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Smart Traffic Detection and Control Using Canny Edge Detection Algorithm

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Abstract:

The project which is entitled as density based smart traffic control system using canny edge detection algorithm for congregating traffic information deals with problem of urban traffic congestion. As the population in the urban areas increasing there is a necessity for an effective and smart traffic control system using advanced and latest technology and equipment to improve the traffic control. The current methods for controlling traffic are timers or human control are proved to be ineffective as the traffic is increasing rapidly. In this project we are developing a method where the time is allocated according to the measure of the vehicle density using canny edge detection with digital image processing is proposed. This imposing traffic control system offers great improvement in response time, vehicle management, automation, reliability and overall efficiency over the existing systems. To implement this technique we are uploading the current traffic image to the application and application will extract edges from images and if there is more traffic then there will be more number of edges with white color and if the uploaded image contains less traffic then it will have less number of white color edges..

Keywords – Convolutional neural networks, medical image analysis, machine learning, deep learning.

I. Introduction

Fast transportation system and rapid transit system are important for economic development of any nation. Mismanagement and traffic congestion results in wastage of time, loss of fuel and money, there is a need for fast, efficient and economical traffic management system. The monitoring and controlling traffic become a major problem nowadays. The numbers of users are increasing day by days due to this proper management is being required and there is a need for smart traffic control system. To have proper traffic management there are several techniques are available. But no technique is perfect itself as the real-time situation is continuously changing and the no system is suitable to adopt the change continuously.

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There is two standard traffic control system such as 1) manual controlling: It requires manpower to control the traffic. Traffic police are allocated to that particular area and he will carry the signboard, sign light, Whistle.2) automatic controlling: Controlled by the timers and electronic sensors. The sensor detects the availability of the vehicle and according to that the timers are adjusted. But it has too many drawbacks not adaptable and not an efficient system. [4] We proposed a system for controlling density based smart traffic light control system in these is aims are to achieve goals:

- Distinguish presence and absence of vehicles in capture road image.
- Signal traffic light goes red when the road is empty.
- Signal the traffic light go green accordingly to the density of the vehicle and the duration of green light adjusted based on calculation.

This proposed system can be done by using mat lab software and aim to have proper traffic management. The camera is installed in the particular area where all the lanes are visible just above the traffic light. The film comes in the form of consecutive frames and each frame is compared with the first frame from which the density of car specified, further,

the number of vehicles are displayed on the screen. According to that traffic control algorithm is used to display the allocation time. Accordingly, the green light adjusted. Then the use of emergency vehicle detection is made which helps to detect the ambulance and the emergency vehicle accordingly the lane is given higher priority. These are passed on the hardware which is consists of ATMEGA 8 microcontroller for controlling traffic light and USART module for sending control information to the microcontroller. According to that, the traffic signal is being controlled. Using the information of traffic density is passed on the android application user can select the location as per his choice. It gives various locations along with the traffic status. This status provided information can use to choose the particular location to the destination. This application is easy and no extra cost is required. In this use of canny edge detection made because 1,) Have a proper detection, a strong response even at low. contours.2) a good location guarantee ensures .3) for a contour there will be only one edge detection avoid the effects of rebounds. [9] As per stated in [7], Here these shows the comparison between different edge detection technique such as zero crossing, Prewitt, LOG, Robert, canny and Sobel. The Canny edge detector is better than other techniques due to its higher accuracy in detection of an object with higher entropy, PSNR (Peak Signal to Noise Ratio), MSE (Mean Square Error) and better execution time. It's having better overall performance as compared to other techniques.

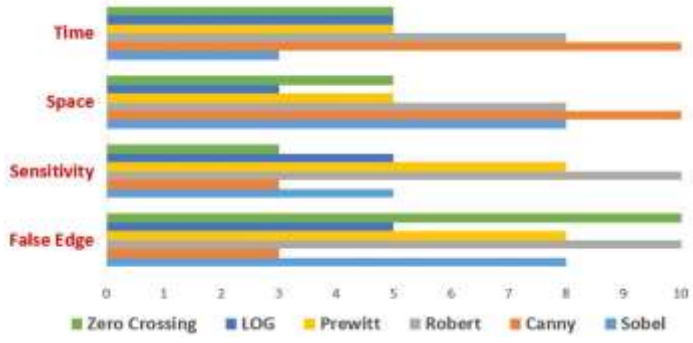

Fig -1: Comparative analysis of distinct edge detection technique.

In the BTS field, two main tumor segmentation approaches can be found: generative and discriminative. Generative approaches use explicit anatomical models to obtain the segmentation, while discriminative methods learn image features and their relations using gold standard expert segmentations [2]. Published studies following the discriminative approach have evolved from using classical Machine Learning [6–9] to more recent Deep Learning techniques [10–14].

