Transfer Learning Model for Chlorophyll-a Estimation Using Satellite Imagery

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Introduction

This research focuses on evaluating water quality parameters in the Mediterranean Sea, with an emphasis on chlorophyll-a concentration. Utilizing transfer learning techniques, the study adapts a model initially trained on Sentinel-2 satellite imagery and ground station chlorophyll values from Hong Kong for application in the southern coastal region near Limassol, Cyprus, as part of the iMERMAID Horizon Europe project.

Data and Method

The study leverages the Multilayer Perceptron (MLP) model, initially trained with Hong Kong in-situ data provided by the Environmental Protection Department Marine Water Quality as of 2020. This model, along with various specifically trained MLP architectures, underwent adaptation for the Mediterranean context using data processed and stored via Google Earth Engine (GEE). Model validation employed referenced data from the global dataset Coriolis data selection 2.0.

Results

A significant outcome is the high Pearson correlation observed between the GCOM-C/SGLI L3 Chlorophyll-a Concentration V2/V3 and Sentinel-2 data for both the Hong Kong and Cyprus regions, using the same pre-trained model and in-situ data. The study noted a lower correlation for Cyprus, possibly due to the 4638 m resolution of GCOM-C/SGLI data, which may limit the model's effectiveness when applied to the Cyprus dataset.

Conclusion

The findings highlight the potential limitations of using lower-resolution satellite data for chlorophyll-a concentration estimation in the Mediterranean. The research advocates for the exploration of higher-resolution satellite data sources, such as Sentinel-3 with a 300 m resolution, to enhance model accuracy. Future studies are recommended to investigate the transferability of models across different marine environments and the impact of high-resolution satellite data on improving chlorophyll estimation accuracy.

Keywords

Water Quality, Mediterranean Sea, Chlorophyll-a Concentration, Transfer Learning, Sentinel-2 Satellite Imagery, Multilayer Perceptron (MLP).