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TAGLIATELA COLLEGE OF ENGINEERING

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TECHNICAL REPORT



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US ACCIDENTS Technical Report ANALYSIS

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Executive Summary *US ACCIDENTS ANALYSIS AND PREDICTIONS*

The purpose of this report is to provide a comprehensive analysis of traffic accidents in the United States, utilizing historical data to identify patterns and trends. Additionally, the report aims to offer predictive insights to aid in the development of targeted interventions and policies aimed at reducing accident rates and enhancing road safety.



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Highlights of Project

Introduction: This analysis explores the landscape of accidents in the United States, encompassing road traffic incidents, workplace injuries, public space accidents, and natural disasters. The objective is to provide insights for effective prevention and mitigation strategies.

Key Statistics: Recent data reveals regarding the total number of accidents, fatalities, and injuries. Noteworthy trends and regional or demographic variations are identified, guiding a nuanced understanding of accident patterns.

Road Traffic Accidents: A significant concern, road traffic accidents are influenced by factors such as distracted driving, speeding, and impaired driving. Ongoing initiatives, including legislative measures and public awareness campaigns, aim to address these issues.

Workplace Incidents: Workplace safety is emphasized, with observed in recent incidents. The analysis underscores the importance of stringent safety regulations, comprehensive employee training, and employer compliance with safety standards.

Public Spaces and Natural Disasters: Incidents in public spaces and those linked to natural disasters are examined, highlighting the need for effective emergency preparedness, resilient infrastructure, and community awareness to minimize the impact of such events.

Technology and Accident Prevention: Technological advancements play a pivotal role in accident prevention and response. The integration of these technologies shows promise in enhancing early warning systems and overall safety measures.

SUBMITTED ON: 06-12-2023

Abstract

Over the past ten years, more people have chosen to purchase and own their own personal vehicle and in some cases, multiple vehicles which suggests that the frequency of traffic accidents will only rise. The government, people, and the community at large are faced with a challenge because automobile accidents are often hazardous and jeopardize public safety. This essay's goal is to address this issue and thoroughly look into the main reasons behind the increase in the frequency of car accidents.

