A

MINI PROJECT REPORT

on

LANE LINE DETECTION USING A.I

BACHELOR OF TECHNOLOGY

in

COMPUTER SCIENCE AND ENGINEERING

Submitted by

(BATCH : B-22)

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EMPOWERING THROUGH INNOVATIONS

MLRS

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

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INSTITUTE OF TECHNOLOGY AND MANAGEMENT

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CERTIFICATE

This is to certify that the project report titled **"LANE LINE DETECTION USING A.I"** is being submitted by **SHIVA.S (207Y1A05F9)** in IV B.Tech **II** Semester **Computer Science & Engineering** is a record bonafide work carried out by him. The results embodied in this report have not been submitted to any other University for the award of any degree.

Internal Guide **HOD**

Principal **External Examiner**

DECLARATION

I hereby declare that the Minor Project Report entitled, "**LANE LINE DETECTION USING A.I "** submitted for the B.Tech degree is entirely my work and all ideas and references have been duly acknowledged. It does not contain any work for the award of any other degree.

Date:

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CONTENTS

LIST OF TABLES

SYMBOLS & ABBREVIATIONS

ADAS	:	ADVANCED DRIVING ASSISTANCE
CNN	:	CONVUTIONAL NEURAL NETWORKS
RNN	:	RECURRENT NEURAL NETWORKS
GPS	:	GLOBAL POSTIONING SYSTEM
AI	:	ARTIFICIAL INTELLIGENCE
UML	:	Unified Modeling Language
URL	:	Uniform Resource Locator
USB	:	Universal Serial Bus

ABSTRACT

As the need for an intelligent transport system is growing rapidly, lane line detection has gained a lot of attention recently. Aiming at the problem that the YOLOv3 algorithm has low accuracy and high probability of missed detection when detecting lane lines in complex environments, a lane line detection method for improving YOLOv3 network structure is proposed. The improvement is focused on detection speed and accuracy. Firstly, according to the characteristics of inconsistent vertical and horizontal distribution density of lane line pictures, the lane line pictures are divided into $s * 2S$ grids. Secondly, the detection scale is adjusted to four detection scales, which is more suitable for small target detection such as lane line. Thirdly, the YOLOv3's backbone is changed by adopting Darknet-49 architecture. Finally, parameters of anchor and loss function are optimized so that they focus on detecting lane line. The experimental results show that on the KITTI (Karlsruhe Institute of Technology and Toyoko Technological Institute) dataset, the mean average precision value is 92.03% and the processing speed is 48 fps. Compared with other algorithms, it is significantly improved in detection accuracy and real-time performance. It is promising to employ the proposed approach in lane line detection system.

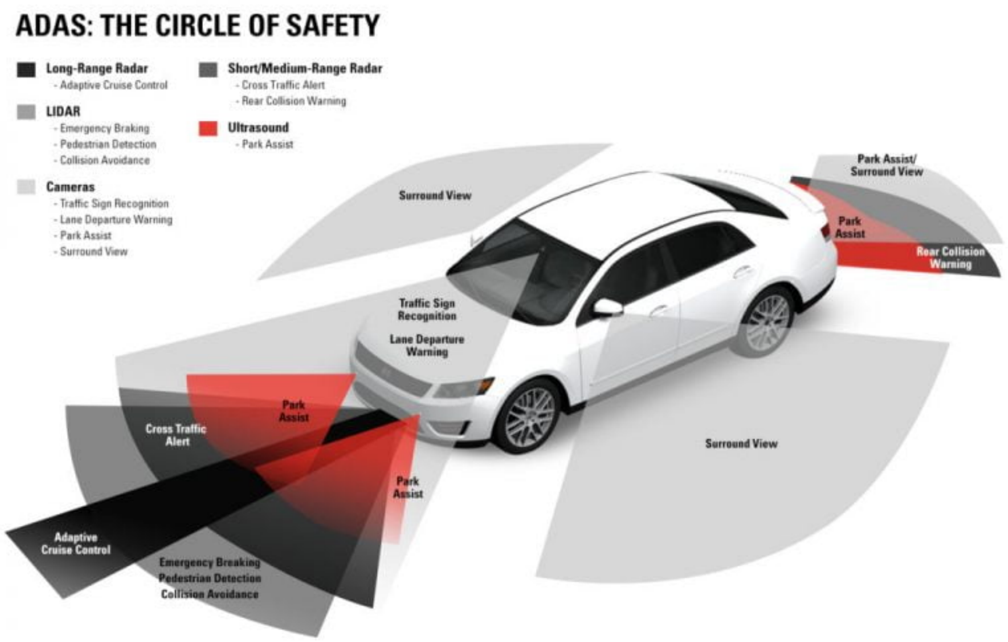
INTRODUCTION

1.1 Information on line and lane

Lane line detection is an essential part of autonomous vehicles and advanced driver assistance systems (ADAS).Artificial intelligence (AI) plays a crucial role in detecting lane lines accurately and quickly.Lane line detection using AI can improve driving safety and reduce accidents caused by lane deviation.

