AUTOMATED IDENTIFICATION OF UNFORESEEN INCIDENTS UNDER CCTV SURVEILLANCE IN TUNNELS UTILIZING DEEP LEARNING

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ABSTRACT
An accident is an unforeseen and undesirable occurrence. Excessive speed is a key contributor to vehicular accidents. Numerous lives may be saved if emergency services were promptly informed of accidents and responded swiftly. The advent of technology and infrastructure has simplified human existence. In light of the alarming increase in accidents in India, this strategy guarantees that authorities are alerted before or at the time of the incident. The progression of technology has led to a rise in traffic hazards and road accidents, causing significant loss of life and property owing to insufficient emergency services. The inability to get prompt medical attention is the primary cause of death in road accidents, representing fifty percent of all deaths. Given that every second is critical after an accident and prompt intervention is essential to prevent fatalities, intelligent transportation systems have recently emerged as a significant tool for enhancing the analysis of transportation networks and advancing travel safety. Accident detection systems are among the most successful technology for reducing mortality rates in road incidents by facilitating prompt medical treatment for victims. This article discusses a computer vision-based emergency warning system developed in Python that use object tracking algorithms to identify accidents. An effective automated accident detection system that facilitates the reporting of the accident scene to emergency personnel is essential for preserving human life. This technology aims to detect accidents in advance and relay the information to emergency services to provide prompt assistance to the injured individual. The objective of the study is to assess the severity of an accident and to alert the rescue team promptly.

INTRODUCTION

The rapid expansion of economic development persists in elevating individuals' living standards. Road traffic accidents often occur, leading to substantial losses of life and property for the nation and its populace. Traffic has emerged as a significant occurrence in the national interest. Inadequate emergency response significantly contributes to the elevated incidence of road deaths and mortality rate in our nation. Numerous technical and cultural developments have facilitated a decrease in road deaths over the last decade; for instance, a 1% increase in seatbelt use is estimated to save around 136 lives. Moreover, each moment a victim of an accident is deprived of timely emergency medical treatment substantially impacts their survival rate; research indicates that reducing accident response time by approximately 60 seconds correlates with a six percent increase in lives saved. Minimizing the interval between an accident's incidence and the prompt response of first responders, including medical personnel, may substantially mitigate the severity of the incident. The Accident Emergency Alert System utilizes object tracking via a camera to identify the occurrence of an accident [8]. The probability of an accident is determined by the vehicle's speed and deviations in trajectory before to or after a collision with other vehicles. The proposed framework offers a dependent approach for attaining a high detection rate and a low false alarm rate in typical road-traffic CCTV surveillance footage. This approach was evaluated using the recommended dataset across several conditions, including bright sunshine, poor visibility, rain, and snow [9]. This design has shown efficacy, facilitating the development of real-time, general-purpose vehicle accident detection and emergency alarm systems [10]. In recent years, vehicle accident detection has emerged as a prominent area for the use of computer vision technology, addressing the complex challenge of providing prompt medical assistance without the need for manual human intervention to monitor and react to accidents swiftly. This research offers a pragmatic solution to the aforementioned issue by presenting a method for the real-time identification of accidents, which is essential for paramedics and traffic authorities to promptly respond to the incident. This study introduces a technique for detecting a substantial number of recognized roadside objects using a supervised deep learning architecture and comprehensive training datasets..

LITERATURE REVIEW

“ROAD TRAFFIC INJURIES AND DEATHS GLOBAL PROBLEM,” HTTPS://WWW.CDC.GOV/FEATURES/GLOBALROADSAFETY/INDEX.HTML. We provide a theoretically straightforward, adaptable, and comprehensive system for object instance segmentation. Our methodology effectively identifies items inside an image while concurrently producing a high-fidelity segmentation mask for each instance. The technique, known as Mask R-CNN, enhances Faster R-CNN by including an additional branch for concurrently predicting an object mask with the existing branch for bounding box detection. Mask R-CNN is straightforward to train and incurs little additional overhead compared to Faster R-CNN, operating at 5 frames per second. Furthermore, Mask R-CNN readily generalizes to other applications, such as enabling the estimation of human postures within the same framework. We demonstrate superior performance across all three categories of the COCO task set, including instance segmentation, bounding-box object recognition, and human keypoint detection. Mask R-CNN, devoid of embellishments, surpasses all current single-model submissions across all tasks, including the victors of the COCO 2016 competition. We anticipate that our straightforward and efficient methodology will provide a robust foundation and facilitate further research in instance-level recognition. The code is accessible at: https://github.com/facebookresearch/Detectron

