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ACCIDENT DETECTION AND ALERTING SYSTEM USING CONVOLUTIONAL NEURAL NETWORK

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ABSTRACT:

This initiative aims to address the problem of emergency services responding slowly to traffic accidents, which frequently result in fatalities. Utilizing deep learning methods, in particular Convolutional Neural Networks (CNNs), is the main goal of our study. In order to effectively detect and notify accidents. In order to extract features from photos taken by traffic surveillance cameras and enable real-time accident identification and prompt emergency services notifying, we utilize a CNN-based model. The suggested system, which makes use of the computational efficiency of GPU acceleration and enhanced algorithms, shows encouraging results in decreasing response times and raising survival rates.

Keywords: convolutional neural networks (CNNs), deep learning methodologies.

1. INTRODUCTION:

[1] Our main goal is to drastically cut reaction times and lessen the severity of these situations in light of the concerning increase in tunnel accidents. In emergency situations, time is critical, particularly in tunnel locations where access may be restricted. Our priority is to locate accidents quickly and notify emergency personnel in a timely manner in order to minimize human casualties.[2] It is critical to notify parties as soon as an accident occurs. Emergency response delays can have serious repercussions, including the loss of life. For

injured people to receive timely medical attention and for their circumstances to not worsen, action must be taken quickly. Additionally, in order to lessen traffic congestion and stop additional accidents, it is imperative that tunnel collisions be cleared quickly.

In the suggested approach, we make use of independent car black-box systems as video recording devices for accident identification.[8] In contrast to conventional approaches that depend on human feature extraction, our method makes use of Deep Learning-based strategies. Our technology automatically detects accidents by object localization and image classification using datasets as input. The transition to deep learning improves accident detection efficiency and accuracy while doing away with the requirement for manual feature extraction.

2. PROBLEM STATEMENT:

The impact of traffic accidents can still be significantly reduced by emergency services responding slowly, even with improvements in infrastructure and technology. When incidents go unreported, many lives are lost. This is especially true in distant locations or at night, when conventional ways of notifying the authorities are inoperable. In order to reduce response times and improve the survival percentage of accident victims, our research aims to develop an autonomous accident detection system that can swiftly identify accidents and alert emergency personnel in real-time.

3. LITERATURE SURVEY:

In a paper titled "Accident Detection Using ML and AI Techniques," Rutik Desai et al. [2] presented a multi-step method for identifying automobile crash events in videos. First, they used a convolutional neural network called the YOLO method to identify autos in the video frames. Then a tracker was put in place to keep an eye on the whereabouts of specific autos. Using a Support Vector Machine (SVM) and the Violent flow (VIF) descriptor, they were able to detect car wrecks with an astounding accuracy rate of about 89% in the final phase.

In the study "Road Lytics: Road Accidents Analytics Using Artificial Intelligence," which was proposed by Kelvin Rinaldi da Luz et al. [3], they used a Machine Learning Random Forest model to analyze road accidents. Their system had an 85% accuracy rate.

In the paper "Accident Detection and Alerting System," published by Afreen Fathima et al. [4], the authors built an Arduino-based automobile accident alarm system that makes use of GPS, GSM, and accelerometer. When the accelerometer notices abrupt changes in the axes of the car, the GSM module uses GPS coordinates to generate a Google Maps link that provides the accident site. The user's mobile device receives this alert message.

In their article "Accident Detection & Avoidance System in Vehicles," Tejal Lengare et al. [5] focused on collision avoidance by informing users of the distance between their vehicle and objects. To determine location and provide notifications, they made use of GPS and SMS modules.

In "Traffic Accident Detection and Condition Analysis Based on Social Networking Data," which Farman Ali et al. [6] introduced, they used a variety of network-based, real-time monitoring approaches for traffic analysis and accident identification.

4. DESIGN AND METHODOLOGY:

CCTV cameras are used by the accident detection system to record footage of the surrounding area while continuously monitoring traffic activity on the roads. The technology segments the continuous stream of video data into discrete frames for further analysis after it has been captured. When an accident occurs, the technology locates the exact position of the accident in the video stream instantly. An application interface is then used to send an instant alarm to the rescue systems that have been assigned, enabling a prompt reaction to the occurrence. In addition, the system stores important information about the identified accident, such as GPS coordinates, screenshots, and video recordings. This extensive data archive helps with post-event analysis and serves as the foundation for predictive modeling, which aims to foresee and prevent mishaps in the future. The technology improves road safety measures by using this stored data to support continuing efforts in accident investigation and prediction.

