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**Machine Learning for Traffic Prediction and Congestion Management
in Smart Cities**

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ABSTRACT

Rapid urbanization has increased travel demand and produced chronic congestion in many cities. Conventional traffic models often fail to capture the nonlinear, time-varying, and spatially connected nature of urban traffic, especially under mixed vehicle composition, incidents, and changing demand. This research examines machine learning methods for short-term traffic prediction and congestion management within a smart-city Intelligent Transportation System (ITS) framework.

The study will assemble multi-source data such as loop detectors, GPS probe vehicles, cameras, and weather and event records. After cleaning and fusion, supervised and ensemble models will be developed to forecast traffic volume, speed, and travel time at corridor and network levels. Predicted states will support management actions including adaptive signal timing, ramp metering, incident response, and traveler information. Model performance will be assessed using standard error measures and operational indicators such as delay, queue length, and corridor throughput. Case studies on selected urban corridors will test robustness under peak, off-peak, and disrupted conditions.

The work is expected to provide a practical prediction–management pipeline that transportation agencies can use to reduce congestion, improve reliability, and support data-driven operations. Findings will also clarify which machine learning approaches are most suitable for typical urban data quality and mixed-traffic environments.

Keywords: *Traffic Prediction; Congestion Management; Smart Cities.*