AI BASED LANE AND OBJECT DETECTION FOR SAFE VEHICLE DRIVING

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Abstract—Humans use their optical vision for vehicle manoeuvring when driving. The road lane markings serve as a constant reminder for moving trafficnavigation.The creation of an automatic lane detection system that uses an algorithm is one of the requirements for a self-driving car. Cars may be able to comprehend their environment thanks to computer vision technologies. It isa subfield of artificial intelligence that gives computer programmes the ability to comprehend the information of images and videos. Because to advancements in deep learning, modern computer vision has come a long way. Now, it can identify various things in photos by analysing and comparing millions of samples and identifying the visual patterns that characterise each object. While particularly useful for categorization jobs.Several technologies, including sensors, computer vision, machine learning, and natural language processing, can be used to create an AI-based safe driving vehicle.A suggested system for an AI-based safe driving car is as follows:Computer Vision:Algorithms for computer vision will process the sensor data to find and identify things in the surroundings. These algorithms will aid the car in recognising other vehicles, pedestrians, and roadblocks.The car will be trained to recognise patterns and make choices based on the data gathered by the sensors using machine learning techniques. The algorithms will be created so that the car can learn from its mistakes and develop better driving habits.

I. INTRODUCTION

Computer vision is building a major role in automatic vehicles. In safe driving automatic vehicles there has many advancement in the field of AI. One of the most important requirement to drive a vehicle is object and lane detection. This detection can be easily done by normal humans but it is challenging for the physically challenged people. Automatic vehicles will make this job easy. Object tracking is typically used procedure to detect the moving Objects beyond time by utilizing the camera in video sequences. This tracking performance is to identify the target objects and location of the objects in successive video sequences. Subsequently classification of objects, identification of the objects, and its detection is essential for object tracking and recognizing in computer vision application and it's also a initial step towards detecting any moving lane in the frame of the video material. Although, in image processing approach for lane tracking with the help of video sequences is a challenging task.

Detection of objects such as vehicles, pedestrians, birds, animals and so on. Furthermore, several other issues ascribed to occlusion for the lane and object to scene, object to object, complex object motion, cleaning the visual in objects, real-time processing requirements as well as the improper or distorted shape of the curve-lines in road. However, this type of tracking is being used in traffic monitoring, robot vision, surveillance, security and video communication, public areas like underground stations, airports, animation.

The main object in this project is to help the physically challenged people who can't able to drive the cars without the help of others. To make it possible AI algorithm is used. This algorithm needs an optical trade-off among computing and communication relies in relating the revenue on the amount and type of cooperation executed to reduce the estimation errors and ambivalences, they are executed among cameras for data collection, dispending and processing to confirm decisions. Lane and object tracking is imposing its importance in the area of computer vision because of the expansion of high- powered computers and the heightened of automated surveillance systems. It is mainly used in the sector of automated surveillance, robotics monitoring, driverless vehicles, human-machine interface, motionbased recognition, vehicle navigation, traffic monitoring and video indexing. To meet the real-time restrictions and challenges, illumination of scenes such applications requires much reliable and efficient tracking methods are used. The results of road lane and object tracking could be impacted by the disparity of one among the parameters. To overcome the above explained issues and in object tracking and lane detecting a large number of approaches have been proposed. In this road lane line and object tracking, target will be in straight parallel lane-lines like cars and pedestrians. The current PC vision, the innovation is utilized in independent by controlling the AI's input channels to drive it to commit errors.

