A Novel Machine Learning Process for Proactive Management of Cyanobacteria Blooms and Microcystin Toxins

Wagner, Griffin (School: Vero Beach High School)

This project integrates three individual studies: microcystin detection, bloom prediction, and septic distribution analysis. With the data from a four month longitudinal collection period, a machine learning algorithm was created with the ability to predict microcystin, a hepatotoxin currently in the Indian River Lagoon (IRL), with 96.78% validation accuracy and high rates of precision and recall. Secondly, a literal algorithm was improved to predict the onset of a blue green algal bloom 6 to 7 days in advance with a preserved 93% accuracy. Finally, a correlation between increased septic distribution and microcystin concentration was found and implemented into the machine learning component of this project. Combining the models for algorithmically detecting microcystin toxins and predicting algal blooms, an iOS application (built in Swift with the Cocoa Touch framework) allows community members and government officials to view the algorithms' predictions and make more informed decisions regarding recreational activity and algal mitigation efforts. The iOS application sends phone notifications to warn users about unsafe IRL conditions and uses location notifications to alert users if they are in a region with unsafe levels of microcystin toxin. Finally, a highly positive correlation between the density of septic tanks and mean concentration of Microcystin was found that explains 83.31% of variability. More sampling at an increased number of sites would be required to suggest a causative relationship. No previous model predicts microcystin or algal blooms in the IRL and this provides a resource to proactively manage recreational activity, fertilizer usage, and fresh-water discharges.

Awards Won: