

CHAPTER V

CONCLUSIONS AND SUGGESTIONS

5.1. Conclusion

Based on the results of the implementation and evaluation that has been carried out in this study, the following conclusions can be drawn:

1. The Bidirectional Long Short-Term Memory (BiLSTM) method has been successfully implemented to predict the speed and direction of sea surface currents in the Bali Strait. The model is able to process time series data by reading information from two directions (forward and backward), so that non-linear current fluctuation patterns can be recognized quite well. This is evident from the prediction results of component V which reached a MAPE value of 12.03%, which is included in the accurate category.
2. Based on the hyperparameter batch size and epoch tests, the BiLSTM model with a hidden layer 50 and batch size 32 configuration produced the best performance for both components, namely component U and component V. In component V, this configuration resulted in a MAPE value of 12.03%, which is included in the accurate category. The training loss graph shows that the training process achieved a good fit condition in both components, with a final loss value below 0.0005. Epoch 50 times is considered sufficient because the subsequent improvement in accuracy is only marginal.
3. In the U component, the MAPE calculation produces an infinite (inf) value because there is an actual value of zero that is the divisor in the MAPE formula. Visually, the prediction line is still able to follow the general trend of current movements despite technical constraints in the evaluation metrics used.
4. Based on validation using the last 9 days of the dataset period, the BiLSTM model was able to predict the speed and direction of the flow very well. In the first 5 days, the MAPE speed was below 2.5% with a best value of 1.91% on January 24, 2026. The resulting directional MAPE is also very low, ranging from 0.34% to 4.00%. The cardinal conversion shows a full match between the prediction and the actual, i.e. East (T) for January 23-28, 2026 and Northeast (TL) for January 29-31, 2026. This proves that the BiLSTM model has good generalization capabilities to new data that has never been seen before.

5.2. Suggestions

Based on the experience during conducting this research, some suggestions that can be given for further development are:

1. For future research, it is best to use alternative evaluation metrics such as RMSE or MAE in addition to MAPE. This is important because ocean flow data often contains zero values that can cause MAPE to be undefined.
2. It is necessary to test the value of different time steps in the sequence formation process. This study uses certain time step values, but has not been tested for its effect on prediction accuracy.
3. The data used in this study is sourced from satellites. The research can then compare the prediction results using direct observation data in the field to see a more realistic level of accuracy.
4. The BiLSTM model that has been built can be further developed into an early warning system for ship captains crossing the Bali Strait, considering that accurate current information is needed for navigation safety.