K. HE, G. GKIOXARI, P. DOLLR, AND R. GIRSHICK, “MASK R-CNN,” IN PROC. OF IEEE INTERNATIONAL CONFERENCE ON

COMPUTER VISION (ICCV), OCT 2017. Object detection is a method aimed at identifying occurrences of tangible items inside photos or films. Object identification systems evaluate intricate pictures with a diverse array of objects situated at variable distances and positions, among fluctuating and often visually cluttered backdrops. Objects may manifest anywhere inside the visual frame, at varying distances, and may overlap one another. Object detection consists of location and categorization. Localization determines the position of an individual item inside an image and encapsulates it within a bounding box. Every localized picture is categorized into one of several distinct classifications. Localization and classification are performed repeatedly for each picture to ascertain the composition of items inside it.

"OBJECT DETECTION FOR DUMMIES PART 3: R-CNN FAMILY," HTTPS:// LILIANWENG.GITHUB.IO/LILLOG/ASSETS/IMAGES/RCNN-FAMILY- SUMMARY.PNG. This essay examines the issue of monitoring dynamic objects with deformable models. A Kalman-based approach is introduced, derived from a novel category of restricted clustering techniques described by Abrantes and Marques (1996) for static shape estimation. A collection of data centroids is monitored using intra-frame and inter-frame recursions. Centroids are calculated as weighted aggregates of the border edge points of the item. The use of centroids facilitates competitive learning processes inside the tracking algorithm, enhancing resilience against occlusion and contour displacement. Experimental outcomes with traffic sequences are shown.

J. C. NASCIMENTO, A. J. ABRANTES, AND J. S. MARQUES, "AN ALGORITHM FOR CENTROID-BASED TRACKING OF MOVING OBJECTS," IN PROC. OF IEEE INTERNATIONAL CONFERENCE ON ACOUSTICS, SPEECH, AND SIGNAL PROCESSING (ICASSP), VOL. 6, MARCH 1999, PP. 3305–3308. Two techniques for image-centroid tracking based on fuzzy logic are described. Fuzzy logic has many applications in signal and image processing, control systems, and sensor data fusion, and it is also a fundamental component in the development of viable artificial intelligence (AI) systems. The centroid tracking algorithms (CTA) are predicated on: a) adaptive neuro fuzzy inference system (ANFIS), and b) fuzzy logic (FL) function process; both use the Kalman filter (KF) for tracking purposes. The centroid tracking methods are assessed using MATLAB-simulated synthetic image data. While both CTAs demonstrated good performance, the FL-based CTKF outperformed the ANFIS-based CTKF. In certain image-based air traffic control and air defense systems, automated target acquisition, identification, and tracking via the processing of a succession of actual photographs of the moving object are crucial.

R. J. BLISSETT, C. STENNETT, AND R. M. DAY, "DIGITAL CCTV PROCESSING IN TRAFFIC MANAGEMENT," IN PROC. OF IEE COLLOQUIUM ON ELECTRONICS IN HANDLING ROAD CAPACITY DEMAND, NOV 1993, PP. 12/1-12/5. The rising demand for automobiles has heightened traffic risks, resulting in a rise in road accidents. Minimizing emergency response time is crucial for improving survival rates in vehicular accidents. Nonetheless, it constitutes a formidable endeavor. This study introduces a computer vision system that autonomously identifies traffic accidents from CCTV data using machine learning and deep learning methods. Our approach use a supervised CNN classifier to ascertain the likelihood of an accident in each frame. An alarm message appears on the screen, and an email is sent via the SMTP protocol upon the detection of an accident. This approach has shown efficacy in swiftly and correctly identifying accidents. Our computer vision-based solution reduces delays in rescue operations, therefore saving several lives. Annually, roughly 1.3 million individuals lose their lives due to road traffic collisions. Between 20 and 50 million more individuals have non-fatal injuries, with several sustaining disabilities due to their injuries [9]. Given the rise in population and the proliferation of cars on the road, it is increasingly imperative to devise efficient strategies for accident detection and prompt response.

