DRIVING CHANGE

EMPOWERING DATA-DRIVEN INSIGHTS FOR SAFER ROADS AND SMARTER POLICIES

Introduction

- This project uses data from the Chicago Police Department's E-Crash system to uncover patterns in traffic accidents, aiming to improve road safety and inform strategic policy decisions. By analyzing this data, we seek to optimize resource allocation and reduce accidents through data-driven insights.

- Key stakeholders, including the Vehicle Safety Board and local authorities, will benefit from actionable recommendations that guide road safety measures and resource distribution.

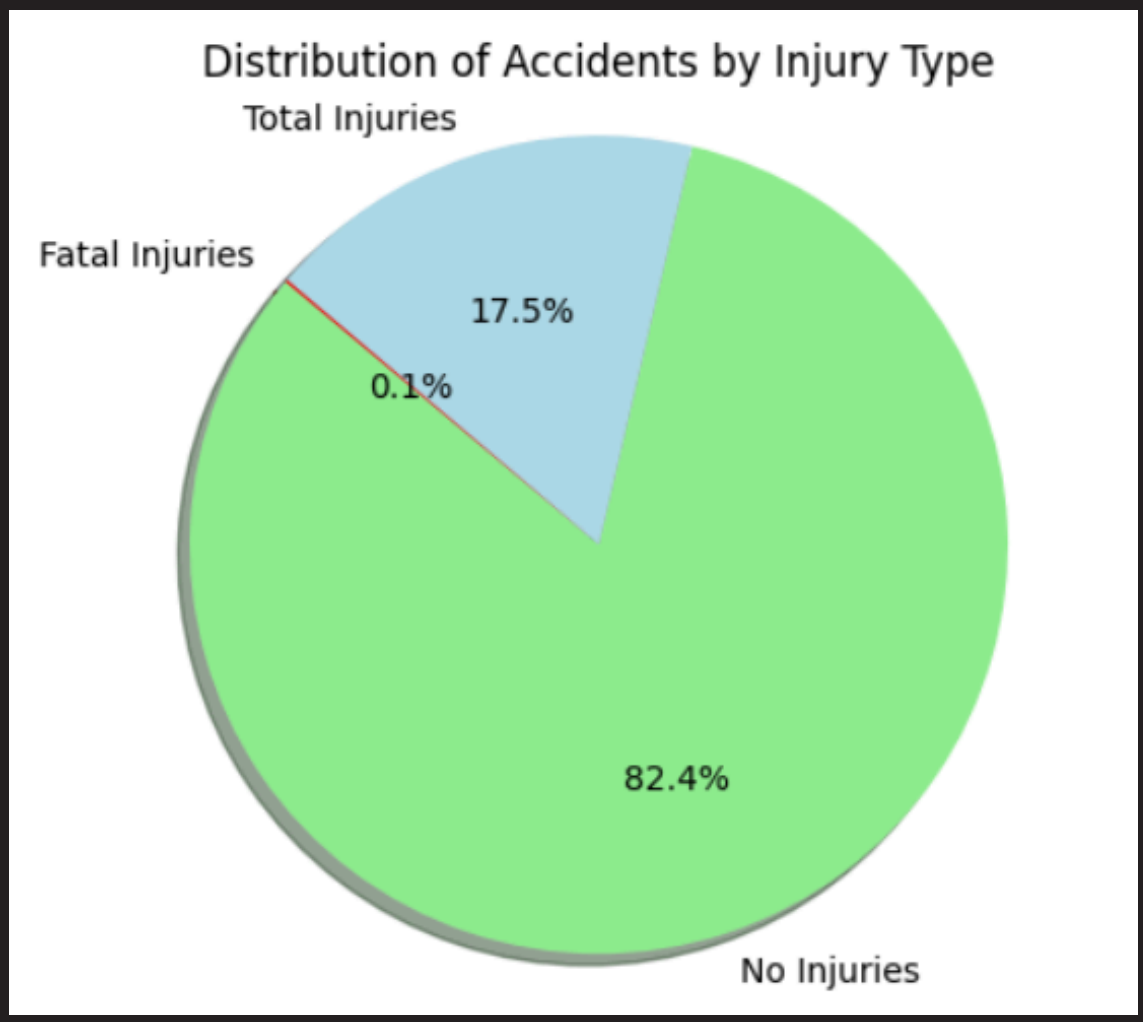
- This project is crucial in guiding the implementation of policies that create safer communities and more resilient transportation systems.