II. LITERATURE REVIEW

Enhancing autonomous driving, especially by performing accurate road lane line detection, has been a major research interest in past few years. Several researchers have performed real time vision based lane detection using various techniques. This chapter discusses few of those research works and related algorithms in brief. Yuan et al. [18] established a novel method for tracking road lanes for vision-guided autonomous vehicle navigation. They use an inverse perspective mapping to remove the perspective from the camera and then detect the edges of the road lanes from the inverse perspective mapping images. An algorithm for 'particle filtering' is used to compute the likelihood between all the particles with the edge images, hence forth estimating the three parameters of the real state of road lane lines. This lane detection method is tested in real road images to achieve reliable results. P. Mandlik and A.B. Deshmukh [5] presented a Lane Departure Detection System(LDWS) in accordance with Advanced Diver Assistance System(ADAS) to warn the driver when the vehicle tends to depart it's lanes. LDWS is based on the lane identification and tracking algorithm and uses OpenCV implementations of 'Canny Edge Detection' and 'Hough Transform' to detect vehicle lane departure on a Raspberry Pi. The experiments are conducted on the images captured using a toy vehicle with a USB camera,'Intex IT-305WC webcam', mounted on top. Out of many straight lines detected by Hough Transform, the longest straight lines are identified as the lane lines. The results are collected using Intel Core i3 1.80 Ghz processor. X. Du et al. [16] proposed a robust vision-based methodology to deal with challenges during lane detection like shadows, shifting lighting conditions, faded-away lane lines, etc.

The methodology incorporates four key advances: Using a ridge detector, the linepixels are pooled. Then, using a noise filtering mechanism, noisy pixels are removed. After removing noises, a sequential Random Sample consensus is employed to ensure that each lane line in the image is collected correctly. In the final step, a technique: parallelism reinforcement is employed to enhance the accuracy of the model. The model is also fit to localize vehicles with respect to the road lane lines. Q. Truong and B.R. Lee [6] used the principal approach to detect road boundaries and lanes using a vision-based system in the vehicle. The paper presented a methodology to detect and estimate the curvature of lane boundaries. Avector-lane-concept and nonuniform B-spline (NUBS) interpolation method is used to construct the boundaries of road lane lines. Based on the lane boundary, the curvature of left and right lane boundaries are calculated. For experimental purposes, images are captured using a monocular camera. Experimental results are based on real world road images, as presented in the paper. A.A.M. Assidiq et al. [15] exhibited a vision-based lane detection approach to handle frequently varying lighting and shadow conditions. The framework acquires the frontal view of the road by utilizing a camera mounted on the vehicle. A couple of hyperbolas, fitting to the edges of the lane, are paired with Hough Transform to extract the lane lines. It has also been asserted that the proposed lane detection framework can be used on both painted as well as unpainted roads, as curved and straight roads. The experimentalresults demonstrate that the proposed framework can be utilized for real time requirements. R. Lienhart and J. Maydt. An Extended Set of Haar-like Features for Rapid Object Detection. The framework is boosted cascade of simple feature classifier. In this paper they have a introduce a novel set of rotated Haar-like features. These novel features significantly enrich the simple features of Viola et al.And can also be calculated efficiently.

III. PROBLEM STATEMENT

Currently, there are no fully autonomous vehicles that can transport blind individuals without the need for human assistance. However, there are several assistive technologies that can help blind people travel by car with minimal assistance.

GPS Navigation: Blind individuals can use GPS navigation systems to navigate to their desired destination. These systems provide audio directions, which the user can hear through a Bluetooth headset or the car's speakers.

Blind Spot Detection:Blind spot detection systems can detect objects in a driver's blind spot and provide an audible or tactile warning to the driver. This technology can help blind individuals change lanes more safely.

Adaptive Cruise Control:Adaptive cruise control systems use radar or cameras to maintain a safe distance between the car and the vehicle in front of it. Blind individuals can use this technology to maintain a safe following distance without the need for constant monitoring.

Voice Commands: Many modern cars have voice-activated controls that can be used to adjust the temperature, change the radio station, or make a phone call. Blind individuals can use these voice commands to control the car's features without having to take their hands off the steering wheel.

Ride-Hailing Services: Ride-hailing services like Uber and Lyft allow blind individuals to travel independently without owning a car. These services provide an accessible option for individuals who cannot drive and may not have access to public transportation.

Overall, while there is no fully autonomous vehicle solution for blind individuals at this time, these assistive technologies can help blind people travel by car with greater independence and safety.

IV. PROPOSED SYSTEM

An AI-based safe driving vehicle can be designed by integrating multiple technologies, including sensors, computer vision, machine learning, and natural language processing. Here is a proposed system for an AI-based safe driving vehicle:

Computer Vision: Computer vision algorithms will process the data collected by the sensors to detect and recognize objects in the environment. These algorithms will help the vehicle to identify other vehicles, pedestrians, and obstacles in the road.

