

GROUP 13

Deciphering Road Accidents: Predictive Analytics for Road Accident Severity

Staying ahead of road accidents



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Let's dive



Problem Statement

Road accidents are a major concern worldwide, causing injuries and deaths that have a profound impact on families and communities.

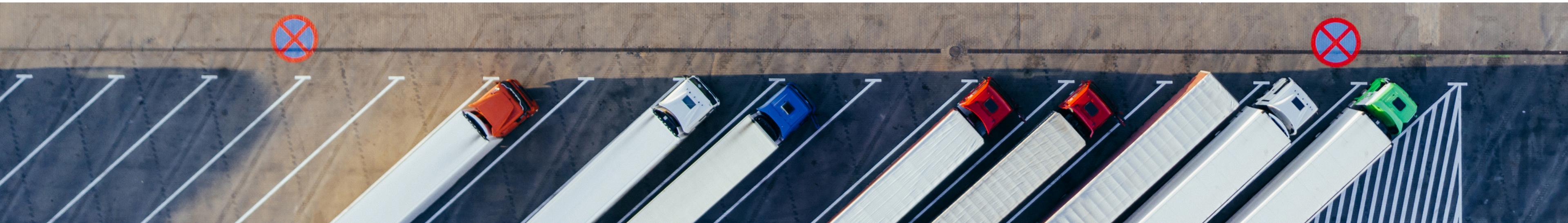
According to the World Health Organization (WHO), road traffic injuries are among the top 10 leading causes of death worldwide, highlighting the urgent need for effective prevention strategies.

By studying the reasons behind these accidents, we can develop targeted interventions to improve road safety and reduce the number of accidents, injuries, and fatalities on roads



Objectives

1. Identify Key Predictive Factors: Analyze various factors including roadway conditions, environmental influences, and driver behavior to identify the most significant predictors of crash occurrences.
2. Build a Predictive Model for Crash Severity: Construct and train a predictive model to accurately forecast the severity of road accidents, categorizing outcomes as non-injury, minor, serious, or fatal.
3. Develop an Early Warning System: Create a system that uses the predictive model to identify high-risk areas and times for potential accidents.
4. Optimize Resource Allocation with Predictive Analytics: Utilize the predictive model to improve the allocation of emergency response and medical resources.



