21st IAA SYMPOSIUM ON SPACE DEBRIS (A6)
Interactive Presentations - 21st IAA SYMPOSIUM ON SPACE DEBRIS (IPB)

Author: Mr. Eliott Simon
Belgium, eliottsimonapple@gmail.com

Dr. Evridiki Ntagiou
European Space Agency (ESA-ESOC), Germany, evridiki.ntagiou@esa.int
Dr. Jan Siminski
ESA - European Space Agency, Germany, jan.siminski@esa.int
Dr. Emiliano Cordelli
GMV, Space Debris Office (SDO), ESA/ESOC, Germany, emiliano.cordelli@gmv.com
Dr. Pietro Bonizzi
The Netherlands, pietro.bonizzi@maastrichtuniversity.nl

RESIDENT SPACE OBJECT CLASSIFICATION FROM LIGHT CURVES WITH DEEP LEARNING.

Abstract

In this study, a novel data-driven pipeline is suggested for classifying resident space objects (RSO) into different attitude modes from photometric light curve data. The latter is extracted from the MiniMega-TORTORA (MMT) monitoring system. MMT provides light curves for inactive satellites, rocket bodies, and space debris. A subset of light curves representative of multiple modes is chosen and divided into training and testing. For each 1D feature, the corresponding time series was decomposed by means of Empirical Mode Decomposition (EMD), to extract information about the most dominant frequency bands in that feature. The different time series components provided by EMD are then stacked together into a matrix and provided as input to a Convolutional with Attention (CoAtNet) model yielding a 92.0% top-1 accuracy on the testing set. Tests with an imbalanced dataset and with different input sizes were conducted to evaluate the robustness of the model. Experimental findings show that the approach is a robust method for classifying space objects while requiring few input data.