Traffic Accidents: A Persistent Challenge in Chicago

- Despite advancements in vehicle safety technology and traffic management systems, traffic accidents remain a significant public health and economic concern in Chicago. Even with extensive data available from the Chicago Police Department's E-Crash system, a lack of detailed analysis and predictive capabilities has hindered efforts to address this problem effectively.

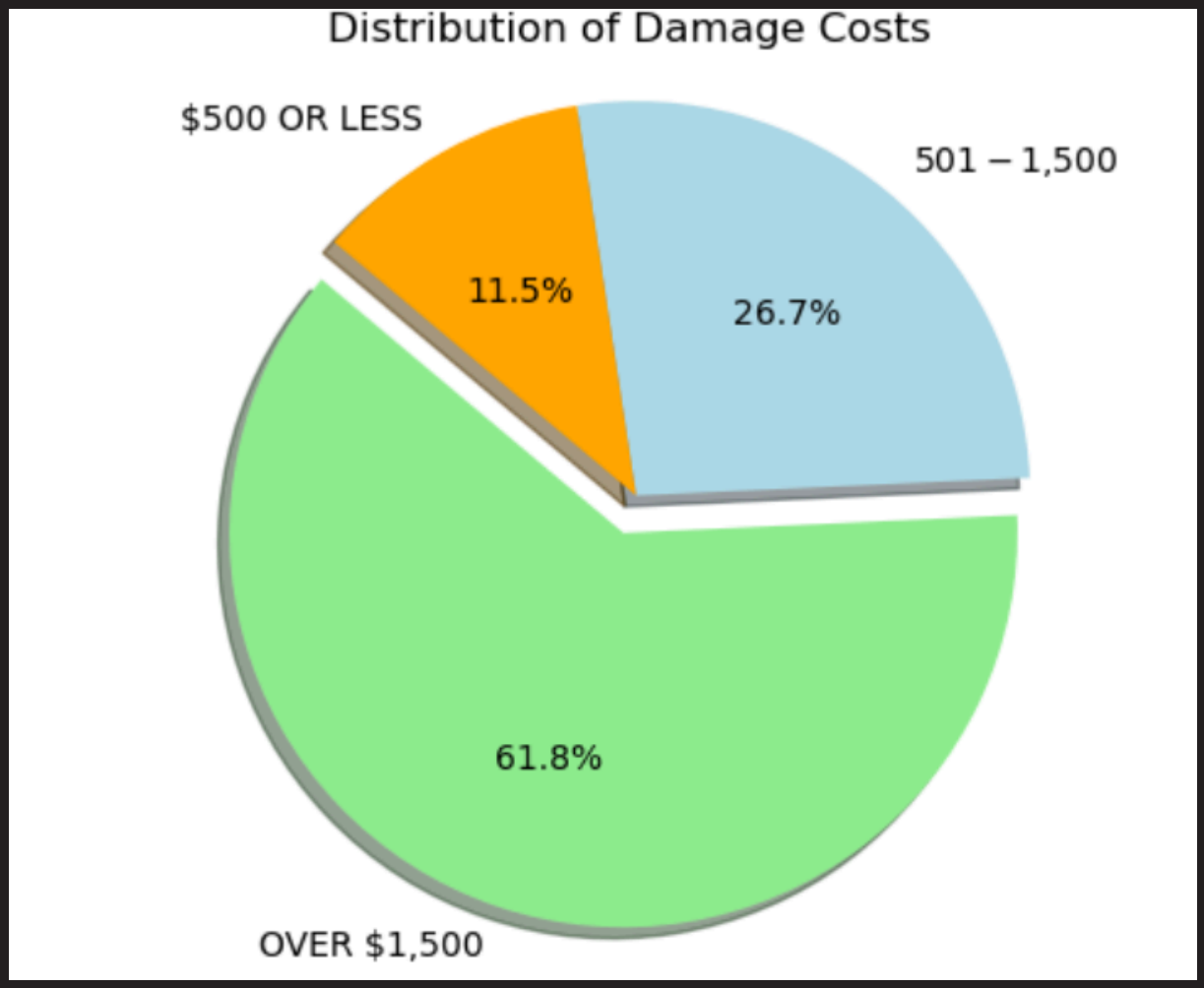
- The challenge isn't just collecting data—it's about understanding it. Without the ability to predict and identify the primary causes of crashes, mitigation efforts remain reactive rather than proactive

