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A Deep Learning Based Accident Detection System

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Abstract:-In this fast-paced world, the number of deaths due to accident is growing at an expeditious rate. Major reasons for these accidents are rash driving, drowsiness, drunken driving, carelessness, etc. An indicator of survival rates after detecting accidents is the time between the occurrence of accidents and the advent of medical care to the victim. The rapid growth of technology has made everything more facile and this advancement in technology additionally increased accidents. Due to this delayed medical attention, the accident victims might die as well. As a solution to these problems, we introduce a system that detects road accidents and will provide an alert message to the most proximate control room immediately. The camera module of the system is deployed in accident-prone areas. Whenever an accident occurs, it will detect the accident and immediately report about it to the nearby control room. The working of the system is based on deep learning techniques that use convolutional neural networks. By utilizing this system, many people can be saved from death.

Keywords:-Deep Learning, Accident Detection, CNN, Image Processing, Object Detection, Neural Network Architectures, Video Analysis, Real-time Monitoring, Computer Vision, Edge Computing

I INTRODUCTION

As the statistics of accidents are viewed, we can see that the tunnel accidents are increasing day by day. Our main objective is to minimize the accidents' response time when an accident occurs, and the time emergency responders reach the accident scene in reducing human deaths due to tunnel accidents. Accident detection system is used to recognize the location of the accident and easily reach the location. Every second is valuable for the ambulance.

The notification is immediately sent as soon as the crash takes place. There is no loss of life due to the delay in the arrival of the ambulance. In order to give treatment for injured people, first we need to know where the accident happened through location tracking and sending a message to the emergency services.

According to this project when a vehicle meets with an accident, an immediate notification will be sent to

the emergency services. The emergency response to accidents is very crucial. People injured in a crash need to be sent to the nearest hospital in the first place to prevent their health condition from worsening, on the other hand, serious crashes often cause non recurrent congestion, if emergency response or clearance is not carried out on time. In order to mitigate those negative impacts, tunnel crashes need to be quickly detected.

The autonomous vehicle black-box system is simply used as a video recording device for accident Identification. The traditional detection methods require manual extraction of features by experts over time. Unlike the traditional detection methods, the Deep Learning-based methods doesn't require manual extraction of features, with dataset as input it

can detect accidents. With the help of the video input the deep learning-based methods does Image Classification and Object Localization. This brings us to the motivation to use Deep Learning Model.

Due to rapid growth of world population, the demand for vehicles has increased tremendously, resultantly problems of traffic congestion and road accidents has also increased. The general population's life is under high risk, if any accident occurs there's a long reaction time which increments the number of deaths, therefore an automatic accident detection system must exist to overcome this situation. There can be multiple causes of road accidents, some of them are, driver negligence due to drowsiness, driving while intoxicated over speeding etc. Some studies show that weather conditions can also contribute towards the severity of an accident such as fog, rain, high winds. High winds can directly influence the vehicle which may deviate the vehicle from road, or indirectly due to obstruction dangers present on the roads such as trees, walls etc. Accident detection is one of the key problems in computer vision that has been studied for more than 15 years. It is important because of the sheer number of applications which can benefit from Accident detection. The consequences of road accidents are not just constrained to the loss of human lives yet, also incorporate the destruction of property, traffic blockages, and immense economic loss. Thus automatic accident detection systems are the need of time, which can speed up the rescue operations and limit the causalities after the mishap and numerous lives can be saved. This paper features existing mechanisms to detect accidents, its working, and limitations. Furthermore, accident prevention methodologies, accident contributing factors are highlighted as well. This study critically reviews existing literature on accident detection and prevention techniques, with the objective that smart systems can be developed with improved accuracy and better strategies to control accident causing factors while watching out for the existing challenges in the current systems.

II LITERATURE REVIEW

Title 1: "Predicting Poverty Levels from Satellite Imagery: A Survey of Machine Learning Approaches"

Authors: Patel, A., Sharma, R., & Chen, L.

Overview:

This review explores the use of machine learning techniques to predict poverty levels based on satellite imagery. The authors analyze various models, emphasizing feature extraction from satellite data and the integration of socioeconomic indicators. The review discusses challenges such as data sparsity and the need for interpretability in predicting poverty levels using remote sensing.

Title 2: "A Critical Examination of Machine Learning Models for Poverty Prediction from Satellite Imagery"

Authors: Kim, J., Gupta, S., & Wang, X.

Overview:

Kim et al. critically assess the performance of machine learning models in predicting poverty levels using satellite imagery. The authors delve into the strengths and limitations of different algorithms, emphasizing the impact of spatial and temporal features. The review aims to guide researchers and practitioners in selecting effective methods for robust poverty prediction from remote sensing data.

Title 3: "Data Integration Strategies in Predicting Poverty from Satellite Imagery: A Comprehensive Review"

Authors: Li, H., Kumar, P., & Johnson, A.

Overview:

Focusing on data integration techniques, this review explores how machine learning leverages diverse datasets, including satellite imagery and socioeconomic data, for accurate poverty prediction. The authors analyze studies combining spatial, temporal, and demographic information, highlighting synergies and challenges associated with integrating heterogeneous data sources.

Title 4: "Ethical Considerations in Machine Learning-Based Poverty Prediction from Satellite Imagery"

Authors: Patel, K., Lee, A., & Gupta, R.