Lane line detection is an important part of intelligent transport systems, such as in traffic monitoring and autonomous cars. Therefore, the need for the lane line detection system is increasing in the industry.There have been various approaches to lane line detection. These approaches are generally divided into two categories: traditional methods and deep-learning-based methods. Traditional methods use statistical approach in extracting image features, such as color, gray, and edge.On the other hand, deep learning-based approaches use convolutional neural networks as their feature extractor .Although the accuracy of traditional approach is still acceptable, the traditional approach must go through a complex process and requires high human involvement in the development and deployment process.Furthermore, traditional approaches also cannot propagate its training feedback to its feature extractor section.Therefore, this approach is considered not good for industry's production. The use of deep learning is one solution to answer the problem faced by the traditional approach.One of the main issues in developing a deep learning model is the tradeoff between the level of accuracy with the speed of detection of the model. Models with high accuracy generally require quite complex feature extraction, which results in low detection speed. Therefore, building a deep learning model architecture needs to pay attention to both aspects.

Fig1.1 ADAS THE SYSTEM FOR LINE AND LANE



.1

Fig. 1.1 ADAS THE SYSTEM FOR LINE AND LANE

1.2 PROBLEM DEFINTION

At present, the main methods of lane line detection include the method of extracting road features by machine vision, the method of establishing road model for detection, and the method of multi-sensor fusion detection The method of extracting road features by machine vision mainly uses machine vision technology to classify the gray value features and color features of lane lines. After learning, the lane lines on the road can be detected. Because the gray value, color and other features in the image are often affected by external conditions such as light intensity and shadow; the lane line detection using this method is easy to be disturbed by environmental changes.

1.3 PROJECT PURPOSE

The method of establishing the road model for detection is to establish a two-dimensional or three-dimensional image model of the road image and then compare it with the lane line in the photo which is to be detected. The application scope of this detection method is relatively small, and it is only suitable for roads with the characteristics of known templates. In addition, the algorithm has a large amount of computation and poor real-time performance.The method of multisensor fusion detection is to detect the lane line by means of high-definition camera, UAV aerial photography, GPS, radar, and other fusion methods .

1.4 PROJECT FEATURES

TRADITIONAL LINE AND LANE DETECTION

Traditional methods include edge detection, Hough transform, and color-based segmentation.These methods have limitations in detecting lane lines under different lighting and weather conditions.Traditional methods require manual parameter tuning and are time-consuming.

1.6 PROJECT OBJECTIVE

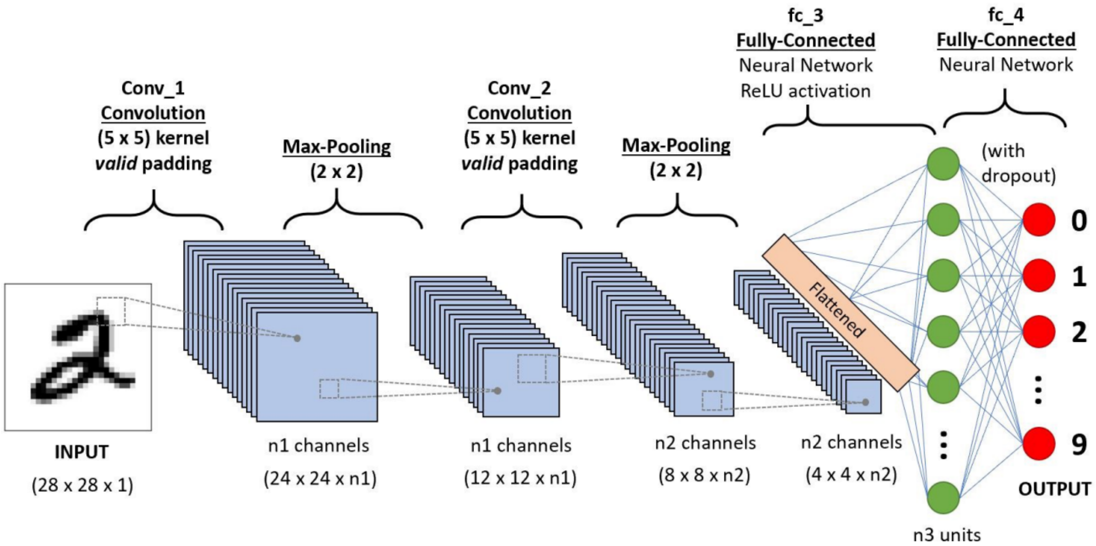
It is promising to employ the proposed approach in lane line detectioLane line detection is an important part of intelligent transport systems, such as in traffic monitoring and autonomous cars . Therefore, the need for the lane line detection system is increasing in the industry.There have been various approaches to lane line detection. These approaches are generally divided into two categories: traditional methods and deep-learning-based methods. Traditional methods use statistical approach in extracting image features, such as color, gray, and edge.

