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Highly accurate DAS for detecting speed limit signs

Gifty Saju
sajugifty94@gmail.com
Mangalam College of Engineering, Kottayam, Kerala

Anna Prethibha Shobak
anna.shobak@mangalam.in
Mangalam College of Engineering, Kottayam, Kerala

ABSTRACT

Driver Assistance Systems (DAS) are the systems to help the driver in the driving process. This work checks the road in front of a vehicle and detects speed limit sign. Highly reliable and accurate classification is done through three main phases named acquisition, detection, and recognition. Optical Character Recognition (OCR) technique is used in this algorithm to recognize traffic sign templates. This proposed system results in more accuracy over existing DAS. The capacities and vigor of the proposed system are tried against various situations.

Keywords: *Driver's assistance system, Automotive machines, Traffic sign detection, Optical character recognition.*

1. INTRODUCTION

Speed limit sign identification is a little challenging issue. Due to this, the speed-related traffic accidents have an enormous increase. Additionally now and then the drivers redirect their consideration from the heading to some other action. For reducing risk many technologies have been introduced. Those systems help the driver by rendering warnings, instructions etc [1, 2].

Speed limit sign tracking and recognition are one of the essential targets in this exploration. In the intelligent vehicle driving system, the automatic identification and reorganization of speed limit signs would be a very critical component [5].

The purpose of this system is to gather direct data for the driver with a specific goal to help the driver for a protected drive. Such systems alarm the drivers about the helplessness to dangers and troubles around them, they can give preventative guidance to the driver and henceforth make drive secure and to maintain the current speed within the speed confine zones. This will decrease the measure of accidents caused by over-speed. The speed limit sign recognition is a major and challenging task for a Driver's Assistance System (DAS). The general point of this system is to ensure the traffic safety and driving-comfort.

Reorganization of the traffic sign from a live digital frame is the major objective of this paper. The signs viewed from different frames (different angles) will then be marked after identification. The recognition of speed limit templates is done by Optical Character Recognition (OCR) based template matching technique. The LCD placed in the car show the digital display of detected speed. A normal street gives a tangled scene irregular movement. It might have people on foot, transports of various vehicles, shop boards and traffic signals to control the vehicles on the streets. Hence it is a difficult task [8].

2. PROPOSED ALGORITHM

A. The Acquisition phase

The automatic identification of speed limit boards by the system can be divided into a number of modules which is shown in Fig1. Image captured from a live digital frame is the input to the system. The preprocessing obtains and stacks the frames from the video. It also adjusts the brightness, clarity, contrast, and brightness.

B. The Detection Phase

This phase is also known as Color Segmentation. It wipes out all background objects and pointless data in the picture. This step decreases the number of operations in the following modules as it reduces the number of probable objects.

This picture and an informational collection of some more pictures are utilized to test the system at first. As red is the shade of interest so most importantly red parts will be subtracted from whatever is left of colors i.e. green and blue.

This extraction of red shading from rest of color is the major step in the detection phase.

The median filter is then applied to the picture got after the extraction of red part. It is a nonlinear digital filtering approach which helps to remove noise. It is generally utilized as a part of expelling salt and pepper impulse noise.

After the utilization of Median filter, small noise components will be evacuated and furthermore, it will make the edges of the image more sharp and fresh that will help in the detection of a traffic sign. A binary picture is represented by M×N matrix where 1 (true) or 0 (false) are the pixel value. This is finished by characterizing a specific level in the range [0, 1] called the threshold value. This will change all points in the input pitcher above threshold with 1 and points below threshold with 0. The binary image may contain a number of flaws. Morphological picture preparing is a blend of nonlinear tasks related to the shape or morphology of highlights in a picture. Morphological tasks depend just on the relative ordering of pixel values, not on their numerical values, and consequently are changed to the preparing of binary pictures. Morphological techniques search an image with a small shape or template called a structuring element.

A morphological activity [4] when connected to a binary image makes another binary image with morphological tasks. The essential enlargement, fill in picture areas and holes and morphologically close

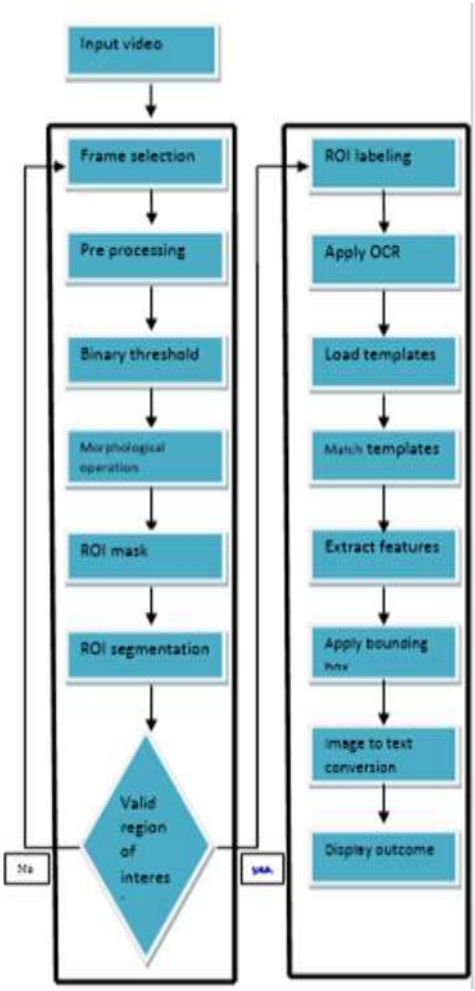

Fig 1: System Overview

picture is utilized in order to remove all the unwanted noise and acquire a picture.

