A COMPREHENSIVE ANALYSIS ON NYC TRAFFIC ACCIDENTS

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Motivation/Introduction

Traffic collisions in cities like New York pose a serious threat to public safety, affecting thousands of lives each year. Despite modern infrastructure, the frequency and severity of these incidents remain high. This project is driven by the need to uncover patterns in collision data using time series analysis. By identifying trends and high-risk factors, we aim to support safer urban planning and contribute to SDG 3: Good Health and Well-being through data-driven solutions for road safety.

SCOPE of the Project

This project focuses on the analysis and forecasting of traffic collision data in New York City using time series techniques. It includes:

· Cleaning and preprocessing real-world collision datasets.

· Exploring temporal trends and seasonal patterns in traffic injuries and fatalities.

· Identifying key contributing factors affecting road safety.

· Applying Prophet for short-term forecasting of daily injury counts.

· Generating insights to support city planning, traffic regulation, and public safety campaigns.

Methodology

The project follows a structured data science pipeline to analyze and forecast NYC traffic collisions:

1. Data Collection & Cleaning

· Import the NYC collisions dataset.(Maven)

· Handle missing values by replacing them with realistic random entries.

· Normalize formats for time, date, and coordinates.

2. Exploratory Data Analysis (EDA)

· Visualize injury and fatality trends.

· Analyze contributing factors, borough-wise collisions, and time-of-day effects.

3. Time Series Preparation

· Combine date and time into a unified datetime index.

· Aggregate data to daily totals for injuries and fatalities.

4. Seasonal Decomposition

· Use additive decomposition to separate trend, seasonality, and residuals.

· Identify weekly patterns and long-term trends.

5. Forecasting Using Prophet

· Train a forecasting model using historical injury data.

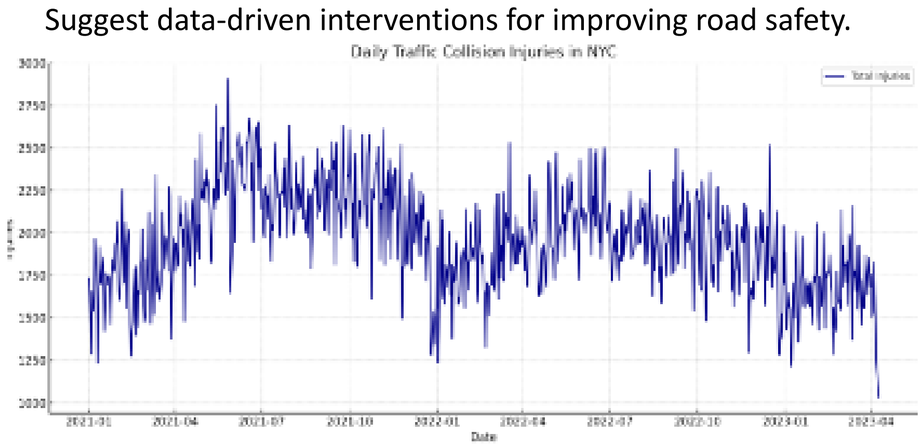
· Predict injury counts for the next 30 days.

· Visualize forecasts and interpret trend/seasonality components.

6. Interpretation & Inference

· Draw conclusions from patterns and forecasts.

· Suggest data-driven interventions for improving road safety.



Results

1. Temporal Trends Identified

- Daily time series revealed consistent fluctuations in traffic injuries.
- Peak injury days were typically Fridays and weekends, indicating strong weekly seasonality.

2. Seasonal Decomposition Insights

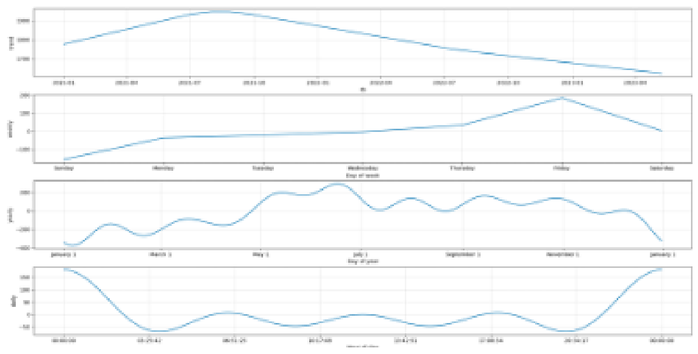
- Trend component showed a gradual increase in injury rates over time.
- Seasonal component highlighted 7-day cycles, reinforcing weekly behavioral traffic patterns.
- Residuals confirmed the model's effectiveness in capturing key patterns.

3. Forecasting with Prophet

- Prophet successfully forecasted injury counts for the next 30 days.
- Predicted a slight upward trend, with increasing uncertainty for longer-term predictions.
- Weekly seasonality confirmed injuries are more likely during weekends.

4. Actionable Insights

- Time-based collision patterns can inform targeted traffic enforcement and awareness campaigns.
- Forecasts can support resource planning, like deploying emergency services more efficiently.



Conclusion/Summary

This project successfully applied exploratory data analysis and time series forecasting to uncover critical insights from NYC traffic collision data. By cleaning and transforming the dataset, we identified clear temporal patterns, such as a weekly seasonality with peak injuries on weekends and an overall rising trend in injury counts. The use of Prophet enabled us to forecast future injury trends, providing valuable insights for proactive urban planning and road safety strategies. The findings reinforce the need for data-driven interventions, especially on high-risk days, and align with SDG 3's vision of improving health and well-being through safer transportation systems. This project demonstrates how real-world data and predictive analytics can empower policymakers and communities to build safer and more resilient urban environments.

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Acknowledgments/References

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