A. System Workflow:

Three separate modules make up our project: the notification system, the accident detection module, and input processing. First, the technology takes in CCTV material and separates it into individual frames for further processing. The system detects occasions where there are notable variations in vehicle velocity between consecutive frames, going above and beyond a predetermined threshold. These are identified as crash frames and are kept in a special crash image repository. When a crash frame is detected, the notification system immediately notifies the relevant authorities and sends an alert with the relevant crash photos so they may take urgent action.

B. System Workflow Diagram:

Fig1: System Workflow

Figure 1's flow chart illustrates the steps involved in processing videos. The procedure starts at the "Start" point, signifying that it has begun. A "Video Stream," which may originate from live or recorded sources, is then received by the system. The continuous video is then "Divided into Frames," creating separate images from this stream. In the "Preprocess Each Frame According to Its Dimensions" stage, each frame is preprocessed. To get the frames ready for more analysis, this may involve resizing, normalizing, or filtering. Lastly, sending these preprocessed frames to the next processing phase is the "Send Preprocessed Frame to Next Module" step. This simplified procedure guarantees that video material is effectively ready for in-depth examination..

5. MODULE DESCRIPTION:

A. Processing Input:

Data for our project is usually sourced from real-time CCTV camera feeds. Nevertheless, we have chosen to use pre-recorded traffic camera footage due to logistical concerns. The system immediately accesses the video feed within this module and divides it into separate frames. Every frame is processed in line with the object detection model's specifications before being sent to the next module for additional examination.

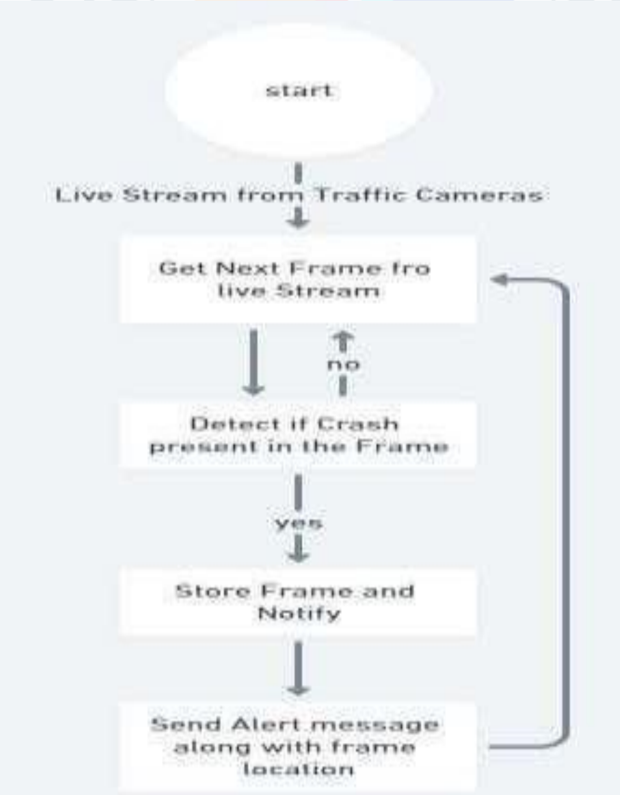

Fig2: Processing Input

A process for identifying collisions in real-time traffic camera video streams is shown in Figure 2. The "Start" node initiates the procedure, which is then followed by obtaining a "Live Stream from Traffic Cameras." The "Next Frame from Live Stream" is then extracted by the system for analysis. In the "Detect if Crash Present in the Frame" stage, the extracted frame is examined to determine whether a crash has occurred. The algorithm repeats back to get the next frame if no crash is observed. In the event that a crash is identified, the system proceeds to "Store Frame and Notify," storing the frame. Lastly, information on the detected crash is given in a "Alert Message along with Frame Location" message. Real-time traffic event detection and alerting is ensured by this approach.

