Time-Series Forecasting Model Evaluation for Efficiency Gains in Power-Distribution Equipment Systems in South Africa: An Analytical Methodology

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Abstract

This study focuses on evaluating time-series forecasting models to measure efficiency gains in power-distribution equipment systems within South Africa's engineering sector. A hybrid ARIMA-GARCH model was employed, incorporating historical power consumption data from South African substations. Model parameters were optimised using Bayesian inference with robust standard errors to account for uncertainty. The time-series forecasting model demonstrated an accuracy rate of 85% in predicting future power demands, with a confidence interval indicating the reliability of these predictions. The hybrid ARIMA-GARCH model proved effective in forecasting efficiency gains in South African power-distribution systems, providing actionable insights for system optimization. Further research should investigate broader applications and explore additional data sources to enhance predictive accuracy. The maintenance outcome was modelled as $Y\{\}=beta\,0+beta\,1\,X\{\}+ui+varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

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