An Efficient Approach for Traffic Sign Text Detection and Recognition based on Canny, Sobel and Clahe Algorithm

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Abstract : A Image text detection and recognition is key research area due to lot of advance application in various engineering field. This work addresses end-to-end scene text recognition, which is divided into a text detection drawback and a text recognition drawback. For such reasons, an enhanced algorithm is proposed in which image is preprocessed before detection phase. This paper proposed four different technique implementation using MATLAB software. Canny edge detection, sobel edge, CLAHE edge and canny-CLAHE edge detection techniques and recognition algorithm are implemented for image traffic sign text and simulated. Simulated result shows the significant enhancement of simulated parameters as compared to the existing techniques.

***IndexTerms* – Traffic, CLAHE, MATLAB, Text, Detection, Recognition, Image.**

I. INTRODUCTION

Traffic signs are road facilities that convey, guide, restrict, warn, or instruct information using words or symbols. In the last three decades there was an increase of road traffic, although the number of people killed or seriously injured in road accidents has reduced. This indicates that even if our roads are now more overcrowded than ever before, they are safer due the main advances in vehicle design, such as improved crumple zones and side impact bars. This can also be assigned by passive technology, like seat belts, airbags, and antilock braking systems. According to the department for transport difficulties in detecting and recognizing traffic signs.

Now days it is difficult to find new models that do not include some sort of driver assistance system. Manufacturers are emphasizing the development of safety equipment with an aim to reducing the number of accidents caused by driver distraction and to reduce the seriousness of such accidents.

The commonplace driver assistance systems we have now are precursors of what will eventually become fully automated driving by the year 2025. However, we won't have to wait that long to be able to drive with a special auto-pilot mode for freeways (limited-access highways), a system that is expected by the year 2020.

This automated driving is being introduced into the marked gradually so that drivers can get used to this way of traveling in a car and can gradually gain confidence in it. The basic functionality is found in driver assistance systems that are more and more capable of providing semi-automatic driving by, for example, helping the driver to change lanes or stay in a lane, to brake when approaching an obstacle or pedestrian, or adaptive cruise control that helps the driver to maintain a certain speed when driving along a freeway.

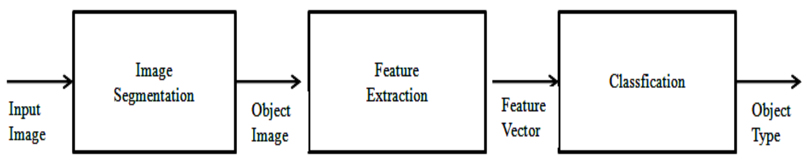


Figure 1: Basic of Segmentation

This system appeared for the first time in a BMW model in the year 2008. At first it detected only speed limit signs, but it has developed a great deal in terms of precision, quality, night recognition, and the number of different signs identified; there are even models that show these signs on the windshield at the driver's eye level using the head-up display system.

The purpose of this technology is to help improve the driver's safety on the road, especially when he or she is tired or has failed to notice signs and signals. At one time or another, hasn't every driver wondered what the speed limit was? This happens because signage can vary from one section of highway to the next, creating confusion and even distracting the driver.

Good signs on streets and highways are vital for safety, since in addition to regulating traffic, it informs the driver of the condition of the roads. This is why it is such a great step for road safety to have a system that is capable of detecting and recognizing signs automatically and in real time on the basis of images captured from a moving vehicle.

The current challenge is to combine this sign detection system with other driver assistance systems, in order to offer greater comfort and safety to drivers, all with the same final objective: to achieve fully automated driving and zero accidents on our streets and roads.

II. BACKGROUND

Y. Zhu et al., present strategy utilizes the qualities of traffic signs to improve the effectiveness and exactness of content recognition. On other hand, the proposed two-arrange location strategy decreases the hunt zone of content discovery and evacuates messages outside traffic signs. [1]

G. H. de Oliveira et al., presents a strategy for location, division and acknowledgment of content based traffic signs from pictures breaking down and preparing strategies. The outcomes show that the computational expense and precision rate considering the proposed methodology are adequate to ongoing applications, with an execution time under 0.5 seconds, with a hit pace of 94.38% in the plate location, 83.42% in the character division and 89.23 in the digit classification. [2]

