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ROAD ACCIDENT DETECTION

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ABSTRACT

Detecting accidents through video surveillance using computer vision has become a useful but daunting task in recent years. This project proposes a method for detecting road accidents. An efficient centroid-based GMM algorithm is used for surveillance footage followed by axis bounding box technique for accurate object detection. On general road-traffic CCTV surveillance footage, an important feature of the proposed framework is that it provides an effective method with high detection rate and low false alarm rate. Different kinds of conditions were tested, including broad daylight, low visibility, rain, hail, and snow. A real-time vehicle accident detection algorithm can be developed using this framework, which has been found to be effective. This project also use geopy library to capture the live location and we can send notification to the nearby police station and hospital with the snap of accident image. So by seeing the image they can take necessary resource allocation and the recovery is made very easy in less time. Alarm buzzer is also included to notify the nearby people.

Keywords: Background subtraction, Geocoding, Human supervisor, CCTV, Image enhancement.

1. INTRODUCTION

With an increase in vehicle traffic, motorways, highways, and roads are becoming increasingly congested. Intelligent transportation systems (ITS) are emerging around the world to improve the efficiency and reliability of transportation, cleaner, and safer by collecting, cognizing, and managing a variety of sources provide information on transportation flows [1]. It is becoming increasingly important to detect, track, and count moving vehicles in order to monitor, plan, and control traffic flow. Traditionally, vehicle detection can be accomplished using an inductive loop detector, these detectors range from infrared to radar to video-based solutions. Open-air monitoring cameras-based video solutions as weather, lighting, and shadows compared to other techniques [2].

Even though there are several advantages to using video-based processes over other methods, including continuous traffic flow. Ease of installation, and ease of modification, during the past decade, they have received a great deal of attention from researchers [3]. The term "background subtraction" refers to a conventional computer vision technique for detecting moving objects in video-based systems which involves calculating the difference between someone reference image and the current frame, which necessitates estimating a robust knowledge to agree with the changeable object [4, 5]. As a result, for real-time road situations requiring vehicle detection, an adaptive rather than static background is required [6].

The critical issue with real-time vehicle tracking systems is automatically starting a track. In this section, we identify two major systems that take very different approaches to the problem [7]. The first is a virtual detector constructed in each frame from a collection of rectangular regions. Due to the fixed nature of the camera, the processor observes alterations in the region where the virtual detector indicates the presence of a vehicle and blob tracking is the second approach [8].

2. METHODOLOGY

2.1 *INPUT*

- The video is input to the system.
- The collected video is read through opencv library.
- The system works by capturing video frames.
- The input is from the CCTV install in highway road or any road where there is a necessity to reduce the accident.
- The majority of the video in real time comes from CCTV.

2.2 *BACKGROUND LEARNING*

- This is the system's second module, and its main goal is to learn about the background and how it differs from the foreground [9].
- Additionally, because the system under consideration with this module, frames are extracted from a video feed and gets to know about the background only. Moving objects are considered the foreground a stationary camera placed by the side of the road filmed the traffic scenario [10]. While static objects are considered the background.
- MOG Learning about the background is accomplished through the use of the aforementioned technique and algorithms.
- It is a Background/Foreground Segmentation Algorithm based on Gaussian mixtures. It employs a method that employs a collection of K Gaussian distributions (K = 3 to 5).
- The combination of putting on weight correspond to the proportions of time that all of those colors remain in the scene [11].
- The most likely background information colors are those that remain static for a longer period of time.
- We must use the function cv2.createBackgroundSubtractorMOG to create a background object while coding ().
- It has some parameters that can be changed, such as the history's length, the number of Gaussian mixtures, and the threshold, and so on [12].
- The foreground mask is then obtained by using the backgroundsubtractor.apply() method within the video loop [13].

2.3 *FOREGROUND EXTRACTION MODULE*

There are three steps in this module: background removal, enhancement of images and extraction of foregrounds are both possible. The background has been removed; leaving only the things in the background can be seen [14]. Typically, this is accomplished by transforming Pixels from static objects are converted to binary 0.

The use of noise filtering, dilation, and erosion techniques to enhance images are used after background subtraction to obtain proper foreground object contours. This module's output is the foreground [15].

2.4 *ACCIDENT DETECTION*

- Proper contours are acquired after using the foreground extraction module.
- The centroid, aspect ratio, area, size, and solidity of contours are extracted and utilized to classify vehicles.
- Bounding box is introduced around the foreground.
- The collision of two bounding box in respect to the position is calculated [16].
- From this the frame is classified as whether it is accident or normal vehicle movement.

