LANE DETECTION USING ARTIFICIAL INTELLIGENCE

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Abstract: *There is always a huge demand for the development of the self-driving cars since they are the future of the autonomous vehicles. In the field of autonomous vehicles, problems still remains unsolved when there occurs any obstacle in the road lane while driving. In Self-driving cars, Lane detection is considered to be the most important part in reducing the number of accidents and risks. In this paper we have discovered the methodologies existing in the lane detection, the advantages and disadvantages of models. We have proposed a model that can detect lane in the straight and curved roads and detect vehicle existing in the lane. We have implemented a deep learning algorithm for the Vehicle Detection. The proposed methodology has been successfully applied to the data set, the results are recorded and the performance metrics are tabulated. We have also discussed on the future scope of the Lane detection.*

Keywords: **Lane Detection, Deep Learning, Convolutional neural network.**

1. INTRODUCTION

The lane detection starts from lane markers in a complex environment and is used to estimate the vehicle's position. At the same time, lane detection has a major role in the lane departure warning system. The main challenges lies in the parked and moving vehicles, Bad quality lane lines or no lines at all, Shadows that exists because of the trees, Improper parking of vehicles, irregular shape of lane, merging of lanes, sharper curves, improper pavement material and dissimilar slopes and the unnecessary humps in the road which causes problems in lane detection.

The application of a lane detecting could be directing the lane for the driver, giving alerts or warnings, identifying lane markings, identifying vehicles that already exists in the lane, stating different road marking such as white lanes, yellow lanes to more complex tasks such as finding any lane change is needed, vehicle position change, speed control according to different lanes etc. Many algorithms have been in- vented for the detection, giving alerts and tracking techniques. Many methods have been invented and tested for lane detection, which can be classified as either feature-based or Model-based. Feature- based methods detect features of the lane from the given input through edges of the lane. The feature- based methods lie on the clear lane-markings, but find it so tough for the improper lane markings or edges.

2. WORKING

2.1. Feature Work:

The feature based detection of lanes is based on the extraction of the necessary features from the input image to detect the edges and the lanes. The feature detection model is further subdivided into Edge detection approaches [1] and Hough transform based approaches. The advantage of this model is that it can find the lane markings even having Darker Background environments. The model used Artificial Neural Networks (ANN) for the detection and the particle filter for the Tracking of the lane.

P. Daigavane in his model used canny edge detector for Pre-processing and Ant Colony Optimization for detection and line detection is done through the Hough transform. It performs well even in shadows. It was suitable for both curved and straight roads. Z. Kim [2] proposed a model that used Edge detector and intensive bump detector for the Pre-processing. The model used artificial neural networks (ANN) for the detection and the particle filter for the Tracking of the lane**.**

2.2. Region Based Detection:

The region based lane detection method is further divided into Texture based, Color based detection approaches. The model works on focusing the major difference between the lane lines and the non-lane line regions such as separating the lane lines needed using the Boundary approaches thereby eliminating the non-road, non-lane

regions. Basic Process of Region Based Lane detection is done by Extracting features to initialize lane markings such as edges, color, and other features from the image then processing the features extracted to remove outlines.

It works based on the lane markings which uses least square method for the lane detection and the lane extension. It is useful in detecting in the Light environment but not in the darker background. Kuo-Yu Chiu [3] proposed a model that is used for the structured roads which involves the Color based lane detection. It works based on the lane markings which uses least square method for the lane detection and the lane extension.

3. BACKGROUND WORKING

3.1. Canny Edge Detection:

A lot of people consider the Canny Edge Detector the ultimate edge detector. You get clean, thin edges that are well connected to nearby edges. If you use some image processing package, you probably get a function that does everything. Here, I'll go into exactly how they work. The two key parameters of the algorithm are - an upper threshold and a lower threshold. The upper threshold is used to mark edges that are definitely edges. The lower threshold is to find faint pixels that are actually a part of an edge.

The canny edge detector is a multistage edge detection algorithm. The steps are:

- Preprocessing
- Calculating gradients
- Non-maximum suppression
- Thresholding with Hysterysis

