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Penerapan Metode Neural Hierarchical Interpolation for Time Series (N-HiTS) untuk Long-Horizon Forecasting (Studi Kasus: Data National Energy System Operator)
Talitha Tahara Daffa Mentari, Prof. Dr. Drs. Gunardi, M.Si.
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

INTISARI

Penerapan Metode *Neural Hierarchical Interpolation for Time Series* (N-HiTS) untuk *Long-Horizon Forecasting* (Studi Kasus: Data National Energy System Operator)

Oleh

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Peramalan permintaan listrik dengan horizon panjang menjadi tantangan karena data per jam memiliki pola pada beberapa skala temporal dan akurasi sulit dipertahankan seiring bertambahnya horizon. Penelitian ini menerapkan *Neural Hierarchical Interpolation for Time Series* (N-HiTS) untuk *long-horizon forecasting* pada data *National Demand* (ND) dari *National Energy System Operator* (NESO), serta membandingkannya dengan Holt-Winters dan *Neural Basis Expansion Analysis for Time Series* (N-BEATS). Data univariat periode 1 Januari 2023–29 Mei 2026 diagregasi menjadi frekuensi per jam dengan horizon 168 jam. Konfigurasi *hyperparameter* N-BEATS dan N-HiTS ditentukan melalui *grid search* berdasarkan MAE validasi. Evaluasi dilakukan dengan skema *rolling-origin* pada 36 *window* uji menggunakan *Mean Absolute Error* (MAE), *Mean Squared Error* (MSE), *Root Mean Squared Error* (RMSE), dan *Mean Absolute Percentage Error* (MAPE), lalu dilengkapi uji Friedman dan uji Wilcoxon *signed-rank* dengan koreksi Holm. N-HiTS memperoleh kinerja terbaik dengan MAE sebesar $1.818{,}28$, MSE sebesar $6{,}06 \times 10^6$, RMSE sebesar $2.461{,}41$, dan MAPE sebesar $6{,}67\%$, mengungguli N-BEATS dengan MAE sebesar $2.033{,}01$ dan Holt-Winters dengan MAE sebesar $2.795{,}27$, serta unggul pada 25 dari 36 *window*. Uji Friedman menghasilkan nilai-$p < 0{,}0001$, dan seluruh pasangan model berbeda signifikan pada taraf 5%. Dengan jumlah parameter yang jauh lebih sedikit dan waktu inferensi tercepat, N-HiTS memberikan keseimbangan terbaik antara akurasi dan efisiensi.

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ABSTRACT

Application of the Neural Hierarchical Interpolation for Time Series (N-HiTS) Method for Long-Horizon Forecasting (Case Study: National Energy System Operator Data)

By

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Long-horizon electricity demand forecasting is challenging because hourly demand data exhibit patterns across multiple temporal scales, and accuracy becomes harder to maintain as the horizon grows. This study applies *Neural Hierarchical Interpolation for Time Series* (N-HiTS) for *long-horizon forecasting* on *National Demand* (ND) data from the *National Energy System Operator* (NESO), comparing it with Holt-Winters and *Neural Basis Expansion Analysis for Time Series* (N-BEATS). The univariate series, spanning 1 January 2023 to 29 May 2026, was aggregated to an hourly frequency with a 168-hour horizon. Hyperparameters for N-BEATS and N-HiTS were selected via *grid search* based on validation MAE. Evaluation used a *rolling-origin* scheme over 36 test *windows* with *Mean Absolute Error* (MAE), *Mean Squared Error* (MSE), *Root Mean Squared Error* (RMSE), and *Mean Absolute Percentage Error* (MAPE), complemented by the Friedman test and the Wilcoxon *signed-rank* test with Holm correction. N-HiTS achieved the best performance, with an MAE of $1{,}818.28$, an MSE of 6.06×10^6, an RMSE of $2{,}461.41$, and a MAPE of 6.67%, outperforming N-BEATS with an MAE of $2{,}033.01$ and Holt-Winters with an MAE of $2{,}795.27$, and achieving the best performance in 25 of the 36 *windows*. The Friedman test yielded a p-value below 0.0001, and all model pairs differed significantly at the 5% level. With far fewer parameters and the fastest inference time, N-HiTS offered the best balance between accuracy and computational efficiency.