

# Chapter 24

## Short-Term Traffic Prediction:

### A Bayesian Fusion of Graph Attention Network and SARIMA Model With Quantum Networking

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#### **ABSTRACT**

*Traffic prediction accuracy is pivotal for fruitful urban transportation management. Existing methodologies often struggle to record complex spatio-temporal features of traffic patterns, which results in sub-optimal congestion management. This approach integrates Bayesian inference with a graph attention network (GAN) and a SARIMA model to comprehensively record complex traffic dynamics. The GAN focuses on spatial-dependencies in data, whereas SARIMA considers temporal patterns. Bayesian inference facilitates seamless integration of predictions from both models, enhancing overall forecasting accuracy. To further enhance the accuracy and efficiency of traffic prediction and management, quantum networking is integrated with the Bayesian fusion of GAN and SARIMA. To evaluate, metrics like mean*

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*absolute error, root mean squared error, and mean absolute percentage error are calculated. The research contributes to advancing traffic forecasting methodologies and holds promise for enhancing short-term traffic management strategies.*

## **I. INTRODUCTION**

Metropolitan cities around the world are grappling with the challenge of heavy traffic, which does not only hamper the productivity of transportation systems but also poses significant economic and environmental burdens. Effective traffic management strategies rely heavily on accurate short-term traffic forecasting, which enables authorities to anticipate congestion hotspots and take appropriate steps to alleviate its impact. However, existing forecasting methods often fall short in recording the complex spatio-temporal dynamics inherent in traffic patterns, leading to suboptimal congestion management outcomes. In response to this challenge, there is a growing interest in developing advanced forecasting models capable of accurately predicting traffic flow. Along with Quantum Networking, techniques like deep neural networks and the time-series-analysis, record the intricate relationships across various factors influencing traffic dynamics. Quantum Networking offers immense computational power and the ability to handle complex spatio-temporal features inherent in traffic patterns more effectively. One promising avenue of research involves the fusion of different modeling approaches with Quantum Networking to harness their complementary strengths and improve prediction accuracy.

## **II. RELATED WORKS**

Traffic prediction serves as a cornerstone in smart transportation networks. It allows for proactive traffic management strategies, congestion mitigation, and improved travel efficiency. The paper explores a different approach used for short-term traffic forecasting. Here, we discuss relevant research in this domain: *J. Liu, 2023* Focuses on combining multiple models: This paper builds on the idea of Bayesian Combination Methods (BCM) which integrate predictions from different models to potentially improve overall accuracy. The authors discuss prior work using BCM with neural networks, ARIMA, and Kalman filters. *A. Khan, 2023* evaluates leveraging Long Short-Term Memory to forecast traffic: For traffic forecasting, this research examines the use of LSTMs, a specific class of recurrent neural networks. The benefits of using LSTMs to capture temporal dependencies in data are covered. *G. Guo, 2023* Explores dilated temporal convolutions: This paper focuses on a specific neural network architecture using dilated temporal convolutions for traffic forecasting. It

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