Forecasting Domoic Acid Levels From Harmful Algal Blooms Along the Pacific Northwest Coast

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Here is the edited version: In spring 2015, the U.S. Pacific Coast experienced an unprecedented surge in domoic acid concentrations, exceeding federal safety limits by over 700% in some parts of Washington State, resulting in extensive fishery closures. Domoic acid, a potent neurotoxin produced by harmful algal blooms of Pseudo-Nitzschia, poses risks to human health by causing amnesic shellfish poisoning and is lethal to marine wildlife. Previous domoic acid forecasting methods primarily relied on imprecise qualitative techniques without quantitative support, while prior machine learning approaches were limited in terms of geographic scope and time span. This project aimed to develop a machine learning model capable of precisely quantifying and forecasting domoic acid risk across the Pacific Northwest. A comprehensive database was compiled, integrating weekly biotic beach sampling data, environmental factors, and satellite observations spanning 21 years, facilitating the training and evaluation of multiple forecasting algorithms. Key factors influencing domoic acid levels were identified through rigorous feature selection, including temporal features, Pacific Ocean indices, latitude, and harmful algal bloom-related environmental metrics. The final random forest regression and classification model (DAtect) achieved a relative mean squared error of 10.04 and an R-squared of 0.59 for direct domoic acid concentration forecasting. When predicting threat levels relative to the regulatory limit of 20 ppm, the DAtect model attained an accuracy of 0.82. Thus, this model could potentially supplement previous qualitative domoic acid forecasts for additional accuracy, enabling proactive measures to safeguard shellfish fisheries and public health along the Pacific Coast.

Awards Won:
Second Award of $2,000