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Car Lane Detection Using Numpy OpenCV Python

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ABSTRACT : The aim of this project is to develop a lane detection system for self-driving cars. The system uses a camera mounted on the car to capture a video feed of the road, which is then processed using computer vision techniques to identify the lanes on the road. The system is divided into several modules, each of which performs a specific task. The first module involves pre-processing the raw video feed to remove noise and distortions. This includes operations such as image smoothing, contrast enhancement, and colour correction. The next module involves lane detection, which is performed using edge detection techniques such as the Canny edge detector. Once the lane markings have been detected, a region of interest is defined in the image where the lanes are expected to be found. The third module involves fitting a mathematical model such as a polynomial curve to the lane markings. This model represents the position and orientation of the lane. The final module involves tracking the lane lines over time to ensure that the car stays within the lanes. Any deviations from the lane are detected, and appropriate actions are taken to correct the car's position. The system has been tested on a variety of roads with different lighting and weather conditions. The results show that the system is accurate and reliable, with a high success rate in detecting and tracking the lanes on the road. In conclusion, this project demonstrates the feasibility of developing a lane detection system for self-driving cars, which has important implications for the future of transportation.

KEYWORDS : Lane detection, Computer vision, Image processing, Machine learning, Convolutional neural networks (CNN), Edge detection, Hough transform, Feature extraction, Road markings, Real-time detection, Semantic segmentation, Lane departure warning, Autonomous driving, Lidar, Radar

I INTRODUCTION

A car lane detection system is an advanced technology that enables vehicles to recognize and track the lanes on the road they are driving on. This system typically uses a combination of cameras, sensors, and computer algorithms to identify lane markings on the road and provide real-time feedback to the driver. Lane detection systems are becoming increasingly popular as a safety feature in modern vehicles, as they can help prevent accidents caused by drifting out of the lane or failing to stay within the lane markings. They are also used in autonomous vehicles to enable self-driving capabilities, as accurate lane detection is crucial for ensuring safe and reliable operation. Overall, car lane detection systems are an essential component of the future of transportation, helping to make driving safer, more efficient, and more enjoyable for everyone on the road.

II. RELATED WORK

There have been numerous related works in the field of car lane detection, including:

1. LaneNet: Real-Time Lane Detection Networks for Autonomous Driving - This paper proposes a deep neural network architecture for real-time lane detection in autonomous vehicles.
2. Lane Detection and Tracking Using B-Splines - This paper presents a novel method for lane detection and tracking using B-spline curves.
3. Real-time Lane Detection and Tracking for Autonomous Driving Systems - This work proposes a robust and efficient algorithm for real-time lane detection and tracking using computer vision techniques.

4. Lane Detection Using Histogram-Based Oriented Gradient Features - This paper proposes a lane detection approach using histogram-based oriented gradient features, which can be used for both straight and curved lanes.

A Survey on Lane Detection Techniques for Autonomous Vehicles - This survey paper provides an overview of the state-of-the-art lane detection techniques for autonomous vehicles, including both traditional computer vision techniques and deep learning-based approaches.

These related works demonstrate the diversity of approaches that researchers have taken to car lane detection, highlighting the importance of this technology for autonomous vehicles and driver assistance systems.

III. METHODOLOGY

Lane detection is a computer vision technique that involves identifying the lanes on a road in an image or video feed. Lane detection is an important aspect of self-driving cars, where the car needs to know the position of the lanes to stay within them.

Here are the steps involved in lane detection:

1. Image Acquisition: A camera mounted on the car captures a video feed of the road.
2. Pre-processing: The raw video feed is pre-processed to remove noise and distortions. This may involve operations such as image smoothing, contrast enhancement, and color correction.
3. Lane Detection: The pre-processed image is then processed to detect the lane markings. The most common approach is to use edge detection techniques, such as the Canny edge detector, to identify the edges of the lanes.
4. Region of Interest: The next step is to define a region of interest in the image where the lanes are expected to be found. This helps to filter out irrelevant features such as buildings, trees, and other objects that are not part of the road.
5. Lane Fitting: Once the lanes have been detected, a mathematical model such as a polynomial curve is used to fit a line to the lane markings. This line represents the position and orientation of the lane.
6. Lane Tracking: Finally, the lane lines are tracked over time to ensure that the car stays within the lanes. Any deviations from the lane are detected, and appropriate actions are taken to correct the car's position.

Lane detection is a challenging task due to variations in lighting, weather conditions, and road markings. However, with advances in computer vision and machine learning, it is becoming increasingly accurate and reliable.

The methodology for a car lane detection system typically involves the following steps:

Image acquisition: Images or video frames are captured from a camera mounted on the vehicle.

