

## INTISARI

### PERAMALAN DATA RUNTUN WAKTU MENGGUNAKAN MODEL HIBRIDA *AUTOREGRESSIVE INTEGRATED MOVING AVERAGE* DENGAN VARIABEL EKSOGEN DAN *LONG SHORT-TERM MEMORY* BERDASARKAN ALGORITMA GENETIKA

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Peramalan merupakan prediksi mengenai kejadian di masa depan. Dalam konteks runtun waktu, metode peramalan memiliki kompleksitas tinggi akibat adanya pola linier, nonlinier, dan keterkaitan variabel eksogen. Metode *Autoregressive Integrated Moving Average* dengan variabel eksogen (ARIMAX) dapat menangkap pola linier pada data runtun waktu dan mengungkap hubungan variabel eksogen dengan variabel endogen. *Long Short-Term Memory* (LSTM) dirancang untuk mengatasi ketergantungan jangka panjang serta dapat mengidentifikasi pola nonlinier dan kompleksitas pada peramalan data runtun waktu. Keterlibatan variabel dengan jumlah besar dapat meningkatkan kompleksitas model. Maka dari itu, seleksi fitur menggunakan Algoritma Genetika diterapkan untuk memilih *subset* fitur yang relevan. Peramalan runtun waktu dengan model hibrida ARIMAX dan LSTM berbasis seleksi fitur dilakukan untuk menghasilkan model peramalan yang lebih akurat. Penelitian ini berfokus pada peramalan harga penutupan Indeks Harga Saham Gabungan (IHSG) yang dipengaruhi oleh berbagai faktor seperti faktor makroekonomi, indeks saham global dan regional, serta harga komoditas dunia. Model hibrida ARIMAX dan LSTM berbasis seleksi fitur dengan Algoritma Genetika (ARIMAX-LSTM-GA) tanpa dekomposisi memberikan kinerja peramalan terbaik dibandingkan model ARIMAX, LSTM, hibrida ARIMAX-LSTM tanpa dekomposisi, hibrida ARIMAX-LSTM dengan dekomposisi, ARIMAX-GA, LSTM-GA, dan hibrida ARIMAX-LSTM-GA dengan dekomposisi, dengan nilai RMSE sebesar 271,96.

**Kata Kunci:** peramalan, runtun waktu, seleksi fitur, *Autoregressive Integrated Moving Average* dengan Variabel Eksogen, *Long Short-Term Memory*, Algoritma Genetika, Indeks Harga Saham Gabungan.

## ABSTRACT

### TIME SERIES FORECASTING USING A HYBRID AUTOREGRESSIVE INTEGRATED MOVING AVERAGE WITH EXOGENOUS VARIABLE AND LONG SHORT-TERM MEMORY MODEL BASED ON A GENETIC ALGORITHM

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Forecasting is a prediction of some future events. In the context of time series, forecasting methods exhibit high complexity due to the presence of linear and nonlinear patterns and the interactions with exogenous variables. The Autoregressive Integrated Moving Average with Exogenous Variables (ARIMAX) method can capture linear patterns in time series data and reveal the relationships between exogenous and endogenous variables. Long Short-Term Memory (LSTM) is designed to handle long-term dependencies and can identify the nonlinear patterns and complexity in time series forecasting. The inclusion of a large number of variables increases the model's complexity. Therefore, feature selection using Genetic Algorithms is applied to choose relevant feature subsets. Time series forecasting using a hybrid ARIMAX and LSTM model based on feature selection is conducted to produce more accurate forecasting model. This research focuses on forecasting the closing price of the Composite Stock Price Index (IHSG), which is influenced by various factors such as macroeconomic factors, global and regional stock indices, and global commodity prices. The hybrid ARIMAX and LSTM model based on feature selection with Genetic Algorithm (ARIMAX-LSTM-GA) without decomposition produced the best forecasting performance compared to the ARIMAX, LSTM, hybrid ARIMAX-LSTM without decomposition, hybrid ARIMAX-LSTM with decomposition, ARIMAX-GA, LSTM-GA, and hybrid ARIMAX-LSTM-GA with decomposition models, with an RMSE score of 271.96.

**Keyword:** forecasting, time series, feature selection, Autoregressive Integrated Moving Average with Exogenous Variable, Long Short-Term Memory, Genetic Algorithm, Composite Stock Price Index.