

ABSTRAK

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Judul : Peramalan Data *Time Series* Menggunakan *Hybrid Model* ARIMA, *Exponential Smoothing* Dan *Long Short-Term Memory* Dengan *Genetic Algorithm Optimization*

Pergerakan harga saham Bank Central Asia (BBCA) merupakan *time series* non-linear, tidak stasioner, dan bervolatilitas tinggi. Penelitian ini mengembangkan *hybrid model parallel* yang mengintegrasikan model *Autoregressive Integrated Moving Average* (ARIMA(2,1,1)), *Exponential Smoothing* (ES) tipe Error Trend Seasonal (ETS(Aditif,Aditif,None)), dan *Long Short-Term Memory* (LSTM) dengan ukuran *look-back window* 5 hari, di mana bobot kombinasi dioptimasi menggunakan *Genetic Algorithm* (GA). Data yang digunakan adalah harga penutupan harian BBCA periode 28 Mei 2018 sampai 21 Mei 2026 sebanyak 1910 data latih dan 90 data tes. GA dieksekusi selama 150 generasi untuk mencari bobot optimal pada tiga periode peramalan jangka pendek (7 hari), menengah (30 hari), dan panjang (90 hari). Hasil evaluasi menunjukkan adanya dinamika performa yang bergantung pada periode waktu prediksi. Pada prediksi jangka pendek, model *hybrid* menghasilkan tingkat kesalahan yang lebih tinggi dibandingkan model tunggal, di mana model tunggal LSTM lebih unggul pada metrik *Mean Absolute Error* (MAE) dan *Root Mean Square Error* (RMSE), sedangkan model tunggal ES lebih unggul pada metrik *Mean Absolute Percentage Error* (MAPE). Namun demikian, pada periode prediksi jangka menengah dan jangka panjang, model *hybrid* terbukti sangat tangguh dengan menghasilkan tingkat akurasi yang jauh lebih tinggi dibandingkan seluruh model tunggal lainnya. Kesimpulannya, arsitektur *hybrid parallel* ini terbukti sangat efektif dalam menutupi kelemahan masing-masing model tunggal, khususnya untuk menjaga stabilitas dan meminimalisasi akumulasi galat pada peramalan jangka menengah dan panjang.

Kata Kunci: ARIMA, *Exponential Smoothing*, LSTM, *Genetic Algorithm*, Peramalan Saham, BBCA.

ABSTRACT

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Title : Peramalan Data Time Series Menggunakan Hybrid Model ARIMA, Exponential Smoothing Dan Long Short-Term Memory Dengan Genetic Algorithm Optimization

The stock price movement of Bank Central Asia (BBCA) is a non-linear, non-stationary, and highly volatile time series. This research develops a parallel hybrid model that integrates the Autoregressive Integrated Moving Average (ARIMA(2,1,1)) model, Exponential Smoothing (ES) of the Error Trend Seasonal (ETS(Additive,Additive,None)) type, and Long Short-Term Memory (LSTM) with a look-back window size of 5 days, where the combination weights are optimized using a Genetic Algorithm (GA). The data used are the daily closing prices of BBCA for the period from May 28, 2018, to May 21, 2026, comprising 1,910 training data points and 90 testing data points. The GA was executed for 150 generations to find the optimal weights across three forecasting periods: short-term (7 days), medium-term (30 days), and long-term (90 days). The evaluation results indicate performance dynamics that are dependent on the prediction time period. In short-term predictions, the hybrid model yielded a higher error rate compared to the individual models, where the individual LSTM model was superior in the Mean Absolute Error (MAE) and Root Mean Square Error (RMSE) metrics, while the individual ES model excelled in the Mean Absolute Percentage Error (MAPE) metric. However, in the medium- and long-term prediction periods, the hybrid model proved to be highly robust, producing a significantly higher level of accuracy compared to all other individual models. In conclusion, this parallel hybrid architecture is proven highly effective in mitigating the weaknesses of each individual model, particularly in maintaining stability and minimizing error accumulation in medium- and long-term forecasting.

Keywords: ARIMA, Exponential Smoothing, LSTM, Genetic Algorithm, Stock Forecasting, BBCA.