After the implementation of filtering and morphological activities, a mask is gotten. Mask creation is an important step in the detection phase. This mask is then used to identify the traffic sign. This mask is then multiplied by the original picture to get the detected sign. At the point when the mask is multiplied by original picture, background vanishes because of multiplication with 0‘s and speed limit sign holds as it is multiplied with the 1‘s of the mask. After detection, this block will take the information and make the last output. Without an ROI distinguished, nothing will be outputted. In the event that an ROI has been distinguished the system will highlight that sign.

C. The Recognition

After fruitful identification of traffic sign, following stage is to recognize the sign. Recognize is critical as to illuminate the driver about the idea of the speed limit sign. The technique utilized for this intention is Optical Character Recognition (OCR) [6]. Template matching is a system model that is noteworthy to recognize the characters or letters in order by contrasting two pictures of the character. Keeping in mind the end goal to apply this technique, perfect detection is required. To perfectly recognize the sign with least noise, some additionally filtering is done. It includes Laplacian, Sobel and averaging filters [9], to upgrade the edges of detected sign and expel any little noise parts left.

Template matching is utilized as a part of OCR technique. This technique can be applied just with the template pictures. It is utilized to discover the pixel level in the template picture. Numerous template matching technique is utilized as a part of picture handling, which is utilized to discover the area of the search image. This procedure utilizes a database of characters called templates. There exists a format for all conceivable input characters.

Performance Index Method techniques are used here [3]. By representing the coordinates of each source image and template (search) image we adjust the center. Then calculate the sum of products between the coefficients in input and template. Sum of absolute differences (SAD) is a measure of template matching used to match the intensities of the pixels in the image [7].

The driver can easily identify the speed limit sign from the device just in front of him. A HUD, also known as head-up display or heads-up display [10] is used here for this purpose. This presents data without requiring users to look away from their usual viewpoints and it is a transparent display.

Fig 3: HUD

3. RESULT ON DISCUSSIONS

During this research, diverse pictures were gathered from neighborhood condition (Pakistan urban and provincial territories) for the growth and confirmation of the algorithm utilized for traffic sign recognition. Around 115 pictures and 20 recordings were gained from various roads with various lightning conditions

The camera was set to 640x480 pixels. Obtained Images were in JPEG, PNG and BMP format. Camera can gain 30FPS. Color modes were RGB color space. Processing is completed on each tenth frame. In any case the speed of the car is depended. Fig.6 demonstrates some example pictures whose outcomes are compressed in Table. The processing time of every division algorithm have no such remarkable delay happening in classification and recognition stage. Generally misclassification rate is detailed by the correct and false positive and correct and false negative parameters:

$$100 \times \left[\frac{C_P + C_N}{F_P + F_N + C_P + C_N} \right] = \text{ACCURACY}$$

Where Cp → True Positive
Cn → True Negative
Fp → False Positive
Fn → False Negative.

Our purposed system collected 314 images as a truly positive image and 271 as false positive images with an accuracy of 97.5%. The existing systems classify 290 true positives and 268 as false positive images with an accuracy of 93%.

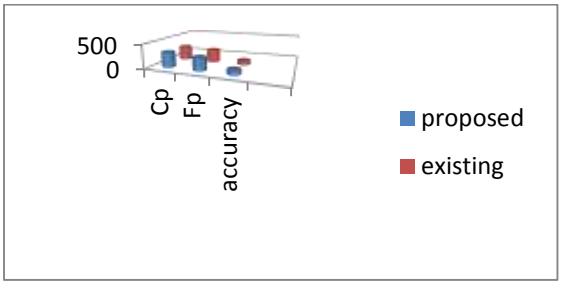

Fig 5: Case I

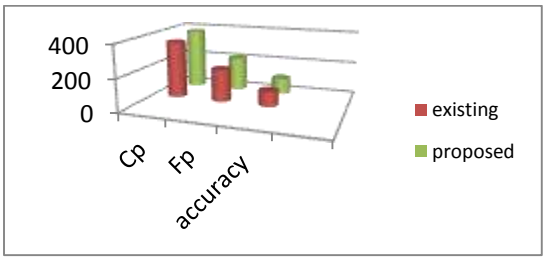

Fig 6: Case II

Table-I: Performance Evaluation Results

	Classification type	True positive	False positive	Accuracy
Case I	Proposed Method	314	271	97.5%
	Existing method	290	268	93%
Case II	Proposed Method	378	212	98.3%
	Existing Method	353	202	92.5%

4. CONCLUSION

The viability of proposed system is processed by contrasting the outcomes and ground truth pictures. The examination has been made with regular method and proposed method for traffic sign identification system in Table I. The current model shows lower accuracy rate than our proposed method for classification.

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