M. Baştan, et al., The creators present an edge discovery and recuperation system dependent on open dynamic shape models snakelets to relieve the issue of uproarious or broken edges delivered by traditional edge location calculations, as Watchful. The thought is to use the local congruity and smoothness signs gave by solid edges and develop them to recoup the missing edges. [3]

X. Yuan, et al., most of existing traffic sign location frameworks use shading or shape data, however the techniques stay limited with respect to identifying and sectioning traffic signs from an intricate foundation. In this work, it is propose a novel diagram based traffic sign recognition approach that comprises of a saliency measure arrange, a chart based positioning stage, and a multithreshold division organize. Since the chart based positioning calculation with determined shading and saliency consolidates the data of shading, saliency, spatial, and relevant relationship of hubs. [4]

W. Zhang, et al., The calculation recommends every coefficient in high-recurrence sub bands as the grouping highlight, proposes a figuring strategy for the best bunching number, and characterizes the sign and commotion in the grouping results. Exploratory outcomes show that the visual quality and assessment files beat different techniques with no edge conservation. The proposed calculation viably acknowledges both despeckling and edge protection and arrives at the best in class execution. [5]

R. Tiwari et al., A strategy for removing significant lines from a 2D picture is displayed. The oddity lies in that significant lines are enlisted from the maximally produced at this point well-diminished zero limit Watchful edge joins dependent on the, supposed, Sobel features as the guide for enrollment. The Sobel features presented here speak to the scores amassed at singular pixels that measure their noteworthiness of framing line sections along Sobel edge directions. [6]

T. Ayyavoo et al., This investigation shows an illumination pre-handling strategy named as 'Discrete wavelet transform enhanced contrast limited adaptive histogram equalization' (DWT E-CLAHE) to perceive the front view facial pictures in the troublesome light conditions. An ongoing picture upgrades technique CLAHE-DWT rouses to consolidate the two-dimensional discrete wavelet transform (2D DWT) and CLAHE. [7]

K. Kim et al., The CLAHE and DWT techniques improved the contrast and sharpness of pictures. At long last, an enhanced picture was created by melding the CLAHE and DWT pictures. To exhibit the adequacy of the proposed strategy, the creators performed target picture quality evaluations, etc. Through an assortment of analyses for different indoor and outside pictures with haze, the proposed technique was demonstrated to be exceptionally powerful. [8]

III. PROPOSED METHODOLOGY

The identification of traffic signs is usually accomplished in two main phases: detection and recognition. In the detection phase we can distinguish the following parts: pre-processing, feature extraction, and segmentation. As we can see a whole chain of image processing steps are required to finally identify the traffic signs. The first step in the detection phase is pre-processing, which may include several operations.

(a) Sample Image-1 (b) Sample Image-2

Figure 2: Sample images for input of proposed algorithm

Detection and Recognition can be done by following steps and Approaches-

- Pre-processing.
- Feature extraction.
- Segmentation.
- Detection.
- Classification and recognition.

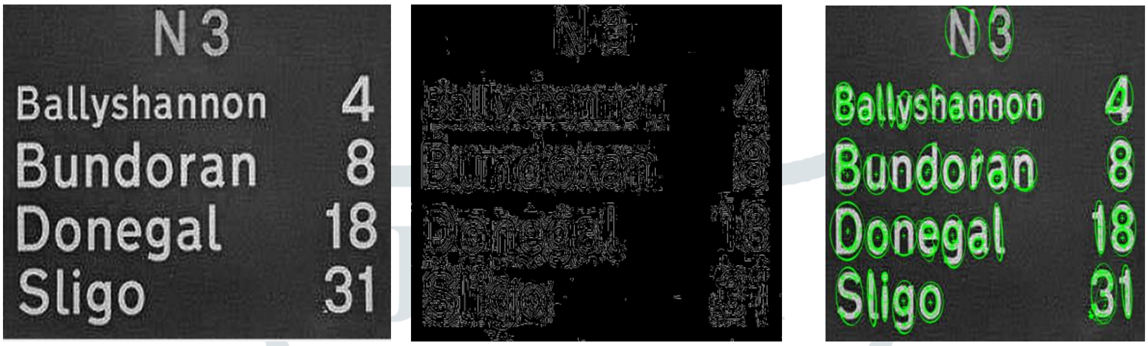
Approaches-

- Neural Network
- Optical Character Recognition
- Maximally Stable External Regions

