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Road Sign Recognition and Lane Detection using CNN with OpenCV

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Abstract — As a result of road traffic crashes, approximately 1.35 million people die each year, and between 40 to 70 million are injured drastically. Most of these accidents occurs because of to lack of response time to instant traffic events. To develop such recognition and detection system in autonomous cars, it is important to monitor and guide driver through real time traffic events. This involves Road sign recognition and road lane detection. In order to make the driving process safer and efficient, a plan is made to design a driver-assistance system with road sign recognition and lane detection features. In this system we have focused on two important aspects, Road sign recognition and lane detection. The process of road sign recognition in a video can be broken into two main areas for research; detection and classification using convolutional neural networks. Road signs will be detected by analysing colour information, which can be red and blue, contained on the images whereas, in classification phase the signs are classified according to their shapes and characteristics. Along with road sign recognition we also focused on Road Lane detection which is one significant method in the visualization-based driver support structure and capable to be used for vehicle guiding and monitoring, road congestion avoidance, crash avoidance.

Keywords — Histogram , Sobel Edge Detection , Canny Detection , Neural Networks , Gussian filters

I. INTRODUCTION

Image processing is among rapidly growing research area today, with in application in various aspects of a business. Image processing is used to convert an image into digital form and also to receive some kinds of information from the same. The two types of methods used and for image processing include analog and digital image processing. Digital image processing techniques helps in manipulation of digital images by using computers. It uses computer algorithms to perform image processing. Camera based traffic sign recognition is a valuable tool for any drivers, particularly with respect to signs indicating danger and speed limits and other different signs. Our system is able to recognize selected traffic signs, identify their meaning and sustainably assist the driver in adapting his or her driving style to the situation and regulations. Detector and Classifier are two main module that used in TSDR. Detector can be implemented using algorithms such as color based, and shape based. Detected traffic signs may need to be preprocessed and corrected before classification stage. The classifier will make use of machine learning techniques such as vector machine to identify the traffic signs. This detection are often done through canny edge detection algorithm. Canny Edge Detector is that the best and widely used algorithm for edge detection. This algorithm provides robust Detection, Localization and Number of response. In this system we use of wavelet compression technique for compression of traffic signs this technique is used because this makes system computationally fast and reduce space complexity. For classification and recognition of traffic sign we use of CNN technique. Template matching technique is a technique to find of small parts of an image which match a template image, this approach may prove further useful if the match in search image might be transformed in some fashion. In this paper we proposed novel method for recognition and identification of traffic signs and addition to that we used compression technique to make the computational fast. This paper is organized as follows: A brief literature survey and limitation of existing works. Working system of proposed method is presented and detail description of dataset is used, and we present of experimentation and obtained results

II. LITERATURE SURVEY

There are many different techniques and different algorithms were used to recognition of traffic signs. TSR support driver to identifying traffic signs by fast computational using the effective algorithms to improve driving safety and make comfort to driver This Canny Detection method is one technique to recognizing of traffic road signs, in this method traffic signs is recognized by seeing outlines in traffic signs, they use artificial neural network for recognizing the traffic signs and they use HSV algorithm to recognize traffic signs which are in cylindrical shapes.[1].Some of present proposed system they only able to recognize of traffic signs which are in round shape traffic signs. They used normalized corelation to match pattern of between captured image and stored image [2]. using Hough Transform and correlation technique is used for classifying and recognizing of red color traffic sign boards, here Noise Removing, Thinning, contrasting operations are implemented in their system [3].

The method can detect all seven main categories Chinese traffic sign, they have trained and compared three models VGG16, VGG_CNN_M_1024 and ZF but they don't have accuracy in obtaining ground truth and the classes of the sign detected automatically [4]. There are many methods in preprocessing of image like Averaging Filter, Guessian Filter, Un-sharp Mask Filtering and when there is a potential danger of collision Automatic Braking System (ABS) and an audio-visual warning signal is given [5]. GLCD display is interfaced to Raspberry Pi for displaying alert text messages, and they used Region of Interest (ROI) method is used to detect the specific character in street board.

III. SYSTEM ARCHITECTURE

In this project, different traffic sign are detected which are of different shape and color. Where the camera is placed back in rear mirror, used to record video. The process consists of 9 modules, video input, image frames, compress image, segmentation, pre-processing, canny edge detection, image classification, recognized result, output comes as alert text and display at User Dashboard. Video input is taken from camera which is placed back in rear mirror, then from the video every frame is processed by compressing image by wavelet compression method, where Discrete Wavelet transform(DWT) is used to compress image. DWT is applied that quantifies the signals by measuring the distance between the zero line and points along each wavelets and records record this distances as coefficients. The coefficients of adjacent images are averaged to produce a simplified version of the signal or wave, which process effectively half the size of the image description. This process is repeated again and again until producing smaller waves. This process is called decomposition. Then after compression, segmentation is processed.

