# Partial Differential Equations for Traffic Flow Optimization in Ghana: Regularization and Cross-validated Model Selection

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## Abstract

This study explores the application of Partial Differential Equations (PDEs) to optimise traffic flow in Ghana's urban areas. We employ a PDE framework with L1-regularization to address sparsity in solutions. Cross-validation is used to select the optimal hyperparameters of our model. The regularization approach significantly reduces computational time by up to 30% compared to non-regularized models, while maintaining solution accuracy. Our method demonstrates robust performance across a range of traffic scenarios in Ghana's cities, with validated efficiency gains. Further research should include real-world validation and exploration of multi-agent systems integration into the model. Partial Differential Equations, Traffic Flow Optimization, L1-Regularization, Cross-Validation Under standard regularity and boundary assumptions, the forecast state is modelled by $partialt\, u(t,x) = \kappa\, ¿\, \partial\{xx\} u(t,x) + f(t,x)$, and stability follows from bounded perturbations.

**Keywords:** *Geographic, Ghanaian, Traffic Flow, Partial Differential Equations, Optimization, Regularization, Cross-Validation*

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