2. LITERATURE REVIEW:

Automatic traffic monitoring system and traffic surveillance are important for road usage and better traffic control. There are various methods are available for traffic management, because it has become serious issues nowadays. There are various techniques are available using different sensors, RFIDs tags etc. Out of all these techniques, the image processing technique is better because it's having its own computer visions, adaptable to the particular environment. Low cost and avoids the distortion and provides the accurate output and helps to control the traffic light time limit, depending on the density of the vehicles. As per [1], the image is acquired by using the web camera and furthers it goes through the four stages such as image acquisition, RGB to grayscale conversion, Image enhancement, and image matching technique. Here the reference image is compared with the captured image and it goes through the different technique. In these RGB to the grayscale conversion of these two images are done further the binary conversion is made. Then gamma correction to remove the error and the edge detection technique using Prewitt edge detection technique. These two images are matched using image matching technique and further the percentage of image matching is used, to indicate the time allocation of a traffic light. In [2] the new technique is used to see the status of the traffic over the android application. When the count of the vehicles is detected, these are passed over the server its updates status as high traffic or medium traffic or small traffic. A new application user is required to update the information during login into the application. Then the application returns the various locations and update of the new location is also available. The user can use the status provided by the server to update the alternative paths to the destination. In [3] the input is taken via the camera of the reference image and the real-time image is passed through the grayscale conversion. Further, the grayscale converted reference image is cropped and is multiplied using the real-time image and the required area is only considered. Then the binary conversion is done the traffic density is detected by making the bounding box property the accurate number of vehicles can be detected. In order to deal with the noise added in different lighting condition at different times of a day, the set of the reference image is captured and stored accordingly different time slots of a day. The system cycles these reference image accordingly the current set of the day. In [4] the new technique is developed to detect the emergency vehicle detection in these the obtained binary image is a threshold in such a way that only red light can be detected. The headlight of the vehicle can be detected, so further the processing is done so that the blinking of redlight should be visible. When this red light is detected that lane is given the higher priority and the entire system is halted for that period of time so that the vehicle can pass easily through that lane. This is

helpful to detect the ambulance, fire vehicle etc. In [5] there are four steps such as Vehicle detection system, Vehicle counting classification system, Traffic signal control system and Data display system. Traffic signal control system detects the number of vehicles on the road and accordingly, the priority is assigned to the particular lane. Data display system display the total number of vehicles and the number of pixels each vehicle contain. Accordingly, the number of vehicles falls in which category is considered. In [6] in these two methods are used to find out the traffic density and both the methods will be used simultaneously. One is using gradient magnitude method and other by using direct subtraction method. This combination of the two methods helps to detect the vehicle without the distortion. The use of traffic control algorithm to implement the traffic system. We take the traffic density of the different roads at a given input time and accordingly the time allocation is done to the traffic signal. Time is allocated

based on traffic cycle and weight factor. This proposed system is implemented by acquiring the traffic information; the mat lab is used for image processing, an ATMEGA8 microcontroller for controlling the traffic light and USART module for sending the control information to the microcontroller. Accordingly, the controlling of the traffic signal takes place. In [7] is shown the various comparison of edge detection method, out of which the canny edge detection method is the best technique. Canny edge detector depicts the higher accuracy in detection with higher entropy, PSNR (peak signal to noise ratio), MSE (Mean square error) and better execution time. It has better overall performance as compared to another method. The image is captured by using the camera; the video is recorded and converted into the frames. The processing of the captured image and reference image. The gray scale conversion than the

Gaussian noise filter is used to eliminate the noise. Further, the use of canny edge detection is applied, the white point is count. Accordingly, the percentage matching and the time allocation is done. Further, these are implemented using the hardware in which the four ways traffic intersection model is designed. These four ways intersection model is consists of four arrays of LEDs with each array having red and green light. Python programming language is used for image processing and Arduino development board is used for controlling the LEDs. In [8] the image is captured by using camera than its converted into a grayscale image. The grayscale image is converted into the threshold image. The edge detection method using canny edge detector. On which the contour has been drawn in order to calculate the vehicle

count. The vehicles are boxed to find the count, the output screen in the command prompt to display the vehicle count.

Density measurement is implemented by using OpenCV software for image processing, by just displaying the various

conversion of the image on the screen. Finally surrounding the box on the vehicle in the given image. The number of

vehicles counted and the density of the vehicle is counted by using mat lab. In [9] the density of the vehicle count is done by using the video and the image. Overview of vehicle detection and counting system consists of the input frame,

segmentation, and detection, tracking, and counting. In these we have used vehicle detection using image processing

consists of the input image, Converting RGB to gray, Convert to binary, Edge detection, Image

enhancement, Labeling the detected region, Vehicle tracking and vehicle counting.