CHAPTER-2

LITERATURE SURVEY

2.1 SYSTEM

AI-based methods use deep learning techniques like convolutional neural networks (CNNs) and recurrent neural networks (RNNs).These methods can detect lane lines accurately under different lighting and weather conditions.AI-based methods can learn and adapt to changing road conditions, making them more reliable than traditional methods.



2.2 OVERVIEW

The traffic safety becomes more and more convincing with the increasing urban traffic.Exiting the lane without following proper rules is the root cause of most of the accidents on the avenues. Most of these are result of the interrupted and lethargic attitude of the driver. Lane discipline is crucial to road safety for drivers and pedestrians alike. The system has an objective to identify the lane marks. It’s intent is to obtain a secure environment and improved traffic surroundings. The functions of the proposed system can range from displaying road line positions to the driving person on any exterior display, to more convoluted applications like detecting switching of the lanes in the near future so that one can prevent concussions caused on the highways.Actuate detection of lane roads is a critical issue in lane detection and departure warning systems. If an automobile crosses a lane confinement then vehicles enabled with predicting lane borders system directs the vehicles to prevent collisions and generates an alarming condition. These kind of intelligent system always makes the safe travel but it is not always necessary that lane boundaries are clearly noticeable, as poor road conditions,

2

Fig 2.2 line detection

2.3 EXISTING SYSTEM

Firstly, we need to reduce out a Region Of Interest (ROI) in the image present originally so that we can omit unnecessary objects such as the sky, street lights, signs, moon, etc. from the image. Cropping also improves both the accuracy and the speed of the lane detection system. The velocity enhancement is obtained from the decrease in the size of the image to be processed. The accuracy can be improved by the alimentation of objects that are present outside the ROI that may have characteristics same as to lanes. In thisimplementation, the ROI is set manually; whereas, to automatically determine a suitable ROI, camera calibration parameters could be used.The conversion of a color image into a gray scale image is the only pre - processing used in this lane detection system; consequently, monochrome images can circumvent this step. It is assumed that the accessible colorful picture is present in Bayer format. Firstly it is demised to extract the color of each pixel.Since the shoulder generally display up as a lengthy and straight line in the image, therefore, for lane detection, the shoulder lane of the road is generally detectable in compared to a traffic lane. Traffic lanes on avenues are dashed lines and, they may be shown as a dot or a short line in the picture, depending on the vulnerability time. In order to expand the traffic lanes and give the presence of a long And continued line, one may use temporal blurring.The adaptive threshold is used to retrieve the lane markers in the average picture. The adaptive threshold changes depends on the features of its nearby pixels in comparison to a global threshold. This is advantageous as isolated bright Objects like street lights and taillights of cars would influence the global threshold, the adaptive method would not be easily altered.In earlier stage, the binary that is obtained by application of the adaptive threshold is divided into its left and right halves. Next, a low resolution Hough transformed is calculated on each hal image in order to get tpositions of straight lines with respect to lan.

2.4 DISADVANTAGES OF LINE AND LANE

Lane lines are painted on roads to help drivers stay in their lanes and avoid accidents. However, there are some disadvantages to relying on lane lines. In bad weather, such as heavy rain or snow, it can be difficult to see the lane lines. When lane lines are faded, they can be hard to see as well. This can make it difficult for drivers to stay in their lanes and can lead to accidents. Additionally, some drivers may become too reliant on lane lines and not pay enough attention to their surroundings, which can also lead to accidents.