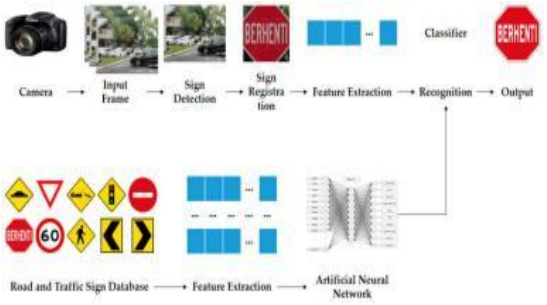

Fig. 1 System Architecture

Where in this the sign board is segmented using color pixel method, where the sign board is detected using pixel intensity value of the sign board colors like red, white, and black. Where every pixel in the image is scanned for the pixel intensity value, when the value is found then the region of that image is put into bounding box. Then the segmented image is pre-processed, where converting into gray scale and removing noise using median filter. Then detecting edges using canny edge detection method. The image is converted into binary image because it makes easy for classifying the image and the processing time also decreases. The classification is done using templates matching method, where the processed image is compared with the templates which is stored in the database. After recognizing the image, the output comes as alert text and display at User Dashboard.

IV. ALGORITHM AND METHODOLOGY USED

In this project we stored the binary images in database which are of different categories of sign board images, which are of canny edge detected images. This is used for comparing the images which are captured by the camera and processed into binary image. This comparison is made using template classification method, where by using binary images the we can decrease the process time. Because, the binary image as one pixel per bit, this make easy for check each pixel faster than other gray scaled or colored images. In this project we have completed with compressing image, segmentation, pre-processing and canny edge detection.

A. Compressing Image

Compression of image means reducing the amount of data required to represent an image. The method used for compression is wavelet compression, which is best compression used for compression. This reduce the pixel size from 1/8 to 1/4 bit per pixel, which is the half the size of pixel. Wavelet is a function use to divide/cut the images to know about their frequencies, this frequency is used to study about components with a resolution matched to its required. Entropy encoding means representing frequently occurring pattern with few bits and rarely occurring patterns with many bits.

B. Segmentation

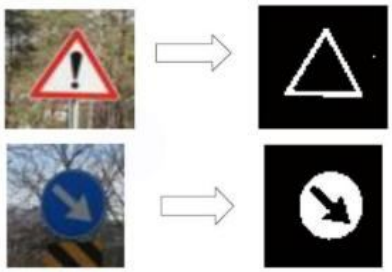

Fig. 2 Shape and Color Segementation

Compression of image means reducing the amount of data required to represent an image. The method used for compression is wavelet compression, which is best compression used for compression. This reduce the pixel size from 1/8 to 1/4 bit per pixel, which is the half the size of pixel. Wavelet is a function use to divide/cut the images to know about their frequencies, this frequency is used to study about components with a resolution matched to its required. Entropy encoding means representing frequently occurring pattern with few bits and rarely occurring patterns with many bits.

Step 1 : The number K value is Fixed.
Step 2 : Choose the K-value randomly as cluster value.
Step 3 : Assign each pixel to the cluster with same seed point.
Step 4 : Go back to 2nd step when there is no more new assignment.

C. Pre-processing

In this Pre-processing step mainly 3 steps included namely conversion of RGB to Gray scale image, compression of segmentation of images using wavelet compression technique, this technique is widely used in image processing this algorithm compress images reduce up to 50% of its original size. In this step it helps in fast computation of system.

D. Canny Edge Detection

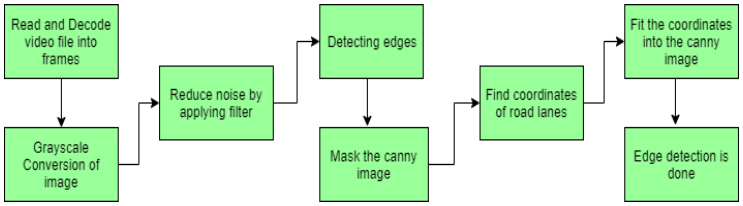

Fig. 3 Canny Detection

Canny Edge Detection is multi-stage algorithm is used to detect wide range of edges in image frames. In this the edges in the images are detected using Canny Edge Detection algorithm. Edge detection is the process of identifying the edge in a digital image where the intensity of the image changes sharply or has discontinuities. Canny edge detection is the Most Effective and widely used algorithm for edge detection. This is used for classification of images in the next module.

