

Towards autonomous spacecraft operations using machine learning

Red Boumghar

Libre Space Foundation



Abstract

Space exploration democratization is largely due to open source developments of small satellites (e.g. Cubesats, 10x10x10cm cubic satellites). One of the critical near future need for space exploration is scaling up spacecraft operations to be able to manage tens of thousands of satellites; literally multiple robots in space with complex dynamic systems. The Polaris project is fully open source, it aims at analyzing robotics systems telemetry, learning from it, keeping operators aware, and generating knowledge transferable to different missions with similar robotics assets.

This project comes in threefold: fetching and normalizing data from radio signals collected by the SatNOGS stations (200 open source ground stations across the world), machine learning models to have dependencies analysis, time series contextual behavior segmentation, and predictions for anomalies prevention, and in the end data visualization to explain the machine learning models and provide widgets for situational awareness of operators.

In this talk, I will go over the developed machine learning models and how we track dependencies between telemetries and how graph visualization permits us to navigate high dimension dataset. I will share the steps we are following to compose future autonomous satellite operations and monitoring and how being open source plays an essential role.

Biography

Red Boumghar is PhD in Robotics and Embedded Systems. After working 10 years as researcher in the robotics and satellite imagery industry, he followed different entrepreneurship projects about data analytics for the Internet of Things. Taking position at the European Space Agency for developing artificial intelligence tools for spacecraft operations, Red became a mentor at the NASA Frontier Development Lab, an AI Accelerator to solve space challenges. As community leader, Red managed the development of several machine learning applications in the central banking systems. He acts as a keynote speaker and startup adviser. Red is now a core contributor at the Libre Space Foundation, creating advanced open source assets for the development of humanity in space, in a fair and ethical way.

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