



UNDERGRADUATE THESIS

IMPLEMENTATION OF BIDIRECTIONAL LONG SHORT-TERM MEMORY (BILSTM) TO PREDICT THE SPEED AND DIRECTION OF SEA SURFACE CURRENTS IN THE BALI STRAIT SHIPPING LANE

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2026**

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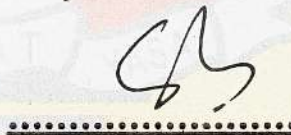
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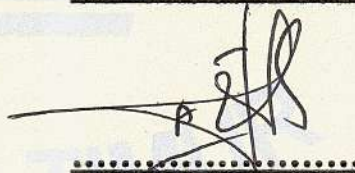
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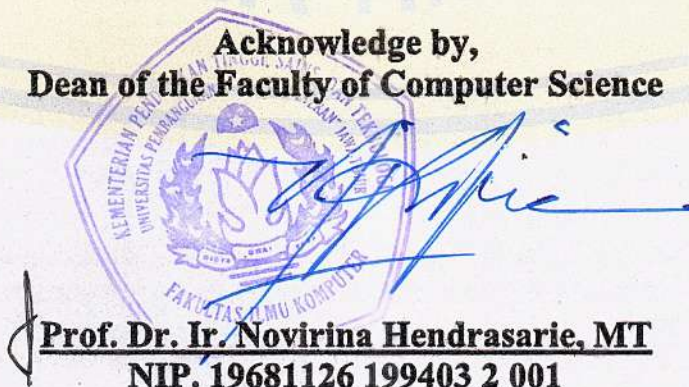
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STATEMENT OF ORIGINALITY

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ABSTRACT

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Thesis Title : Implementation of Bidirectional Long Short-Term Memory (BiLSTM) to Predict the Speed and Direction of Sea Level Flows in the Bali Strait Shipping Lane

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The Bali Strait is a strategic shipping lane with very high traffic intensity, reaching more than 85 thousand ship trips and serving 9.2 million passengers per year. The unique oceanographic conditions of the Bali Strait, namely the topography resembling a funnel, the influence of cross-Indonesian currents (Arlindo), tidal cycles, and monsoon wind variations, produce fluctuating, strong, and non-linear movements of sea surface currents that are very difficult to predict using conventional hydrodynamics models. This study implements the Bidirectional Long Short-Term Memory (BiLSTM) method as a data-driven approach to predict the speed and direction of sea surface currents in the Bali Strait. The data used is in the form of daily time series data of the east-west (U) and north-south (V) flow speed components obtained from the Copernicus Marine Service (CMEMS) with a time range of November 22, 2022 to January 22, 2026, totaling 16,213 data. Hyperparameter tests were carried out on hidden layer (50, 100, 150) and batch size (32, 64, 128, 256) variations with a fixed number of epochs of 50. The results showed that the best configuration was achieved at hidden layer 50 and batch size 32, with the MAPE value of component V being 12.03% (accurate category). In the U component, the MAPE value is not defined (inf) due to the presence of three zero-value data points that are divisors in the MAPE formula, even though visually the prediction is able to follow the actual trend. Validation using the last 9 days of the dataset (23–31 January 2026) shows that the MAPE speed in the first 5 days is below 2.5% with a best value of 1.91%, as well as a very low directional MAPE ranging from 0.34% to 4.00%. The cardinal cardinal conversion shows a full match between the prediction and the actual, i.e. the direction of the East (T) for January 23–28, 2026 and the Northeast (TL) for January 29–31, 2026. These results prove that the BiLSTM model has good generalization capabilities and has the potential to be applied as a navigation decision support system in the waters of the Bali Strait.

Keywords : BiLSTM, sea surface currents, Bali Strait, deep learning, time series prediction, MAPE

FOREWORD

All praise to Allah SWT for all His gifts, guidance, and grace to the author so that the thesis entitled **"Implementation of Bidirectional Long Short-Term Memory (BiLSTM) to Predict the Speed and Direction of Sea Level Currents in the Bali Strait Shipping Lanes"** can be completed well. This thesis was prepared as one of the requirements to complete the S1 (Bachelor) education program at the Informatics Study Program, Faculty of Computer Science, National Development University "Veteran" East Java.

In writing, this thesis requires a lot of time and dedication, so it is not uncommon for writers to need a lot of help, both materially and morally. Therefore, the author would like to set aside a few of the hundreds of pages of this thesis to express his deepest and deepest gratitude to those who have always supported. This thank you is specifically conveyed by the author to:

1. Myself, Alvico Faudiansyah Sumanto, who has been able to survive, struggle, and remain committed in completing the entire process of preparing this thesis. Thank you for not giving up in facing various challenges, and for continuing to try and keep the promise to complete this thesis until the end.
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9. Finally, the author presents this thesis to everyone who often asks, "When is graduation?" The author believes that graduation is just a ceremony that marks the end of a long process of academic struggle. Being late in completing studies or not graduating on time is not a mistake, let alone a disgrace that deserves to be questioned. A person's intelligence, ability, and quality should not be measured by how quickly he completes his studies. In the end, a good thesis is not a thesis that is completed the fastest, but a thesis that can be completed with full responsibility, perseverance, and dedication, whether on time or not.

The author understands that this thesis is still far from perfect and there are still various shortcomings in its preparation. Therefore, the author is open to all forms of criticism and constructive suggestions in order to be material for improvement in future research.

In closing, the author hopes that this thesis will be able to provide benefits for readers and can be used as one of the supporting references for future research development.

Surabaya, June 2026

Author

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