Impact of Traffic Accidents



- 0.1% of accidents result in loss of life, a tragic outcome that could have been prevented. 18% cause injuries, placing a significant strain on healthcare and public safety. While 81% are non-fatal, they still lead to vehicle damage and disruption, highlighting the urgent need for preventive measures.

Economic Impact



- 61.8% of crashes resulted in damages exceeding $1,500, representing a significant economic burden. Another 26.7% caused damages between $501 and $1,500, while 11.5% involved damages of $500 or less. These figures highlight the substantial financial impact of traffic accidents and the importance of preventive measures to reduce costs.

Data Overview

The dataset comprises 794,956 entries of recorded traffic crashes and includes 48 variables. For our analysis, we focused on 28 features to investigate the primary contributory causes of these crashes.

Data Source:
Sourced from the CPD's electronic crash reporting system

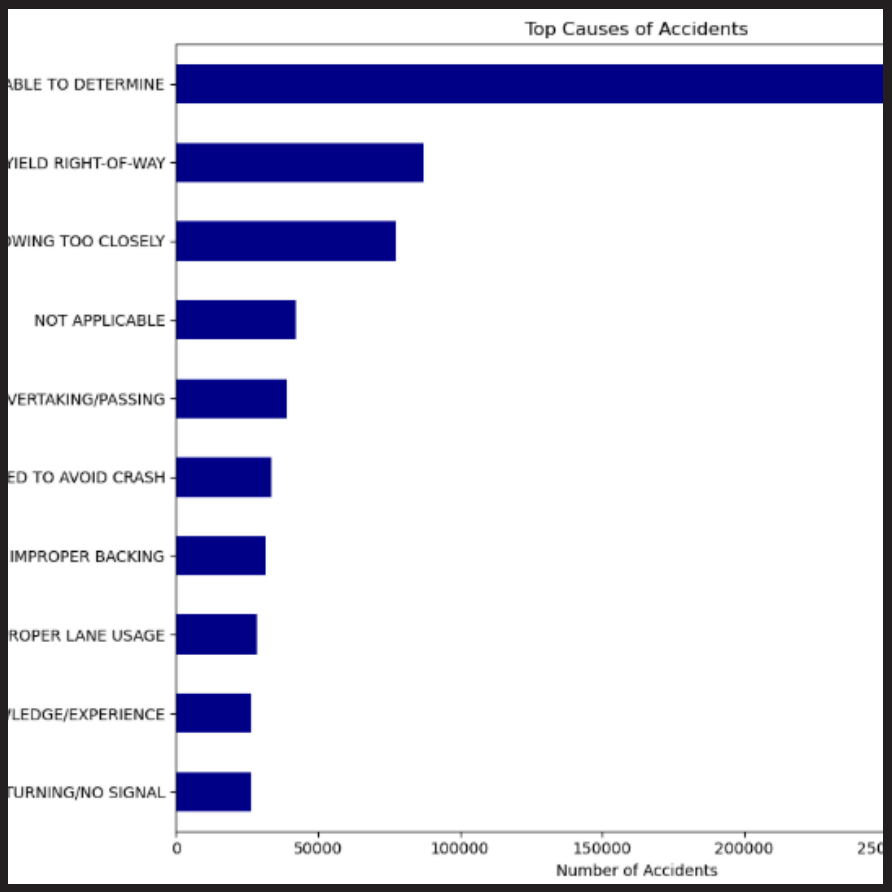
Geographical Scope:
Traffic crash data for the City of Chicago

