FORECASTING OF SMARTCITY TRAFFIC PATTERN

UpSkill Campus, UniConverge Technologies Pvt.Ltd.

Submitted by: J. Dhanush kumar

Correspondence Address:

"Author Note: Correspondence regarding this research should be addressed to:"

J. Dhanush Kumar

Madanapalle Institute of Technology and Science,

Department of Artificial Intelligence,

Angallu, Andhra Pradesh, 517326,

India.

Mail: dhanushkumarjayam1210@gmail.com

Phone: +91 9346935239

ACKNOWLEDGEMENT

The group PROJECT report on "FORECASTING OF SMARTCITY TRAFFIC PATTERNS" is the outcome of guidance, moral support and devotion bestowed on us throughout our work. For this, we acknowledge and express our profound sense of gratitude and thanks to everybody who have been a source of inspiration during the project preparation.

Contents

INTRODUCTION

Smart city traffic management is crucial for efficient urban mobility. This project aims to develop a data-driven approach for forecasting traffic patterns in smart cities. Accurate predictions can help optimize transportation systems, reduce congestion, and enhance overall urban mobility.

Methods:

In this study, a comprehensive dataset was collected from various sources, including traffic sensors, GPS data, and social media platforms. The data collection process involved integrating information on traffic volume, weather conditions, special events, and other relevant factors. Advanced machine learning algorithms were employed to analyze the collected data and develop a forecasting model.

Completed Tasks:

In week 2 we have completed to analyse some algorithms outline which are required for out project “Forecasting of smart city traffic patterns”. The algorithms are listed below:

1. Data Collection:

- Collect historical traffic data for the four junctions in the city, including timestamps and traffic volume information.

- Gather additional relevant data, such as holidays, special events, and other factors that may impact traffic patterns.

2. Data Preprocessing:

- Clean the collected data by handling missing values, removing outliers, and ensuring consistency.

- Convert timestamps into the appropriate datetime format for analysis.

3. Exploratory Data Analysis (EDA):

- Perform EDA to gain insights into the traffic patterns.

- Analyze trends, seasonality, and any noticeable variations in traffic volume.

- Identify patterns associated with holidays and special events.

4. Feature Engineering:

- Extract relevant features from the data, such as time of day, day of the week, holidays, and special events.

- Create additional features to capture seasonality and long-term trends in traffic patterns.

5. Model Selection:

- Choose an appropriate algorithm for traffic forecasting based on the characteristics of the data and the problem statement.

- Consider algorithms like ARIMA, SARIMA, Prophet, Random Forest Regression, LSTM Neural Networks, or XGBoost.

6. Model Training and Validation:

   - Split the data into training and validation sets.
   - Train the selected model using the training data.
   - Validate the model's performance using the validation set.
   - Adjust model parameters and evaluate different models to find the best fit.

7. Traffic Forecasting:

   - Apply the trained model to forecast traffic patterns at the four junctions.
   - Consider different scenarios, including normal working days, holidays, and special occasions.
   - Generate forecasts for specific time intervals, such as hourly or daily predictions.

8. Infrastructure Planning:

   - Utilize the traffic forecasts to inform infrastructure planning.
   - Identify areas prone to congestion during peak periods and propose improvements, such as road expansions, optimized signal timings, or alternative routes.
   - Consider the impact of traffic patterns on holidays and special events while planning infrastructure changes.

9. Evaluation and Fine-tuning:

- Evaluate the accuracy of the traffic forecasting models using appropriate metrics, such as mean squared error (MSE) or mean absolute error (MAE).

- Fine-tune the models based on the evaluation results, incorporating feedback from stakeholders and domain experts.

- Continuously monitor and refine the forecasting system to improve accuracy over time.

10. Documentation and Reporting:

- Document the entire process, including data collection, preprocessing, model selection, training, and validation.

Challenges and Hurdles

Data Integration:

One of the major challenges faced during the week was integrating data from different sources into a unified format for analysis. The data obtained from various sensors and cameras had different formats and structures, requiring extensive preprocessing and data cleaning. To overcome this challenge, we developed custom scripts and algorithms to harmonize the data and ensure compatibility for analysis.

Limited Data Availability:

Another hurdle encountered was the limited availability of real-time traffic data from certain areas of the city. This affected the accuracy of our predictive models and the granularity of our insights. To address this issue, we collaborated with the city's transportation authorities to explore options for expanding the sensor network and enhancing data collection capabilities in those areas.

Lessons Learned

Overall, the lessons learned from the "Smart City Traffic Patterns" project highlighted the importance of data preparation, collaboration, adaptability, continuous improvement, and real-world application. These insights will guide us in future projects and contribute to our professional growth. Also learnt different algorithms that can be used for the solution.