

ABSTRAK

Penelitian ini bertujuan untuk memprediksi jumlah kunjungan wisatawan di Kabupaten Bangkalan menggunakan pendekatan model hibrida Variational Mode Decomposition (VMD) dan Gated Recurrent Unit (GRU). Sektor pariwisata memiliki peran penting dalam mendorong pertumbuhan ekonomi daerah sehingga membutuhkan perencanaan berbasis data peramalan yang akurat. Namun, data kunjungan wisata umumnya bersifat fluktuatif, non-linear, serta memiliki kekosongan data akibat pandemi COVID-19. Data yang digunakan berupa jumlah kunjungan wisatawan nusantara secara bulanan dari Januari 2016 hingga Februari 2025 pada lima destinasi wisata. Pada tahap prapemrosesan dilakukan penanganan data bernilai 0 menggunakan interpolasi linear. Selanjutnya, data deret waktu didekomposisi menggunakan VMD untuk menghasilkan beberapa komponen Intrinsic Mode Function (IMF). Setiap komponen kemudian dimodelkan menggunakan GRU dengan dua skenario optimasi hyperparameter, yaitu Bayesian Optimization dan Random Search. Hasil prediksi dari seluruh komponen kemudian diintegrasikan untuk memperoleh nilai peramalan akhir. Hasil penelitian menunjukkan bahwa model hibrida VMD-GRU dengan Bayesian Optimization menghasilkan performa prediksi terbaik dengan nilai Mean Absolute Percentage Error (MAPE) antara 4,48% hingga 15,95% pada lima destinasi wisata. Hasil tersebut juga menunjukkan kinerja yang lebih stabil dibandingkan skenario Random Search. Dengan demikian, pendekatan hibrida VMD-GRU terbukti efektif dalam memodelkan dinamika kunjungan wisata dan berpotensi digunakan sebagai dasar pengambilan keputusan dalam pengelolaan pariwisata di Kabupaten Bangkalan.

Kata kunci:

Prediksi, Kunjungan Wisatawan, Interpolasi Linear, Variational Mode Decomposition (VMD), Gated Recurrent Unit (GRU), Optimasi Hyperparameter.

ABSTRACT

This study aims to predict the number of tourist visits in Bangkalan Regency using a hybrid model combining Variational Mode Decomposition (VMD) and Gated Recurrent Unit (GRU). The tourism sector plays an important role in supporting regional economic growth; therefore, its management requires decision-making based on accurate forecasting data. However, tourism visitation data tend to be fluctuating, non-linear, and often contain anomalies, including missing values caused by the COVID-19 pandemic. The data used in this study consist of monthly domestic tourist visit records from January 2016 to February 2025 across five tourist destinations. In the preprocessing stage, missing values were handled using linear interpolation. Subsequently, the time series data were decomposed using VMD to generate several Intrinsic Mode Function (IMF) components. Each component was then modeled using GRU with two hyperparameter optimization scenarios, namely Bayesian Optimization and Random Search. The prediction results from all components were aggregated to obtain the final forecasting values. The results show that the hybrid VMD-GRU model with Bayesian Optimization achieved the best predictive performance, with Mean Absolute Percentage Error (MAPE) values ranging from 4.48% to 15.95% across the five tourist destinations. The results also indicate more stable performance compared to the Random Search scenario. Therefore, the hybrid VMD-GRU approach proves to be effective in modeling the dynamics of tourist visits and has the potential to support data-driven decision-making in tourism management in Bangkalan Regency.

Keyword :

Forecasting, Tourist Visits, Linear Interpolation, Variational Mode Decomposition (VMD), Gated Recurrent Unit (GRU), Hyperparameter Optimization.