Using reinforcement learning to control stratospheric balloon routing

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1. My role as an AI apprentice at CNES

The Centre National d'Études Spatiales (CNES), France's eminent space agency, leads the way in satellite technology and Earth observation. Distinguishing itself through pioneering studies of stratospheric balloons, the CNES marks a unique contribution to the evolving landscape of space exploration.

My role at CNES is to use Artificial Intelligence, and more precisely Reinforcement Learning algorithms, to predict balloons trajectories.

2. BalMan, maneuvering stratospheric balloon

The CNES is currently working on an innovative project, BalMan. This stratospheric balloon is able to pilot its trajectory in the stratosphere. It offers a number of advantages :

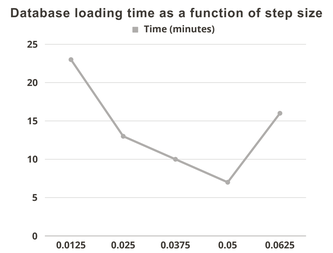
- A stratospheric balloon able to adjust its trajectory in the stratosphere
- Facilitate access to space at a lower cost and environmental impact
- Flying over the same area of interest for a longer time
- Reduction of logistical and operational constraints

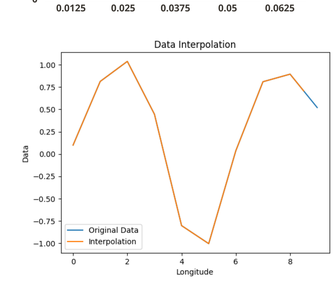
3. Using analytical methods to reduce the size of weather datasets

Since balloon trajectories depend on the wind, it is essential to analyze weather files, which can be very heavy and take a long time to load. When dealing with variables with a specified step (e.g., 0.0125), the choice of the appropriate interval significantly impacts the size of the generated dataset.

In the context of reducing loading times and optimizing resources, it becomes crucial to identify the optimal step for these variables.

To address this issue, we employ interpolation methods to ensure that the new dataset generated with the chosen step remains closely aligned with the original dataset, thereby preventing significant deviations.





4. Developing a website to display balloons’ position in real time

To help the control tower locate stratospheric balloons in real time, I've created a website with HTML, CSS and Javascript that tracks balloon positions in real time. I also used the leaflet javascript library to display an OpenStreet Map.

This website is also useful for CNES engineers, as it will enable them to see the balloons' trajectory over 12 hours.