2.5 *ALARM ALERT*

- The first step would be to import the required packages into our Python code to use them in building the alarm [17].

- Add some alarm tunes to the folder.
- This alarm helps the surrounding members to alert and helps to recover from the incident quickly [18].

2.6 *HOSPITAL MAIL ALERT*

- The location is noted using geocodes and with the help of stop the mail is sent to the particular hospital mail or rescue station.
- In geocoding, a description of a location is converted into a location on the ground using coordinates, addresses, or place names [19].
- SMTP stands for Simple Mail Transfer Protocol.
- To allocate proper resource and to take proper legal action in correct time this module helps a lot.

2.7 *SMTP*

- It enables email exchange between users on the same or different computers, and it also supports.
- Send one or more messages to a single recipient.
- Text, voice, video, or graphics can all be used to send messages.
- Messages should be had sent networks other than the internet. SMTP's primary function is to define communication protocols between servers [20]. The servers have the ability to self-identify and indicate the kind of communication being attempted. Additionally, they have a system in place to resolve mistakes like incorrect email addresses. For instance, the receiving server will send back an error message if the recipient address is wrong.

2.8 *GMM*

GMM is used after block processing to re - create the mean image. The GMM's Gaussian distribution is used to initialize the process, and Then, k Gaussian distributions from the current GMM are utilized to determine whether or not each and every pixel in the current image frame fits them. If the new pixel and the GMM's Gaussian distribution match, then it is presumed that it fits the Gaussian distribution.

$$\left| d_{ij}^{m,k} \right| \le \rho \sigma_{ij}^{m-1,k}$$

$$d_{ij}^{m,k} = G_{ij}^{m} - M_{ij}^{m-1,k}$$

Where d implies the distance in absolute terms between the mean value of the k-th Gaussian distribution model and a new pixel. According to m, the current frame pixel's standard deviation can be calculated. The pixel in the present picture frame is represented by m G, and its mean value is represented by m k 1. The number of image frames, the quantity of Gaussian distributions and the number of rows and columns in the current image frame are all indicated by the letters I j, k, and m, respectively.

If the novel pixel relates to the Gaussian distribution parameters of the model for the kth Gaussian distribution model can be updated as follows:

$$w_{ij}^{m,k} = (1-\alpha)w_{ij}^{m-1,k} + \alpha$$

$$M_{ij}^{m,k} = (1-p)M_{ij}^{m-1,k} + pG_{ij}^{m}$$

$$\sigma_{ij}^{m,k} = \sqrt{(1-p)(\sigma_{ij}^{m-1,k})^2 + p\left(d_{ij}^{m,k}\right)^2}$$

Where p stands for the update rate and m, k, and w are indicators of the weight of the pixels in the recent image frame. These parameters relate to one another as follows: m k p w. If the new pixel does not fit a Gaussian distribution, the Gaussian distribution with the smallest weight is swapped out with a new Gaussian distribution that is created with the least new weight. The average of the currently seen pixels will be used to calculate the new Gaussian distribution's mean. the standard deviation from the maximum initialization value, and the weight from the minimum initialization value.

$$w_{ij}^{m,k} = (1-\alpha)w_{ij}^{m-1,k}$$

The priority of the k Gaussian distributions is determined on this basis, ranging from large too small. Because the initial B Gaussian distributions are used to establish the background model because they are more stable and closer to the

$$B = \arg\min_b \langle \sum_{k=1}^{b} w_{ij}^{m,k} > \tau \rangle$$

background.

2.9 Finding Contours

In this method, the shape of the vehicle is identified by setting boundaries around regions of interest (the vehicle) in the image frames. In the next steps, we can get the coordinates of these contours in the image frame and locate the vehicle. Utilizing these methods selectively, we can easily locate the movements of vehicles in the video or image frame and detect them.

2.10 Image Thresholding

This method works by assigning one of the two values based on a threshold to the pixels in a grey scale image. If a pixel's value exceeds a certain threshold, it is assigned a specific value; otherwise, it is assigned a different value. The objective is to remove unwanted highlighted areas by obtaining a resultant binary image as shown in figure 1.

