Road Accident Severity Insights And Hotspot Prediction

Datathon 2025 Report - Team ROBLOX

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Abstract

Road accidents posses significant safety and financial challenges world wide. This study analyze the synthetic traffic accident data incorporating spatial, temporal, and environmental factors to uncover severity patterns and identify accident hotspots. Using cluster analysis and data visualization,it reveals key trends related to weather, road surface, time and location aimed to notify defensive and emergency response measures.

Introduction

The severity of traffic accidents is influenced by complex elements including weather, road conditions, time of day, and geography. This report examines one and a half month synthetic accident data to extract actionable insights that can benefit policymakers and city planners in targeting interventions and optimizing resource allocation.

Dataset Overview

The data set contains records with timestamp, geographic coordinates, weather conditions, road surface status, hour of occurrence and day of the week. This comprehensive information enables temporal and spatial analyzes to identify peak risk periods and high-density accident zones.

Accident Frequency Analysis

The distributions show notable accident peaks during the morning and evening rush hours, aligning with high traffic volumes. Fridays and Sundays report higher accident

counts, hinting at increased weekend and end-of-week travel risks. Among weather conditions, clear weather is most common, but rain, snow, hail and storms have significant contributions to accident occurrences. Road conditeions such as dries, muddy, wet, icy and snowy surfaces further increase risk profiles.

Impact of Environmental Factors

Accideqnts on adiverse weather (rain,hail,snow, storm)tend to cluster during critical commute times, increasing severity risks. Wet edn icy roads are significantly associated with higher accident frequencies in these conditions, underscoring the need for dynamic safety alerts and infrastructure improvements during such scenarios.

Geospatial Hotspot Clustering

Using spatial cluster analysis, multiple accident clusters were identified across key urban zones often characterized by complex intersections, heavy traffic and adverse weather influences. Prioritized hotspot areas include Salt Lake City, Denver, Chicago, Buffalo and Raleigh among others.

Recommendations

To reduce accident risk and improve emergency response in identified hotspots, it is recommended:

- Enhance law enforcement and traffic surveillance,
- Upgrade road maintenance and signage quality,
- Implement real-time hazard warning systems,
- Improve lighting and road infrastructure around complex intersections.

Conclusion

Integration of environmental, temporal and geospatial data provides a wrong understanding of the dynamics of accident severity. These insights support targeted policy making and resource allocation to improve road safety and mitigate accident impacts effectively.