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Author: Mr. Tatsuyuki Sekine
ELSPINA VEINZ INC., Japan

Mr. Kenichi Sasaki
University of Colorado Boulder, United States

DETECTION OF HARMFUL ALGAL BLOOMS IN GULF OF MEXICO FROM SATELLOGIC HYPERSPECTRAL SATELLITE IMAGERY

Abstract

HABs(Harmful Algal Blooms) are colonies of algae which grow out of control and sometimes produce harmful toxins to humans and animals. Therefore once bloom, they impact severely on coastal resources, economies, and public health. Though there are many factors that cause HABs(wind and water currents for instance), not a precise mechanism is known. NCCOS(National Centers for Coastal Ocean Science) in NOAA(National Oceanic and Atmospheric Administration), US, monitors and provides algal bloom data and forecasts in states. According to them, on February 2023, some HABs, or commonly known as red tide, were detected in Gulf of Mexico, particularly in coasts of Florida. There microscopic algae species Karenia brevis bloom and cause respiratory illness on humans and killing fish. However, the satellite images NCCOS provide from sentinel-3 has only RGB bands with 300m spatial resolution, which is difficult for minute analyses. In this study, we acquired satellite images in Southeast of Florida from Nusat with hyperspectral camera in Satellogic company, and estimated classification performance for HABs. Hyperspectral images have much more spectral bands than multi spectral images, being applicable for wide range of remote sensing tasks including algae detection. Currently, more and more hyperspectral satellites are being launched, but yet less data can be accessed. Hence studys on those data are also important. Satellogic released hyperspectral sensor images in 2022, with 25m spatial resolution and 29 spectral bands in visible to near-infrared wavelengths. We annotated HABs area by combination of human eyes and local reports, trained binary classification models for HABs or not on each sensor. As a result, the model trained with hyperspectral images showed better accuracy than sentinel-3 images. we also inferred in another area, having confirmed enough robustness. However, despite we only care about harmful algaes, we didn't discriminate algae types because of no ground truth data. Building models to discriminate multiple algae types would be our next study.