

INTISARI

Penelitian ini berjudul “*Analisis Prediksi Time Series Harga Produk Shopee Menggunakan LSTM, GRU, dan Transformer dengan Pendekatan Adaptive Window*”. Penelitian ini bertujuan untuk menganalisis dan membandingkan kinerja model deep learning dalam memprediksi harga produk pada platform *e-commerce* Shopee. Variabel penelitian dibatasi pada satu variabel univariat, yaitu harga produk (*price_ori*), yang dianalisis sebagai data deret waktu. Metode yang digunakan meliputi prapemrosesan data, pembentukan urutan data menggunakan pendekatan *fixed window* dan *adaptive window*, serta pemodelan menggunakan arsitektur *Long Short-Term Memory* (LSTM), *Gated Recurrent Unit* (GRU), dan *Transformer*. Evaluasi kinerja model dilakukan menggunakan metrik *Mean Squared Error* (MSE), *Root Mean Squared Error* (RMSE), *Mean Absolute Error* (MAE), dan koefisien determinasi (R^2).

Hasil penelitian menunjukkan bahwa pendekatan *adaptive window* memberikan pengaruh yang berbeda pada setiap arsitektur model. Model LSTM dengan *adaptive window* menghasilkan kinerja prediksi terbaik secara keseluruhan, ditunjukkan oleh nilai kesalahan prediksi yang lebih rendah dibandingkan pendekatan *fixed window*. Model GRU menunjukkan performa yang stabil dan efisien dengan *fixed window*, namun penerapan *adaptive window* tidak memberikan peningkatan kinerja yang konsisten. Sementara itu, model Transformer dengan *fixed window* menunjukkan kinerja prediksi yang kurang optimal serta membutuhkan waktu pelatihan yang lebih lama.

Berdasarkan hasil tersebut, dapat disimpulkan bahwa efektivitas prediksi harga produk *e-commerce* sangat dipengaruhi oleh kesesuaian antara arsitektur model, strategi *windowing*, karakteristik data, dan keterbatasan sumber daya komputasi. Dalam konteks penelitian ini, model LSTM dengan *adaptive window* dan model GRU dengan *fixed window* merupakan pendekatan yang paling sesuai untuk prediksi harga produk Shopee berbasis deret waktu.

Kata kunci: prediksi *time series*, harga produk *e-commerce*, LSTM, GRU, *adaptive window*

ABSTRACT

This research is entitled “Time Series Prediction Analysis of Shopee Product Prices Using LSTM, GRU, and Transformer with an Adaptive Window Approach.” The purpose of this study is to analyze and compare the performance of deep learning models in predicting product prices on the Shopee e-commerce platform. The research variable is limited to a single univariate variable, namely product price (price_ori), which is analyzed as time series data. The research method consists of data preprocessing, sequence generation using fixed window and adaptive window approaches, and modeling using Long Short-Term Memory (LSTM), Gated Recurrent Unit (GRU), and Transformer architectures. Model performance is evaluated using Mean Squared Error (MSE), Root Mean Squared Error (RMSE), Mean Absolute Error (MAE), and the coefficient of determination (R^2).

The results indicate that the adaptive window approach produces different effects across model architectures. The LSTM model combined with an adaptive window achieves the best overall prediction performance, as indicated by lower prediction error values compared to the fixed window approach. The GRU model demonstrates stable and computationally efficient performance when using a fixed window, while the application of an adaptive window does not consistently improve its accuracy. Meanwhile, the Transformer model with a fixed window shows relatively poor predictive performance and requires longer training time.

Based on these findings, it can be concluded that the effectiveness of e-commerce product price prediction is strongly influenced by the compatibility between model architecture, windowing strategy, data characteristics, and computational resource limitations. In this study, LSTM with an adaptive window and GRU with a fixed window are identified as the most suitable approaches for Shopee product price forecasting based on time series data.

Keywords: time series prediction, e-commerce product price, LSTM, GRU, adaptive window