

ABSTRAK

PERBANDINGAN KINERJA MODEL TFT DAN N-BEATS DALAM PREDIKSI HARGA EMAS DENGAN INKORPORASI FITUR MAKROEKONOMI

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Penelitian ini bertujuan untuk membandingkan kinerja dua model *deep learning* berbasis deret waktu, yaitu *Temporal Fusion Transformer* (TFT) dan N-BEATS, dalam memprediksi harga emas dengan dan tanpa inkorporasi fitur makroekonomi. Latar belakang penelitian ini didasari oleh pentingnya prediksi harga emas dalam dunia investasi dan ekonomi, serta potensi peningkatan akurasi melalui pemanfaatan data *multivariate* yang mencakup indikator makroekonomi seperti GDP, CPI, UNRATE, DXY, dan FEDFUNDS. Kedua model dibangun menggunakan pustaka *Darts* dan dilatih dengan skema *time-series cross-validation*, serta diuji secara *out-of-sample* untuk mengukur kemampuan generalisasi. Proses pengembangan mencakup *tuning hyperparameter*, transformasi data (*MinMax* dan logaritma natural), interpolasi (*linear* dan *spline*), serta seleksi fitur menggunakan *Recursive Feature Elimination* (RFE). Hasil eksperimen menunjukkan bahwa model N-BEATS dengan skenario *multivariate*, interpolasi linear, *scaling MinMax*, dan seleksi fitur RFE (N-BEATS1) mencapai performa terbaik dengan sMAPE sebesar 0.5322, RMSE sebesar 9.4337, dan MAE sebesar 7.0903 pada data uji. Secara keseluruhan, model N-BEATS terbukti lebih unggul dibandingkan TFT, serta lebih konsisten menghasilkan galat prediksi yang rendah. Selain itu, inkorporasi fitur makroekonomi terbukti memberikan dampak positif terhadap akurasi model, khususnya saat dikombinasikan dengan proses seleksi fitur yang tepat.

Kata Kunci: Prediksi Harga Emas, *Time-Series Forecasting*, N-BEATS, *Temporal Fusion Transformer*, Fitur Makroekonomi, *Deep Learning*

ABSTRACT

PERFORMANCE COMPARISON OF TFT AND N-BEATS MODELS IN GOLD PRICE FORECASTING WITH THE INCORPORATION OF MACROECONOMIC FEATURES

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This study aims to compare the performance of two time-series deep learning models, Temporal Fusion Transformer (TFT) and N-BEATS, in forecasting gold prices with and without the incorporation of macroeconomic features. The research is motivated by the crucial role of gold price prediction in investment and economic planning, and the potential improvement in accuracy through the use of multivariate data involving macroeconomic indicators such as GDP, CPI, UNRATE, DXY, and FEDFUNDS. Both models were implemented using the Darts library and trained using time-series cross-validation, with out-of-sample testing to evaluate generalization capability. The development process involved hyperparameter tuning, data transformations (MinMax and natural logarithm), interpolation methods (linear and spline), and feature selection using Recursive Feature Elimination (RFE). Experimental results show that the N-BEATS model with multivariate input, linear interpolation, MinMax scaling, and RFE feature selection (N-BEATS1) achieved the best performance, with a sMAPE of 0.5322, RMSE of 9.4337, and MAE of 7.0903 on the test set. Overall, the N-BEATS model outperformed TFT and demonstrated more consistent prediction accuracy. Moreover, the incorporation of macroeconomic features significantly enhanced model performance, especially when combined with proper feature selection.

Keywords: Gold Price Prediction, Time-Series Forecasting, N-BEATS, Temporal Fusion Transformer, Macroeconomic Features, Deep Learning