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BIG DATA PREDICTIVE ANALYTICS AND SELF-LEARNING BASED SITUATIONAL AWARENESS FOR EFFECTIVE DETECTION AND CLASSIFICATION OF SPACE DEBRIS

Abstract

Space surveillance networks (SSN) attempt to detect, track, catalogue and identify object(s)-of-interest orbiting the Earth. In more recent years, SSN's have adopted advanced tracking technologies for the accurate localization of a large number of space debris (otherwise known as space junk) circling the Earth. Such tracking technologies incorporate a wide spectrum of ground and space sensing modalities including Adaptive Optics, Radar Imaging, Space Fence etc. However, one major challenge that continues to remain unsolved is the effective synthesis of this big data generated by various sensors in order to separate serious from non-serious threats autonomously. Decision-making inaccuracies using traditional analytic strategies have led to spending hundreds of millions of dollars each year in the manoeuvring of spacecrafts to avoid collisions. In this paper, an accurate and robust big data analytic framework that seamlessly operates within a self-learning artificial intelligence architecture, is proposed. The proposed predictive analytics framework will enable the intelligent agglomeration of space debris tracking and characterization data from a range of complementary sensors in order to generate an appropriate situational awareness response. The proposed framework will remain an integrated and scalable solution for growing SSN's to provide sophisticated decision-making capability with reduced false alarms using cooperative localization and path-recovery of space debris for the efficient assessment, protection and the preparation of mitigation strategies against space debris.