



EVALUATING PERFORMANCE OF VARIOUS LANE DETECTION TECHNIQUE

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Abstract: Lane detection is one of the methods which use the principle of vision based lane detection. It is a process of detecting as well as recognizing the lanes where the ground traffic circulates. In this paper, a new lane detection technique has been proposed which overcomes various issues of existing techniques. Moreover a comparison table has been designed which brings out the various gaps that are in literature.

Keywords: Lane Detection, Hough Transform

I. INTRODUCTION

In order to increase safety and reducing accident, large amount of money is being spent for the advancement in the driving techniques. The automobile industry is more concerned towards providing safety features like seat belts, air bags and strong body structures which provide the passive safety that may increase security. Avoiding accidents and saving lives are one of great interest that all researchers and Automobile companies work on.

In Advanced Driver Assistance Systems in order to achieve the desired safety. The upcoming task in the near future is that vehicles can perform lane detection or boundaries detection and Obstacles detection especially for moving object detection is a key component of collision avoidance in driving assistance systems. Lane detection is one of the methods which use the principle of vision based lane detection. Lane detection may be defined as detecting as well as recognizing the lanes where the ground traffic circulates. For the upcoming advanced systems, lane detection is one of the essential functions. The lane detection has become very specific term that implies the utilization of certain perceptive sensors, certain processing units, and certain algorithms to perform this functionality.

II. COMPARISON TABLE

Table 1: Comparison Table of various lane detection techniques

REF.	AUTHORS	TECHNIQUES	FEATURES	LIMITATIONS
[1]	Wang, Chenhao, Zhencheng Hu, and Keiichi Uchimura	lane detection fusion by visual and vehicle localization system	parameters tracking will be more efficient and reliable	The effect of the noise on the Multi-Channel ROI based lane recognition technique has been ignored.
[2]	Li, Jian, Xiangjing An, and Hangen He.	Bayesian attention framework	efficient and robust in real scenes	A new modified Hough based lane detection technique to enhance the accuracy rate further especially for curved lanes has also ignored.
[3]	An, Xiangjing, Jian Li, Erke Shang, and Hangen He	local feature extraction algorithm	very efficient for lane detection especially in very complex road seniors	The use of guided image filter based filtering to remove the effect of the noise in road images has not been used.
[4]	Xiaoyun, Wang, Wang Yongzhong, and Wen Chenglin	novel detection method of structured lane based on gradient-pairs constraint	improvement of the performance of lane detection in complicated road environment	The effect of the noise on the Multi-Channel ROI based lane recognition technique has been ignored.
[5]	Keyou, Guo, Li Na, and Zhang Mo	RANSAC	improve real-time and robustness of the lane detection	A new modified Hough based lane detection technique to enhance the accuracy rate further especially for curved lanes has also ignored.
[6]	Benligiray, Burak, Cihan Topal, and Cuneyt Akinlar.	video-based lane detection algorithm	Gives real time results	It uses guided image filter based filtering to remove the effect of the noise in road images has not been used.
[7]	Chen, Yong, and Mingyi He.	effective lane boundaries projective model	more effective and accurate for sharp curve lane detection	The effect of the noise on the Multi-Channel ROI based lane recognition technique has been ignored.
[8]	Deusch, Hendrik, Jürgen Wiest,	multiple lane detection based on multi-object Bayes	applied to a challenging scenario of a rural road	A new modified Hough based lane detection technique to enhance the

	Stephan Reuter, Magdalena Szczot, Marcus Konrad, and Klaus Dietmayer	filtering		accuracy rate further especially for curved lanes has also ignored.
[9]	Yang, Jianyu, Zhuo Li, and Liangchao Li	lane detection based on Lane geometric model	prove the effectiveness of the proposed lane detection algorithm	The use of guided image filter based filtering to remove the effect of the noise in road images has not been used.
[10]	Yoo, Hunjae, Ukil Yang, and Kwanghoon Sohn	gradient-enhancing conversion method	gradient is maximized at lane boundaries on the road	The effect of the noise on the Multi-Channel ROI based lane recognition technique has been ignored.
[11]	Jung, Heechul, Junggon Min, and Junmo Kim	Efficiency is high	Recognition is about 90.16%	A new modified Hough based lane detection technique to enhance the accuracy rate further especially for curved lanes has also ignored.
[12]	Kum, Chang-Hoon, Dong-Chan Cho, Moon-Soo Ra, and Whoi-Yul Kim	lane detection system using around view monitoring	achieve the detection accuracies of 98.78%	The use of guided image filter based filtering to remove the effect of the noise in road images has not been used.
[13]	Beyeler, Michael, Florian Mirus, and Alexander Verl.	RANdom Sample Consensus	improves the execution time and success rate	The effect of the noise on the Multi-Channel ROI based lane recognition technique has been ignored.
[14]	Satzoda, Ravi Kumar, and Mohan M. Trivedi	Efficient Lane and Vehicle detection with Integrated Synergies	average computation costs that are at least 35% lesser than existing techniques	A new modified Hough based lane detection technique to enhance the accuracy rate further especially for curved lanes has also ignored.
[15]	Tan, Huachun, Yang Zhou, Yong Zhu, Danya Yao, and Keqiang Li	Improved River Flow (IRF) and RANSAC method	robustly and accurately detect some challenging markings	The use OF guided image filter based filtering to remove the effect of the noise in road images has not been used.
[16]	Chien, Tsung-Yu, and Sheng-Luen Chung	Android-based solution for lane detection and departure warning	solving curvy lane detection	The effect of the noise on the Multi-Channel ROI based lane recognition technique has been ignored.
[17]	Li, Wenhui, Xiaohu Gong, Ying Wang, and Peixun Liu	lane marking detection and tracking method	virtual video recognized up to 80%, and the real video 85%.	A new modified Hough based lane detection technique to enhance the accuracy rate further especially for curved lanes has also ignored.
[18]	Shin, Juseok, Eunryung Lee, KeeKoo Kwon, and Sooln Lee	Inverse Perspective Mapping using Random Sample Consensus algorithm	detect both straight and curve lane	The use OF guided image filter based filtering to remove the effect of the noise in road images has not been used.

