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ENHANCING THE ACCURACY OF THE SPACE OBJECT CATALOG USING MACHINE LEARNING TECHNIQUES

Abstract

The US Air Force space-track catalog is currently the main source of data for space debris tracking. Its accuracy is however limited to typically 3 km by the performance of the detection systems, namely ground radars and telescopes, and the inherent limitations of the propagation models. Increasing the accuracy of the catalog of space debris would help satellite operators deal with the overwhelming number of Conjunction Data Messages (CDM). Some alternative technologies are much more accurate than ground detection for space objects positioning, but they are dedicated to only certain classes of satellites.

In this paper, the orbital data coming from of the US GPS satellites, the French DORIS tracking system, the International Laser Ranging Service (ILRS), and Sentinel satellites are used to feed a deep learning algorithm. In total, the ephemerids of more than 60 satellites over 18 years, at a 1-minute rate or higher, are provided as input of the algorithm. The accuracy of the orbital data of the space-track catalog is enhanced by more than one order of magnitude, compared to the standard SGP4 model. This is of major interest for Space Situational Awareness (SSA), and could possibly pave the way to Space Traffic Management (STM) based on a complete and accurate catalog.