# Topological Data Analysis for Optimising Ghanaian Traffic Flow Using Finite-Element Discretization Methodology

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## Abstract

This study explores the application of Topological Data Analysis (TDA) to optimise traffic flow in Ghana's urban areas. A novel approach combining TDA techniques with finite-element methods will be utilised. The methodology assumes that the traffic network can be modelled as a topological space and uses error bounds to ensure accuracy of the discretization process. The analysis revealed significant patterns in traffic flow, identifying areas where congestion is most prevalent (e.g., intersections A and B). Finite-element discretization successfully facilitated detailed insights into complex urban traffic networks, enabling targeted interventions for reducing congestion. Future research should include validation of these findings through pilot projects in selected cities across Ghana. Policy recommendations could then be formulated based on the successful implementation and evaluation phases. Model selection is formalised as $\hat{\{\theta\}} = argmin_{\theta in \theta} ¿ L(\theta) + \lambda ¿ \omega(\theta) ¿$ with consistency under mild identifiability assumptions.

**Keywords:** *Sub-Saharan, Topology, Persistent Homology, Finite Elements, Mesh Generation, Error Analysis, Network Optimization*

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