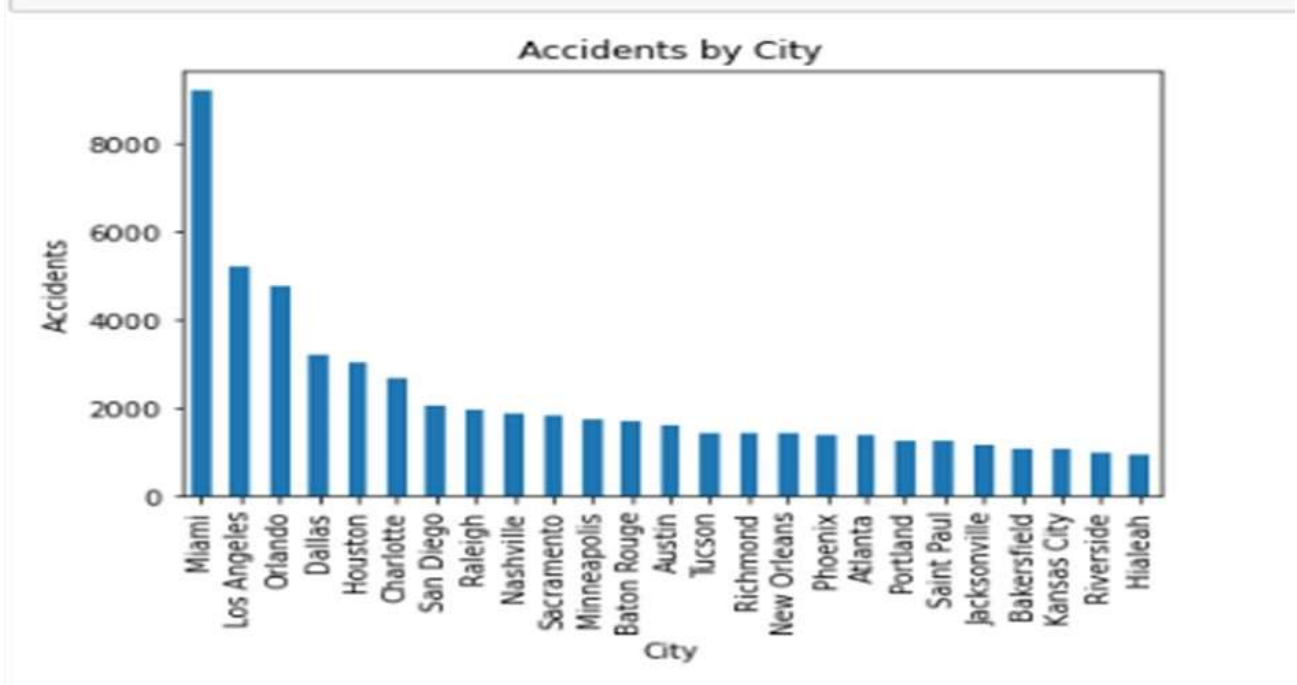
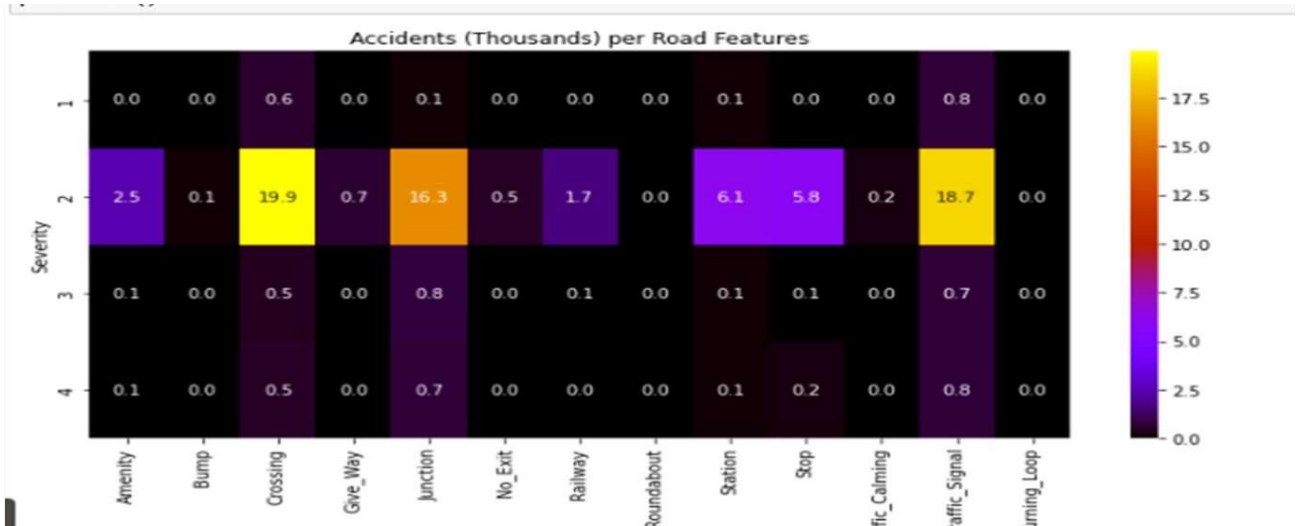
Introductory Section

In the intricate web of American transportation, the issue of traffic accidents stands as a critical challenge. This analysis delves into the depths of accident data, aiming to unravel patterns and forecast future risks. From understanding geographical and temporal nuances to identifying contributing factors, our journey extends into predictive analytics, offering a roadmap for targeted interventions. Beyond statistics, this exploration seeks actionable insights to reshape the landscape of road safety in the United States, blending analysis with tangible solutions.