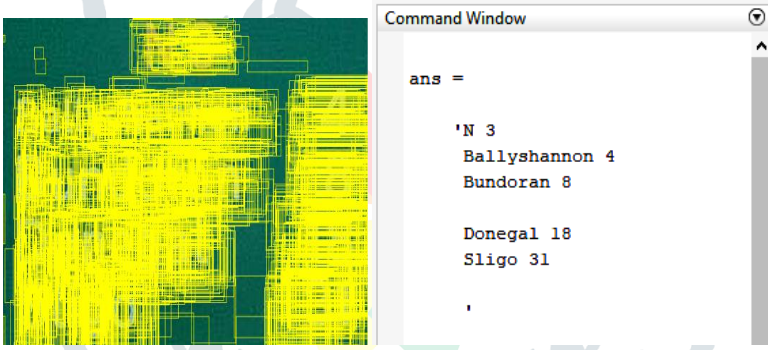
IV. SIMULATION RESULT

Results of method with CANNY Contrast Adjustment Sample Image -1

(a) Input Image (b) Crop Image (c) Enhanced Image



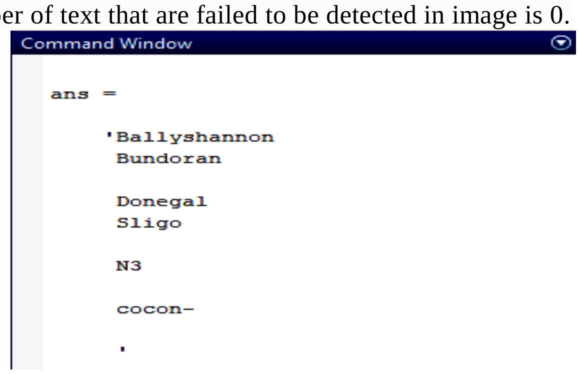
(d) Gray level Image (e) Canny Edge Image (f) MSER Regions



(g) Bounding Box (h) Detected Text

Figure 3: Result with CANNY Enhancement for Traffic sample image-1

In figure 3, showing results of proposed method with CANNY Enhancement. Input sample image shows in first part (a). Then image is crop using imcrop command, it shows in part (b). Now image is enhanced, shows in part (c). Convert image into gray level in this part (d). Now apply canny edge image for edge detection in part (e). In part (f) apply maximally stable external regions (MSER). Then, the bounding box is merely the coordinates of the rectangular border present in part (g). After successfully simulation of sample image 1, detected and recognised image text output shows in command window of MATLAB i.e shows in part (h). Therefore the total the number of correctly detected text in image is 40, the number of text incorrectly identified in image is 0 and the number of text that are failed to be detected in image is 0.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Command Window