F. BASELICE, G. FERRAIOLI, G. MATUOZZO, V. PASCAZIO, AND G. SCHIRINZI, "3D AUTOMOTIVE IMAGING RADAR FOR TRANSPORTATION SYSTEMS MONITORING," IN PROC. OF IEEE WORKSHOP ON ENVIRONMENTAL, ENERGY, AND STRUCTURAL MONITORING SYSTEMS, SEP 2014, PP. 1–5. Currently, there is an increasing interest in vehicle sensor monitoring systems. A primary task is to provide them a useful and valued resource in hazardous conditions, hence enhancing transportation safety. The primary disadvantage of visual assistance systems is their inability to provide correct findings during crucial visibility circumstances, such as rain, fog, or smoke. Radar systems may significantly assist in surmounting these restrictions. Imaging radar is increasingly attracting attention within the context of Driver Assistance Systems (DAS). This paper proposes a novel way for reconstructing the 3D photographed scene and detecting numerous targets inside each line of sight. The method utilizes Compressive Sensing (CS) theory to estimate numerous targets for each line of sight, including their range distances and reflectivities.

EXISTING SYSTEM In the existing system detects vehicle object and classifies the type of vehicle by Convolutional Neural Network (CNN). The vehicle object tracking algorithm tracks the vehicle object by changing the tracking center point according to the position of the recognized vehicle object on the image. Then, the monitor shows a localized image like a bird's viewpoint with the visualized vehicle objects, and the system calculates the distance between the driving car and the visualized vehicle objects.

DISADVANTAGES OF EXISTING SYSTEM:

- This system extracts the feature from the satellite image through CNN using the satellite image as an input value and performs the binary classification with SVM to detect the vehicle BBox.
- This system utilizes BBox obtained by object detection based on videos or images. The algorithm applied to the system was compared with the Gaussian Mixture Model.
- **Algorithm**: Support Vector Machine (SVM),Convolutional Neural Network(CNN),Gaussian Mixture Model

PROPOSED SYSTEM

In the proposed system we attempt is made for generate an object detection & tracking system (ODTS) with yolo, that can obtain moving information of target objects with names by combining object tracking algorithm with the deep learning-based object detection process. It is assumed that ODTS has been trained enough to perform object detection properly on a given image frame. ODTS receives selected frames of video at specified time interval c and gains sets of coordinates, n BBoxs are detected. BBoxT of objects on the given image frame at the time T, from the trained object detection system. The corresponding type or class ClassT of each detected object BBoxT is simultaneously classified by the object detection module.

ADVANTAGES OF PROPOSED SYSTEM:

- A deep learning model of R-CNN was used for training with yolo object detection model.
- This object tracking module was composed by introducing an object tracking model called yolo.

Algorithm: R-CNN (Regional Convolution Neural Network),YOLO Model

IMPLEMENTATION

SYSTEM ARCHITECTURE

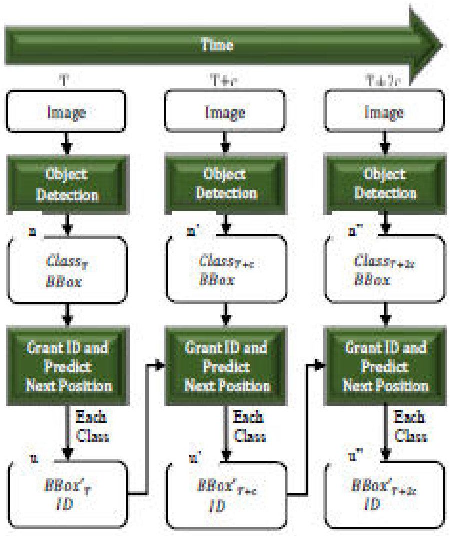


Fig: System Architecture

MODULES:

- User
- Object Detection and Tracking
- RCNN
- Average Precision

MODULES DESCRIPTION:

User:

User can load the cctv videos. To start the project user has to give –input (Video file path).The open cv class VideoCapture(0) means primary camera of the system, VideoCapture(1) means secondary camera of the system. VideoCapture(Videfile path) means with out camera we can load the pre recorded ideo file to the system. After that user has to load the yolo object detection system which is implemented on RCNN concepts. This yolo module is used for identify the objects from each frame and name that. It can be idenfied humans things fire etc…

Object Detection and Tracking:

Prior detection systems repurpose classifiers or localizers to perform detection. They apply the model to an image at multiple locations and scales. High scoring regions of the bounding box of the image are considered detections. We apply a Regional Convolution neural network to the full image. This network divides the image into regions and predicts bounding boxes and probabilities for each region. These bounding boxes are weighted by the predicted probabilities. Our model has several advantages over classifier-based systems. It looks at the whole image at test time so its predictions are informed by global context in the image.

