algorithm has a strong scalability feature on its own. Suppose that you want to predict adversarial satellites that might be able to monitor you while you are driving during a subset of timeline in future, assuming that the set of adversarial satellites is known a priori. The *WatcherCatcher* of SpaceMap can quickly report you the candidate schedules of the satellites. This capability can be easily extended to identify the time interval and traveling path that will be safe from being monitored by satellites, possibly through an optimization procedure based on, e.g., the generate-and-test scheme. WatcherCatcher can be used to the case that you are flying in an airplane, instead of driving a car. There are other critical applications of WatcherCatcher: e.g. the prediction of potential spectrum interference among satellites and the data hopping path to avoid the predicted interferences. SpaceMap currently uses the TLE data available from Space-Track but can import telemetry data, measurement data, ADS-B, AIS, etc.