Data Understanding

- **Source of Data:** The dataset utilized for this analysis was obtained from the official New Zealand Government data website. It encompasses comprehensive information regarding road accidents spanning from the year 2000 through April 2024.
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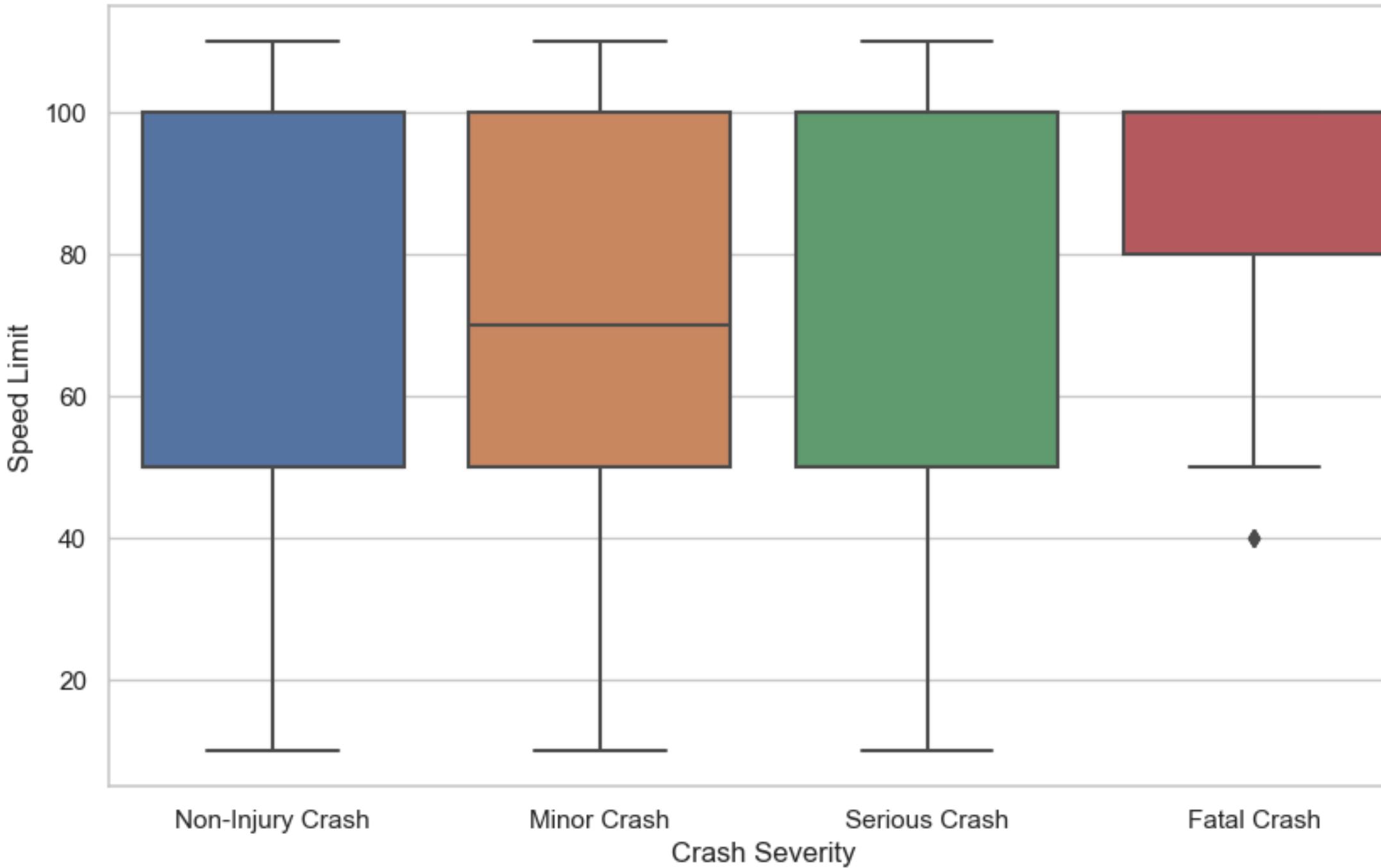
Data visualizations

We looked at the following visualizations:

1. Spread of speed limit by crash severity
2. Count of fatal road accidents in different weather conditions
3. Chart of fatal road accidents in different road terrain
4. Model performance



