Project report

Network of Resources Initiative on ESA Sponsoring request ID: 2113e2

Canopy height from spaceborne sequential imagery using deep learning with calibrated uncertainty quantification

Leonidas Alagialoglou, PhD Candidate
Multimedia Understanding Group
Department of Electrical and Computer Engineering Aristotle University of Thessaloniki
E-mail:lalagial@mug.ee.auth.gr

Objectives of the project

- The objective of the project is to improve the accuracy of canopy height estimation using multitemporal information from Sentinel-2 images.
- Additionally, the study aims to provide meaningful uncertainty estimates on the predictions using deep ensembles and to calibrate the predictions through postprocessing isotonic regression model.
- Finally, the study aims to evaluate the transferability of the model to other countries in Europe using fine-tuning with a small area of 2 km^2.

The description of how using tools and data within cloud environments helped you to achieve your goals

Using cloud environments can greatly facilitate the project's goals by providing scalability, computing power, storage, accessibility, and cost efficiency.

In our project, a large amount of data in the form of a sequence of Sentinel-2 data was acquired for a study area in the Bohemian Forest, Germany in 2017. The data includes 160 timeframes from both S2A and S2B satellites, with cloud coverage percentages. To test the model's transferability, data from 2018-2021 was also acquired for a smaller area in the Bohemian Forest. Additionally, similar amount of data was acquired for a region in Switzerland, to evaluate the model's performance in different geographical areas.

Publication

Alagialoglou, Leonidas, et al. "A Learnable Model With Calibrated Uncertainty Quantification for Estimating Canopy Height From Spaceborne Sequential Imagery." IEEE Transactions on Geoscience and Remote Sensing 60 (2022): 1-13.

* The authors acknowledge in the manuscript the European Space Agency for sponsoring their EDC Sentinel Hub subscription.