CorAI: Global Coral Bleaching Prediction Using Region-Specific Artificial Intelligence and Machine Learning Models

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Coral reefs are the world's most vital marine ecosystems, producing 50% of the world's oxygen and sustaining the livelihoods of 1 billion people globally. However, coral bleaching, a phenomenon linked to global warming, has killed 50% of the world's reefs, with an estimated 90% predicted to be dead by 2050, threatening the lives of billions globally. Conservation efforts are underway in many reefs. However, such efforts are highly effective only when applied proactively before bleaching events. This research focuses on developing region-based artificial intelligence models that cover the global coral reef landscape and can forecast bleaching 1 year in advance with low error. This study finds that a latitudinal-based split with 12 regions using Random Forest Regression Models with Extra Trees is optimal for bleaching prediction, with a Mean Absolute Error (MAE) of just 5.742, while a longitudinal-based split with 4 regions using LSTMs is optimal for sea surface temperature prediction, with a MAE of 0.225 degrees Celsius. When validated using data augmentation, the framework demonstrated an overall error rate of 11.7834%. Thus, this study developed a novel coral bleaching prediction mechanism that can predict reef-scale coral bleaching with a 4x improvement in spatial scope, 52x improvement in temporal depth, and a 3x reduction in error compared to the current state of the art. This tool enables proactive, targeted conservation efforts and can help enhance reef survival rates worldwide, hopefully preserving these critical ecosystems for generations to come.

Awards Won:

Third Award of $1,200

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