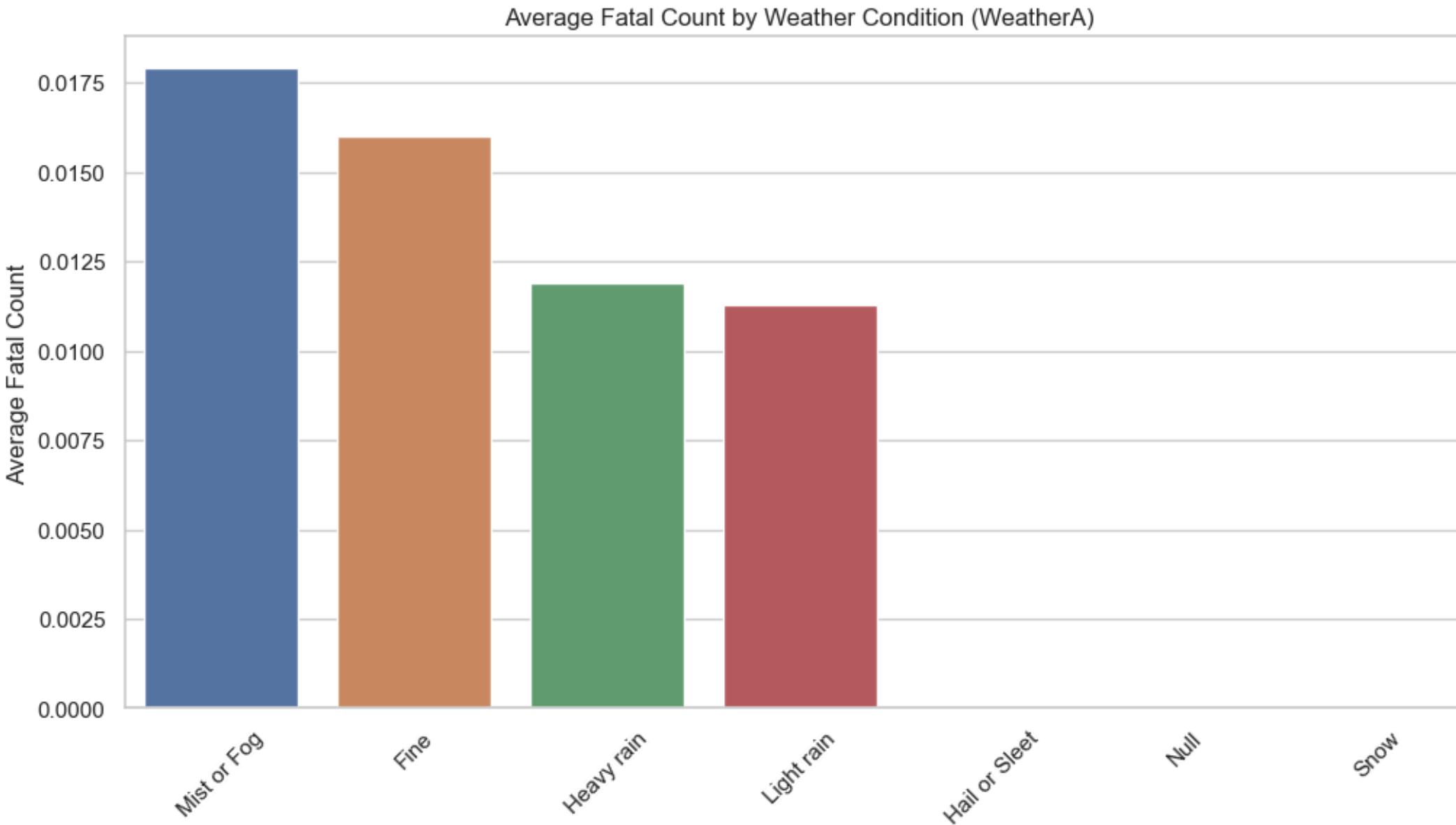
Spread of speed limit by crash severity



Most fatal crashes occur when the speed limit is