A Comparative Analysis of Lane Detection Techniques

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ABSTRACT
In this paper comparison is drawn between the existing and proposed techniques of lane detection. Lane detection techniques are proved to be helpful in avoiding accidents on highways. The proposed system has a goal to detect the lane marks even in the presence of high level of noise in the input image. The proposed technique has proved itself as more efficient than that of existing technique.

Keywords
Lane detection, Vanet.

1. INTRODUCTION TO LANE DETECTION
In many proposed systems [6], the lane detection consists of the localization of particular primitives such as markings of the plane of the painted roads. Various challenges like parked and moving vehicle, bad feature lines, shade of trees, buildings and other vehicles, road curvature, uneven lane shapes, integrated lanes, writings and other markings on the road, unusual pavement materials and dissimilar slopes causes problems in lane detection.

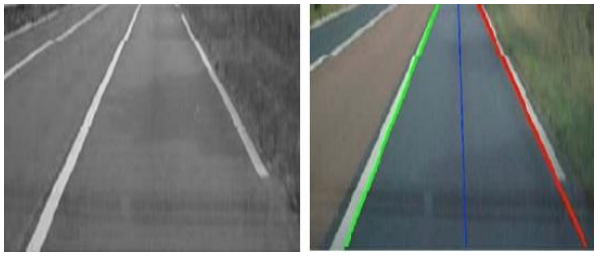

Fig 1. a) Input Image b) Detected Lanes [8]

Lane detection is an active area of research and a wide variety of algorithms of various representations, detection and tracking techniques, and modalities have been proposed [8]. Many approaches have been applied to lane detection, which can be classified as either feature-based or model-based [13-17]. Feature-based methods detect lanes by low-level features like lane-mark edges [20-21]. The feature-based methods are extremely reliant on clear lane-marks, and suffer from weak lane-marks, noise and occlusions. Model-based methods characterize lanes as a type of curve model which can be determined by a few critical geometric parameters. The model-based methods are less sensitive to weak lane appearance features and noise as compared to feature-based methods [22].

2. RESEARCH METHODOLOGY
In order to achieve the proposed objectives, step-by-step methodology is used. Subsequent are the different phases which are used to accomplish this work. A research model shown in Figure 2 is used in this research work.

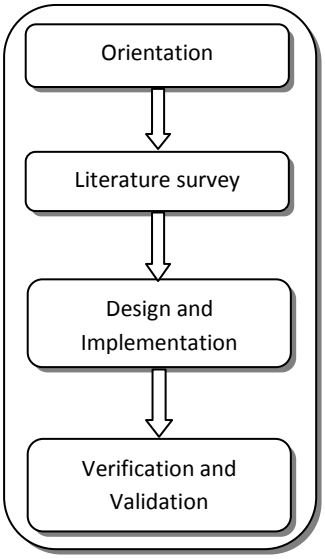

Fig 2. Research Model

The orientation work started in the area of VANET and digital image processing. In this research the questions are formulated by consulting different websites, articles, seminars, workshops, discussing digital image processing, discussing VANETs, lane coloration algorithms and various image filtering techniques.

To answer the research questions, knowledge must be obtained that supplements the information found during the orientation on this topic. This research employs a structured method to obtain high quality information, called a literature review.

Literature survey: To explore the available knowledge on the area of digital image processing, lane coloration algorithms and image filtering techniques, literature review is conducted using a systematic approach. The first step in a literature review is selecting the top journals for searching the required information.

Simulation environment: A suitable simulation environment will be made based upon proposed algorithm in MATLAB. It will give detail of investigational set-up and the outcomes of the simulation in various circumstances i.e. when noise is present in signal and when not.

3. EXPERIMENTAL RESULTS AND COMPARISON
This section contains the results taken by implementing the proposed and existing algorithm. Figure 3 shows the input noisy image which is passed to both the implemented simulations i.e. proposed algorithm and existing algorithm. Figure 4 shows the results of given algorithm and Figure 5 shows the results of proposed algorithm respectively. It is clearly shown in Figure 4 that the image is quite sharper than that of the existing algorithm's output image.

