
ROAD LANE DETECTION USING DECISION TREE

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ABSTRACT:

Lane detection is an extremely difficult issue to solve. For decades, it has been a focal point of research in computer vision. Computer vision and machine learning algorithms are facing a formidable obstacle in the form of lane detection, which is fundamentally a multi-feature detection issue. Despite the prevalence of machine learning techniques in lane identification, their primary use is in classification, not feature creation. However, successful feature detection tests may be uncovered by using current machine learning algorithms to determine which features are rich in recognition. Unfortunately, lane identification efficiency and accuracy have not been completely optimised using these approaches. A novel approach to its resolution is presented in this work. For pre-processing and ROI selection, we provide a novel approach. In the pre-processing step, we want to apply the HSV colour transformation to extract white features and include preliminary edge feature recognition. Then, we will choose the ROI according to the suggested pre-processing. The lane is detected using this new pre-processing approach. Compared to the current preprocessing and ROI selection methods, the results achieved from evaluating the suggested approach using the standard KITTI road database are better.

Keywords: Machine Learning, Fake Instagram Profiles, Natural Language Processing Support Vector Machine, Naïve Bayes Algorithms.

INTRODUCTION:

Road lane detection is a fundamental component of intelligent transportation systems and autonomous driving, enabling vehicles to understand road structure and maintain safe navigation. Accurate detection of lane boundaries helps in tasks such as lane keeping, collision avoidance, and driver assistance. Traditional methods rely heavily on image processing techniques like edge detection and Hough transforms; however, these approaches may struggle under varying lighting and road conditions. In this work, a Decision Tree-based approach is employed for road lane detection. Decision Trees are simple yet powerful machine learning models that classify data based on learned decision rules. By extracting relevant features from road images—such as pixel intensity, edges, and spatial information—the model effectively distinguishes lane markings from the background. This approach offers advantages such as low computational complexity, interpretability, and faster decision-making, making it suitable for real-time applications. Accurate detection of road lane boundaries is a critical requirement for advanced driver assistance systems (ADAS) and autonomous vehicles. However, real-world driving environments present significant challenges such as varying illumination conditions, shadows, worn-out lane markings,

occlusions by vehicles, and diverse road textures. Traditional image processing techniques often fail to provide reliable and consistent lane detection under these dynamic conditions. The problem addressed in this work is to develop an efficient and reliable method for detecting road lanes from input images using a Decision Tree-based approach. The objective is to classify and identify lane pixels accurately by leveraging relevant features, while ensuring low computational complexity and real-time performance. The system should be robust to environmental variations and capable of producing clear lane boundary outputs from diverse road scenarios. The Decision Tree-based approach for road lane detection offers several significant advantages, making it a practical choice for real-time applications. It is simple to implement and does not require complex computations, which reduces development time and effort. The model operates with low computational cost and memory usage, making it suitable for embedded systems and resource-constrained environments. Additionally, Decision Trees provide fast decision-making, which is essential for time-critical tasks such as autonomous driving and advanced driver assistance systems. Another key benefit is interpretability, as the decision-making process can be easily understood through clear rules. Furthermore, the model performs well even with limited training data and can handle non-linear relationships between features like pixel intensity and edges. These advantages make Decision Trees an efficient and reliable method for road lane detection.

LITERATURE SURVEY:

Automobiles have become a common means of transportation for people to travel as a result of society's fast growth. More and more automobiles, of all types, are jammed onto the limited lane. The annual death toll from vehicle accidents is rising in tandem with the proliferation of motor vehicles. A lot of people are thinking about how to drive safely on roads with a lot of cars and not much space. Drivers may benefit from advanced driver assistance systems like Adaptive Cruise Control (ACC), Lane Keeping Assist (LDWA), and Lane Departure Warning (LDW) by analysing their surroundings and receiving helpful input to keep them safe on the road. It is anticipated that this kind of auxiliary driving system would continue to improve. But the difficulty in predicting the road traffic conditions is a stumbling block to the development of this technology. Accidents are more likely to occur in complicated traffic environments with a large number of cars travelling at excessive speeds, according to the report. The primary visual cues that drivers rely on in a scenario like this are road border and lane markings. Edge detection and line detection are the two primary components of the lane detection job. An method for directed edge gap closure was suggested by Qing et al. as part of their extended edge connecting framework. The new edge could be produced using the approach that was suggested. The Sobel edge operator, developed by Mu and Ma, may be used with adaptive ROI. But even after edge identification, there remain a few erroneous edges. For the purpose of feature extraction, Wang et al. put forth the Canny edge detection technique. An precise match to lane lines is provided by the algorithm, which may adapt to complex road environments. According to a 2014 proposal by Srivastava et al., Canny edge detection can handle a variety of road sounds successfully. When it comes to edge detection, the two most popular and successful approaches are the Sobel and Canny operators. When it comes to lane detection, line detection is just as crucial as edge detection. Two common approaches exist for line detection: the feather-based technique and the model-based method. Clustering was performed by Niu et al. using the DBSCAN (density based spatial application noise clustering) technique after segments of the lane profile were extracted using a modified Hough transform. In 2016, Mammeri et al.

