TrafficTelligence: Advanced Traffic Volume Estimation With Machine Learning

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# Abstract

This project aims to develop an intelligent traffic volume estimation system using machine learning techniques. By leveraging historical traffic data, weather data, and time-based factors, the model predicts traffic volume to aid traffic management and urban planning.

# Introduction

Traffic congestion is a significant problem affecting cities worldwide. Accurate traffic volume estimation can help reduce congestion, optimize signal timings, and improve commuter experiences.

# Problem Statement

Manual traffic estimation is inefficient and error-prone. This project addresses the need for automated, data-driven traffic volume prediction to improve traffic flow and urban development.

# Objectives

- Predict traffic volume accurately using machine learning.  
- Build a user-friendly web application for predictions.  
- Support traffic management and urban planners.

# Methodology

1. Data Collection: Gathering traffic, weather, and time-based data.  
2. Data Preprocessing: Cleaning and transforming data.  
3. Model Building: Using Random Forest regression.  
4. Application Development: Deploying via Streamlit.

# System Architecture

The system comprises Data Ingestion → Preprocessing → Model Training → Prediction → Streamlit Web App.

# Tools and Technologies

Python, Pandas, NumPy, Scikit-learn, Streamlit, Joblib, Matplotlib, Seaborn

# Results and Evaluation

The Random Forest model achieved satisfactory accuracy with low error rates. Sample predictions demonstrate reliable estimation of traffic volumes based on input features.

# Conclusion

TrafficTelligence provides a robust solution for traffic volume estimation. Future improvements can include integration with live traffic APIs and deploying more advanced deep learning models.

# References

- Scikit-learn Documentation  
- Streamlit Documentation  
- Kaggle Traffic Datasets  
- Research articles on Traffic Prediction