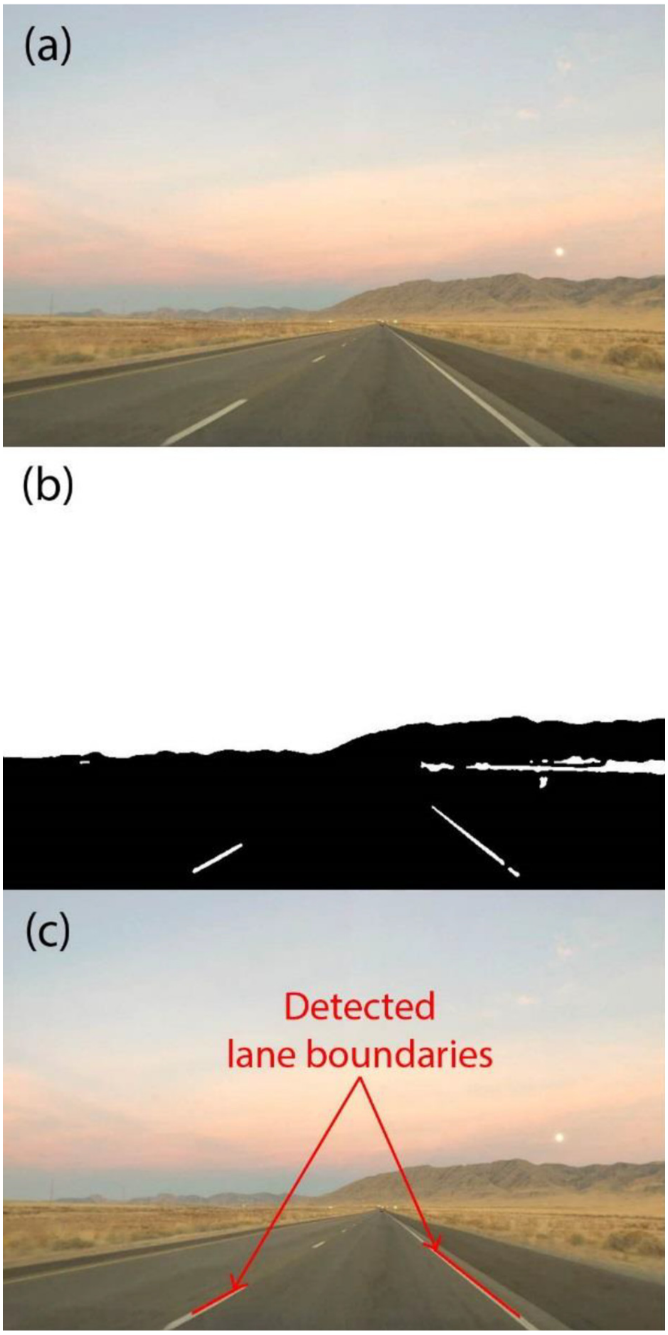


Fig: 2.4 (a),(b),(c) disadvantages of the detection

Figure shows the lane detection performance of the HT-based algorithm at dusk on the highway. Despite the change of illumination condition, the road lanes can still be easily separated from the background without the application of the gradient-enhancing method, as shown in Figure (b). The successful lane detection results shown in Figure (c) suggest that the algorithm is robust against illumination variations in simple highway scenarios, such as those shown in Figures 1 and 2. This is because dividing lines are in strong contrast to the background under these scenarios, which guarantees the road markings to be correctly extracted from surroundings during the binarization process.

2.5 ADVANTAGES

lane departure warning systems. These systems will quickly alert the driver if their vehicle should cross over the line dividing lanes, thereby helping to avoid an accident. Like many other safety features, creators of this technology claim that it will help prevent car accidents. In a car without a lane departure system, if a driver strays into the path of oncoming traffic, they could collide with a car travelling in the opposite direction before they even realize their car had drifted from their own lane.

2.6 SUMMARY

Lane line detection is an important part of intelligent transport systems, such as in traffic monitoring and autonomous cars [1]. Therefore, the need for the lane line detection system isincreasing in the industry [2].There have been various approaches to lane line detection. These approaches are generally divided into two categories: traditional methods and deep-learning-based methods

CHAPTER-3

ANALYSIS

3.1 INTRODUCTION

Lane line detection is an essential part of autonomous vehicles and advanced driver assistance systems (ADAS).Artificial intelligence (AI) plays a crucial role in detecting lane lines accurately and quickly.Lane line detection using AI can improve driving safety and reduce accidents caused by lane deviation.

3.2 SOFTWARE REQUIREMENT SPECIFICATION

Real-time lane line detection requires high-performance hardware.GPUs and specialized hardware like FPGAs can accelerate lane line detection.Real-time detection is essential for autonomous vehicles and ADAS.Lane line detection can be challenging in adverse weather conditions like rain and snow.AI-based methods can handle challenging conditions by learning from diverse data.Advanced techniques like semantic segmentation can improve accuracy in challenging conditions.