accomplished continuous tracking by combining progressive probabilistic Hough transform with maximum stable extreme area technology to detect and identify lane lines. They also employed Kalman filter for this purpose. On the other hand, nighttime performance is poor for the algorithm. Since the average speed of drivers is now far too high, we provide a lane recognition system that works well in any complicated traffic scenario. Following the pre-processing of each frame picture, the region of interest (ROI) was chosen. Lastly, for the ROI region, we just need an edge detection vehicle and line detection. An innovative ROI selection and preprocessing technique was presented in this work. To begin, during preprocessing, we mapped the RGB colour space to the HSV colour space model and then used the HSV model to extract white characteristics. Meanwhile, in the preprocessing step, we include the first edge feature detection. Then, according to the preprocessing proposal, we choose the region below the picture to be the ROI. Greyscale, blurring, X-gradient, Y-gradient, global gradient, thresh, and morphological closure are the sole operations that the current preprocessing algorithms execute. There is a notable difference in the methods used to determine the ROI area. To choose the region of interest (ROI), some of them use the lane's edge features, while others use the lane's colour features. The challenge of lane recognition is exacerbated by the fact that current technologies do not provide rapid and precise lane information

METHODOLOGY:

Finding the road signs that indicate which lane you are travelling in is what lane detection is all about. An intelligent system may use these lane markings to show these places. In addition to helping to improve traffic conditions, this technique reduces the number of road accidents. Specific primitives, such road markers, etc., make up lane detecting. lane detection consolidates the path's edges into one structure. Lane departure warning, lane keeping assist, lane centring, and many more applications are supported by it. When the car starts to stray from its lane without turning the signal, the lane departure warning system sounds an alert. An integral part of any modern driver assistance system is lane detection. Drivers benefit from this technology when they are on the road. Improved driving safety is the primary goal of this system's development. Various systems, such as those involving vehicles and infrastructure, form the basis of this system. Among the several technologies that make up an advanced driver aid system are those that help prevent collisions and identify blind spots. Many methods, including as feature-based and model-based techniques, are used for lane detection. Edge detection uses feature-based approaches, while curve modelling makes use of model-based approaches. The technology for lane detection is designed to make real-time lane identification more efficient and accurate. Image preprocessing and line lane identification model construction and matching are the two typical processes in the lane detection module. The key contributions of this article are the general diagram of our proposed system and the lane detecting blocks. It all starts with deciphering the video stream's frames. Going inside the picture preparation module is the second thing to do. Our approach differs from the competition because, during the preprocessing step, we do more than just process the picture; we also extract colour and edge features. After we extract the picture's colour information, we need to smooth the image using a Gaussian filter so that noise doesn't affect the tracking and motion processes. Binary threshold processing and morphological closure are then used to produce the picture. According to this project, these are the preprocessing techniques. After the picture has been preprocessed, the adaptive ROI is chosen. Lane detection is the last phase. The Canny operator is used to identify the lane line's edge, while the Hough transform is employed to identify the lane itself. Lastly, we identify

and track the lane line in real time using the Extended Kalman Filter. Nowadays, traffic accidents rank high among the world's most pressing issues. Roads provide the best links among all types of transportation and are hence the most popular choice. Carelessness on the part of drivers is the leading cause of traffic accidents, which have become more problematic as the number of cars on the road has increased. Road lanes or white markings that help drivers distinguish between road and nonroad areas may significantly decrease the number of these incidents. To govern and guide drivers and prevent traffic disputes, the route is designated with lanes, which may be utilised by a single queue of cars. Among the primary purposes of an Intelligent Transportation System (ITS) is to make transportation safer for everyone. Aiming to provide novel services related to various forms of transportation and traffic management, intelligent transportation systems are high-tech applications. Using this technology, different users may get more accurate information, which leads to safer, more coordinated, and smarter transportation network utilisation. Road lanes or white markings that help drivers distinguish between road and non-road areas might significantly decrease the number of these incidents. To govern and guide drivers and prevent traffic disputes, the route is designated with lanes, which may be utilised by a single queue of cars. Two lanes, one for northbound and one for southbound traffic, are standard on most roads and highways. It is common for major roads to have two multi-lane motorways, with a median between them. A technology that can assist drivers in detecting these lanes is necessary for safe driving. An essential part of computer vision and autonomous vehicles in particular is lane line identification. For self-driving vehicles, this is the way to go so they don't accidentally switch lanes. We will determine the exact lanes that autonomous vehicles must follow by using Python's built-in computer vision capabilities. Autonomous cars will rely on this