Machine Learning: Machine learning algorithms will be used to train the vehicle to recognize patterns and make decisions based on the data collected by the sensors. The algorithms will be designed to learn from the vehicle's experiences and improve its driving behaviour.

Natural Language Processing: Natural language processing (NLP) will be used to enable the vehicle to communicate with passengers and other vehicles on the road. The NLP system will also help the vehicle to understand and respond to voice commands.

Redundancy: The AI-based safe driving vehicle should have a redundant system that can take over in case of a failure in the main system. This will ensure that the vehicle can continue to drive safely even in the event of a malfunction.

V. BLOCK DIAGRAM

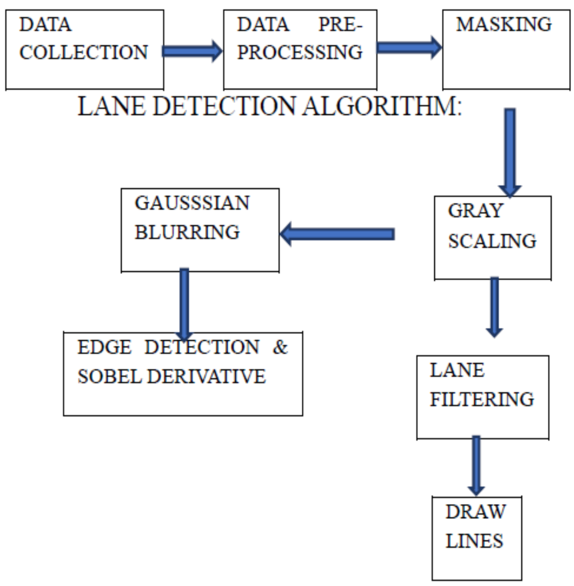

Figure 3.0 lane detection process flow chart

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VI. MODULE DESCRIPTION

The algorithm designed for the real time road lane lines detection. The algorithm is divided into five stages - data collection, data pre-processing, gradient change detection using Sobel, line detection using Hough, and line filtering using slope and intercept values. Subsequent sections describe each stage in detail. The flow process used in the lane detection is shown in below figure 3.

LANE DETECTION ALGORITHM:

Figure 1. basic flow diagram of object detection

Figure 2. basic flow diagram of lane line detection

VII. IMPLEMENTATION & RESULTS

DATA COLLECTION:The data set is collected over multiple drives during varying climate conditions. A camera is used to capture 10 frames per second over an interval of 30 minutes (i.e.1800 seconds). The camera settings for capturing the data is given in the algorithm section below. For experiments, the collected videos are saved to the local in the memory space provided by the attached memory card. The videos collected in h264 format are converted into mp4 and individual frames are extracted from mp4 videos and are converted to jpg images.

The results from the above algorithm are stored in a directory on the local machine and each file is read individually to be processed and saved in the output directory.

DATA PRE-PROCESSING: The images collected are iterated over individually and re-sized using algorithm3.1. A resized original image can be seen in Fig. 3.1.

The resizing is performed using cv2.resize() method of OpenCV. The resized image then undergoes masking, Gray scaling and Gaussian blurring.

Figure 3.1 resized original image

MASKING:It is understood that in any image containing road (or lane lines), the road surface area is present in the bottom half of the image. Using this knowledge, the region of interest is decided. The entire y section (vertical height) of the image is horizontally cut into the half and the region lying above that horizontal line is discarded. This was performed using cv2.fill Polly() and cv2.bitwise and() method of OpenCV. This method takes a row number as an input and creates a mask such that the region of interest is only below the given row. The below figure 3.2 shows the output image after masking.

Figure 3.2 Image after masking

GRAY SCALING:In the future stages of the presented algorithm such as edge detection and Hough transformation converts the image into a single colour scale, this is also called as grayscale. Therefore, the region of interest extracted in the previous stage during masking, is rendered.This is performed using cv2.cvtColor() method of OpenCV. This method takes a coloured image as an input (RGB) and returns a grayscale image as an output. Further processing is done on the resulting grayscale image.

