Lane Detection Techniques – A survey

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Abstract - Detection of road lanes is an important technology, which is being used in autonomous vehicles from last few years. This method is very helpful and supportive for the drivers to provide them safety and to avoid road accidents. Alot of methods are being used to detect road lane markings. We can categorize them into three major categories: sensor-based, feature-based, and model-based methods. And in this study we give the comprehensive survey on lane marking techniques.

Keywords—lane marking; image processing; lane; detection

I. INTRODUCTION

Lane detection technology has its roots back to past century, but it has got the real boom and fame over the last two decades. There are three main methods to cope with the structure of road: sensor-based, feature-based and model-based method. Because of lower cost, the two later methods are being used more commonly than the former one.

- The feature-based method: Extracting features to initialize lane marking such as edges, gradient, intensity, color, etc. Among these features, edges are considered one of the most significant features.
- The model-based method: This method requires many camera parameters and road lane.

II. PREVIOUS RESEARCH

REAL TIME LANE DETECTION IN URBAN STREETS [1]

A simple, fast, robust and real-time approach for lane marker detection in urban streets is presented. It is based on taking a top view like bird-eye view of the road, called the Inverse Perspective Mapping (IPM), then it is filtered by using selective Gaussian filters to detect vertical lines. Threshold is applied to filtered image to remove noise, and straight lines are detected using simplified Hough transform. For refining the detected straight line and correctly detecting cured lanes, a novel RANSAC spline is implemented, which is then followed by a post-processing step.

The algorithm can detect all lanes in still image of the street in various conditions, while running at 50 Hz frequency, 640x480 dimension images on Intel Core2 2.4 GHz machine.

REAL-TIME ILLUMINATION INVARIANT LANE DETECTION [2]

Purpose of this paper is detecting lanes on the road under various conditions especially in bad weather, shadow and at night time etc. that is based on color space. As we know lanes are usually painted by white, yellow or blue color, so lane colors have distinct properties under various illumination conditions. First of all, vanishing point is detected automatically by using Hough transform to establish an adaptive Region of Interest (ROI), which reduces the computational complexity and time. From created ROI image, they convert RGB color space to HIS (Hue, Intensity, Saturation) or custom color space to detect white lane and yellow lane on the road, and then combine two result into one by OR operator.

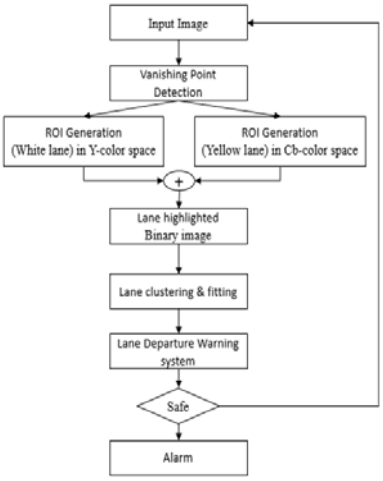

Figure 1: Flowchart of the proposed algorithm

In the next step, connected component are used in clustering method, and labels' angle are checked to group a cluster. Finally, acquired image is divided into 5 sections, and extracted center point from each cluster in each section, then one line is created by using least square line algorithm.

LANE DETECTION USING A VANISHING POINT ESTIMATION [3]

This method is based on EDLines algorithm [4] to detect lane. The first step is to extract and validate the line segments from the input image. Then based on angle properties of lane marking, elimination of line segments is executed. Left lanes are considered that have angle between 20-85 degrees, and right lanes have angle from 95-160 degrees. In the next step remaining line segments are extended to detect the location of vanishing point (point where most lines converge) in an image. Remove the lines that do not intersect the vanishing point. Finally, the remaining line segments will be clustered such that each cluster represents a lane marking. The nearest two clusters to the vehicle are chosen as the lines that bound the lane that is being driven on.

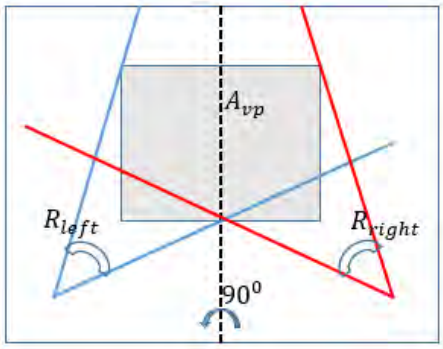

Figure 2: Remove invalid line segments based on attributes of lane angle

LANE DETECTION METHOD BASED ON B-SPLINE CURVE [5]

Compare with three feature-based methods above, this study is in one of the model-based methods. A new structure road detection algorithm based on B-spline curve model is proposed. Firstly, the road edges are extracted by using Canny edge detection algorithm, and then edges are denoised by multi-regional two-threshold segmentation algorithm [6]. Secondly, the image is divided into a small number sections, and then the point sets on the edges of line marking in each sections are obtained by using Mid_to_Side method [7]. The final step is to fit the entire road. B-Spline is used in this proposed method to fit the central line of the road. This algorithm is depicted in Figure 3.

III. CONCLUSION

Lane detection is important because it is an integral part of autonomous vehicle control system. The survey of existing methods for detection and marking of lane is provided in this study.

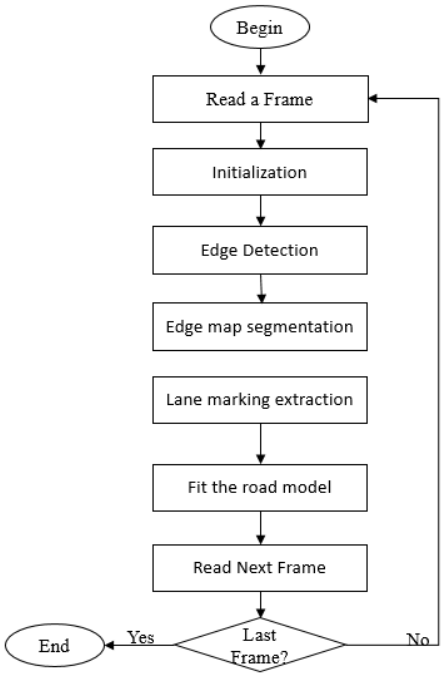

Figure 3: Algorithm structure of B-Spline curve

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