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Machine Learning Based Traffic Anomaly Detection in Video Surveillance

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Abstract

Nowadays, The traffic inconsistency is increasing as the number of motor vehicles on the road are increasing gradually. Various anomalies related to traffic jams, vehicles at zebra crossings, triple seats on bikes, etc. are reported. The manual process of handling violations of such traffic rules is difficult, time-consuming, and requires more manpower. Therefore, an automated traffic monitoring system is proposed so as not to limit existing systems. In this study, two traffic discrepancies for implementation e.g. Vehicles at Zebra Crossing, signal detection, and traffic jams (based on traffic density) are considered. It makes reality visible so that it works much more superior than such systems that depend on finding the metal content of motor vehicles. This present study can be more convenient for catching the lawbreaker and greater for traffic control. This study has been implemented using the Open CV Image Processing Library with Python language. The plan is to carry out the Raspberry Pi hardware platform to construct the system transferable and real-time easy.

Keywords- *Anomaly detection, Video surveillance, Traffic anomaly*

1. Introduction

Anomaly means an anomalous person or thing; one that is abnormal or does not fit in and Anomaly detection means that rare objects, events, or observations make them suspiciously different from the majority of data. In this study, there are basically three anomalies that are considered i.e. Vehicle on a zebra crossing, traffic congestion, and Speedy vehicle detection. Basically traffic anomalies are different from the normal traffic pattern.

A huge quantity of reports and data show the worrisome role performed by walkers in traffic incidents, specifically in areas that are perceived to be secure by them. Walking is a good exercise that is nearly caused by road traffic with a seductive negative effect.

Walking in such conditions is 10 times more harmful than traveling as a traveler [1]. The accessibility of a comprehensive database of the reasons of accidents is considered the most essential building structure block in the development scheme of smart incorporated road protection systems [2], for example, 15 percent of the whole population kill on European roads are pedestrians, 28% are unsafe road people [3]. It has been reported that most incidents occur in urban city areas where severe and fatal crashes can occur at comparatively low speeds, especially speaking of children [4].

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In the face of many stationary cameras or camcorder currently being used in our city (department store, banks, underground train stations, etc.) their primary dedication is just to help the operator in making the best decision regarding the safety or to keep the user informed on the flow of traffic. Several computer vision apps have previously arrived at the masses as an onboard system by Daimler Chrysler [5,6].

India's population is growing rapidly as the number of motor vehicles on the road increments. Traffic management is the most important task to reduce the number of road accidents and traffic jams due to violation of rules like violating traffic light signals, hurrying, driving on the side, etc. To avoid traffic violations and traffic jams, it is necessary to develop automatically. In this proposed approach, we will develop a picture processing technique and computer vision-based model. In this present system, we will concentrate on three traffic infractions.

2. Related Work

All Hiroaki Nakanishi et. al[1] propose the system for traffic signal control according to the density of traffic to modify at any moment in the street network. We concentrate on calculating the most appropriate reporting split based on road traffic estimates by model forecast control. For this reason, we focus to reduce obstruction in road traffic networking by consideration of the actual traffic condition. Numerical simulations evaluate the accomplishment of this objective by controlling traffic signals and examining the relationship between green time and traffic density.

S. Alvarez et. al[2] propose the system Camera self-calibration model and zebra crossing supported on the one-eyed vision for apps within the structure of Intelligent Transportation Systems (ITS). Since through the camera zoom and a very common part of city traffic infrastructure is the pedestrian crossing, it is suggested to achieve self-calibration of the camera, unless any prior awareness of the scene by the main point and vanishing point extraction. This standardization is very much helpful to recuperate the measures from images or appeal the information of 3D models to calculate the 2D pose of targets, making rearward object detection and keep an eye on more vigorous to clamour and blockage. Additionally, the algorithm is an individualistic of a location of a camera, and it have proficiency to work including fluctuating pan-tilt-zoom cameras in fully versatile mode.

