International Journal of Scientific Research in Science and Technology
Available online at : www.ijsrst.com
OPEN ACCESS
Print ISSN: 2395-6011 | Online ISSN: 2395-602X
doi : https://doi.org/10.32628/IJSRST52411284

Road Accident Prediction Using Machine Learning

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ARTICLEINFO

Article History:
Accepted: 20 March 2024
Published: 05 April 2024

Publication Issue :
Volume 11, Issue 2
March-April-2024
Page Number :
454-457

ABSTRACT

Road accidents are a significant cause of fatalities and injuries worldwide. Predicting road accidents is crucial for implementing preventive measures and saving lives. This paper presents a deep learning-based road accident prediction system utilizing various factors such as speed, traffic condition, weather, and more. By leveraging publicly available datasets and external data sources, the model aims to accurately predict road accidents, ultimately contributing to enhancing road safety.

Keywords: Road Accidents, Machine Learning, Traffic Prediction, Accident Prevention

I. INTRODUCTION

Road Traffic Accidents (RTA) are a global menace, causing countless fatalities and injuries annually despite regulatory efforts. Predicting RTAs remains a daunting challenge due to multifaceted influencing factors. This paper aims to address this issue by creating an interactive traffic accident predictor embedded in a user-friendly web interface. By analyzing various parameters, the system will offer route suggestions and identify accident-prone areas, empowering users with real-time insights.

Utilizing advanced technologies like machine learning and data analytics, this system will leverage diverse datasets encompassing traffic flow, weather conditions, and historical accident data. Through sophisticated algorithms, it will forecast the likelihood of RTAs in specific locations and timeframes, aiding both individuals and authorities in making informed decisions and implementing targeted interventions.

The proactive approach of this interactive system holds the potential to significantly reduce RTA incidence and mitigate associated human toll. By harnessing technology and data-driven insights, it strives towards a future of enhanced road safety and resilience in transportation systems.

II. LITERATURE SURVEY

Researchers such as Dr. Priya Sharma, Dr. Rahul Gupta, Dr. Ankit Patel, and Dr. Neha Singh conducted a comprehensive analysis of road accident data collected over a period of five years. Their study aimed to identify patterns and underlying causes of

road accidents by analyzing factors such as weather conditions, road types, and driver behavior. Through advanced machine learning algorithms, including Decision Trees and Random Forests, they sought to predict the likelihood and severity of road accidents in different scenarios [1].

The RoadGuard Project, led by Dr. Aakash Singh and Dr. Neha Verma, proposes a collaborative platform involving government agencies, law enforcement, and technology companies to improve road safety measures. By leveraging machine learning models trained on historical accident data, the RoadGuard Project aims to predict accident-prone areas and implement targeted interventions such as improved signage, road repairs, and enhanced traffic monitoring systems. Additionally, the project integrates real-time data from GPS-enabled vehicles and crowd-sourced information to provide timely alerts and assistance to drivers, thereby reducing the risk of accidents [2].

III. METHODOLOGY OF PROPOSED APPROACHES

The methodology section of the paper provides a detailed overview of the machine learning approaches employed in road accident analysis. These approaches include Decision Tree, AdaBoost, KNN (K-Nearest Neighbors), and Naïve Bayes algorithms. Decision Tree constructs classification models by deriving decision rules from the features present in the data. Through a recursive process, nodes representing specific features are split based on the most informative attributes, ultimately leading to the classification of data points into different categories.

Additionally, the paper discusses AdaBoost, a boosting algorithm utilized in conjunction with decision trees. AdaBoost assigns weights to each example in the training dataset based on its performance, with more weight given to instances that are difficult to predict accurately. By iteratively adjusting the weights and training multiple weak classifiers, AdaBoost aims to improve the overall predictive power of the model. Furthermore, the methodology covers KNN, a classification algorithm that groups data points based on their similarity in feature space. By measuring the distance between data points, KNN assigns a class label to a new data point based on the classes of its nearest neighbors. Lastly, the methodology introduces Naïve Bayes, a classification method based on the Bayes theorem. Naïve Bayes predicts the probability of different classes based on the input attributes, assuming independence among the features.

IV. ROAD ACCIDENT DATA SOURCE

The paper underscores the significance of government data as a cornerstone in road accident analysis. These data sources are lauded for their reliability and historical depth, providing researchers with a comprehensive repository of information regarding past accidents. By tapping into these government databases, analysts can uncover trends, patterns, and contributing factors to road accidents, facilitating evidence-based policymaking and intervention strategies aimed at enhancing road safety.

Moreover, the paper emphasizes the value of open data sources in complementing government data for road accident analysis. These publicly accessible datasets offer researchers a broader perspective, encompassing information from diverse regions and jurisdictions. By leveraging open data sources, researchers can conduct comparative studies, identify regional disparities, and gain insights into best practices for road safety initiatives, ultimately fostering collaboration and knowledge-sharing among stakeholders.

Social media emerges as a novel yet challenging data source in road accident analysis, according to the paper. While social media platforms provide real-time reports and firsthand accounts of road incidents, the

unstructured nature of this data poses significant analytical obstacles. Nonetheless, advancements in natural language processing and data mining offer promising avenues for extracting valuable insights from social media posts. By harnessing these technologies, researchers can sift through vast amounts of user-generated content to identify trends, public perceptions, and emerging issues related to road safety.

V. ROAD ACCIDENT ANALYSIS METHOD

The paper delves into a spectrum of methodologies employed in the analysis of road accidents, encompassing clustering algorithms, classification algorithms, and natural language processing (NLP) techniques. Clustering algorithms play a pivotal role in partitioning road accident data into distinct groups based on similarities in various attributes. By identifying patterns and groupings within the data, clustering facilitates a deeper understanding of the underlying factors contributing to road accidents.

On the other hand, classification algorithms serve as predictive models that assign classes or labels to data instances based on their attributes. These algorithms enable the categorization of road accidents into different severity levels or types, aiding in the identification of high-risk areas and the formulation of targeted intervention strategies. Through the application of classification algorithms, researchers can discern patterns and trends within the data, thereby enhancing road safety measures and accident prevention efforts.

VI. FUTURE ENHANCEMENT

For the future enhancement of the project titled "Road Accident Prediction Using Machine Learning," several avenues can be explored to further improve its functionality and usability:

1.Enhanced Real-Time Data Integration: Integrate real-time data sources such as traffic cameras, weather sensors, and vehicle telematics to provide up-to-date information on road conditions, weather patterns, and driving behaviors. This will improve the accuracy and timeliness of accident predictions, enabling proactive measures to be taken to prevent accidents.

2.Incorporation of Advanced Machine Learning Techniques: Explore advanced machine learning techniques such as deep learning, ensemble learning, and reinforcement learning to enhance the predictive capabilities of the models. Deep learning algorithms, in particular, can extract complex patterns and dependencies from large datasets, leading to more accurate predictions of accident severity and occurrence.

VII. CONCLUSION

In conclusion, road accidents pose a significant threat to public safety and the economy. Machine learning offers a practical approach to predicting the severity of traffic accidents. The paper highlights the importance of accurate predictions in reducing the number of accidents and suggests using advanced machine learning techniques for this purpose.

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