between 80 and 100 kph



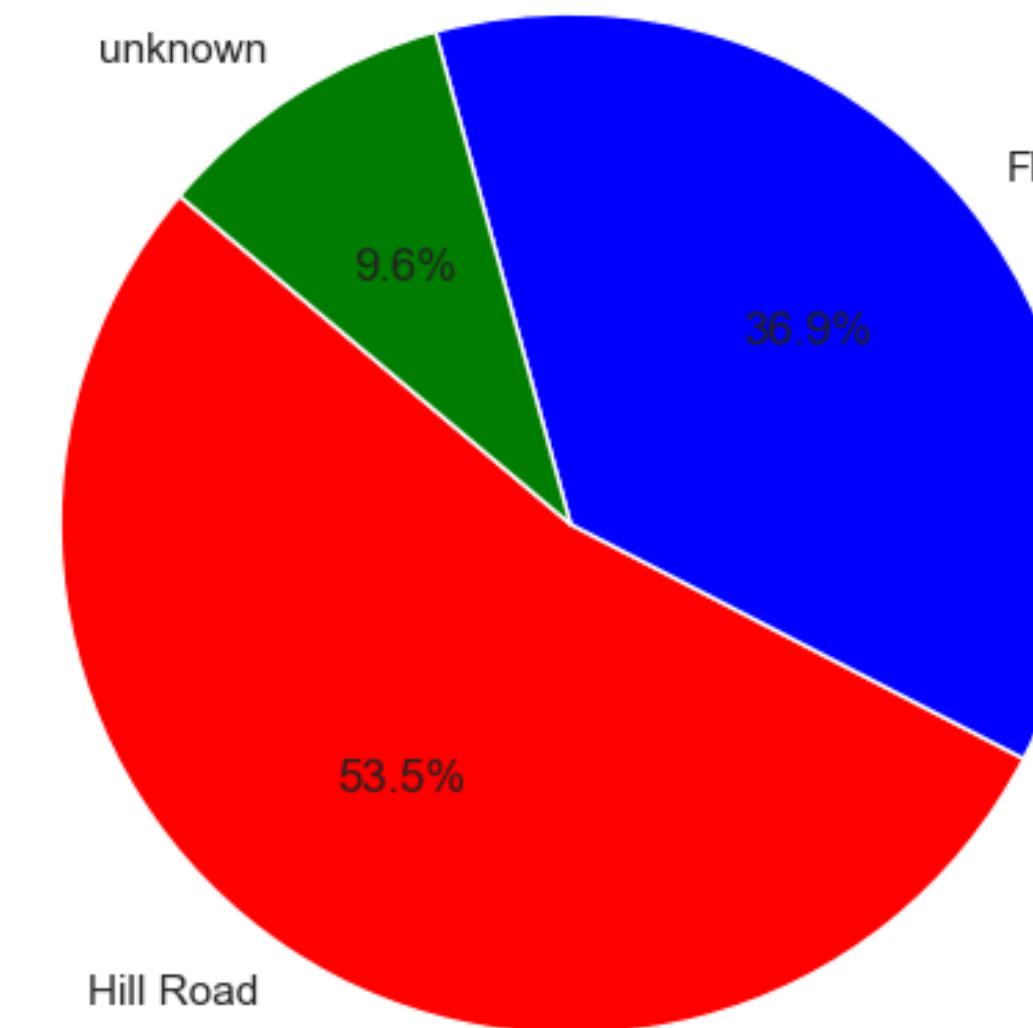
Count of fatal road accidents in different weather conditions



