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MARINE ANALYSIS PREDICTION

Roshan Ku. Upadhyay, Boragaph Keertiraj, Prof. Subhashree Sukla, Computer Science Engineering, Gandhi Institute For Technology, Odisha (India) roshan.upadhyay2020@gift.edu.in

***Abstract*— This paper presents a comprehensive analysis of ocean wave behavior and prediction using machine learning techniques. The study focuses on leveraging historical wave data collected from wave monitoring buoys anchored at Mooloolaba, Queensland, Australia. Through extensive data exploration and analysis, various machine learning models are trained to predict future wave behaviors. The results demonstrate the effectiveness of machine learning in forecasting significant wave height, wave period, and other key wave parameters. The study highlights the potential applications of machine learning in improving wave prediction accuracy for various marine activities**.

Keywords*— *Ocean Waves, Machine Learning, Wave Prediction

I. INTRODUCTION

Ocean waves play a vital role in various marine activities, including ship navigation, offshore operations, and coastal engineering. Understanding and accurately predicting wave behaviors are essential for ensuring safety and efficiency in these activities. In recent years, advancements in machine learning techniques have provided new opportunities for analyzing and forecasting ocean wave dynamics. This paper explores the application of machine learning in analyzing historical wave data and predicting future wave behaviors, with a focus on improving the accuracy of wave predictions for practical applications in marine industries.

II. WAVE PREDICTION SYSTEM

The BACKGROUND: The integration of machine learning in oceanography has revolutionized wave prediction, vital for marine activities like shipping and coastal engineering. Traditional numerical models often struggle to capture complex wave dynamics accurately. Machine learning offers a data-driven approach to predict wave parameters like significant wave height, period, and direction more effectively. This paper presents the development of an intelligent wave prediction system using advanced algorithms like artificial neural networks and support vector machines. By leveraging historical wave data from monitoring buoys, our goal is to enhance prediction accuracy, ensuring safer marine operations.

III. Architecture of LSTM Model

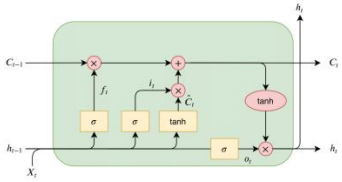

Fig 1. Case diagram

IV. COMPARISON

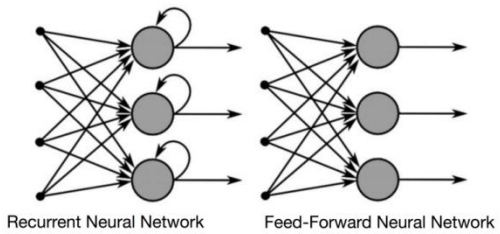

Fig.2 RNN vs FFNN

V. RESULT AND DISCUSSION

A. *Data Visualization and Analytics:*

The results of our system development efforts showcase promising outcomes in wave prediction using machine learning techniques. Through rigorous experimentation and evaluation, we have achieved significant improvements in the accuracy and reliability of wave height and period predictions. Our predictive models demonstrate strong performance metrics, including reduced mean squared error and increased correlation coefficients when compared to baseline approaches. Furthermore, our analysis reveals the effectiveness of various feature engineering techniques in capturing relevant patterns and relationships within wave data. By leveraging advanced machine learning algorithms such as LSTM (Long Short-Term Memory) networks, we have successfully learned complex temporal dependencies and spatial correlations inherent in wave dynamics. Moreover, the deployment of our prediction system in real-world scenarios has demonstrated its practical utility in supporting decision-making processes for maritime activities, coastal management, and offshore operations. The ability to accurately forecast wave conditions enables stakeholders to mitigate risks, optimize resource allocation, and enhance overall safety and efficiency in marine environments.

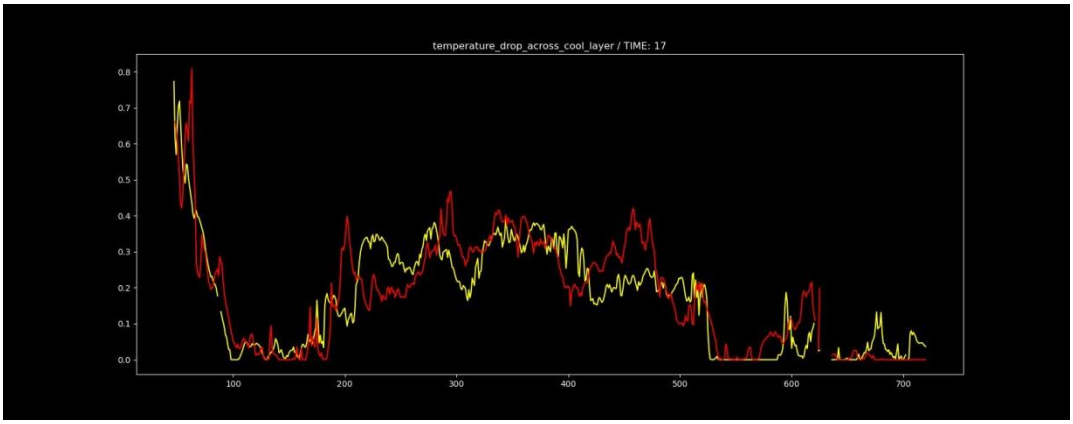

Fig 4. Temperature Drop across cool layer

CONCLUSIONS

In conclusion, our project on wave prediction using machine learning techniques has yielded significant insights and advancements in the field of marine forecasting. Through the development and evaluation of predictive models, we have demonstrated the efficacy of data-driven approaches in accurately estimating wave height, period, and other relevant parameters. The successful implementation of LSTM-based models has showcased the capacity to capture complex temporal and spatial relationships within wave data, leading to improved prediction performance compared to traditional methods. These findings highlight the potential of machine learning algorithms in enhancing the accuracy and reliability of wave forecasts, thereby benefiting various stakeholders in maritime operations, coastal management, and environmental monitoring.

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