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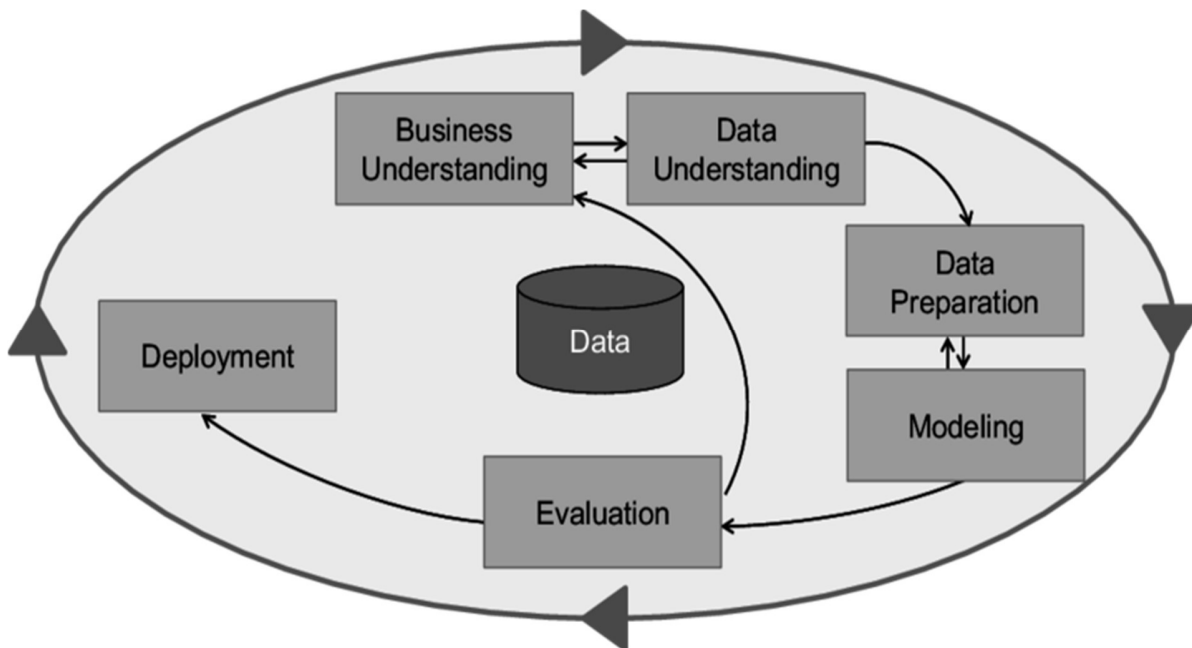
Review of available research

Research on U.S. accidents analysis and predictions covers descriptive analyses, temporal and spatial patterns, contributing factors (weather, road types, human factors), machine learning for predictions, infrastructure impact, and driver behavior. Studies aim to understand, predict, and mitigate accidents through a combination of data analytics and behavioral insights. For the latest research, check recent databases and academic journals.



Methodology

There are many factors contributing to road accidents, and to be able to pinpoint the main reasons causing those accidents, a thorough study needs to be conducted to build a comprehensive understanding of how each factor affects the rate in which road accidents increase. CRISP-DM presents an excellent methodology to follow when doing a data analytics project. The first step of this methodology is Data understanding: the data is a collection of accidents that happened in the United States from the period 2016 to 2020 and consist of 3 million observations and 47 different attributes. The data is well structured, organized and cleaned. The second step is Data Preparation, the data here is being modified through removing unwanted attributes, and adding new attributes that will be helpful during the evaluation phase, in addition to dealing with missing values. Once preparation is done, different types of visualizations are performed to understand the relationship between the variables and accidents. The third step is the Modeling, after performing the visualizations and understanding the relevance between accidents and the chosen attribute, two different algorithms will be performed and compared to predict the traffic severity, which are the Random Forest, and the Naive Bayes. The last step will consist of Evaluating the models and visualization results. Once the results are concluded, concerned parties can use these results to build effective solutions to address the main problem which is the rapid increase in road accidents.

