Technische Universität Braunschweig

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Technische Universität Braunschweig

Master Thesis
(German/English)

Observation strategies for telescope and radar networks

Current trends in spaceflight, such as megaconstellations (e.g., Starlink and OneWeb) or increasing launch rates in general, lead to increasing object numbers in Earth's orbit. More objects in a confined space lead to higher risks of collision and, therefore, failure of a mission. To maintain safe space activities near Earth in the future, it is essential to have as accurate a picture as possible of the actual space situation. This includes knowledge of the positions of as many human-made objects orbiting Earth as possible. Such data is usually gathered within catalogs that must be kept updated with continuous observations of the contained objects using different kinds of sensors, such as radars or telescopes.

Today, several different catalogues and networks that generate the underlying observations exist. Examples include the Space Surveillance Network that is operated by the United States Space Force and the network of phased-array radars operated by LeoLabs. With increasing object numbers to observe the importance of using the existing sensor networks as efficiently as possible increases as well. To provide single sensors or sensor networks with tasks sensor tasking / scheduling methods are used to distribute tasks as ideally as possible to the different sensors depending on their locations, the objects to be observed and, possibly, different aspects.

In this context, the goal of this work is to analyze observation strategies or sensor tasking methods for sensor networks regarding their potential for building and maintaining object catalogs and identify possible improvements.

The following sub-aspects must be considered for the work:

1. Research and familiarization with the basics of observation of objects in Earth orbit, sensor networks and catalogs of space objects

2. Simulate and analyze different sensor networks using the Sensor Network Simulator tool suite

3. Analyze and compare different observation strategies and evaluate the results

4. Identify promising observation strategies based on these analyses and evaluations

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