Most fatal road accidents occur when there is mist or fog



Chart of fatal road accidents in different road terrain

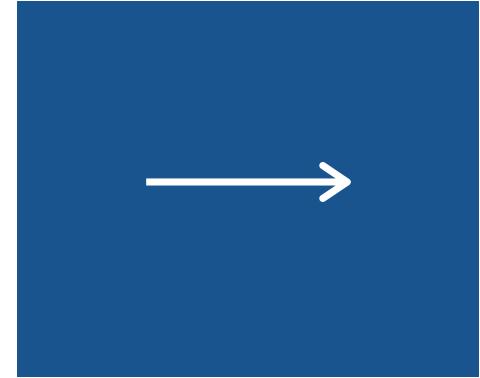


Most fatal road accidents occur on hilly roads

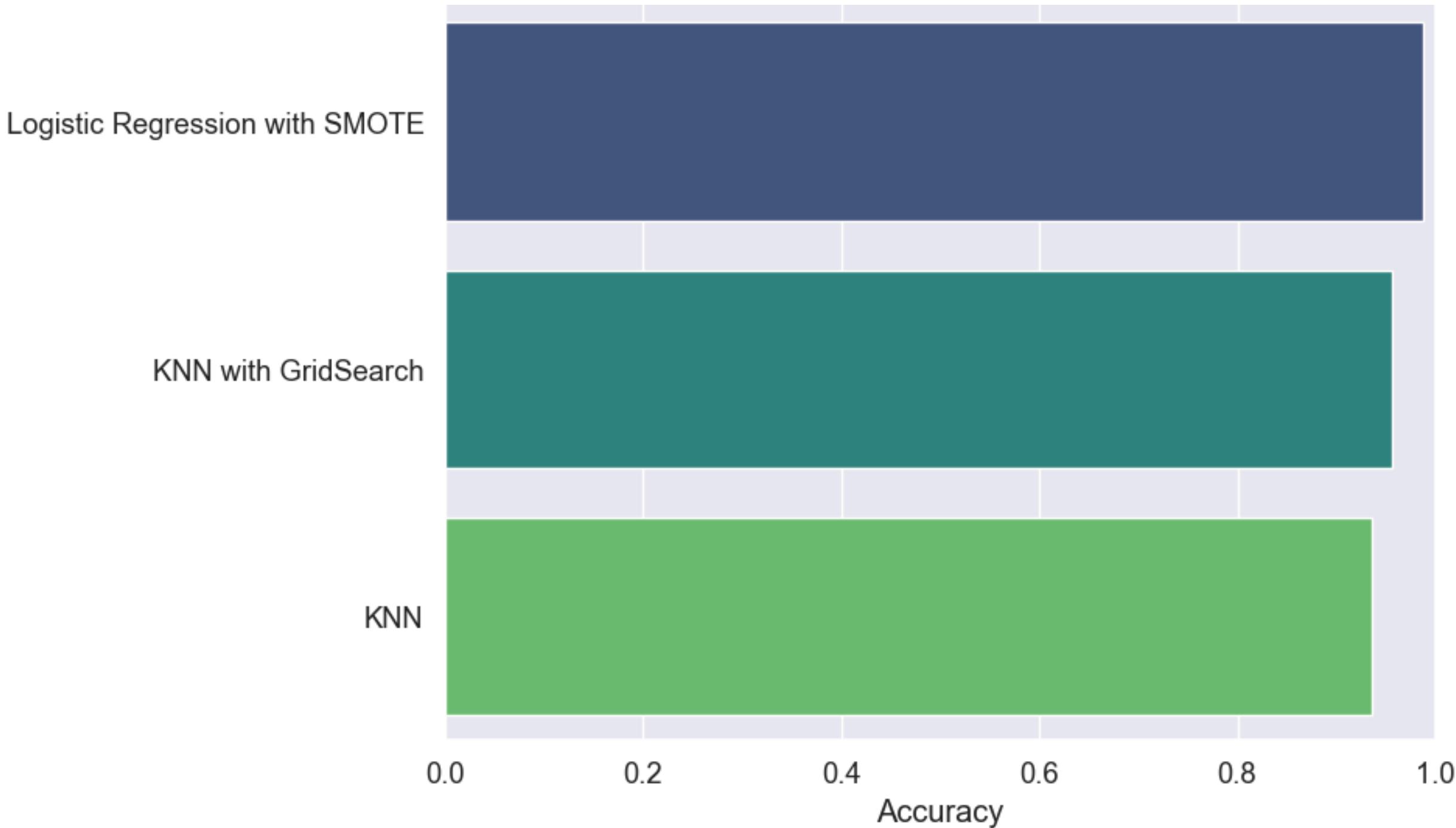




Most important features that determine road accident severity

1. Street Light - Whether streetlights are on, off, or unavailable
 2. Pedestrian - Whether pedestrians are involved
 3. Speed Limit - The speed limit on the road
 4. Vehicles involved - The type of vehicles involved
 5. Light - Whether it is dark, bright, twilight or overcast
 6. Holiday - The holiday celebrated on a specific day
 7. Flat/Hill - Whether the road is flat or hilly
 8. obstacles hit - Number of obstacles on the road
 9. weather - The weather conditions
 10. Road surface - Whether the road is sealed or unsealed
 11. Injury count - The number of injured people and the severity
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Model Performance



Logistic regression with SMOTE and KNN with gridsearch were the two best performing models



Conclusions

The models were able to predict how severe a road accident can be with an accuracy of up to 95.56%.

Factors such as holiday periods, inadequate lighting, pedestrian presence, road conditions, and the number of vehicles involved significantly influence the severity of crashes."

Critical risk factors that contribute to the frequency and intensity of accidents include hilly terrain, foggy weather, limited street lighting, and nighttime conditions.



Recommendations

Enhancing Road Safety During Mist and Foggy Conditions

Improve visibility during mist or fog, including reflective road signs and vehicle lighting.

Use advanced weather forecasting to provide real-time alerts.

Educate drivers on safe practices during foggy conditions.

Upgrade roadside infrastructure to alert drivers of fog conditions

Reducing the number of obstacles on the road

Reducing the number of buildings, trees, kerbs, posts and other obstacles on highway roads ensures more smooth rides for motorists, and should road accidents occur, they will be fewer fatal ones.



Recommendations

Data collection

More data from different countries all over the world need to do a more thorough documentation of road accidents occurring so as to have more sufficient data to build more accurate predictive models to assess severity of road accidents.

Safety campaigns

Implement targeted road safety campaigns focusing on the identified risk factors to raise awareness among road users and promote responsible driving practices in challenging terrain and low-light areas.



Questions ?