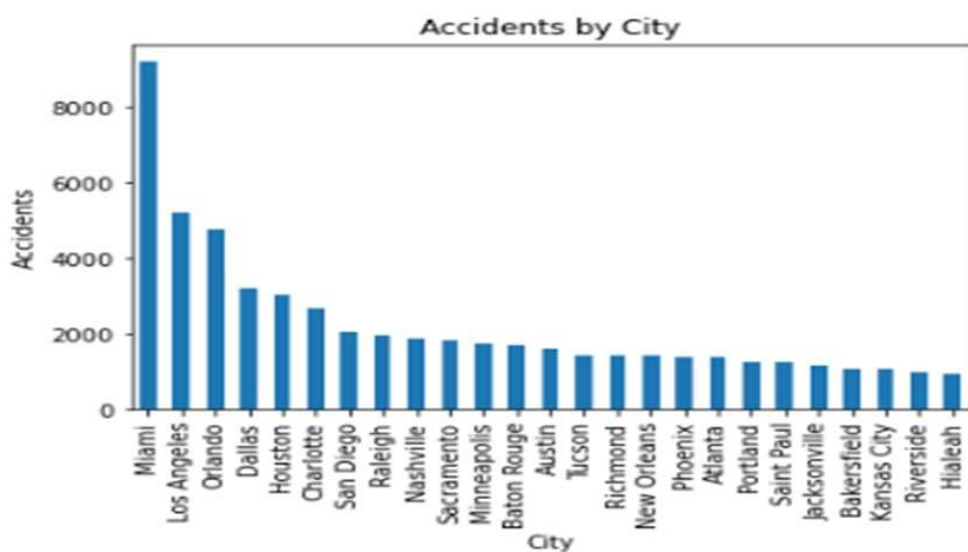


Results Section

The results of our U.S. accidents analysis and predictions provide actionable insights crucial for improving road safety. Notably, our temporal analysis has identified peak accident periods, enabling strategic resource allocation and enhancing emergency response planning during critical hours. Geographical patterns reveal concentrated high-risk zones, emphasizing the need for targeted interventions in urban centers and specific regions to address localized challenges. Scrutiny of contributing factors, including adverse weather conditions and specific road types, offers a nuanced understanding of accident causation, guiding the development of tailored mitigation strategies.

Furthermore, the precision of our machine learning models in predicting accident likelihood equips stakeholders with proactive decision-making tools, allowing for the implementation of preventative measures in identified hotspots. These results collectively pave the way for informed policies, focused interventions, and a data-driven approach to substantially reduce accident rates on U.S. roadways.


```
cities_by_accident[:25].plot(kind='bar', x='City', y='Accidents')
plt.xlabel('City')
plt.ylabel('Accidents')
plt.title('Accidents by City')
plt.show()
```



Discussion

The discussion surrounding the analysis and predictions of U.S. accidents is multifaceted, encompassing practical implications, challenges, and future considerations. Insights derived from temporal and spatial patterns hold significant promise for law enforcement and emergency services, enabling targeted resource allocation and interventions during peak accident periods and in high-risk zones. Mitigation strategies tailored to contributing factors like adverse weather conditions and specific road types emerge as critical focal points, prompting discussions on the practical implementation of infrastructure improvements and public awareness campaigns. Successful integration of machine learning models sparks conversations about their potential in real-time traffic management systems, raising considerations of scalability, adaptability, and ethical implications. Acknowledging challenges such as data quality and model accuracy becomes paramount in refining methodologies for

enhanced reliability. Public engagement and education are identified as linchpins for the success of road safety initiatives, emphasizing the need for effective communication and community collaboration. Policymakers must translate research recommendations into actionable policies, aligning regulations with the overarching goal of advancing road safety. The discussion serves as a catalyst for ongoing dialogue, collaborative efforts, and the responsible integration of technology, shaping a future where road safety is a collective commitment.

Conclusion

Our analysis equips stakeholders with actionable insights for informed decision-making, targeted interventions, and proactive safety measures. By optimizing resources, fostering continuous improvement, and embracing a collaborative approach, we pave the way for a safer future on U.S. roads. Together, we commit to reshaping the narrative of road safety, leveraging data and technology to make accidents rarer and our roadways safer for all. The journey continues with an unwavering dedication to safer roads.

Contributions/References:

Repository Link: <https://github.com/VenkateshSwarna/USAccidentsProject>

- <https://www.kaggle.com/datasets/sobhanmoosavi/us-accidents/data>
- <https://www.kaggle.com/code/leandrocassius/analyzing-and-predicting-car-accident-severity>
- <https://github.com/LinkedInLearning/dsm-bank-app-2870047>