Fig 3. Input image

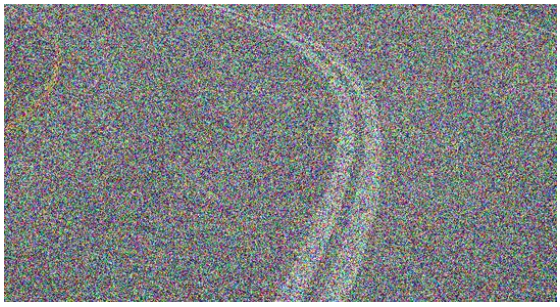

Fig 4. Filtered image in existing algorithm

Fig 5. Filtered image in proposed algorithm

Fig 7. Grayscale image in proposed algorithm

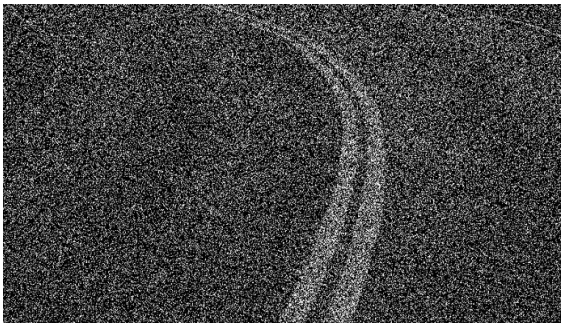

Fig 8. Binary image in existing algorithm

Fig 9. Binary image in existing algorithm

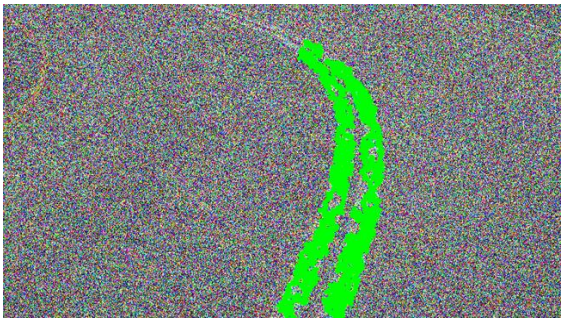

Fig 10. Final image in existing algorithm

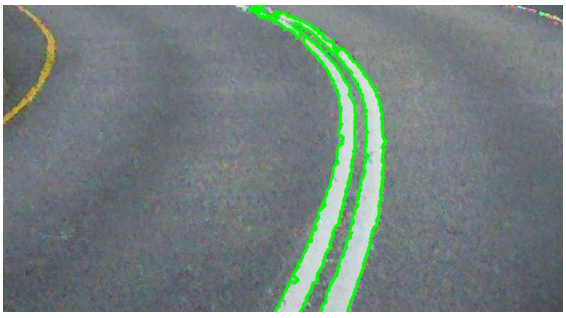

Fig 11. Final image in proposed algorithm

The image is converted into greyscale if it is in colour plane otherwise conversion is not required. It is clear that the existing algorithm's result shown in figure 6 is inaccurate than that of the image shown in Figure 7 i.e. output of the image filtered by switching median filter. Figure 8 and 9 shows the Binary images in existing and proposed techniques respectively. This conversion is required in order to reduce the processing time so as to enhance the performance of the proposed algorithm.

The lane colorized images are shown in Figure 10 and 11. The image shown in Figure 10 is produced without using switching median filter, so has shown poor results where lanes are not properly detected. But image shown in Figure 11 is showing the smoothed image even the colorized lanes are properly shown as it is produced using switching median filter. So it shows that the proposed algorithm is quite better than the existing algorithm.

4. SIMULATION SETUP

Various parameters are considered to compare the performance of existing and proposed technique. Tables are created to clearly distinguish the reading and values. Following are the tables which give a detailed over view of parameter analysis. In every table there are 15 images taken as input and corresponding to every image column efficiency of given and proposed technique is given. Following is the list of

parameters which are considered to evaluate the performance of proposed work:

a) Recall evaluation

b) Bit error Rate

c) F-measure

d) Balanced classification rate

e) Area under curve

Recall evaluation: It compute the recall of a set of predicted labels. Figure 12 shows the recall evaluation of the proposed and exiting technique. It is found that the accuracy of the proposed algorithm has shown quite effective results.

