Abstract

In recent years, traffic congestion has become a growing concern in urban areas, leading to inefficiencies in transportation systems and increased environmental pollution. To mitigate these challenges, predictive models that estimate traffic density and optimize traffic control mechanisms are crucial. This study proposes a machine learning-based framework for predicting traffic density and enhancing traffic control systems. By leveraging historical traffic data, real-time sensor inputs, and weather conditions, we develop predictive models to forecast traffic flow and congestion at different times of day and across various road segments.

The approach utilizes advanced machine learning algorithms such as Random Forest, Support Vector Machines (SVM), and Deep Learning techniques to model the complex relationships between traffic parameters and predict traffic density levels. Key features include vehicle count, average speed, road capacity, and environmental factors. We evaluate the models' performance based on prediction accuracy, computational efficiency, and scalability. The study also investigates the potential for integrating the predicted traffic density data into adaptive traffic signal control systems to optimize traffic flow, reduce congestion, and enhance the overall efficiency of urban transportation networks.