E. Convolutional Neural Network

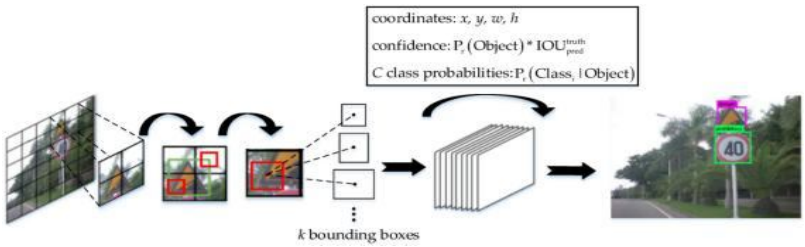

Fig. 4 Convolutional Layers

In order to get rid of those false detected windows, we use a special classifiers such as CNN. It is the state of the art pattern recognition method in computer vision. Each convolutional layer consists of a set of trainable filters , computes dot productions between these filters and layer input to obtain an activation map. These filters are also known as kernels which allow detecting the same features in different locations..

F. Histogram of Gradient

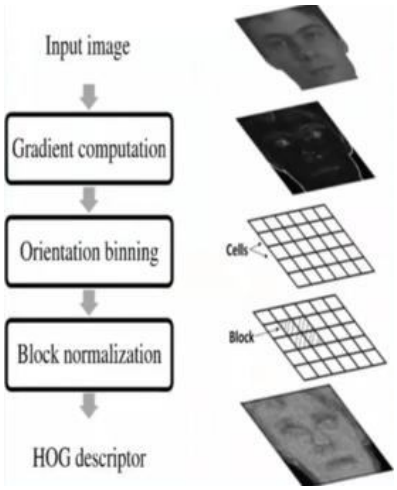

Fig. 5 Gradient Detection

In computer vision and image processing, Histogram of Gradients is often utilized to describe features of the object. Features of local area can be calculated by statistic image histogram oriented gradient. Gradient exist in the edge of the region, and the statistical information of gradient is often able to express the object contour well. So that, HOG is usually employed in target detection.

G. Sobel Edge Detection Algorithm

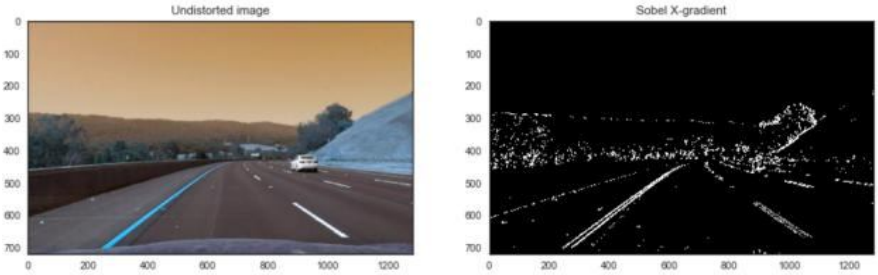

Fig. 6 Sobel Edge Detection

Sobel Edge detection is a Most widely used algorithm of edge detection in image processing. Along with Canny , Sobel is one of the most popular & effective edge detection algorithms used in today's technology. The Sobel filter is used for Edge detection. It works like by calculating the gradient of image intensity at each pixel within the image. It finds the direction of the largest region increase from light to dark and the rate of change in that direction.

V. RESULTS

Real time Traffic Sign and Edge Covered input video is Used in our Project where we have given Segemented Some Sign short videos as an Input Test Cases for quick processing and it detected Expected Sign and Lane with giving text msg at dashboard .

A. Steps for Implementation

1) *Step 1 :* SignUp Needed Once for Every New User .
2) *Step 2 :* DirectlyLogin after successful Registration in System'
3) *Step 3 :* Select the Process for Detection as per Our Requirement.
4) *Step 4 :* Successfully Detected Traffic Sign / Road Lane .

Fig. 7 Signup Window for New User

Fig. 8 Login Window For Authentication

Fig. 9 Selection Process

Fig. 9 Traffic Sign Detected

Fig. 10 Road Lane Detected

VI. CONCLUSIONS

The goal of this research is to develop an efficient Traffic Sign Recognition and Lane Detection System based on Indian traffic sign dataset. In this paper "Traffic Sign Recognition with Lane Detection System" has been Introduced. Two driving task are considered, Lane Detection and Traffic Sign Recognition. Firstly, lane detection method has been developed which is based on Histogram of Gradient & Sobel Algorithms. This approach for safe lane system has developed a safety system for avoiding lane departure for a large and complex set of traffic scenarios. Then Second, traffic sign recognition system has been developed which is based on canny edge detection algorithm, efficient approach for traffic sign recognition system was developed extensively through various tests set. The result prove the efficiency of the presented algorithms and shows that our approach could have good prospects for application.