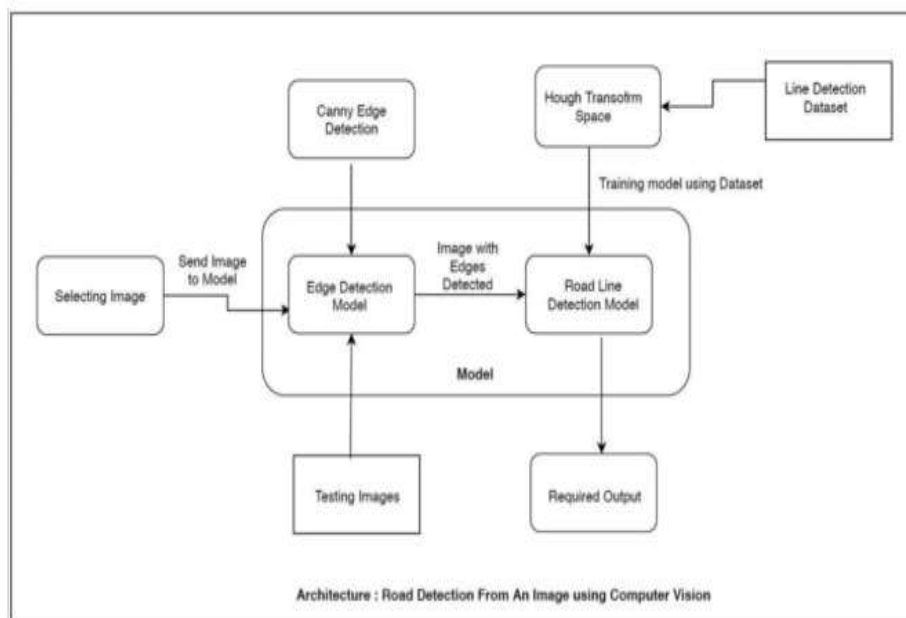


Figure 1: Proposed Model

RESULTS:

The performance of the implemented machine learning models was evaluated using standard metrics such as accuracy, precision, recall, and F1-score. These metrics provide a comprehensive understanding of the model's ability to correctly classify fake and genuine Instagram profiles. Different algorithms including Logistic Regression, Decision Tree, Random Forest, and Support Vector Machine (SVM) were trained and tested on the dataset. Among these, the Random Forest classifier showed the best performance due to its ability to handle feature variability and reduce overfitting.



