African Probability and Statistics (Pure Science)

Asymptotic Analysis and Identifiability Checks in Graph Theory for Power-Grid Forecasting in Nigeria

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Abstract

Graph theory is a fundamental tool in network analysis, offering insights into complex systems such as power grids. In Nigeria, understanding and predicting power grid behaviour is crucial for ensuring reliable electricity supply. Graph theory principles, including node and edge representations, were utilised. Asymptotic analysis was conducted using stochastic processes for large-scale networks. Identifiability checks ensured that the model parameters could be uniquely determined from observable data. An empirical study on a representative Nigerian power grid revealed significant convergence in network behaviour over time, supporting the theoretical predictions. The findings confirm the effectiveness of graph theory in forecasting, with notable improvements in accuracy for future electricity supply planning. Further research should focus on integrating real-time data into the models to enhance predictive capabilities and ensure grid stability. Graph Theory, Power Grid Forecasting, Asymptotic Analysis, Identifiability Checks The analytical core is $\hat{\{} y\} t = mathcal\{F\}(xt;\theta)$ with $\hat{\{}\theta\} = argmin_{\theta} L(\theta)$, and convergence is established under standard smoothness conditions.

Keywords: *Sub-Saharan, African diaspora, Network science, Graph theory, Spectral clustering, Perturbation analysis, Identifiability*

ABSTRACT-ONLY PUBLICATION

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