S. k. Riyazhussain et. al[3] the proposed the system was used the Raspberry Pi microcontroller which was used to controlled the Traffic Density monitoring system. This system is used for traffic scrutiny motive where a traffic on different roads are uninterruptedly observe and then recorded. Moreover, these system was used for recognition or analyzing the bulk of traffic and this generated report is send to the small travelers or other vehicles . This report is continuously updated intermittent and show on the visual display unit where the screens are installed at the public places. Raspberry Pi microcontroller is used for managing the predilection of promulgating and disposing the traffic reports. This inauguration is support the Government by creating these all these things digitalized and easy to understand. This also helps it keeping things away for utilization of papers and polymer for promulgating means it is totally the digital. Its result are in saving the environs by decreasing the polymer utilization and as well as by decreasing this logging.. This technique is very financial rewarding.

Md. Khaliluzzamanet. A1[4] proposed the system is the type of zebra-crossing, It is a stimulating task for a propose system to recognize zebra-crossing regions by

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crosswalk images to support visually impaired individuals to visually navigate the external environment. This paper proposed to find a crosswalk using as scaffolding based on the idiosyncratic geometric features of the crosswalk. The isolated geometric property is that the edges of the zebra-crossing strip are put out in ascending order. In the first instance , pre treating an images of the crosswalk by appealing a guided gabber filter used for removing sound or boisterous data and to remove the shadow effects and to enhance the aspiration of the parallel edges of the crosswalk. Sobel edge detector is the filter which is used for finding the parallel edges. Future parallel margin are drawn from the images by removing short and non-candid margin. Then, the process of connecting the edges is to take advantage of the prolonged parallel margins. The drawn crosswalk margins are adjusted by extending in parallel order or by arranging horizontal edge sections in ascending direction. At last, these parallel margins were used by other comparative patterns or techniques to verify the zebra-crossing edges and to measure the scattering point to confirm the cross walking applicant area investigation. Different crosswalk pictures are being taken to estimate the proposed scaffolding.

O.K. Rahmat et al[5] Spying cameras were usually fit out at main route linkage and criss-crossing in city areas for personage operator surveillance. Rather than restrict a work of a camera for those motivation, pictures are captured from the camera and analyzed this pictures for later law making. These present paper recommended that the image processing technique is used for the measuring the rush on roads, vehicle classification, and momentum. The rush on road is counting using counting algorithms which is espouse in these learning are performed by noticing the small changes in the pixels utility in the traffic lane at the mid. Measurement of speed determination, and categorization of vehicles, a one pixel is set across the traffic line. A sample of this pixesl utility value are used to calculate the distance of a queue, to discover the location of a specific motor /vehicle within a small distance from a separate vehicle and within a short distance of time.

Siddharth Shashikar and VikasUpadhaya[6] proposed anomaly detection in traffic surveillance using basic image processing technique. In this paper, entire process is divided into 2 parts: 1)Ecplicit event recognition 2)Anomaly detection. Using these technique we get resultant image of object and direction anomaly of detected vehicles. These techniques can give accurate result in day time as well as night time. The disadvantages are false detection of object and manual lane detection. In future we can implement shadow removal technique for shadow removal and advanced algorithm for automatic lane detection.

3. Methodology

The In proposed system, the camera will be placed close to the traffic signals. This system captures videos of the traffic which is forthcoming from a specific regulation or may be any regulation. This system will be placed on a specific perspective so it may be captured the maximal number of motor vehicles. A camera firstly captured the continuous video and then it will pass to the Raspberry Pi microcontroller. The captured video will be processed in Raspberry Pi board. Pictures will be pull out such as one frame per second from the live streaming video. The image processing technique algorithm will be imposing on the pull out frames. The objects are counted which is seen in picture and it will be considered as an input. To synchronize the traffic signals the dynamic traffic management algorithm will be for the Indian traffic, the traffic signals are monitored