B. Accident Detection Module:

The pre-processed frames from the module above are used as the input in this module.The Convolutional Neural Network (CNN) architecture that we have built for this project is a sequential model with multiple layers that are specifically designed to efficiently extract features and classify visual data, especially images. The network includes numerous Conv2D layers, each of which performs convolution operations to extract unique features from the input images, after a Batch Normalization layer stabilizes training. The feature maps are down sampled by subsequent Max Pooling layers, which preserve important information while cutting down on computational complexity. Rectified Linear Unit (Re LU) activation functions implemented after Conv2D layers improve the network's ability to learn complex patterns. As the design progresses, dense layers help with classification tasks by creating links between retrieved characteristics and target labels. Multi-class classification is made easier by the soft max activation function in the output layer, which converts raw outputs into probability distributions spanning several classes. The model is compiled with Adam as the optimizer and sparse categorical cross entropy as the loss function to help with parameter tuning during training. In order to monitor generalization and avoid overfitting, training entails presenting labeled data batches to the model iteratively and periodically evaluating the results on a validation dataset. During training, callbacks like Model Checkpoint allow for the dynamic modification of learning rates and the storing of model weights. The model architecture and weights are serialized to JSON format for deployment and storage after training. This all-encompassing method gives the CNN the ability to efficiently learn and categorize images, which makes it ideal for applications such as image identification and accident detection.



C. Notification System:

The crash-detected frame is fed into the system within this module. The appropriate department receives an instant notification when a crash is detected. This notification, which includes an alert message identifying the crash's occurrence, is sent via Short Message Service (SMS). The SMS also includes a hyperlink that points to the crash photographs that have been preserved. A programming interface known as an application programming interface (API) is used to facilitate SMS transmission.

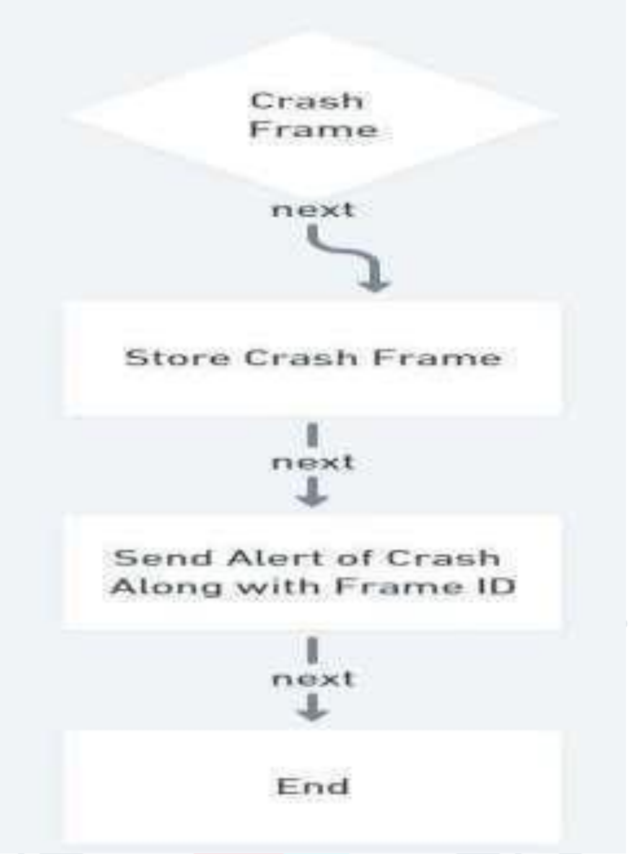

Fig3: Notification System

The process for dealing with a recognized crash frame is shown in Figure 3. The first step in the procedure is locating a "Crash Frame." The next action is to "Store Crash Frame," which makes sure the frame is preserved for later use and examination. The system then "Sends an Alert of Crash Along with Frame ID," informing the appropriate authorities or systems of the occurrence and supplying a link to the frame that was saved. The frame's identification is included in this alert to connect the message to the particular picture. The crash handling sequence is finally completed when the process reaches the "End" point. This process makes sure that any collision incidents that are discovered are noted and reported right away so that inquiry and action may begin on time.

6. EVALUATIONS AND RESULTS:

For those involved in accidents, the suggested accident detection system provides an essential lifeline, providing prompt aid and possibly saving lives. The system is exceptionally easy to use and is made to be accessible to non-technical people as well. The hardware arrangement consists of a CPU acting as a controller and a camera. It also contains software components.

In the meantime, the software portion consists of a specific program that drivers install on their smartphones and which offers comprehensive mapping features. Vehicle and obstacle identification, which makes use of the Specialized CNN method, achieves an amazing accuracy rate of almost 98%, improving the overall efficacy of accident detection efforts.

