Comparison Bioinformatics Study: Novel Machine Learning Algorithms for Detecting Zooxanthellae Expulsion for Insight Into Coral Conservation Efforts

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Zooxanthellae expulsion (Coral bleaching) is a significant concern for biodiversity and economic prosperity, considering mass bleaching has now occurred in every region worldwide. This study's objective was to evaluate computational algorithms: CSV Classification, Image Classification, and Object Detection to determine various numerical variables in dynamic equations in marine applications, especially those that depend on complex oceanographic measurements and conservation technological fields. Regarding CSV, we combined two distinct models: KNN and LGBM, to develop a hybrid model that capacitated anomaly detection. Among various models, the accuracy of CSV Classification was outstandingly high when utilizing the LGBM hybrid model resulting in a substantial increase (30%) in the AUC score compared to the default LGBM model. Through Exploratory Data Analysis (EDA), the MobileNet model for Image Classification had an accuracy value of 100%. For Object Detection, while most of the previously proposed methodologies have utilized either YOLO v4 or YOLO v5, this paper takes account of the YOLO v7 algorithm. This approach enables the visualization and monitoring mechanism for coral reef bleaching by paralleling the real-time segments. By enabling Hyper Parameter Tuning, it modified the batch size to identify the balance between faster convergence and memory usage. Utilizing YOLO-v7 resulted in a 0.72 mean average precision (mAP) score, significantly improving over previous versions. While several published studies appear to lack the appropriate levels of validation and accuracy due to their region-based research; this study focuses on a broader approach and comparative analysis to analyze future trends, making provisions for coral conservation.

Awards Won:
Fondazione Bruno Kessler: Award to participate in summer school "Web Valley"
University of Texas at Arlington College of Science: Scholarship of $10,000