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IMPROVING CUBESAT OPERATIONS USING FLIGHT PERFORMANCE TELEMETRY

Abstract

The increasing number of Cubesat launched during the last five years offer an opportunity of learning and optimizing satellites operations through the collection, analysis and use of their flight performance data. Global networks of ground stations, for instance, SATNOGS allows users from all around the globe to collect, store and regularly share satellites telemetry. This massive amount of data can be post-processed to produce knowledge that enables a smother operation of current and future missions. This paper presents and describes a methodology to analyze telemetry data from CubeSat missions using state-of-the-art techniques for unsupervised machine learning. The aim of this work is to find and understand hidden patterns that affect the operations of a satellite. An example of these patterns is the effect of rotation rates of the satellite on the number of telemetry packages received at the ground station. The methodology focuses on the development of a temporal pattern recognition algorithm that produces a set of parameters that can be used for tuning the satellite's operation at ground system level. A case study is developed and shown in this work to demonstrate the feasibility of the proposed methodology and the implementation of the machine-learning algorithm. From that case study, key learnings are documented concerning the input format of the data, as well as the list of parameters that can be modified during the operation of the satellite. The conclusions of this work can be adopted by other satellite operators to improve their mission's performance and to define new mission requirements for future ground systems design.