CORAL REEFS BLEACHING PREDICTION

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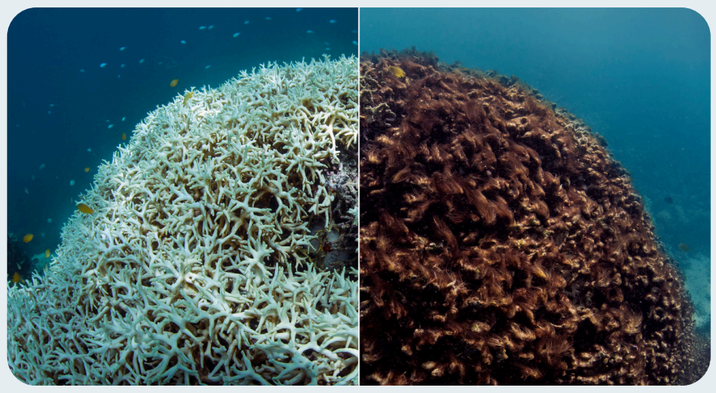
INTRODUCTION

Coral Reefs are essential ecosystems that sustain over 25% of all marine life, protect coastlines and sustain livelihoods yet they are threatened by coral bleaching, a phenomenon caused by climate change. NASA estimates that 70–90% of reefs may vanish by 2050. Traditional monitoring methods are time consuming and prone to human errors. The project aims to address this issue by exploring the application of machine learning models to predict coral bleaching using environmental data by the Biological and Chemical Oceanography Data Management Office (BCO-DMO).



Source: The Ocean Agency – *Coral Bleaching, Lizard Island, Great Barrier Reef, Before (March 2016) & After (May 2016)*

OBJECTIVES

- To identify key environmental factors that influence coral bleaching
- To develop machine learning models for coral bleaching prediction
- To evaluate machine learning models for coral bleaching prediction using various evaluation metrics.

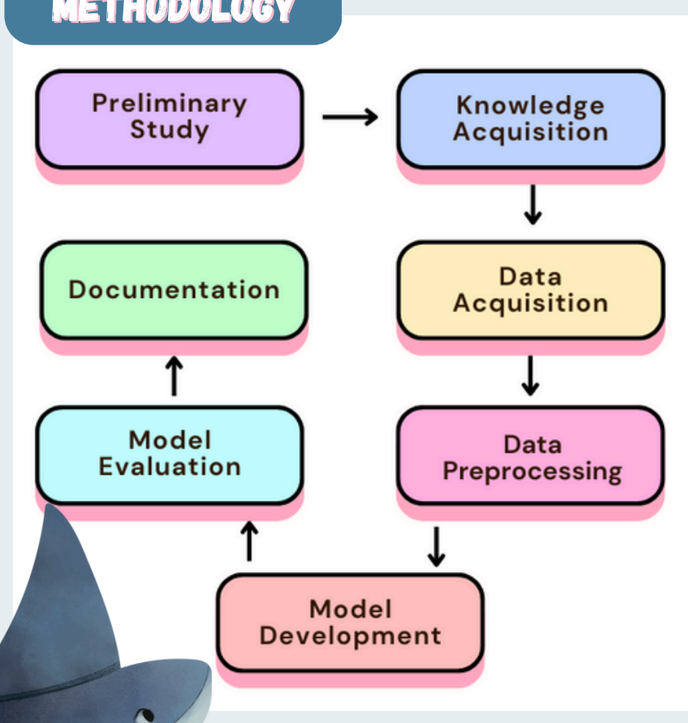
SCOPE

This study uses the Global Bleaching and Environmental Data from BCO-DMO to analyze key environmental factors. It focuses on comparing machine learning models LSTM, SVM, RF, XGBoost, MLP, and DT using evaluation metrics such as Accuracy, MAE, RMSE, and MAPE.

SIGNIFICANCE

- Aligns with UN Sustainable Development Goal 14: "Conserve and sustainably use the oceans, seas, and marine resources."
- Supports sustainability and coral reef conservation.
- Improve prediction of coral bleaching to reduce climate change impacts.
- Fisheries dependent on coral reefs in the U.S. generate around $100 million annually

METHODOLOGY



RESULTS

Model	Accuracy	MAE	RMSE	MAPE
Random Forest	99.22%	0.008	0.088	0.78%
XGBoost	99.25%	0.008	0.087	0.75%
Decision Tree	98.67%	0.013	0.115	1.33%
MLP	92.57%	0.074	0.272	7.43%
LSTM	84.37%	0.156	0.395	49.62%
SVM	87.69%	0.123	0.351	12.31%

DISCUSSION

Experiments

- Experiments were conducted with 80:20 split ratio involving data preprocessing, feature selection and hyperparameter tuning that improved model performance.

Model Comparison

- Tested six ML models: Random Forest, SVM, LSTM, XGBoost, MLP, Decision Tree.
- Ensemble models (XGBoost and Random Forest) outperformed others.
- MLP & SVM showed moderate performance
- LSTM had the lowest performance due to lack of time-series structure in the dataset.

CONCLUSION

This research demonstrates that machine learning models can accurately predict coral bleaching. Among the six models tested, XGBoost and Random Forest emerged as the most reliable and accurate, achieving over 99% accuracy with minimal error. These results show that data-driven models can be effective tools for coral bleaching monitoring to support conservation efforts and early prevention. Future works may integrate satellite imagery and expand real-time capabilities

References

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