Time Period:
Data spans from 2013 to 2024

Purpose of Analysis:
To identify trends and factors contributing to traffic crashes and inform safety interventions

Key Findings and Insights

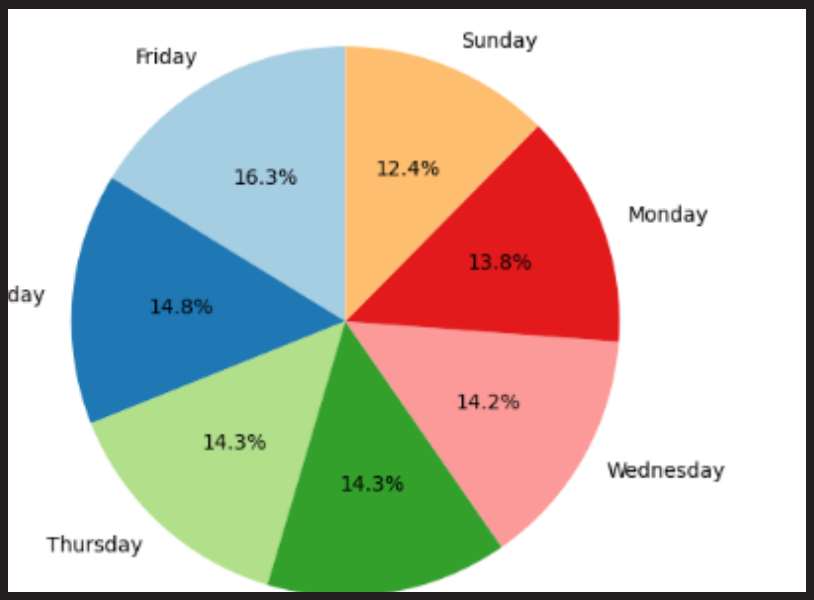
Primary Contributory Causes of Traffic Accidents in Chicago

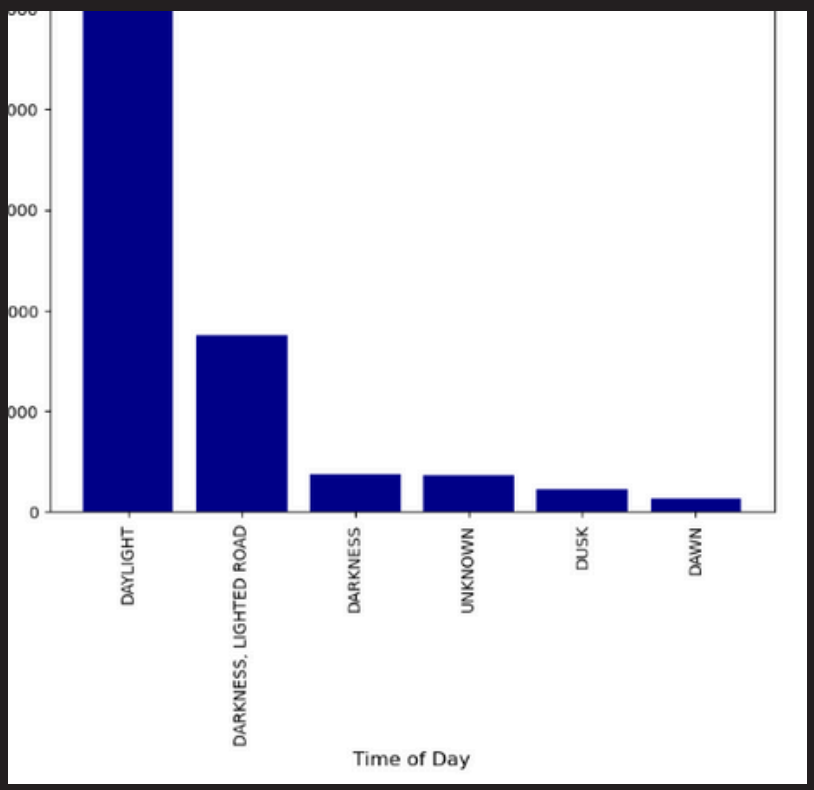


- The leading cause of accidents, "Unable to Determine," accounts for the largest portion with 308,842 cases, suggesting a significant gap in data reporting or cause identification. Other major contributors include "Failing to Yield Right-of-Way" (87,251 cases) and "Following Too Closely" (77,622 cases), highlighting critical areas for targeted interventions and improved driver education.

