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Automatic Vehicle Detection and Counting System

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Abstract **–** Vehicle detection and counting is very important in traffic monitoring, toll collection, military applications etc. The technology of vehicle detection in the captured video has implementation in a variety of fields. In this paper, we implemented a basic model of Vehicle detection and counting. The video clip is taken as input, many frames are extracted and background is estimated along with shadows. The next frame is subtracted to detect all moving objects from the estimated background. From that moving objects, vehicles are detected, classified and counted for traffic estimation using OpenCV, Numpy and object detection algorithms.

Keywords: Vehicle counting, Vehicle Detection, OpenCV, Classification, Preprocessing.

I. INTRODUCTION

In this paper, we detect and classify the vehicles on road, and count the number of vehicles traveling through two lane roads. We're creating a vehicle.py program that contains all the user defined functions that will be imported in the main.py program to detect, and classify vehicles[5].

BackgroundSubtractorMOG2 algorithm is used which works based on Gaussian Mixture and help us in Foreground/ Background Segmentation. Also used an OpenCV which is a real-time computer vision library of Python.

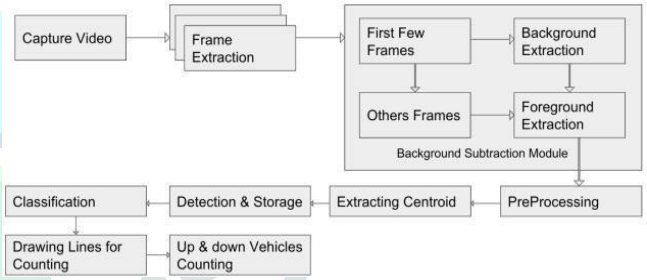

Fig1: Vehicle counting and Detection Workflowin main.py

II. LITERATURE REVIEW

Vehicle detection and tracking is a common problem. For this problem many have created projects and prototypes. Few of them are: Traditionally, identification and tracking has been carried out manually.

Vehicle detection and counting system using OpenCV and haar cascade algorithm: This paper done by Aman Preet Singh Gulati, they have coded on Vehicle counting and detection system for both image and video using [1,2]OpenCV library for carrying all the image processing operations and for classification the car and bus haar cascade classifier for detecting and counting the cars and buses. *Link:https://www.analyticsvidhya.com/blog/2021/*

12/vehicle-detection-and-counting-system-using-opencv/

Vehicle Counting, Classification & Detection using YOLO3: [3,4]In this paper, the authors focused on to detect and classify the cars, Heavy Motor Vehicle, Light Motor Vehicle on the road, and count the number of vehicles traveling through a road.
Link:-https://techvidvan.com/tutorials/opencv-vehicle-detection-classification-counting/

Vehicle Detection, Tracking and Counting: In his paper, he detected moving vehicles using the Background Subtraction (BS) algorithm.

Link:https://github.com/andrewssobral/simple_vehicle_counting

Vehicle Detection and Tracking Using YOLOv3: [6,7]This paper is done by Atharva Musale.I have used the YOLOv3 Algorithm for Vehicle Detection and Deep Sort Algorithm for Vehicle Tracking.

III. ALGORITHM

Two papers were published in 2004 and 2006, one is "Improved adaptive Gaussian mixture model for background subtraction" and the other one is "Efficient Adaptive Density Estimation per Image Pixel for the Task of Background Subtraction" respectively by Z.Zivkovic.

Background Subtraction algorithm is based on these two papers. One of the most important features of the Background Subtraction algorithm is that it chooses the appropriate number of gaussian distribution value for each pixe[9]l.

Background Subtraction algorithm provides better adaptability for varying scenarios due to illumination changes. While coding, we can create a background subtraction object using cv2.createBackgroundSubtractorMOG2() function. It has some optional parameters like number of gaussian mixtures, detectShadows, threshold, length of history, etc.

Inside the loop of video, we will be using backgroundsubtractor.apply() function to get the foreground objects. Then we're applying morphological opening to the results to remove thenoises.

IV. METHODOLOGY

The below step diagram is to detect, classify and count vehicles. From the input video,images are extracted from the input and backgrounds are subtracted, which gives the changes between two frames. [8]This Background Subtraction method can be used only for moving objects in the input video, not for the objects which are idle for some period of time in the video.

