INTISARI

IMPLEMENTASI SISTEM PREDIKSI BEBAN LISTRIK HARIAN BERBASIS DATA HISTORIS MENGGUNAKAN ALGORITMA XGRADIENT BOOSTING UNTUK OPERASIONAL PEMBANGKIT

Prima Dwi Gustina
22/504642/SV/21671

Seiring meningkatnya kebutuhan efisiensi dan keandalan sistem pembangkit, informasi beban yang akurat sangat penting untuk perencanaan dan pengambilan keputusan operasional. Proyek ini mengembangkan sistem prediksi beban listrik harian berbasis *machine learning* menggunakan data historis beban pembangkit dan cuaca BMKG untuk mempelajari pola beban listrik. Algoritma *XGBoost* digunakan dengan fitur time-series seperti lag, rolling mean, dan kalender untuk menangkap pola tren dan musiman, sementara Random Forest digunakan sebagai pembanding. Pengujian performa model melalui sejumlah metrik evaluasi yakni RMSE, MAE, MAPE, DAN R^2 mengindikasikan bahwa XGBoost lebih akurat dibandingkan Random Forest, dengan pembagian data 70:30 memberikan hasil terbaik. Pengujian kinerja komputasi menunjukkan bahwa Google Colab stabil dengan penggunaan CPU di atas 100%, sementara Kubernetes mengalami fluktuasi dengan kisaran penggunaan CPU antara 90% hingga 100%. Pengujian penggunaan RAM menunjukkan Google Colab menggunakan 287.53 MB, sedangkan Kubernetes 236.78 MB, dengan selisih 50.75 MB lebih tinggi di Colab. Sistem ini diimplementasikan di cloud menggunakan Docker dan Kubernetes, memungkinkan efisiensi dan fleksibilitas dalam pengelolaan. Hasil prediksi disajikan melalui dashboard interaktif berbasis Streamlit, yang mendukung pemantauan dan analisis untuk perencanaan operasional pembangkit berbasis data.
Kata Kunci: *Forecasting, Machine Learning, XGBoost, Time Series, Cloud Computing, Fast API, Streamlit.*

ABSTRACT

THE IMPLEMENTATION OF A DAILY ELECTRICITY LOAD PREDICTION SYSTEM BASED ON HISTORICAL DATA USING THE XGBOOST ALGORITHM FOR POWER PLANT UNIT OPERATIONAL

Prima Dwi Gustina
22/504642/SV/21671

As the demand for efficiency and reliability in power generation systems continues to grow, accurate load information becomes increasingly critical for operational planning and decision-making. This project develops a machine learning-based daily electricity load forecasting system, utilizing historical load data from power plants and meteorological data from BMKG to learn and recognize electricity consumption patterns. The XGBoost algorithm is employed with time-series features including lag values, rolling mean, and calendar attributes to capture both trend and seasonal patterns, while Random Forest is incorporated as a comparison model. Model performance assessment through several evaluation metrics — namely RMSE, MAE, MAPE, and R^2 — indicates that XGBoost achieves higher accuracy than Random Forest, with the 70:30 data split yielding the most optimal results. Computational performance testing reveals that Google Colab maintains stable CPU utilization above 100%, whereas Kubernetes experiences fluctuations with CPU usage ranging between 90% and 100%. RAM consumption testing shows that Google Colab requires 287.53 MB, compared to 236.78 MB on Kubernetes, reflecting a difference of 50.75 MB higher in Colab. The system is deployed on a cloud environment using Docker and Kubernetes, enabling greater efficiency and flexibility in system management. Forecast results are presented through an interactive Streamlit-based dashboard, supporting monitoring and analysis for data-driven operational planning of power generation.

Keywords: Forecasting, Machine Learning, XGBoost,Time Series, Cloud Computing, Fast API, Streamlit