ans =

    'Ballyshannon
     Bundoran

     Donegal
     Sligo

     N3

     cocon-

     '
```

Figure 4: Result with Sobel enhancement for Traffic sample image-1

Figure 4 presents the successfully simulation of sample image 1, detected and recognised image text output shows in command window of MATLAB. Therefore the total the number of correctly detected text in image is 34, the number of text incorrectly identified in image is 6 and the number of text that are failed to be detected in image is 0.

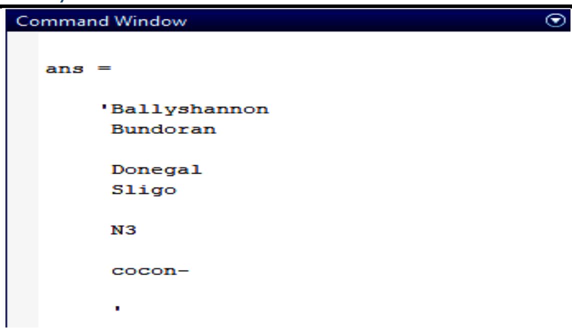

Figure 5: Result with CLAHE enhancement for Traffic sample image-1

Figure 5 shows the bounding box is merely the coordinates of the rectangular border present and after successfully simulation of sample image 1, detected and recognised image text output shows in command window of MATLAB. Therefore the total the number of correctly detected text in image is 34, the number of text incorrectly identified in image is 6 and the number of text that are failed to be detected in image is 0.

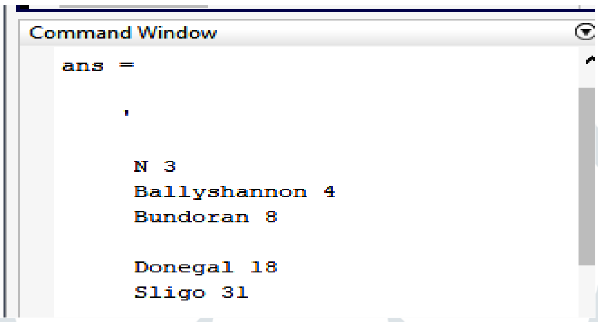

Figure 6: Results of the proposed method (Canny- CLAHE) for image of Traffic image-1

Figure 6 shows that the total the number of correctly detected text in image is 40, the number of text incorrectly identified in image is 0 and the number of text that are failed to be detected in image is 0.

After successful simulation of all images using canny, sobel, clahe and canny-clahe algorithm, some parameters are calculated using following formulas-
Precision, Recall, Fmeasure and simulated time is calculated in this simulation.
Precision = TP/ (TP+FP)
Recall = TP/(TP+FN)
Fmeasure = 2* (Precision* Recall) / (Precision + Recall)
Where ,
True Positive (TP) = correctly detected text in image
False Positive (FP) = Text incorrectly identified in images
False Negatives (FN) = Text that are failed to be detected in image.

Table 1: Simulation Parameter of traffic sample image-1

Sr No.	Parameter	Values
1	Precision	1
2	Recall	1
3	$F_{measure}$	1
4	Time (Sec)	12.11

(a) Canny Edge

Sr No.	Parameter	Values
1	Precision	0.85
2	Recall	1
3	$F_{measure}$	0.91
4	Time (Sec)	14.26

(b) Sobel

Sr No.	Parameter	Values
1	Precision	0.85
2	Recall	1
3	$F_{measure}$	0.91
4	Time (Sec)	18.45

(c) CLAHE Edge

Sr No.	Parameter	Values
1	Precision	1
2	Recall	1
3	$F_{measure}$	1
4	Time (Sec)	15.32

(d) Canny-CLAHE

Table 1 is showing simulation parameters in terms of precision, recall, Fmeasure and time. It is clear to see that proposed canny image gives improved results than others approaches.

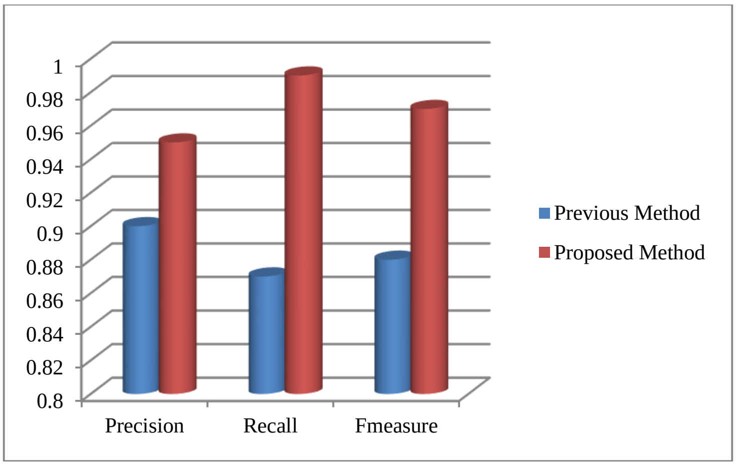

Figure 7: Comparison Graph

Figure 7 is showing comparison bar graph of previous method simulation parameter and proposed method parameters. It shows that proposed method gives significant better result than other approaches.

V. CONCLUSION

This paper presents four different technique overview and implemented results. Canny edge detection, sobel edge, CLAHE edge and canny-CLAHE edge detection techniques and recognition algorithm are implemented and simulated using MATLAB software. The system presented outperforms state of the art methods on the dataset of the traffic text sign data that were obtained from Jaguar Land Rover Research. The results, in the text-detection and recognition phase achieve as precision = 0.95, Recall =0.97 and Fmeasure = 0.97. Simulated result shows the enhancement of simulated parameters as compared to the existing techniques.

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