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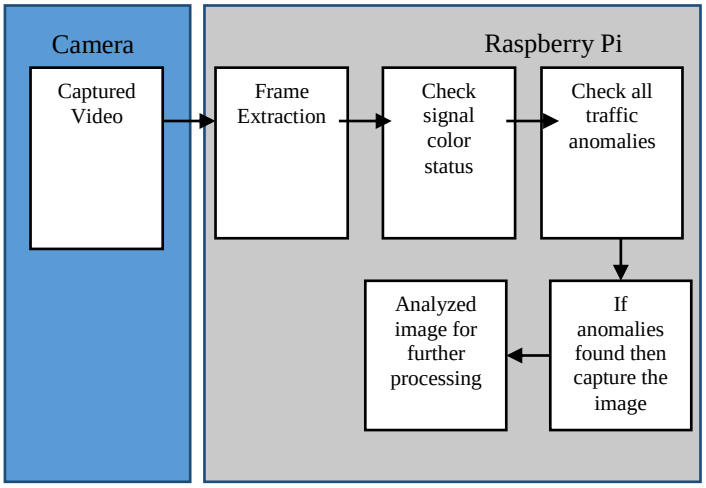

Figure 1. Proposed System

Determine in HSV(Hue, Saturation and Value)ranges then the first convert into RGB(Red, Green and Blue) image into the HSV format. The HSV ranges for Red color , Green color and Yellow color is detected by using image processing technique and the using image processing algorithm. The process of conversion on RGB to HSV value is as described as follow:
The color vision are processed it is use the RGB color space or HSV color space. RGB color space report .the colors in terms of quantity of red color, Green color and blue color are present. HSV color space descibes the colors in terms of Hue, Saturation and Value. In this case the color explain the plays,work and integral role .the HSV color model are preferred over the RGB model. The HSV model are describes the colors and this similarly to how the human eye tends to perceive color. RGB color is defined the combination of primary colors, whereas, HSV describes color using familiar differentiation as color, vibrancy and brightness. The basketball robot are use the HSV color space to process vision.

4. Result and Discussion

The result and analysis of the proposed system is presented in a qualitative and quantitative manner.

4.1 Qualitative Analysis

Basically the measure of something by its standard rather than there amount When we do the standardised analysis and we are exploring how we define anything. we cannot use the numbers or numerical expressions to define those things. When we do the standardised work, we work with there information, we work with feelings, we work with thoughts, and perceptions. We attempt to understand motivations and behaviors; the qualitative analysis is the pictorial representation of the approach.

The qualitative analysis of the proposed approach is as shown below:

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1. Zebra Crossing:

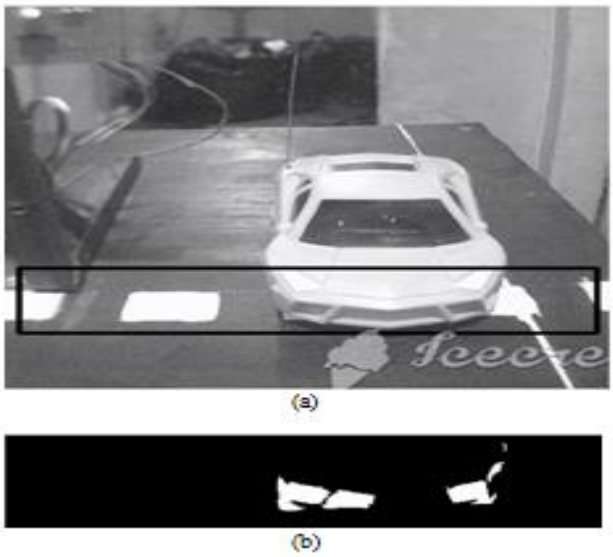

Figure 2.Vehicle on Zebra crossing

Figure 3. Vehicle not on Zebra crossing

Fig 2(a), shows the vehicle on the zebra crossing when the red light is ON. It is calculated by the frame differencing between the first frames where the object is not present and the current frame. It gives the difference and its binary image is as shown in Fig 2(b). When an object is detected, the frame is saved for further investigation and evidence.