VII. FUTURE WORKS

The future scope of the Sign Recognition And Lane Detection System includes complex environment taking into account the different environments such as the weather conditions eg. Fog, Mist, Cloudy, Sunny, Darker Shadow or when there occurs obstacles and humps, speed breakers in the road. Another aspects of Sign recognition system that it could recognise less known traffic signs that are used in various countries.We would also connect the steering wheel mechanism to lane detection system for more safer driving experience

VIII. ACKNOWLEDGMENT

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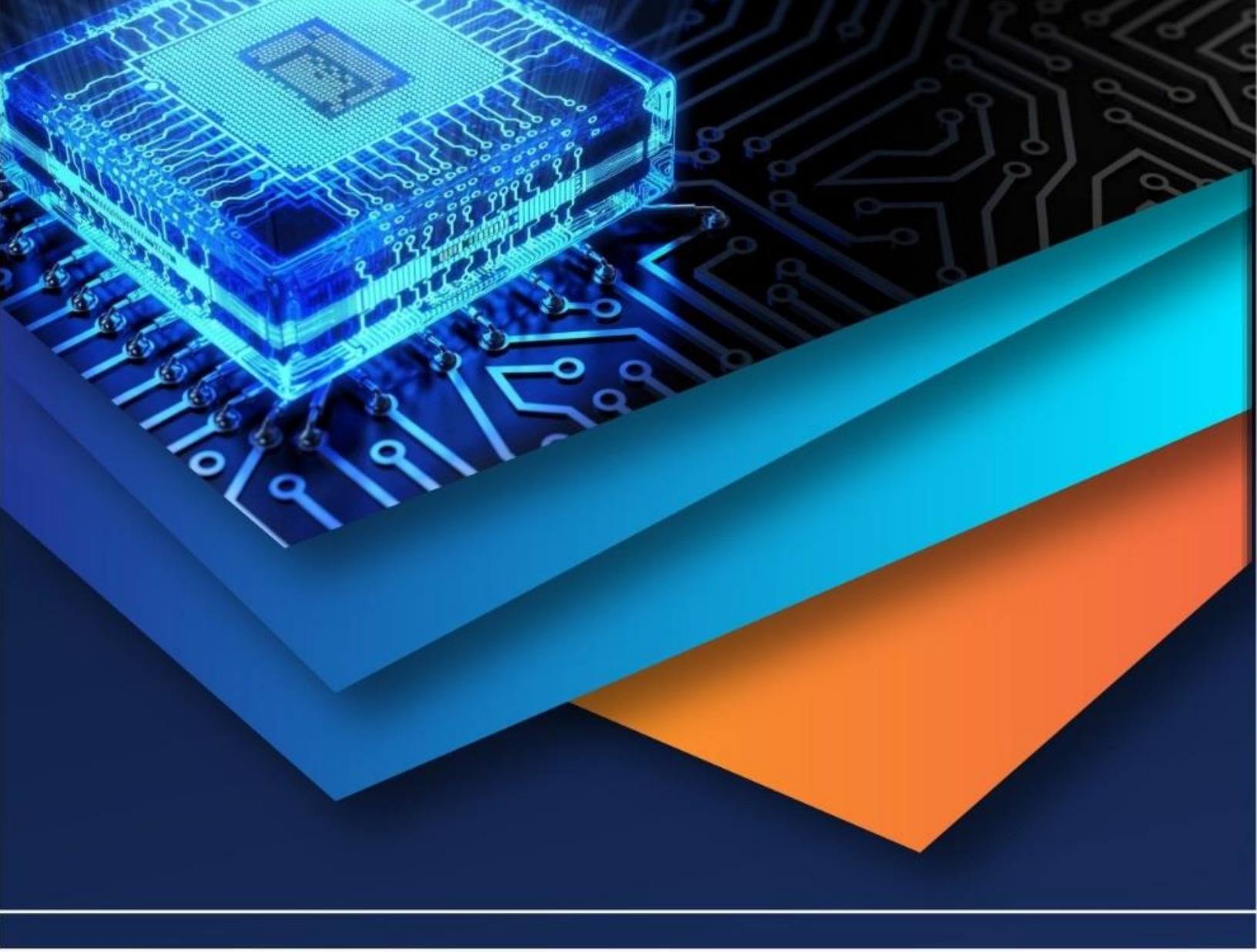

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