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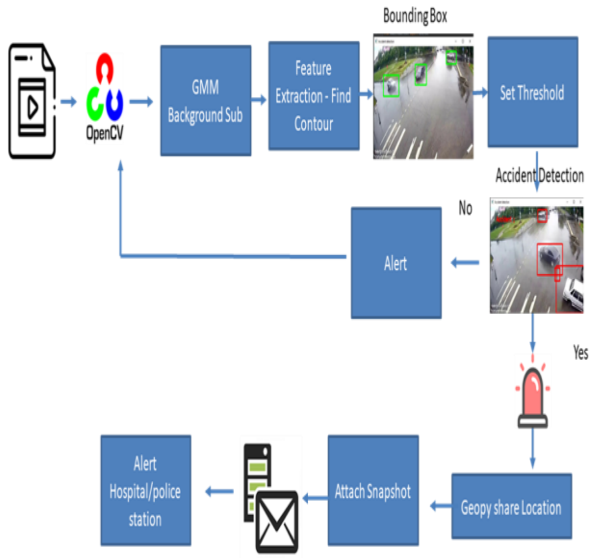

Figure 1: Accident Detection System

2.11 Frame Differencing

We know that a video is essentially a collection of image frames put together and played in a continuous stream. Therefore, it is noticeable that the vehicle changes coordinates in each successive frame and, hence, its location. Also, it can be noted that only the pixels representing the vehicle will undergo changes in these consecutive frames. Thus, the frame differencing method aims to notice the changes in the pixel and location of the moving vehicle.

3. RESULTS AND DICUSSION

This algorithm builds a model of the background of the scene. To extract foreground blobs for each frame of the input image, the absolute difference between the input image and the background image is analyzed. that correspond to the moving objects on the road. Due to shadows, occlusions, and big vehicles, many vehicles look as a single zone in both methods (e.g., trucks, trailers). In this paper, we present an advanced method that, by combining the moving cast shadow detection approach and Otsu's thresholding method both get beyond earlier restrictions on vehicle recognition and tracking. The method attempts to appropriately the adaptive background model and the vehicle foreground should be separated.

Otsu's method and the shadow detection method are used in conjunction with the adaptive background and foreground categorizing algorithm. Detecting objects is an exciting area of computer vision. It takes on a whole new meaning when we're dealing with video data. The difficulty grows, but so do the rewards! We can use object detection algorithms to perform extremely useful high-value tasks such as surveillance, traffic management, and crime fighting, among others.

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We can use object detection algorithms to perform extremely useful high-value tasks like surveillance, traffic management, and crime fighting, among others. Counting the number of objects, determining their relative size, and determining their relative distance from one another are all sub-tasks in object detection. All of these sub-tasks are critical because they contribute to the resolution of some of the most difficult real-world problems.

Many computer vision applications rely on background subtraction. It is used to count the number of vehicles that pass through a toll booth. A common computer vision task is background removal. We investigate the standard pixel-level approach. Using Gaussian mixture probability density, we devise an efficient adaptive algorithm. Recursive equations are used to modify the parameters repeatedly while also determining the correct number of components needed for each pixel.

We know that a video is essentially a collection of image frames put together and played in a continuous stream. Therefore, it is noticeable that the vehicle changes coordinates in each successive frame and, hence, its location. Also, it can be noted that only the pixels representing the vehicle will undergo changes in these consecutive frames. Thus, the frame differencing method aims to notice the changes in the pixel and location of the moving vehicle.

Image Thresholding works by assigning one of the two values based on a threshold to the pixels in a grayscale image. If a pixel's value exceeds a certain threshold, it is assigned a specific value; otherwise, it is assigned a different value. The objective is to remove unwanted highlighted areas by obtaining a resultant binary image.

4. CONCLUSION

Python is used to implement the proposed solution, which uses OpenCV bindings. Traffic cameras are being used to capture a variety of footage. In order to analyze an area of interest, a user interface is developed that allows him to select the area of interest, then image processing techniques are used to analyze the data to detect the accident. It is possible to modify the proposed system to handle live video streams, in addition to working with already captured videos. One of these systems' flaws is its inability to detect vehicle occlusion, which affects both counting and classification. Implementing this issue might be resolved by classifying second-level features, such colors. The current system has the limitation that defining the region of interest requires human intervention. For the counting of vehicles, because the user must draw an imaginary line in which the centroids of the contour lines intersect and accuracy depends on the supervisor's decision-making. Furthermore, camera angle has an impact on the system; thus, camera calibration techniques may be employed for lane detection to provide a better vision of the road and increased efficiency. Because it needs to see foreground objects to extract contour properties and features for classification using SIFT features, the system cannot detect vehicles at night.

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