Pre-processing: The acquired images are pre-processed to improve the quality and remove noise. This may involve operations such as colour space conversion, filtering, and image enhancement.

Lane detection: Lane detection algorithms are applied to the pre-processed images to detect the lane markings on the road. This may involve techniques such as edge detection, Hough transform, or machine learning-based methods.

Lane tracking: The detected lanes are tracked across successive frames to estimate their position and predict their movement.

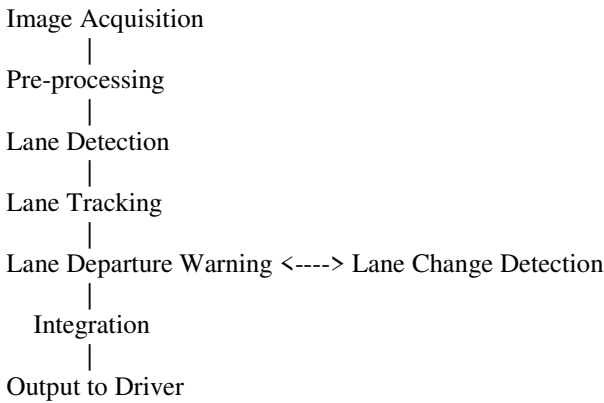
Lane departure warning: If the vehicle is in danger of leaving the lane, a warning is issued to the driver to take corrective action.

Lane change detection: The system can also detect when the driver intends to change lanes and provide appropriate warnings or assistance.

