ABSTRAK

Industri otomotif Indonesia menghadapi ketidakakuratan prediksi penjualan yang dipengaruhi faktor musiman seperti Lebaran dan faktor eksternal seperti inflasi serta Suku Bunga BI. Akan tetapi, belum ada penelitian perbandingan langsung model deep learning yang mengintegrasikan faktor-faktor dalam konteks pasar Indonesia. Penelitian ini bertujuan untuk menerapkan dan membandingkan kinerja Long Short-Term Memory (LSTM), Convolutional Neural Network (CNN), dan hibrida CNN-LSTM untuk menemukan model prediksi penjualan mobil yang paling akurat. Dengan menggunakan metodologi CRISP-DM dengan data penjualan mobil bulanan dari GAIKINDO periode 2006-2024 yang diintegrasikan dengan variabel musiman dan eksternal. Kinerja model LSTM, CNN, dan CNN-LSTM dievaluasi dan dioptimalkan melalui fine-tuning arsitektur, kemudian dibandingkan menggunakan metrik Mean Absolute Error (MAE), Mean Squared Error (MSE), dan Root Mean Squared Error (RMSE). Hasil proses fine-tuning berdampak variatif pada metrik RMSE: model CNN menurun dari 0.370 menjadi 0.331, model LSTM meningkat dari 0.374 menjadi 0.410, sementara CNN-LSTM menurun dari 0.382 menjadi 0.371 Berdasarkan analisis komparatif, model CNN hasil fine-tuning terbukti menjadi arsitektur yang paling unggul dan akurat untuk tugas prediksi penjualan mobil pada kasus penelitian ini.

Kata kunci: Prediksi Penjualan Mobil, Deep Learning, CNN, LSTM, Fine Tuning, CRISP-DM

ABSTRACT

The Indonesian automotive industry faces inaccuracies in sales forecasts influenced by seasonal factors such as Eid al-Fitr and external factors such as inflation and BI interest rates. However, there has been no direct comparative study of deep learning models that integrate these factors in the context of the Indonesian market. This study aims to apply and compare the performance of Long Short-Term Memory (LSTM), Convolutional Neural Network (CNN), and hybrid CNN-LSTM to find the most accurate car sales prediction model. It uses

the CRISP-DM methodology with monthly car sales data from GAIKINDO for the period 2006-2024, integrated with seasonal and external variables. The performance of the LSTM, CNN, and CNN-LSTM models was evaluated and optimized through architecture fine-tuning, then compared using the Mean Absolute Error (MAE), Mean Squared Error (MSE), and Root Mean Squared Error (RMSE) metrics. The fine-tuning process had varying effects on the RMSE metric: the CNN model decreased from 0.370 to 0.331, the LSTM model increased from 0.374 to 0.410, while the CNN-LSTM decreased from 0.382 to 0.371. Based on comparative analysis, the fine-tuned CNN model proved to be the most superior and accurate architecture for the car sales prediction task in this case study.

Keywords: *Car Sales Prediction, Deep Learning, CNN, LSTM, Fine Tuning, CRISP-DM*