Fig. 1. Original Image

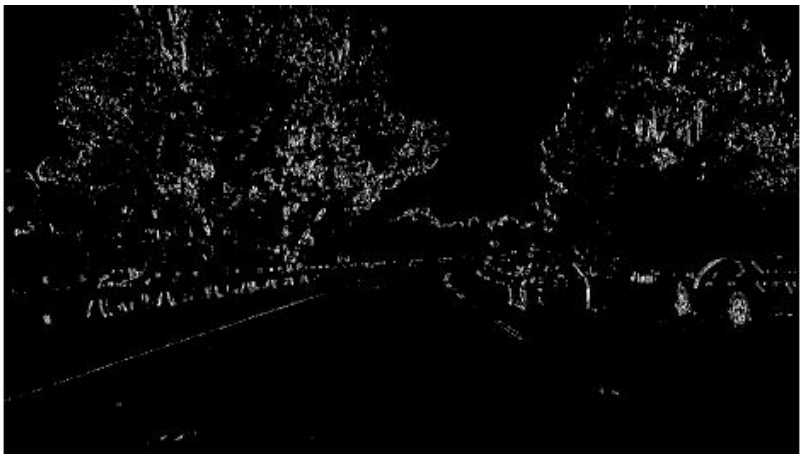

Fig. 2. Image after Canny Edge Detection

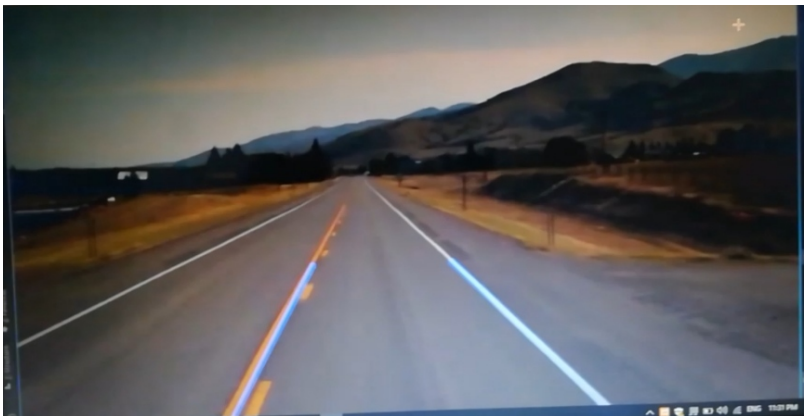

Fig. 3. Outer Lines of Lane

Fig. 4. Image of Lane Detection

3.2 Hough Transformation:

The Hough transform is a technique which can be used to isolate features of a particular shape within an image. Because it requires that the desired features be specified in some parametric form, the classical Hough transform is most commonly used for the detection of regular curves such as lines, circles, ellipses, etc. A generalized Hough transform can be employed in applications where a simple analytic description of a feature(s) is not possible. Due to the computational complexity of the generalized Hough algorithm, we restrict the main focus of this discussion to the classical Hough transform. Despite its domain restrictions, the classical Hough transform (hereafter referred to without the classical prefix) retains many applications, as most manufactured parts (and many anatomical parts investigated in medical imagery) contain feature boundaries which can be described by regular curves. The main advantage of the Hough transform technique is that it is tolerant of gaps in feature boundary descriptions and is relatively unaffected by image noise.
The Hough transform space is now defined in terms of the possible positions of the shape in the image, i.e. the possible ranges of Xref, Yref. In other words, the transformation is defined by [4]:

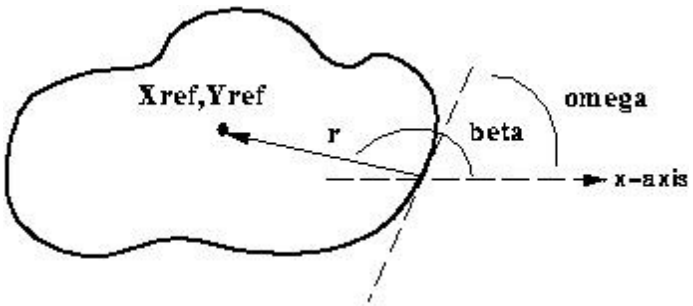

Fig. 5. Common Variant

$$x_{ref} = x + r\cos(\beta)$$

$$y_{ref} = y + r\sin(\beta)$$

Fig 6. Transform Space

3.2 Computer Vision:

Open CV (Open Source Computer Vision Library) is a library used for the computer vision. It optimizes the performance and increase the efficiency in the real time environment.

4. PROPOSED SYSTEM

4.1 Detecting lane in straight and curved roads:

The lane detection mainly has three major steps: Pre-processing, Edge detection and then the line detection. However, the issue in the development of lane detection system is that the road traffic environment which is so tedious to predict. In the complex traffic environment where vehicle moving rate is high and speed is fast, the probability of road accidents are greater than usual.

4.2 Detecting the vehicle in the detected lane roads:

The vehicle detection is implemented through the CNN (Convolutional Neural Network). The training input images are fed into our network. The model first does the normalization while normalizing the data to the same scale approximately.

4.3 Predicting the curvature of the lane and giving warnings when vehicle exists in the lane road:

After filtering the lane lines with the morphological operations and detecting the lane with the edge detection algorithm we have got the resultant lane line. In the resultant lane we will find the left lane and right lane using the center point of the lane and fit the lane line using the triangle region.

Fig.7. Correct Lane Detected

5. CONCLUSION

The Lane Detection is required for today's day to day life. Accidents on road are the major problem for government of any country. The main reason of accidents is sudden change in lane on fast driving roads. To solve this problem this paper proposed an algorithm based on canny edge detector and Hough transform. Most of these problem occurs when in poor environmental condition when it fails to detect or in the curvy roads where detection is too tedious. The future scope of the lane detection includes complex environment taking into account the different environments such as the Weather conditions: fog, mist, cloudy, sunny, bright day light, darker, shadow or when there occurs obstacles and Humps, Speed Breakers in the Road.

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The authors gratefully acknowledge the Department of Computer Science and Automobiles. Today's Cars have 100 million lines of code. Tomorrow's cars will have more than 300 million lines of code, so Cyber-security is a growing concern. The leader in application security testing and software composition analysis, helping automotive customers build security into their software throughout the development lifecycle and across the supply chain.

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