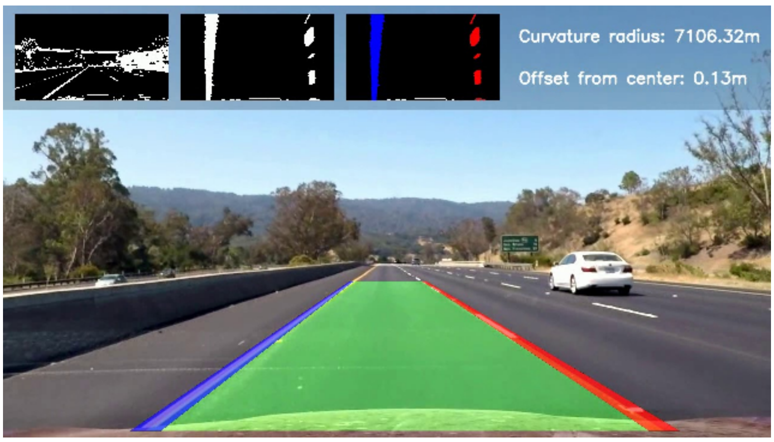


Fig 3.2 determining radius and center

3.3 CONTENT DIAGRAM

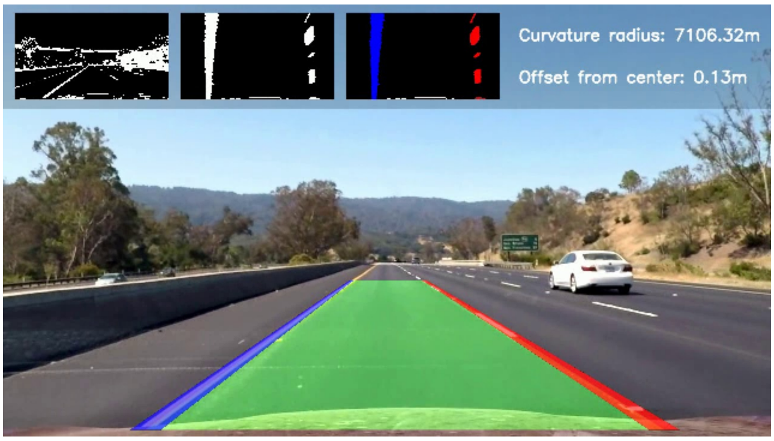


Fig. 3.3 (a)   the distance calculating of line

Fig 3.3(b)   the calculation of the lane

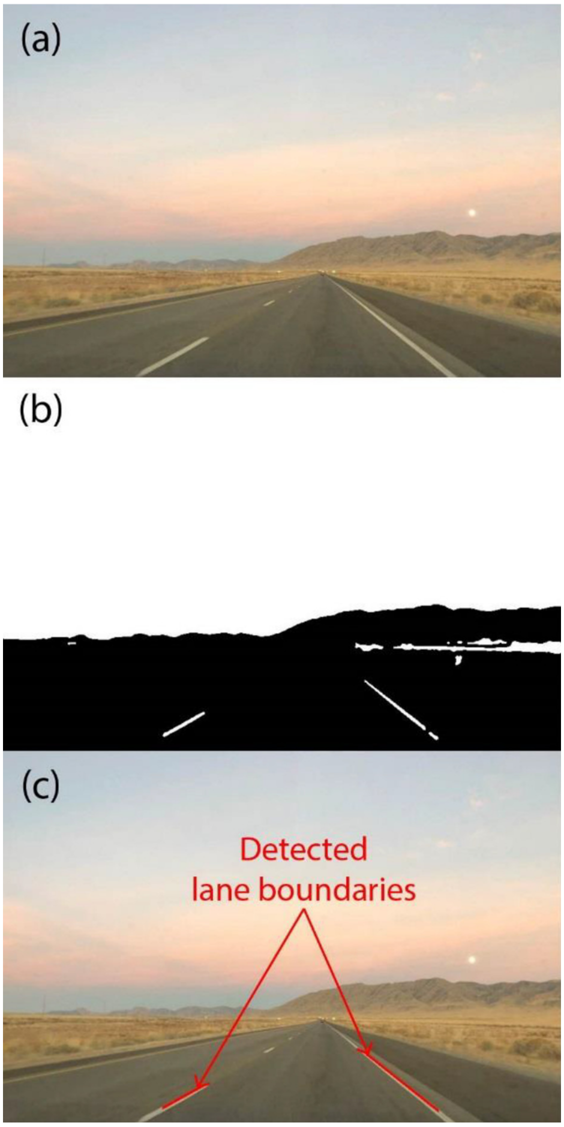
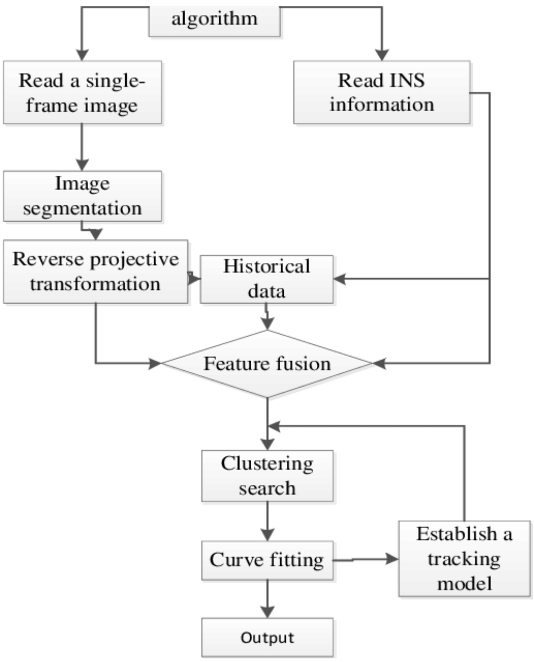
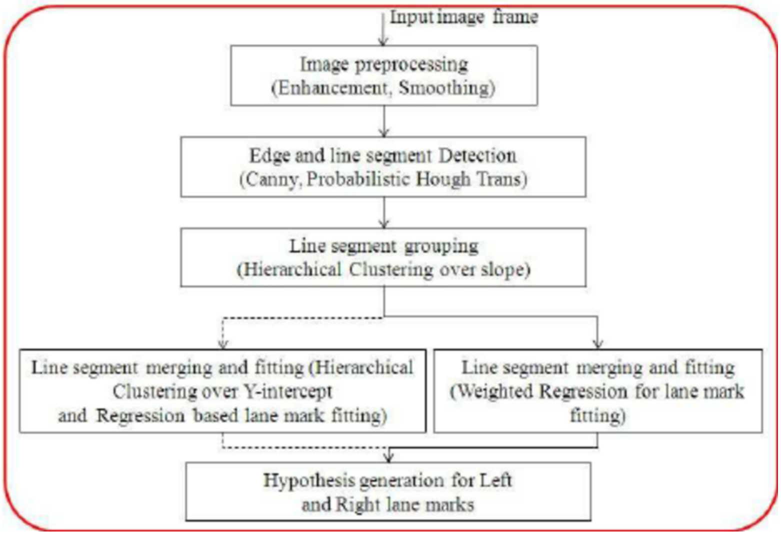


Fig 3.3(c),(d),(e) guassian blur for reducing the size of image

3.4 FLOW CHARTS





CHAPTER-4

DESIGN

4.1 INTRODUCTION

Lane keeping assistance systems use lane line detection to keep vehicles within the lane.AI-based lane keeping assistance systems are more accurate and reliable thantraditionalmethods.Lane keeping assistance systems can reduce accidents caused by lane deviation.Future advancements in AI and hardware can improve the accuracy and speed of lane line detection.AI-based lane line detection can be integrated with other ADAS features like automated emergency braking and adaptive cruise control.Lane line detection can play a crucial role in achieving fully autonomous driving.