2. Traffic Density:

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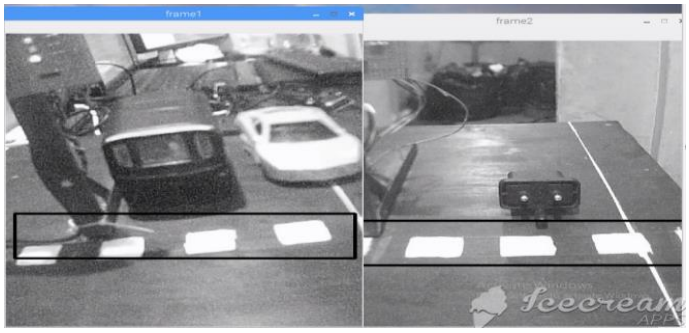

Figure 4a. Figure 4b.

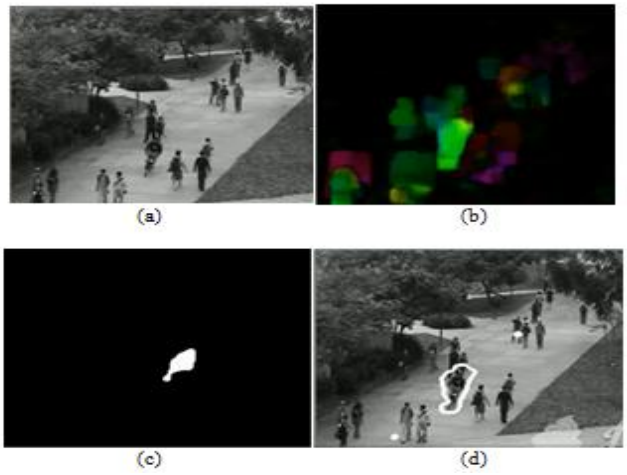

Figure 4c. Traffic Density

Figure 4(a), shows the traffic at signal 2 while Figure 4(b) shows the traffic at signal 1. It is observed that traffic at signal 2 is greater than traffic signal 1. Hence the green signal of signal 2 should be greater than signal 1. Figure 4(c) shows the time of green light at signal 1 is less than signal 2.

3. Speedy Vehicle Detection in the Pedestrian area:

```
count 96
2
True
count 97
2
True
count 98
2
True
count 99
connnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnn22222
1
True
count 10
1
True
count 11
1
True
count 12
1
True
count 13
1
True
count 14
1
True
count 15
1
True
count 16
1
True
count 17
1
True
count 18
1
```

Figure 5. Speedy Vehicle Detection

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Detection of the vehicle in the pedestrian area is also an anomaly. For this purpose, the UCSD database is considered

4.2 Quantitative Analysis

It works as an opposite, to estimate the amount rather than standard. When we dealt with the quantitative analysis of the system them we are trying to investigate measures, numbers, facts and percentages. Whenever we dealt with the quantitative work of system, then we are working with the numbers, formulae, statistics and data for better performance. The qualitative as well as quantitative analysis is vitally important to public relations.
In this approach, the accuracy is taken as evaluation metrics. The number of testing trials are taken and tabulated in Table 1.
.

Table 1. Anomaly Schedule

Situation	Input Positive Sample	Detected As positive	Input Negative Sample	Detected As Negative	Accuracy (%)
Zebra Crossing	50	46	50	49	95
Density	50	43	50	50	93

5. Conclusion

In the proposed system, it is observed that by using machine learning techniques are better to detect traffic anomalies in video surveillance. It envisions the proper actuality so it performs its functions much better than those systems that depend on vehicles metal content detection. In this system we got the 95% accuracy to detect anomaly on zebra crossing and 93% accuracy to detect the density of vehicles on traffic signals. This system is useful to overthrow the criminal and it is mostly used for the for traffic control. It is very simple to make system transferable and real time because it is implemented on raspberry Pi.

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