ABSTRAK

Tinggi gelombang laut signifikan (Hs) merupakan indikator statistik yang menggambarkan rata-rata sepertiga gelombang tertinggi dalam suatu kurun waktu tertentu. Parameter ini sering dijadikan representasi kondisi umum permukaan laut karena lebih sesuai dengan persepsi visual manusia terhadap ketinggian gelombang. Pada bidang ilmu oseanografi, Hs memiliki peranan penting, terutama dalam mendukung keselamatan navigasi laut, perencanaan aktivitas lepas pantai, serta mitigasi potensi bencana maritim. Penelitian ini bertujuan untuk membangun sistem prediksi otomatis terhadap nilai Hs dengan memanfaatkan algoritma *Long Short-Term Memory* (LSTM), yang dikenal efektif dalam mengolah data *time series*. Data yang digunakan bersumber dari buoy di perairan lepas Laut Andaman, dengan resolusi data per jam. Model LSTM dikembangkan dengan menguji berbagai konfigurasi parameter seperti jumlah neuron, tingkat dropout, ukuran batch, dan panjang time step, untuk memperoleh performa model terbaik. Berdasarkan hasil eksperimen, kombinasi parameter optimal (unit 128, dropout 0,2, batch size 32, dan time step 168) menghasilkan koefisien determinasi (R^2) sebesar 0,979 dan nilai Mean Absolute Percentage Error (MAPE) sebesar 3,9%. Hasil ini menunjukkan tingkat akurasi yang optimal, serta mengindikasikan kemampuan LSTM dalam mempelajari pola kompleks gelombang laut secara efektif. Model ini dapat dimanfaatkan dalam sistem prediksi gelombang laut untuk menunjang keputusan operasional di bidang kemaritiman.

Kata kunci: tinggi gelombang laut signifikan, prediksi otomatis, LSTM, time series, deep learning

ABSTRACT

Significant wave height (Hs) is a statistical indicator that represents the average of the highest one-third of waves observed over a specific time period. This parameter is commonly used to describe general sea surface conditions, as it closely aligns with human visual perception of wave height. In oceanography, Hs plays a crucial role in ensuring maritime navigation safety, supporting offshore activity planning, and aiding in the mitigation of potential marine disasters. This study aims to develop an automatic prediction system for Hs using the Long Short-Term Memory (LSTM) algorithm, which is known for its effectiveness in processing time series data. The data used were obtained from ocean buoys located in the offshore waters of the Andaman Sea, with an hourly temporal resolution. The LSTM model was developed and tested using various parameter configurations, including the number of neurons, dropout rate, batch size, and time step length, in order to achieve optimal performance. The experimental results showed that the best configuration (128 units, 0.2 dropout, batch size of 32, and a time step of 168) produced a coefficient of determination (R^2) of 0.979 and a Mean Absolute Percentage Error (MAPE) of 3.9%. These results indicated a high level of accuracy and demonstrate the LSTM model's capability to effectively capture the complex patterns of ocean wave dynamics. This model holds significant potential for implementation in artificial intelligence-based prediction systems to support operational decision-making in the maritime sector.

Keywords: *significant wave height, automated prediction, LSTM, time series, deep learning*