4.2 SYSTEM MODELS

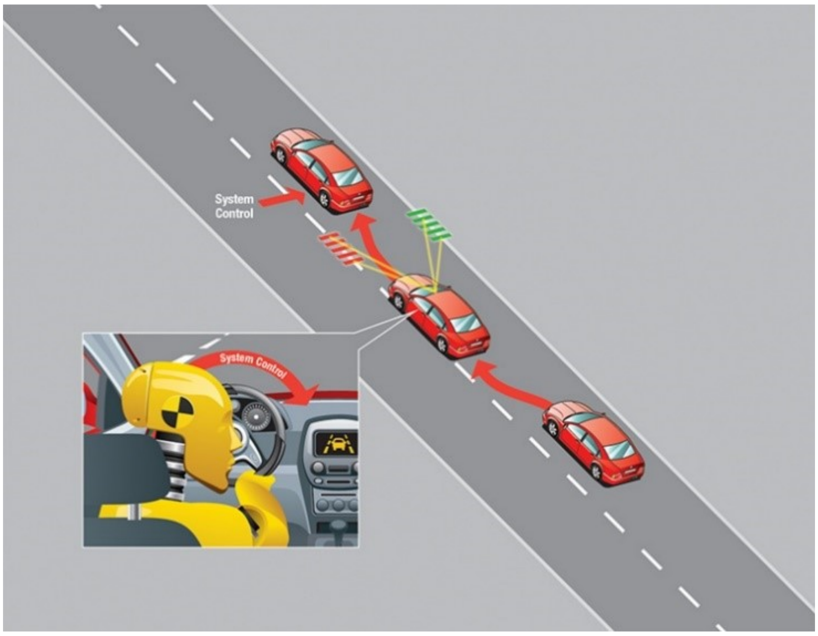


fig 4.2 safetydetection

Fig 4.2(b) converting into gray scale

CHAPTER-5

IMPLEMENTATION

Region Of Interest

A region of interest (ROI) is that area of an image that one want to percolate or allow some other operations on them. One can use the high-level ROI functions in order to create ROIs of many shapes, for example drawpolygon or drawcircle in the library of openCV. The main objective of ROI is to decrease the portion of an image for speedy calculation and also the size of image can be decremented by ROI generation. One can describe several ROI in an image. Generally, ROIs are defined as collections of several contiguous pixels but you can describe them as ROIs by depth values, where it is not necessarily that the regions must be contiguous. Most general use of an ROI is to generate a binary mask image which is defined as the combination of 0 & 1 in the image file matrix. Pixels that belong to the ROI are set to 1 that is white and pixels outside the ROI are set to 0 that is Black In the mask image.There are two images shown below which indicates how one's image may look like after we focus only on the region of interest

Gaussian Blur

We use Gaussian blur which is also known as Gaussiansmoothing, while refining an image. Typically to reduce image noise and reduce detail, it is an extensively used effect in graphics software. We get the result by making our image hazy using a Gaussian function. This function isnamedafter famous mathematician and scientist Carl Friedrich Gauss. Gaussian smoothing is widely used for pre-processing stage of lanedetection in computer vision algorithms. In order to improve image structures at different scales we used the Gaussian Blur. Mathematically,applying a Gaussian blur to an image is similar as convolving the image with a Gaussian Function. This is also called as atwo-dimensional Weierstrass transformation.The image is convoluted with a Gaussian filter inspite of using the box filter, in Gaussian Blur operation. The Gaussian filter is a low-pass filter that omits the highfrequency components which are being reduced.This operation is being achieved with the help of Gaussianblur() function of the imgproc category.Here is an example of what happens after application of the Gaussian Blur Algorithm on an input image.

CHAPTER-6

TESTING

6.1 INTRODUCTION:

1. For training of data , high GPU computational power is required , so time for training is directly connected to system raw power.
2. Output from the camera mounted on the moving vehicle will have great impact on detection result
3. Lane visibility in weather condition will also have high impact of model accuracy for lane detection.

Logical planning dependencies:

1. Python Libraries should be pre-installed for working of this module.
2. All operating System files should be updated.
3. System should have sufficient Memory for module operation

6.2 TEST CASES

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Fig 6.2 (a) going on road using detection

METHOD	LOGIC	SUCCESSFUL
Guass blur	to reduce the size of the image	yes
gray scale	conversion to black white	no
hough transform	to know the line and lane detection	yes
image rendering	to know the correct image	yes

Fig 6.2(b) detecting the lines and lanes

METHOD	LOGIC	SUCCESSFUL
guassian blur	to reduce the size of the image	yes
gray scale	conversion to black white	yes
hough transform	to know the line and lane detection	yes
image rendering	to know the correct image	no

Fig 6.2(c) detecting the cross lane

METHOD	LOGIC	SUCCESSFUL
guassian blur	to reduce the size of the image	**yes**
gray scale	conversion to black white	**yes**
hough transform	to know the line and lane detection	**yes**
image rendering	to know the correct image	yes