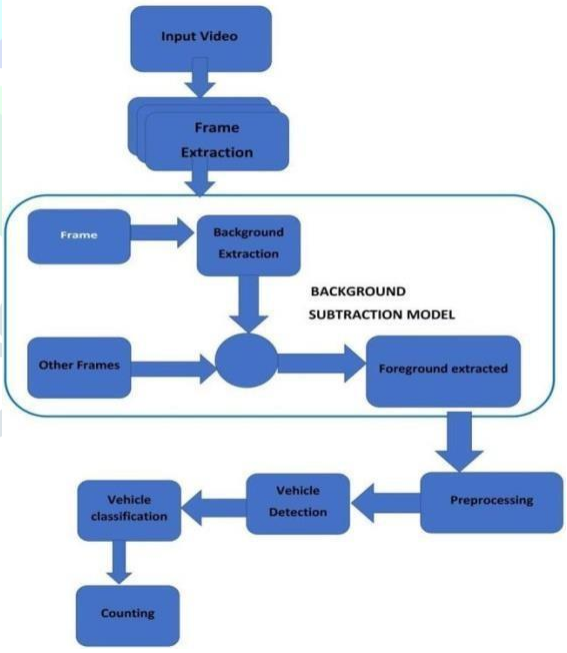

Fig2: Processing steps of proposed work

i. **Background Estimation:** The video is taken as input and then frames are extracted from it, from which, the average of these frames is registered as a background[10]

ii. **Background Subtraction:** From the registered background, the other moving frames are subtracted which gives the moving object.

iii. **Pre-processing:** Dilation andErosion are done to see the object clearly so that boundary regions of vehicles can be clearly seen. Then we'll be taking the mask of the images for detecting and classifying vehicles based on their shape features.

iv. **Vehicle Detection:** Vehicles are detected using bounding boxes around the vehicles. The centroid of a vehicle is detected based on their coordinates and it is represented by a circle in red on the vehicle[11].

v. **Classification:** Vehicles are classified by the ratio of height and ratio of width as the area. Height and width differ in car and truck.

vi. **Counting:** First of all the line is drawn as a region of interest inside the frame. After detecting the moving vehicles,their position and centroid are detected. Whenever the centroid is crossed the line drawn at region of interest, counter is incremented by 1. After all these steps vehicles are classified and counted[12].

V. SCREENSHOTS

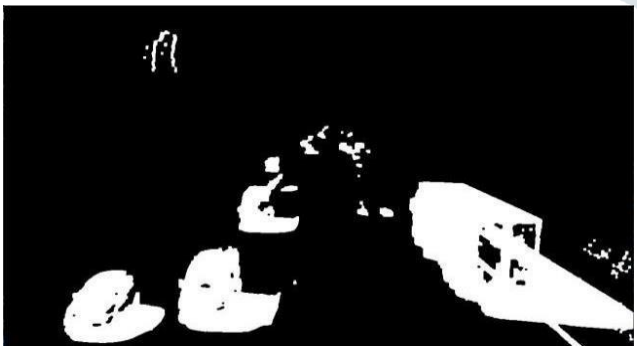

Figure 3: Result of BackgroundSubtractorMOG2 after removing background noise

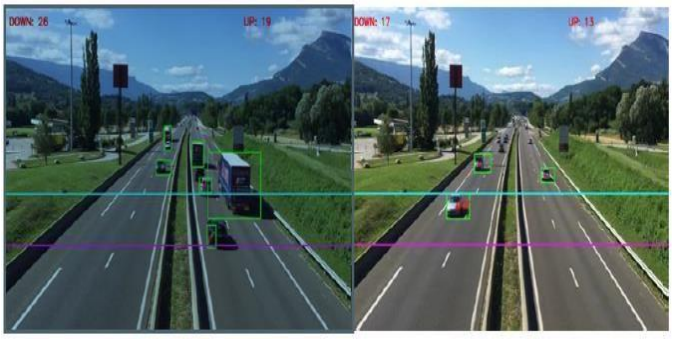

Figure 4:Final output of detection, classification and counting

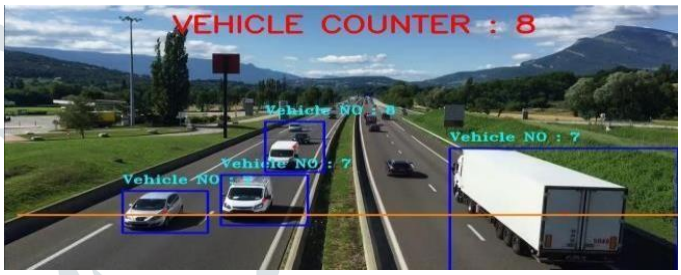

Figure 5:Vehicle detection and Counting

VI. CONCLUSION

Vehicle detection and counting is implemented on python using OpenCV, it is used to improve the quality of intelligent transportation systems. A simple interface is developed for the users to choose the interested regions to analyze and then image processing techniques are applied to classify the vehicles and calculate their count. This solution can be used in parking area allocation, traffic monitoring, etc. This is an easy method to implement at cheap expenses. This system is not efficient at detection of occlusion of the vehicles which affects the accuracy of the classification as well as counting. This can be counted as one of the limitations of this system.

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