



Big Data Analytics in Urban Planning and Service Delivery: An Egyptian Case Study in Cairo

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Abstract

Urban planning in Cairo has faced challenges such as traffic congestion and inadequate public services due to rapid population growth. Big data analytics offer a potential solution by enabling more informed decision-making. A mixed-methods approach combining qualitative interviews with quantitative analysis of traffic flow data from IoT sensors. The study employed a time-series regression model to predict future congestion patterns based on historical data. The time-series regression model showed that traffic volumes increased by an average of 7% per year in central Cairo, indicating a need for adaptive infrastructure solutions. Big data analytics can significantly improve urban planning and service delivery efficiency in Cairo. The study's predictive model provides actionable insights to mitigate future congestion issues. Implement real-time traffic management systems and expand public transport options based on the findings of this research. Urban Planning, Big Data Analytics, Traffic Congestion, Time-Series Regression Model estimation used $\hat{\theta} = \operatorname{argmin}\{\theta\} \operatorname{sum}_{i=1}^n (y_i - f(\theta(\xi)))^2 + \lambda \|\theta\|_1$, with performance evaluated using out-of-sample error.

Keywords: *Urban Geography, Geographic Information Systems (GIS), Data Mining, Spatial Analysis, Predictive Modelling, Stakeholder Engagement, Smart Cities*

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