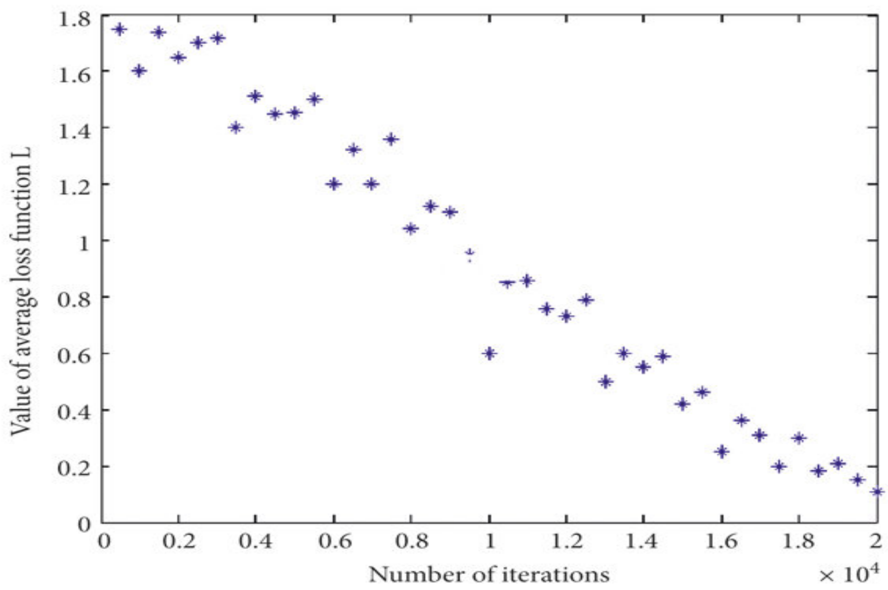
CHAPTER-7

CONCLUSIONS

The main idea is to add white extraction before the conventional basic preprocessing. Edge extraction has also been added during the preprocessing stage to improve lane detection accuracy. We also placed the ROI selection after the proposed preprocessing. Compared with selecting the ROI in the original image, it reduced the nonlane parameters and improved the accuracy of lane detection. Currently, we only use the Hough transform to detect straight lane and EKF to track lane and do not develop advanced lane detection methods. In the future, we will exploit a more advanced lane detection approach to improve the performance.

FUTURE ENHANCEMENTS

This model can be updated and tuned with more efficient mathematical modelling, whereas the classical OpenCV approach is limited and no upgrade is possible as the approach is not efficientIt is unable to give accurate results on the roads which do not have clear markings present on the roads. Also it cannot work for all climatic conditionsThis technology is increasing the number of applications such as traffic



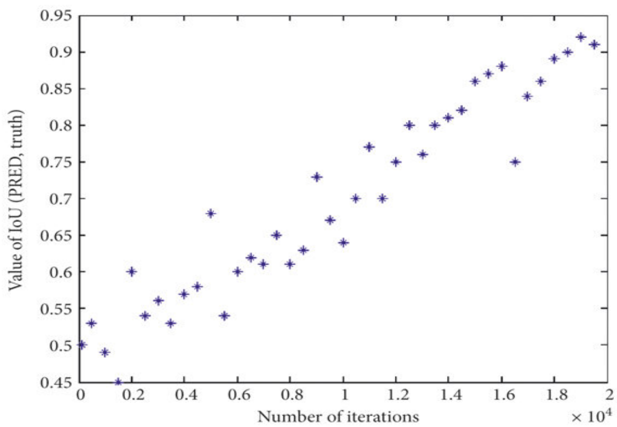


Fig 7.2(a),(b) flow charts for the iterations,loss of functions

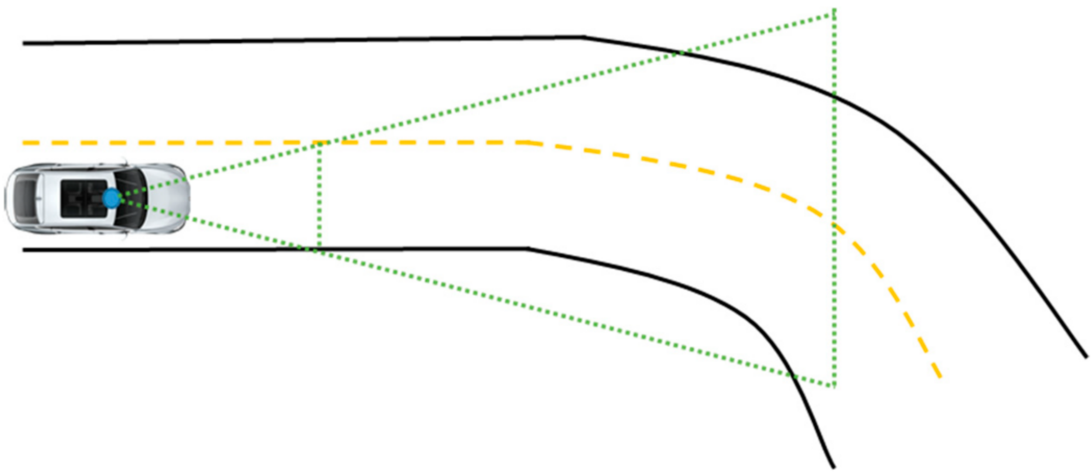


Fig 7.2(c) graphically diagram of line and lane detection

CHAPTER-8

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