GAUSSIAN BLURRING:Once the Gray scaling is done, noise reduction is performed on the image. A gaussian kernel is used to blur/smoothen the image. It is done with the help of an OpenCV function, cv2.GaussianBlur(). The width and height of the kernel are required to be defined which should be positive and odd (both are defined as 5 in our case). It will also specify the standard deviation in X and Y direction, sigma X and sigma Y respectively (defined as 0 in This method takes a grayscale image as an input and returns a blurred image as an output depending on the kernel size. Further processing is done on the resulting grayscale blur(smooth) image.

Figure 3.3 image with detected edge pixel

FILTERING LINES:As shown in figure 3.4, multiple lines detected by Probabilistic Hough Transform do not belong to road lane lines. To discard the unwanted lines, two filtering methods are used - filtering using slope value and filtering using intercept value. These methods are described in the subsections below.

Any line can be represented in the form of ρ and θ. The motivation behind this method is to discover the instances belonging to a line shape by a voting procedure. This voting method is performed in a parameter space.In the given algorithm, this is performed by using an OpenCV method cv2.HoughLinesP().

HOUGH LINES DETECTION:Hough Lines stands for Probabilistic Hough Transform, which is an optimization of Hough Transform discussed above. In addition to minimum number of votes it also takes two more parameters minimum length of line and maximum allowed gap.

Where, threshold is the minimum number of votes required to consider the given edge as a line, min Line Length is the minimum length of line (line segments shorter than this are rejected) and max Line Gap is the maximum allowed gap between line segments to treat them as single line. Detected Hough lines is shown in Fig. 3.4.

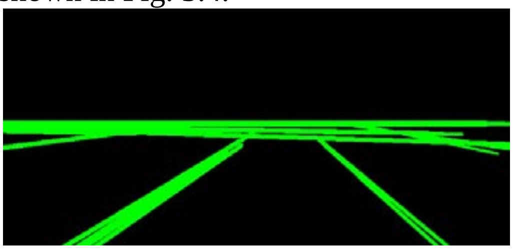

Figure3.4 Detected Hough lines

VISUALIZING LINES:This section describes the last stage of road lane line detection algorithm. Once the edges(gradients change using Sobel operator) on the gray-scaled blur image are detected and transformed into potential lane lines using Probabilistic Hough

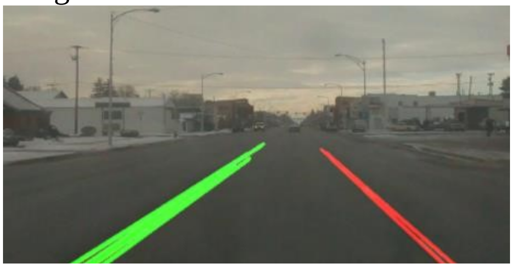

Fig. 3.5Visualizing resultant image

Transform, filtering is performed as mentioned in the above section. The resulting lines are marked in the original picture. A resulting image with lane lines drawn over it can be seen in Fig 3.6.

The left lane lines (with positive slope values) are marked in ‘green’ and the right lane lines (with negative slope values) are marked in ‘red’ using cv2.line().

VIII. CONCLUSION & FUTURE SCOPE

It is concluded that the sole aim of automatic detections is to avoid the major accidents on roads and help the physically challenged people with help of different algorithm such as Hough transformation, Sobel, Ran Sac, Gaussian blur, Canny edge detection. Lane detection was implemented by Hough-based transformation, Gaussian algorithm and Sobel algorithm to detect the lanes successfully. Object detection is implemented by Gaussian algorithm, Sobel, ran sac, cany edge detection algorithm which helped to detect the object successfully. The algorithm were tested and implemented through the video sequence.

The lane and object detection are combined using conditional statement this can be enhanced in future work i.e.without conditional statement. Hough transformation which is used to detect the straight lanes has been achieved curve lane detection will be achieved in future work. In object detection imported video is blurred which will be analyzed and rectified in future work.

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