RCNN(Regional Convolution Neural Network):

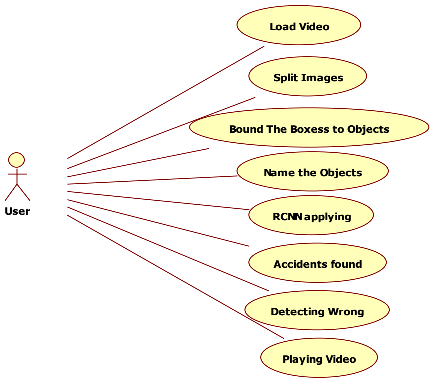
R-CNN models first select several proposed regions from an image (for example, anchor boxes are one type of selection method) and then label their categories and bounding boxes (e.g., offsets). Then, they use a CNN to perform forward computation to extract features from each proposed area. Afterwards, we use the features of each proposed region to predict their categories and bounding boxes.Then, based on the detected object information, a dependent object tracking module is initiated to assign the unique ID number to each of the detected objects, IDt and predict the next position of each of the objects, BBOX. The number of tracking BBox u is different from n. But If past tracked BBox is 0, the number of tracking BBox equals to the number of the detected objects.

Average Precision:

AP values for the target objects to be detected, in the training dataset, the number of Car objects is the largest object and very high AP value was obtained for the Car object in comparison with other classes. That is, the object detection performance of deep running of the Car in the video was expected to be highly reliable. On the other hand, AP for Person object results in relatively low value because Person object exists long, tiny shape in small size. The AP of Fire object was high, but false detection for the object might be highly possible as the number of the objects available for training was very small, Nonetheless, training about deep learning, including No Fire objects, could reduce the false detection of Fire object. However, to detect the Fire in the tunnel control center, it was necessary to collect and involve more images of a Fire event in training.

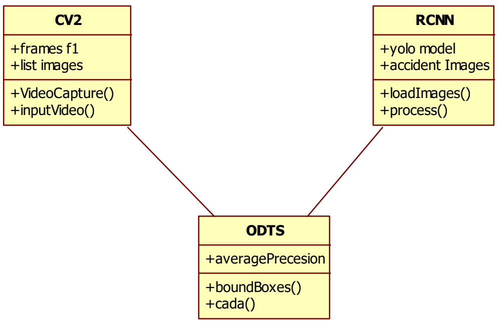
USE CASE DIAGRAM

A use case diagram in the Unified Modeling Language (UML) is a type of behavioral diagram defined by and created from a Use-case analysis. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases), and any dependencies between those use cases. The main purpose of a use case diagram is to show what system functions are performed for which actor. Roles of the actors in the system can be depicted.



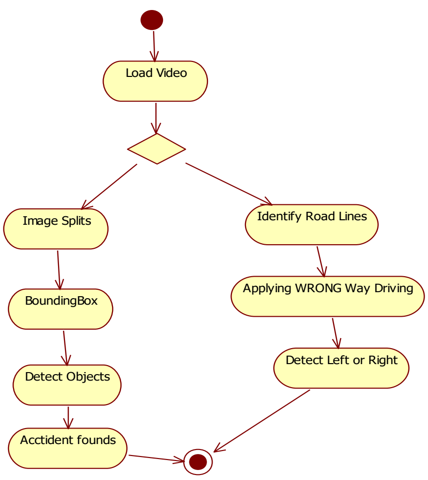
CLASS DIAGRAM

In software engineering, a class diagram in the Unified Modeling Language (UML) is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among the classes. It explains which class contains information.



ACTIVITY DIAGRAM

Activity diagrams are graphical representations of workflows of stepwise activities and actions with support for choice, iteration and concurrency. In the Unified Modeling Language, activity diagrams can be used to describe the business and operational step-by-step workflows of components in a system. An activity diagram shows the overall flow of control.



