Open Internship in the ESA Advanced Concepts Team in 2017

on

Understanding the statistical structure of optimal low-thrust transfers

Stage topic Description

The efficient computation of optimal low-thrust actions is a computationally intensive task that is required in the preliminary phases of a mission when billions of options need to be studied and traded-off. In this internship we will look into the possibility of using pre-formed low-thrust trajectories databases to learn statistical relations between starting and target orbit and the mass required to perform a certain transfer. Different levels of thrust to mass ratio, as well as different objective functions, will influence such a statistical model and will be subject of particular attention. Popular machine learning approaches including gradient boosting and deep artificial neural architectures will be used.

Candidate's tasks

- Create a number of databases containing optimal low-thrust trajectories for different scenarios.
- Develop and benchmark machine learning techniques on such databases.
- Select a number of interesting and hard cases to be offered to the international ML community as test cases

The ideal candidate

Mandatory: Excellent programming skills in Python and C++. Experience on the application of Machine Learning techniques for data regression.

Desirable: Basic background on low-thrust optimization.

References

- Hennes D., Izzo, D. and Landau, D.: Fast approximators for optimal low-thrust hops between main belt asteroids. 2016 IEEE Symposium Series on Computational Intelligence (IEEE SSCI 2016). Athens, Greece, 2016.