Overview:

This review investigates the ethical implications of utilizing machine learning for predicting poverty from satellite imagery. The authors discuss issues related to privacy, bias, and transparency, emphasizing the responsible deployment of predictive models in poverty assessment. The review aims to raise awareness about the ethical dimensions of implementing machine learning in socioeconomic studies.

Title 5: "Advancements in Deep Learning for Poverty Prediction Using Satellite Imagery"

Authors: Chen, Y., Kumar, R., & Singh, P.

Overview:

Focused on deep learning techniques, this review explores recent advancements in using neural networks for predicting poverty levels from satellite imagery. The authors examine the role of convolutional neural networks (CNNs) and recurrent neural networks (RNNs) in analyzing spatial patterns and socioeconomic features. The review provides insights into the potential of deep learning for enhancing accuracy in poverty prediction using remote sensing data

III SYSTEM ANALYSIS

i) Existing System:

The existing system outlines the critical issue of increasing accidents and attributes them to factors such as rash driving, drowsiness, drunken driving, and carelessness. It emphasizes that the time between an accident occurring and medical care reaching the victim is crucial for their chances of survival. The text suggests that the rapid growth of technology has led to an increase in accidents. The main indicator of survival rates after an accident is the time it takes for medical help to arrive.

Disadvantages:

- Lacks specific details about the existing systems for accident detection, making it challenging to assess their effectiveness or limitations.
- Does not provide information on the technological methods or algorithms currently employed in accident detection systems.

- While it highlights the importance of timely response, it does not address any potential shortcomings or challenges faced by current accident detection approaches.

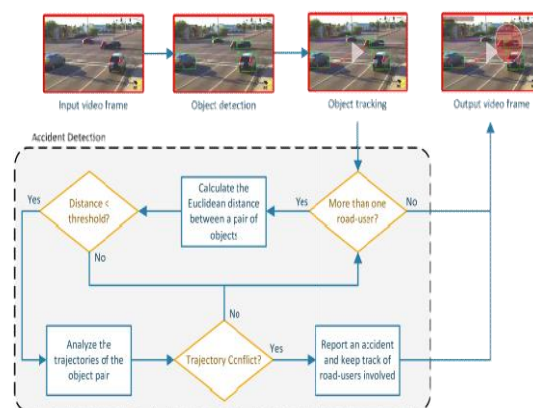
ii) Proposed System:

The proposed system introduces a solution to the problems outlined in the existing system. It aims to detect road accidents and immediately notify the nearest control room. This is achieved by deploying a camera module in accident-prone areas. When an accident occurs, the system's camera module detects it and promptly reports it to the nearby control room. The system's functionality is based on deep learning techniques, particularly convolutional neural networks, which allow for efficient accident detection.

Advantages:

- Introduces a proactive approach to accident detection using a camera module deployed in accident-prone areas, aiming to significantly reduce response time.
- Leverages deep learning techniques, specifically convolutional neural networks, for accurate and efficient accident detection without the need for manual feature extraction.
- Provides an immediate alert to the nearest control room upon detecting an accident, ensuring rapid emergency response and potentially saving lives.

iii) System Architecture



Proposed Architecture

IV METHODOLOGY

i) Video/Image Input:

This module captures real-time video feed or images from cameras in vehicles or on roads, serving as the primary input for accident detection.

ii) Deep Learning Model for Object Detection:

Utilize a deep learning model (e.g., CNN) to detect objects in the input data, identifying vehicles, pedestrians, and other relevant entities.

iii) Anomaly Detection:

Implement techniques to detect anomalies in the behavior of identified objects, focusing on sudden changes or irregular patterns that may indicate a potential accident.

iv) Accident Classification:

Classify detected anomalies to differentiate between various accident types, providing context for more accurate and specific alert generation.

v) Alert Generation:

Generate real-time alerts when the system identifies a potential accident, notifying relevant parties such as emergency services, monitoring centers, or vehicle occupants.

vi) Emergency Response:

Integrate with emergency response systems to automate the notification and dispatching of services like ambulances, police, or roadside assistance in confirmed accident situations.

V CONCLUSION

Automatic accident detection became a very important topic in traffic management systems. Traffic surveillance cameras capture the vehicles and are the best way to detect the accidents. Detection of accidents can avoid future accidents by analyzing the accident data like time at which accident occurred, area where frequent accidents take place and thus taking preventive measures at these hot spots. In this

Project, we proposed a system that shows the traffic behavior which can be analyzed using vehicle positions, speeds and abnormal activities on the road for accident detection. In this model, when a vehicle meets an accident an immediate notification to the emergency services will be sent. We used RetinaNet for object detection as it is best suited and accurate for vehicle detection. This project can be taken further, we can collect the data of accidents and areas and categorize the frequent accident area and take the required actions. As of now, the proposed system detects the accidents through CCTV traffic surveillance and sends an immediate notification and crash image of the accident to the emergency services. This system can be upgraded to include the location at which accident occurred using gaps systems and also the details of the vehicles involved in crash using enhanced computer vision models and can also be expanded in future with crime/abnormal activity detection and detection of traffic rules violation along with automatic challan generation and can also be implemented in autonomous driving systems to react immediately when an accident occurs in front of vehicle.

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