Key Findings and Insights

Impact of Timing on Crash

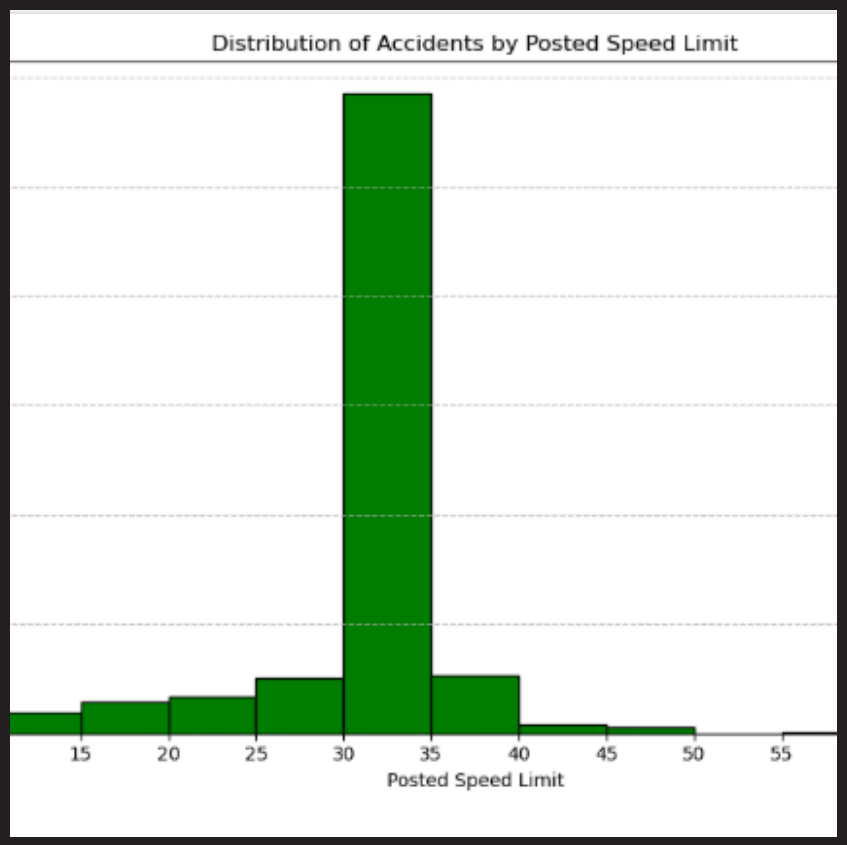


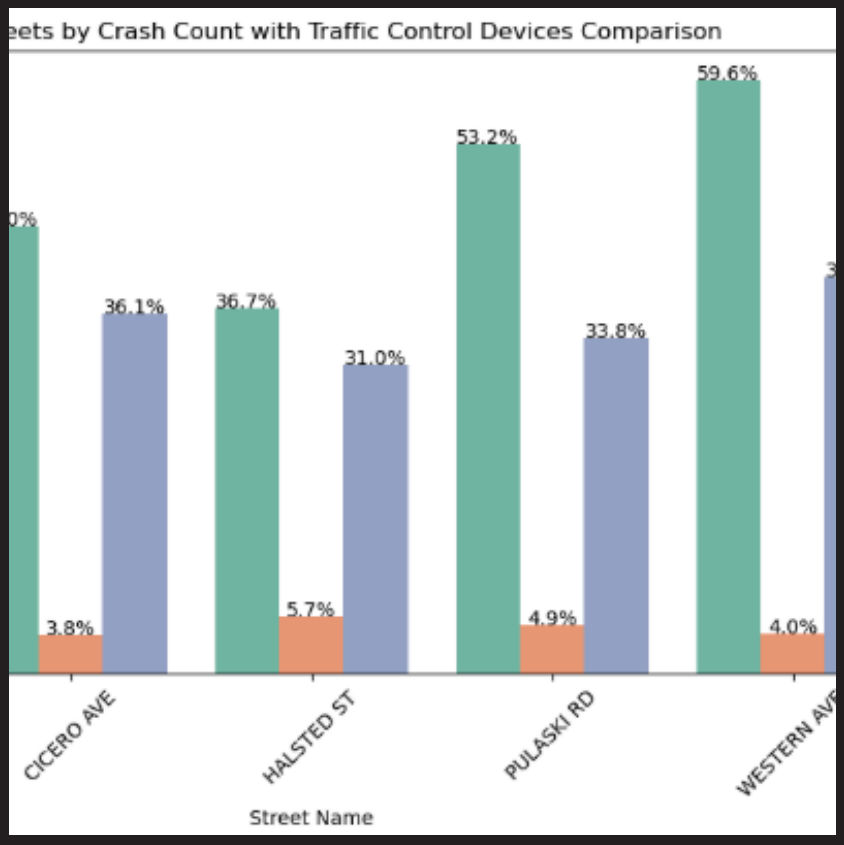


- Peak Accident Day: Friday had the highest number of accidents, requiring increased monitoring and resource allocation.
- Peak Accident Time: Most accidents occurred during the day, suggesting a need for visible patrols and awareness campaigns.
- Peak Accident Month: October recorded the highest number of accidents, highlighting the need for seasonal traffic safety adjustments.

Key Findings and Insights

Influence of Speed and Traffic Control Devices on Accidents





- Most Accidents by Speed Range: The 30 to 35 mph speed range recorded the highest number of accidents, suggesting that this speed zone might require further attention for safety measures.
- Effectiveness of Traffic Control Devices: Areas with traffic control devices showed significantly lower accident rates, indicating the positive impact of such measures in reducing accidents.

Model Results

- The Recurrent Neural Network (RNN) achieved an accuracy of 51.1%, with a precision of 66.2% and a recall of 31.2%. It handled sequential data well but struggled with low recall, missing critical patterns. Despite this, it showed moderate predictive power and generalization.

- The Convolutional Neural Network (CNN) had an accuracy of 48.4%, precision of 64.9%, and a recall of 28.0%. It excelled in spatial feature extraction but struggled with overfitting and poor recall, making it less reliable for this task