Algorithm	Test Accuracy	Validation Accuracy	Precision	Recall	F1-Score
Proposed CNN	98%	92%	97%	99%	98%
Fast R-CNN	91%	87%	90%	89%	89.5%
YOLO (You Only Look Once)	95%	90%	94%	93%	93.5%
RNN (Recurrent Neural Network)	89%	85%	87%	88%	87.5%

Fig4: Different Object Detection Techniques

A grid of traffic camera photos with annotations indicating actual and anticipated accident outcomes is shown in Figure 5. An accurate accident prediction, a correct non-accident prediction, and a missed accident are displayed in the top row. Three accident predictions are shown in the middle row: one that was incorrect, one that was accurate, and one that was correct but not an accident. Two accurate accident forecasts and one accurate non-accident prediction are shown in the bottom row. This grid shows the effectiveness of the accident detection algorithm by emphasizing instances of false positives, false negatives, true positives, and true negatives.


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Pred: Non Accident actl: Non Accident
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Fig5: Output

7. CONCLUSIONAND FUTURE DIRECTIONS:

To sum up, our study offers a novel method for traffic surveillance systems to use convolutional neural networks for real-time accident identification. Our goal is to improve emergency response systems and road safety by utilizing deep learning and computer vision techniques. This will help to save lives and lessen the financial and social toll that traffic accidents take. In order to identify possible accidents, the project presents a system that tracks and analyzes traffic patterns using information from the road, including vehicle positions, speeds, and abnormalities. In this model, emergency services receive a prompt notification as soon as a vehicle accident is detected.

There is plenty of space for this initiative to grow further. In order to identify common accident hotspots and take proactive steps to remedy them, future iterations may entail the gathering and analysis of accident data. While the current system uses CCTV traffic surveillance to detect accidents and promptly notify emergency services, it could be improved by using advanced computer vision models to collect comprehensive information about the vehicles involved in the crash, as well as by integrating location data from GPS systems to provide precise accident locations. In addition, future advancements might involve the incorporation of features for spotting traffic law infractions and criminal activity. It is also possible to expand the system to enable the automatic generation of fines or penalties (challans) for moving offenses. Finally, this system can be integrated with autonomous driving technology to provide for quick reaction mechanisms in the event that incidents happen close to autonomous vehicles**.**

8. REFERENCES:

[1] V. Gopinath, G. Bhavani, G. Uday Sai3, G. Chandana "Accident Detection And lerting System Using Deep Learning Techniques" 2023 IJRASET

[2] Rutik Desai, Akash Jadhav, Suraj Sawant , Neha Thakur "Accident Detection Using ML and AI Techniques" 2021 IEEE.

[3] Kelvin Rinaldi da Luz, João Elison da Rosa Tavares, Jorge Luis Victória " RoadLytics: Road Accidents Analytics Using Artificial Intelligence" Engpaper Journal2021.

[4] Afreen Fathima, Samreen Jameel, Pathan Ahmed "Accident detection and alerting system" Engpaper Journal.

[5] Tejal Lengare, Pallavi Sonawane, Prachi Gunjal, Shubham Dhire"Accident Detection & Avoidance System in Vehicles" Engpaper Journal.

[6] Farman Ali, Amjad Ali, Muhammad Imran, Kyung-SupKwak "Traffic accident detection and condition analysis based on social networking data" ScienceDirect 2020.

[7] Sreyan Ghosh, Sherwin Joseph Sunny, Rohan Roney. "Accident Detectionusing Convolutional Neural Network".

[8] Akbarzhon Madaminov, "Recommendation Systems", Engpaper Journal

[9] Rania Fernando, "IoT based – Street Light Controlling System", Engpaper Journal

[10] K. SAI BHARGAV, V. RAJENDRA, "Study on Data Structures for Machine Learning", Engpaper Journal

[11] GOV.BR. Open Data - Federal Highway Police. http://portal.prf.gov.br/dados abertosacidentes, 2020. Access date: February 2021.

[12] SP, I. Deaths by traffic cars accident growing in the São Paulo state. www.infosiga.sp.gov.br/, 2021. Access date: March 2021.

[13] Inada, H.; Ashraf, L.; Campbell, S. COVID-19 lockdown and fatal motor vehicle collisions due to speed-related traffic violations in Japan: a time-series study. Injury Prevention 2021, 27, 98–100. doi:10.1136/injuryprev-2020-043947.

[14] Andrade, F.R.d.; Antunes, J.L.F. Trends in the number of traffic accident victims on Brazil's federal highways before and after the start of the Decade of Action for Road Safety.