3. PROPOSED SYSTEM

3.1. The architecture of the system

In these cameras is placed at the top of the signal to have a better line of sight. Also, the clear view of the traffic on the

particular side of the signal so that it will capture an image and analyzes the image and get the count of the vehicle at

that particular side. This count helps to detect the density of the vehicle and accordingly the signal is adjusted. [8]

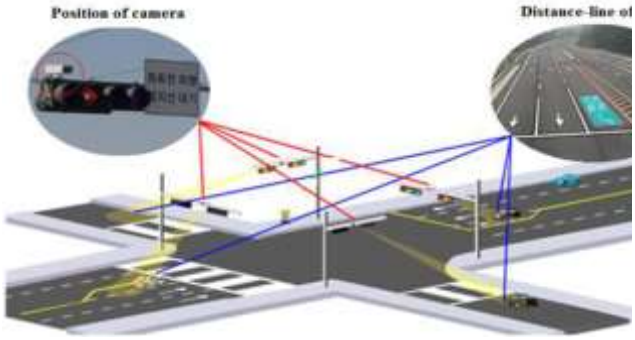

Fig -3.1: System Architecture

3.2. Traffic Information Extraction

Extracting traffic information from image, video camera is placed at an appropriate position is employed for image

acquisition. Camera video stream data is processed frame by frame, to determine how much traffic is on the road. In this background subtraction method is used, here the empty road will be the background image and the subsequent frames from the video camera will be foreground image. By subtracting the background image from foreground image we can find the traffic density of the road. These two methods are consisting of gradient magnitude and another direct subtraction method. As per stated in [6]. A. Gradient Magnitude

1. RGB to the grayscale image

In this, both background and foreground image is converted to RGB to a grayscale image. It's having superior signal

to noise ratio as compared to RGB image. While doing the conversion it's good to consider RGB values of each pixel and make the output as a single value reflecting the brightness of the pixels. FGrgb to FGgray, BGrgb to BGgray.

2. Edge Detection Method

In these, the use of canny edge detector is made for both foreground and background image because as compared to

detection method canny edge detector provides better overall performance. It's mainly used to outline the edges of

the objects. FGp from FGgray and BGp to BGgray.

3. This processed background and foreground image are subtracted to obtain the foreground objects which show only

the vehicle unnecessary area is eliminated. We obtain the object image.

$$Gobj = FGp - BGp$$

4. Filter

We need to do some noise removal to remove the noise introduced during subtraction. Here we choose wiener to filter it's having the ability to remove the additive noise and invert the blurring simultaneously. This filter is used for

finding pixel-wise adaptive Wiener filtering, by using neighborhoods of a size which you wish. Here its consider as

6*6 to estimate the local image mean and standard deviation. Before filtering we try to reduce small intensity pixels of all the value.

Gfilt = {Gtuned if pixel value ≥0

0 else } by subtracting fixed value and

then apply Wiener filter. [6]

Gtuned = Gobj -0.009 (fixed small value)

3.3. Vehicle Count

There are many drawbacks for algorithm search of connecting pixels due to this bounding box property is used to see the no of a vehicle on that particular lane [3]. After labeling the number of pixels of each labeled vehicle contain are counted and accordingly the vehicles are categorized as small, medium and large vehicles. To display the total no of vehicles, the number of pixels each vehicle contains, the number of vehicles falls into each category. Accordingly, the priority is assigned to the road. After comparing the number of vehicles, the traffic signal control assigned the priority which lane should be given first and accordingly the time limit is assigned. [5] For drawing the bounding box we equired to see the information about every region and bring a property of connected components of the binary image. The three properties are considered eccentricity, area and bounding box. Area: returns a scalar that specifies the actual number of pixels in the particular region. Eccentricity: the ratio of the distance between the foci of the ellipse and its major axis length the value is between 0 and 1. Bounding Box: These property helps to locate the vehicle by drawing the smallest rectangle containing the region specified as 1- by- Q *2 vector, where Q is the number of image dimensions.

4.CONCLUSION

This paper we discuss a method for estimating the traffic density on the different lane based on image processing, we can use it to count the number of dynamic vehicles that are passing on the highway and to control the traffic. These are advantageous technique over such as the use of Ariel imagery, complex sensor-based system and using any additional devices, such as RFIDs. The image is acquired by the camera and it's being placed at a particular height. Traffic information extraction is done by combining the two techniques such as gradient magnitude and frame subtraction method. The vehicle count is found out by using bounding box property, further according to the traffic control algorithm we can allocate the time limit to the particular lane according to the traffic density. The use of emergency vehicle detection algorithm helps to detect the vehicle such as ambulance, fire vehicles etc. Helps to give the priority to those emergency vehicles. The controlling of traffic light takes place through the microcontroller ATMEGA8 communication takes place through USART and accordingly the traffic light control based on the priority assigned. The use of the Android-based application to detect the traffic status to the user and accordingly decided the path to the destination. It helps to save the time and also to control the traffic.

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