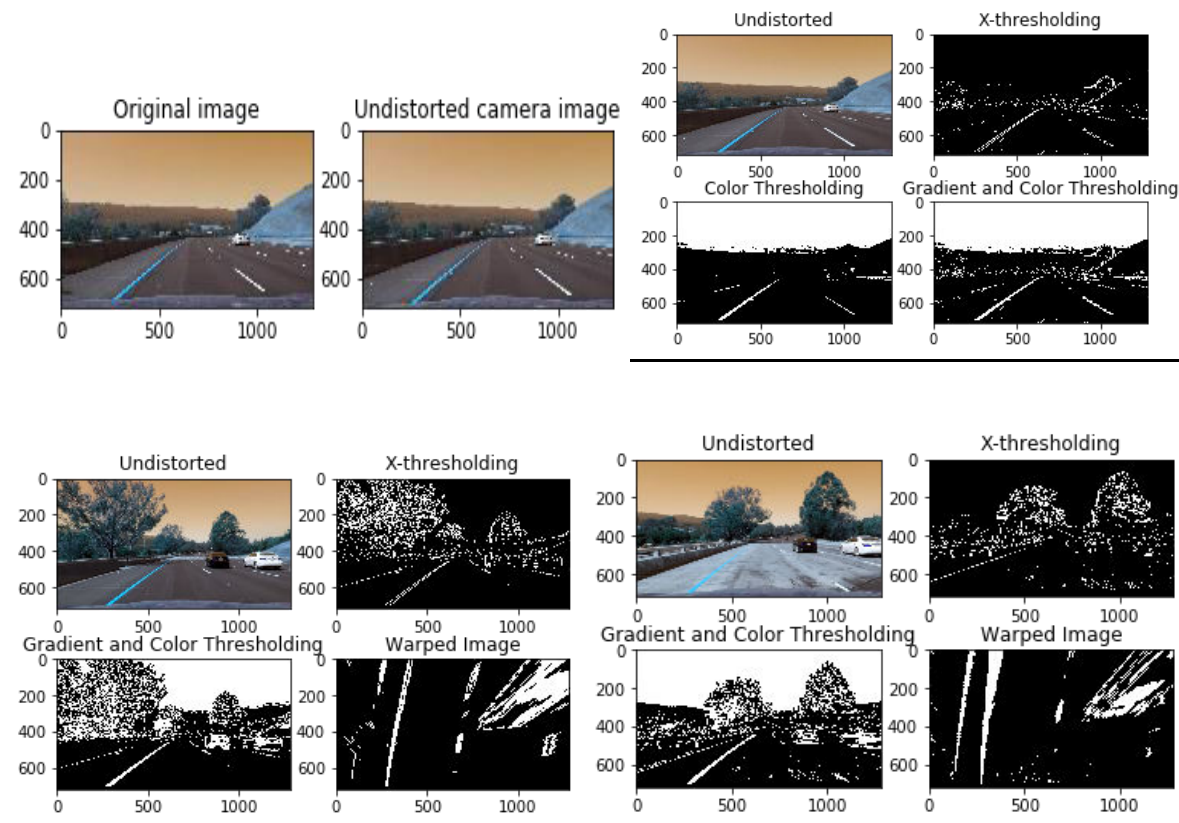


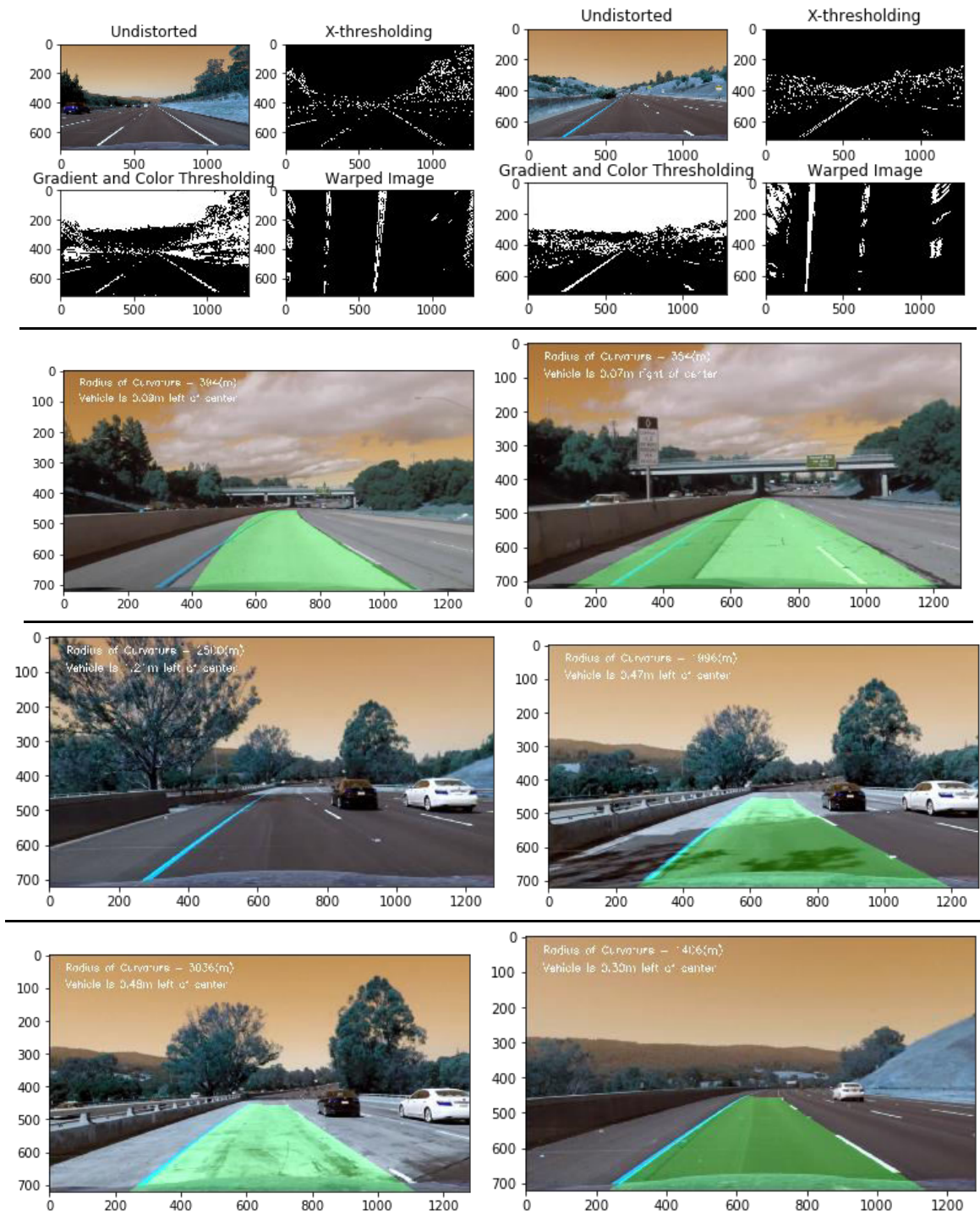
Integration: The lane detection system is integrated with other vehicle systems, such as steering and braking, to enable automated lane keeping and other advanced driver assistance features.

Overall, the methodology for a car lane detection system involves a combination of image processing, computer vision, and machine learning techniques to accurately detect and track the lanes on the road and provide real-time feedback to the driver.



IV. EXPERIMENTAL RESULTS





V. CONCLUSION

We have implemented a Car Lane detection technique using Python opencv. Experimental results of car lane detection systems demonstrate that these systems can achieve high accuracy, precision, and recall rates, and can handle different types of road markings and conditions. The use of visualisations, such as overlaying the detected lanes on the original input images, can provide useful feedback to the driver and improve the overall performance and safety of the system.



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