- The RNN is the better model due to its stronger ability to generalize and capture key sequential patterns, despite its lower recall. It offers more reliable insights compared to the CNN

Conclusion

- Data Gaps: The largest number of accidents is categorized as "Unable to Determine," indicating a significant gap in data reporting or cause identification.
- Timing and Location Insights: Fridays and daytime hours have the highest accident rates, with October showing a peak, pointing to time-specific trends in accidents.
- Speed and Traffic Control: Accidents are most frequent in the 30-35 mph range, and areas with traffic control devices show lower accident rates, indicating their effectiveness.
- Model Performance: The RNN model performs better than the CNN model, with higher accuracy and better alignment with true labels, demonstrating its stronger generalization capability.

Recommendation

- Improve Data Collection: Address the "Unable to Determine" problem by enhancing data collection methods, ensuring more accurate identification of accident causes.
- Seasonal Traffic Safety Adjustments: Implement additional safety measures during October, when accident rates peak, potentially including more visible patrols or awareness campaigns.
- Prioritize Speed Zones and Traffic Control Devices: Focus on enhancing safety in the 30-35 mph speed range and consider expanding the use of traffic control devices in areas with high accident rates.
- Rely on the RNN for Predictive Insights: Given the RNN's superior performance, continue utilizing it for predictive analytics in traffic safety initiatives to better identify accident causes and trends.

THANK YOU!