RESULTS

Fig: Executing The Project

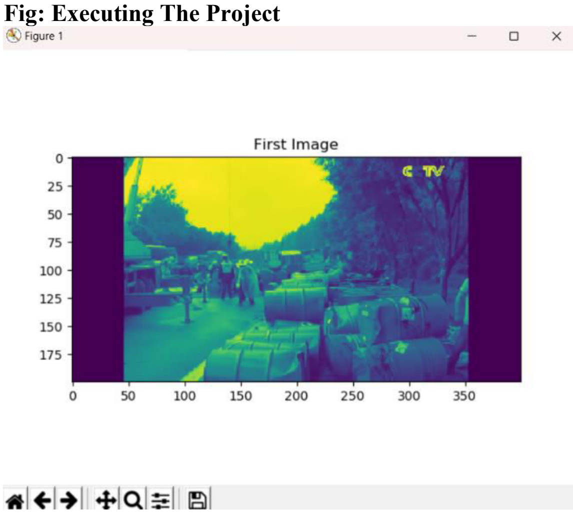


Fig: Pre Processing Of an Image

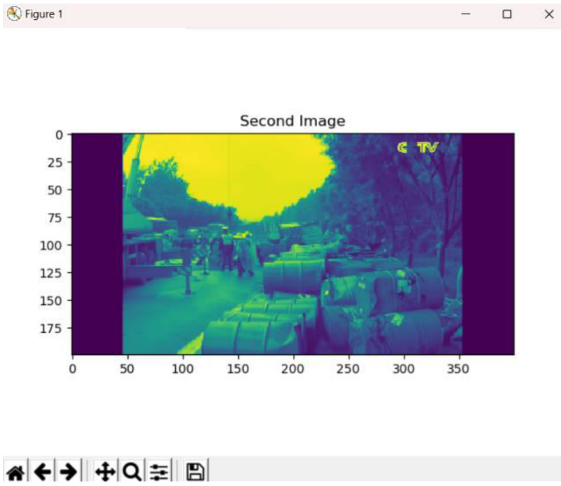


Fig: Preprocessing Of An Image

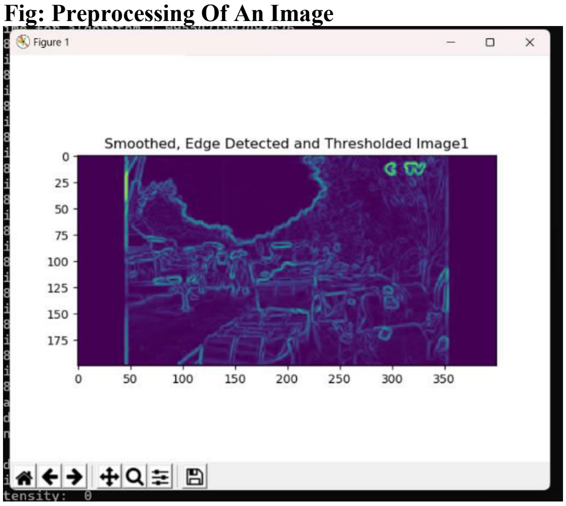


Fig: Segmentation Of An Image

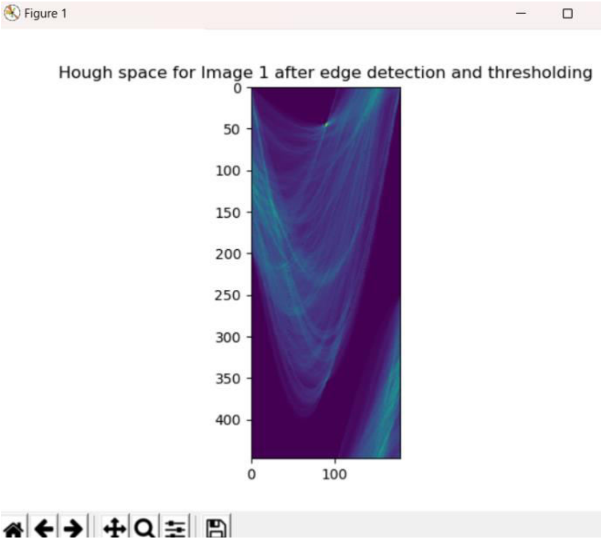


Fig: Applying Transformation

Fig: Detecting an Accident

CONCLUSION

This project has built a fundamental foundation for detecting vehicular collisions and relaying an emergency notification to the closest Accident and Emergency Department. This framework is constructed using local features, including trajectory collision, velocity estimate, and other anomalies. The primary objective of this project is to decrease fatalities resulting from excessive speeding, improve public safety, and provide a more effective traffic regulation system on highways. The technology is economical, scalable, and quick, and it can be seamlessly incorporated into current live surveillance systems. The reliability of our system is augmented by many elements that evaluate the danger of an accident. A limitation of the study is its performance in high-traffic regions and low-light conditions, leading to challenges in vehicle recognition and tracking errors, which will be addressed in future research. Significant obstructions to the cameras' field of view may impede vehicle tracking and, thus, collision detection. The proposed framework can precisely identify accidents with a detection rate of 71 percent and a false alarm rate of 0.53 percent. The experimental results are promising and demonstrate the framework's efficacy.

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