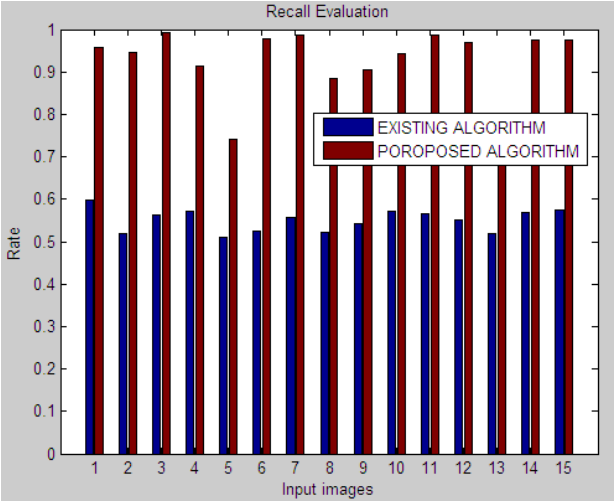

Fig 12. Recall evaluation

Bit Error Rate: It is a parameter to check the performance of proposed technique in contrast to existing technique. The value of this parameter has to be lesser, so as to show the minimum number of errors produced. Figure 13 has shown the BER investigation of the proposed and exiting procedure. It is found that the BER of the proposed procedure in case of the input images shown in table 1 has given fairly effective outcomes than the existing technique. As required BER need to be reduced. It is clearly shown that BER is quite less in proposed algorithm, which has become possible because of switching median filter.

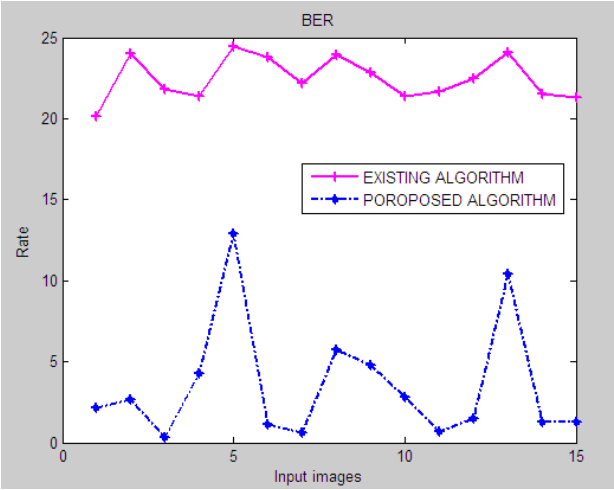

Fig 13. Bit error rate analysis

F-measure Analysis: F-measure is used to measure the relative degree of focus of an image**.** F-measure is calculated as [30]:

temp_f = 100 * 2 * (temp_p * temp_r) / (temp_p + temp_r) (1)

Where temp_p and temp_r are precision and recall values respectively.

BCR Evaluation: In presented work MATLAB is used as a simulator to produce results. Various well known parameters such as f- measure, BER and BCR are used to evaluate the performance of proposed technique. balanced classification rate is computed as:

temp_BCR = 0.5 * (temp_sens + temp_spec) (2)

Where temp_sens represents the sensitivity and temp_spec represents the specificity values.

AUC: It is used to calculate the area under curve for the computed values of X and Y. If you set xVals to 'all' (the default), perfcurve computes AUC using the returned X and Y values. If xVals is a numeric array, perfcurve computes AUC using X and Y values found from all distinct scores in the interval specified by the smallest and largest elements of xVals[30].

5. CONCLUSION AND FUTURE SCOPE

The comparative analysis has shown that the proposed algorithm is quite effective and has quite efficient accuracy rate than the existing algorithm. It is found that the purposed algorithm become even more powerful when noise is present in the input road images.

However in this work canny edge detection is used, but now many edge detectors has been developed so far which works more accurately and detect edge in more efficient manner. So in near future the use of improved canny will be used. Also the threshold has been taken fixed for binarization purpose so in near future we will try to find different binarization technique to make it adaptive and more accurate..

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