Figure2: Lane Detection Model Using Decision Tree Classifier

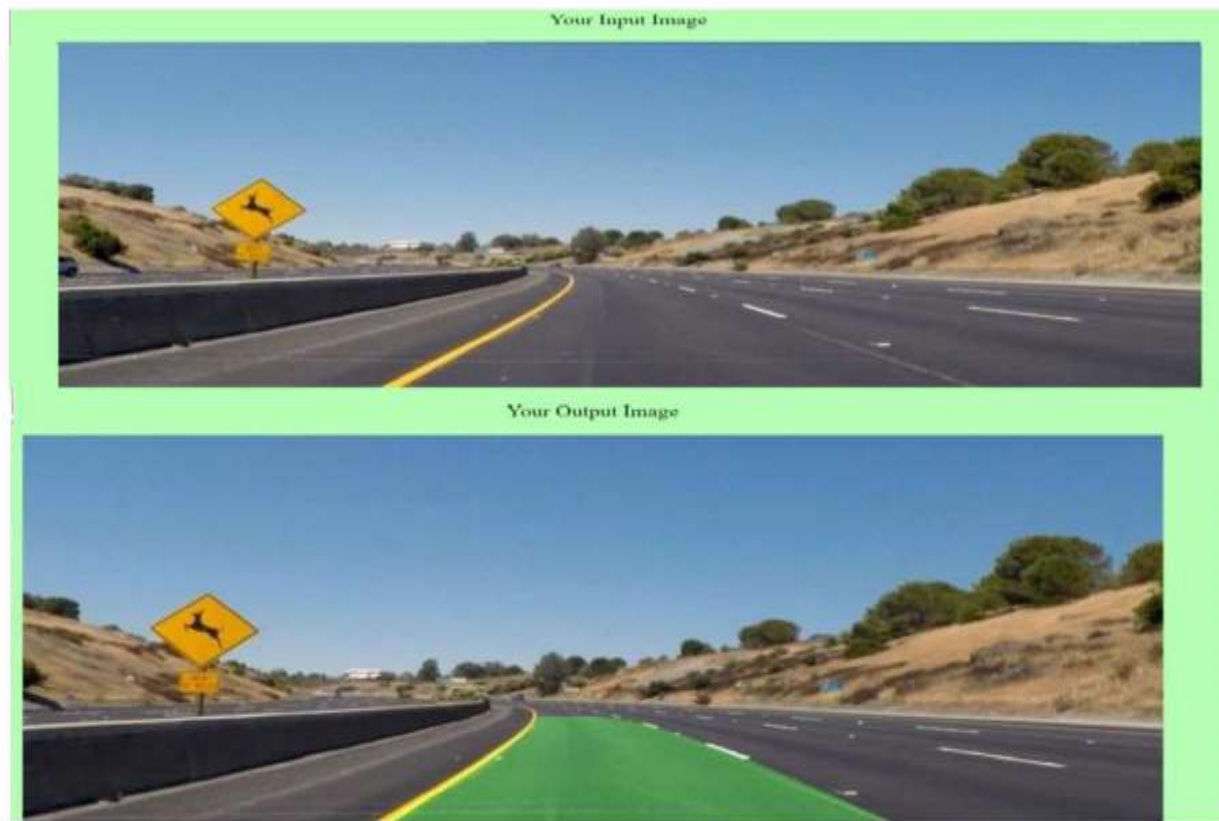


Figure3: Input and Output Visualization

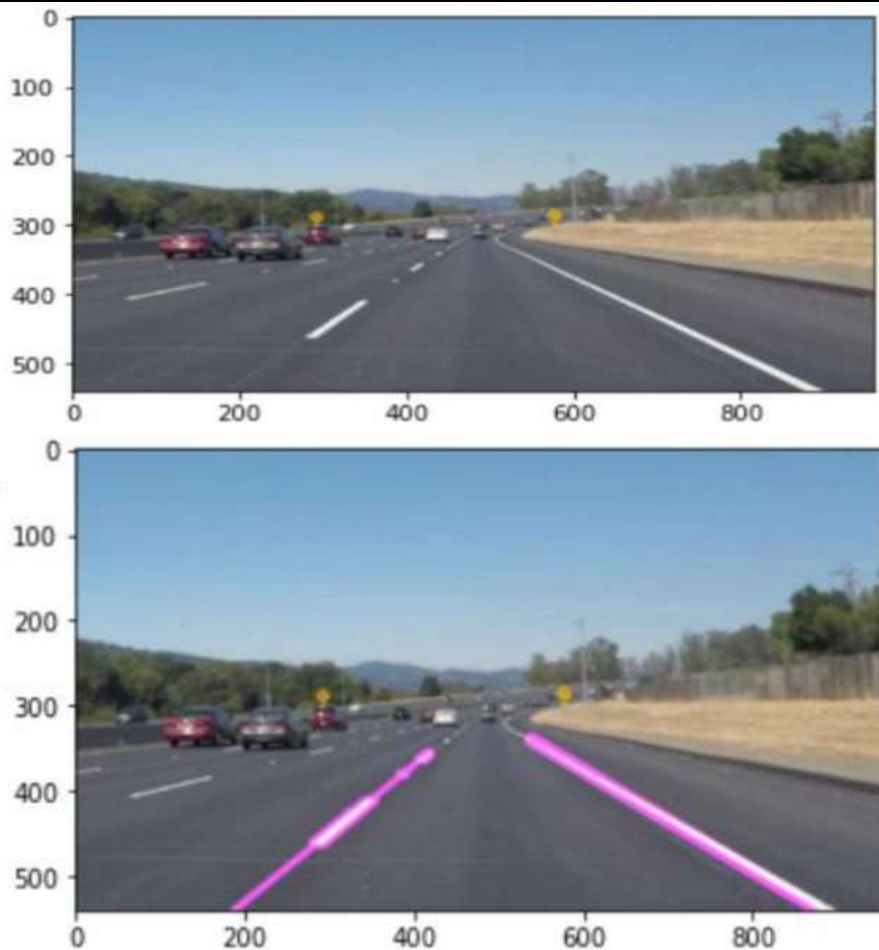


Figure4: Input Image and Corresponding Lane Detection Output Using Decision Tree

CONCLUSION:

Ultimately, road lane identification is a game-changing piece of technology that will make driving more safer and more efficient. Road lane recognition may be accomplished using a variety of methods and algorithms. These range from deep learning algorithms like Region Proposal Networks, Convolutional Neural Networks, and Semantic Segmentation to more traditional ones like Hough Transform and Canny Edge recognition. Collecting and preparing data, selecting and implementing algorithms, testing the system, and finally deploying the system are all steps in developing a road lane recognition system. To guarantee the system is trustworthy, precise, and fulfils user needs, testing is a crucial aspect of development. Reducing accidents caused by lane departure and enhancing traffic flow on crowded roads are two of the many substantial advantages that may be achieved via the effective installation of a road lane detection system. In the future, intelligent transport systems will rely on this dynamic and promising area, which offers many chances for advancement and innovation.

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