III. PROPOSED ALGORITHM

Step 1. Input Image: First of all image of road will be captured and passed to proposed algorithm as input image.

Step 2. Apply Guided Image Filter: This filter is used to restore images corrupted by various noises, let us assume it to be Gaussian noise. Noise here is referred to as different shadows on the road, dust and oil stains, tire marks. This filter helps in removing these clutters. The Guided image filter is an edge preserving smoothing filter and does not suffer from gradient reversal artifacts. The filtering output is locally a linear transform of the guidance image. **Step 3. ROI of Input Image:** Then the Region of Interest will be extracted from the input image

Step 4. Conversion to Grey-scale Image: The filtered image of road are converted into grey-scale images because the processing time of gray-scale images is less as compared to colored images.

Step 5. Segmentation of Image: Image binarization is done to locate the lanes in captured image. Typically, the two colors used for binary image are black and white. Various global and local methods of thresholding are used for binarizing the images. Thresholding is used as setting all pixels of image whose intensity values are above a threshold to a foreground value and all the remaining pixels to a background value.

Step 6. Generation of Magnitude Image: This is done to highlight the lane mark's margins from the image. The magnitude image is calculated as output image (J) which is calculates as square-root of sum of squares of gradient image at X-axis and of gradient image at Y-axis

Step 7. Applying Modified Hough Transformation: It is a technique which is used to isolate features of a particular shape. The Standard Hough Transformation has been ineffective in showing results for curved lanes. Therefore, the Hough Transform is modified in such a manner that straight roads are detected by Standard Hough Transformation and curved roads are detected using dynamic metric by using standard deviation

Step 8. Smoothing of lanes: Binary images may contain number of imperfections. To overcome this, smoothing of images is done by morphological image processing.

Step 9. Color the detected lanes: Add results obtained above to the input image and color the lanes. The image obtained is edge preserving smoothed and is free from gradient reversal artifacts.

IV. RESULTS AND DISCUSSIONS

STANDARD HOUGH TRANSFORM

Fig. 2 shows the input image and its output from the classical Hough Transform. It shows the results of the curved road image in sunny day. It is clearly shown that the lanes have not been detected efficiently.



Figure 2: a) Input Image b) output



Figure 3: a) Input Image b) Results of Classical Hough Transform

Fig. 3 shows the input image and its output from the classical Hough Transform. It shows the results of the curved road image in foggy day. It is clearly shown that no lane is detected. So we can say that the existing Hough Transform is not so efficient for curved lane images.

Fig. 4 shows the input image and its output from the classical Hough Transform. It shows the results of the straight lane image in night time. It is clearly shown that the lanes have not been detected efficiently.



Figure 4: a) Input, b) Results of Classical Hough Transform

RESULTS OF MODIFIED HOUGH TRANSFORM

Fig. 5 shows the input image and its output from the Modified Hough Transform with Guided Image Filter. It shows the results of the curved road image in sunny day. It is clearly shown that all the lanes have been detected efficiently.



Figure 5: a) Input Image, b) Results of Proposed Algorithm



Figure 6: a) Input Image, b) Results of Proposed Algorithm

Fig. 6 shows the input image and its output from the Modified Hough Transform with Guided Image Filter. It shows the results of the curved road image in foggy day. It is clearly shown that all the lanes are detected. So we can say the given technique is efficient for curved lane images. The values of performance metrics for Modified Hough Transform is better as compared to Classical Hough Transform in noisy environment.

Fig. 7 shows the input image and its output from the Modified Hough Transform with Guided Image Filter. It shows the results of the straight lane image in night time. It is clearly shown that the lanes have been detected efficiently. The values of performance metrics for Modified Hough Transform is better as compared to Classical Hough Transform in noisy environment.

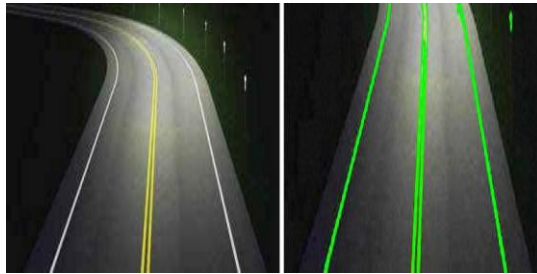


Figure 7: a) Input, b) Output of Proposed Algorithm



Figure 8: a) Input Image, b) Results of Proposed Algorithm

Fig. 8 shows the input image and its output from the Modified Hough Transform with Guided Image Filter. It shows the results of the straight lane image in rainy day. It is clearly shown that the all the lanes has been detected efficiently.

V. CONCLUSION

In this paper, a new lane detection algorithm has been proposed along with guided image filter. On the basis of this algorithm, performance metrics has been evaluated for various images for standard Hough transform and modified Hough transform. Proposed algorithm performs better as compared to the existing algorithm.

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