International journal of advances in engineering and management (IJAEM)
Volume 3, issue 6 June 2021, pp: 1642-1645 www.ijaem.net ISSN: 2395-5252

The Car and Pedestrian Detection System

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Submitted: 01-06-2021 Revised: 14-06-2021 Accepted: 16-06-2021

ABSTRACT - This project focuses on Car and Pedestrian Tracking System using Python. We are using OpenCV (Computer Vision) and HAAR Cascade Classifier Algorithm (Machine Learning Xml files). Since we are tracking both car and pedestrian using computer vision, we have considered two data sets one for car and one for pedestrian with both positive and negative images. We are using the object detection algorithms i.e., HAAR for this project. Some of the possible application can be Traffic Safety, Human - Robot Interaction, Surveillance Application and Some application in vehicle detection where it aims to provide information assisting vehicle counting, Vehicle speed Measurements, Identification of traffic accidents, Traffic flow prediction, and is also being used in Tesla Industry for their Auto Drive mode.

Key Words: Car Detection, Pedestrian Detection, Machine Learning, Artificial Intelligence, Python.

I. INTRODUCTION

As the immensely fast growth of Human Population around the world there exists a massive traffic and a high collision chances among both Pedestrian and Car, Whether its between Pedestrians to Pedestrian, Car to Car or Pedestrian to car all cases of collision are fatal and can be a reason for various accidents that is being encountered every day on roads all over the globe. The amount of fatality's percentage and the graph of accidents reports keep on increasing which in turn increases the risk of casualties day by day which is happening because of these collisions between the two. To reduce this cause many traffic safety pedestrian and car rules is introduced by various road safety departments but these safety measures doesn't seems to make any difference in Graph report.

Thus various automobile industries is coming up with Autonomous car which is very advance and is able to detect pedestrian and car to avoid the collisions before its too late. Also other modes such as Auto - Pilot is being introduced in these Autonomous car which is a driverless function which further function quite similar to the Auto - Pilot mode of aeroplanes. With these Machine Learning and Artificial Intelligence function the car manages to drive by itself successfully.

This same idea is used in our system that is "Car and Pedestrian Detection System". In this system with the help of machine learning and artificial intelligence we detect the car and pedestrian through video input. The work described in this paper is related to developing an autonomous vision system which successfully detects the pedestrian and car in order to reduce this numbers of fatalities in future and collisions between car and pedestrians in the transportation environment.

II. OBJECT DETECTION SYSTEM

Car and Pedestrians Detection System is the application which is designed under automobile safety and driver assistance domain. This application mainly focuses on detecting car as well as pedestrian through a video input provided by the user. This application can also be further developed for real time detection in autonomous cars. It plays a big role in safety measures of Pedestrian and Cars which can reduce the number of accidents to a greater extent.

"It is a major component of the advanced driver assistance system (ADAS) which help the driver to drive safely. Recent literature shows a number of research activities addressing object detection/tracking in general and pedestrian detection in particular. The solutions proposed by different researchers vary in detection methods, detection scenario, feature descriptors, classification schemes, detection performance, as well as computational complexity. However, the average detection accuracy is not much

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promising even after many years of research. The fail-safe and real-time human detection from real life road scenes, even in standard resolution, is far from reality" [1].

Still after all these years of research on detection system one of the automobile industry successfully launched the first Autonomous Advance car with auto pilot mode that is TESLA which used the same machine learning and artificial intelligence technology for detection in all their phases of modes. One of the Machine Learning Concept that is Neural Network is used to train the system in achieving the full self-driving in tesla cars. Thus, such detection system is very useful and life-saving and can be further developed to use differently such as self-aware cruise control, Automatic Lane changing, lane centering and self-parking in autonomous cars

III. METHODOLOGY

Car and Pedestrian Detection System comprise of Artificial Intelligence and Machine Learning using OpenCV and written in python. OpenCV which is a huge open-source library for computer vision, machine learning and image processing. We have used Haar cascade classifier which is a machine learning algorithm for object detection. Two machine learning XML files are used and imported inside project for detection separately one for car and one for pedestrian. Step by Step process of this detection system is explained below with System Architecture and Work Flow diagram.

Step 1 - We first provide the video input on which we have to perform the detection process. We can use images also for this process. Recommend to provide 360p low quality video for fast processing of classifier.
Step 2 - Then we provide the datasets of both the objects separately for training xml including both positive and negative images. Datasets are nothing but a set of positive and negative images of an object we are detecting in the system. There is so many datasets of various object available online if not we can make our own datasets as well. In our case we are training the model for car and pedestrian detection so we have taken the datasets with both positive and negative images from online. Where positive image is an image containing the object which we have to detect and Negative image on the other hand doesn't contain the object, we can also use random picture as a negative image which doesn't contain object. Making our own dataset is tedious task it will consume more time. Because there are two objects to detect car and pedestrian, we have taken two data sets with both positive and negative images for detecting both the objects.

Step 3 - In this step we import our Trained XML file which is being trained by our objects datasets which was provided in step 2. XML is a full extensible markup language which is used for our trained model, we can either take the pre-trained XML file of any particular object or if not we can also train one using various software which is available online. One which we have used is Cascade Trainer GUI. In our case we have imported 2 Xml Files one for car and the other one for pedestrian. The accuracy of these trained Xml files depends on the number of images in the datasets which is being used for training the model with both positive and negative images.
Step 4 - Now, we have to define two classifier for both objects and then we have to placed the trained XML files of particular object into their classifier for further processing.
Step 5 - After creating classifier we have to read the input video frame by frame in a while infinite loop till the video ends or till the loop broke.
Step 6 - If the Initialization of frames is successful then we have to move to next step and if it fails it will break the loop and the program will end.
Step 7 - If the frame initialization is successful then we have to convert the RGB color to grayscale color in order to achieve high processing speed. We can either convert the frame into Grayscale inside the code or we can directly take the grayscale images for our object datasets.
Step 8 - After converting frames into grayscale we can now detect the object in our video input by making different colors rectangle for different object. We have used Yellow color for pedestrian detection and red + blue color for car detection only for user understanding.
Step 9 - Thus, we now display these output frames to user after successfully tracking car and pedestrian.

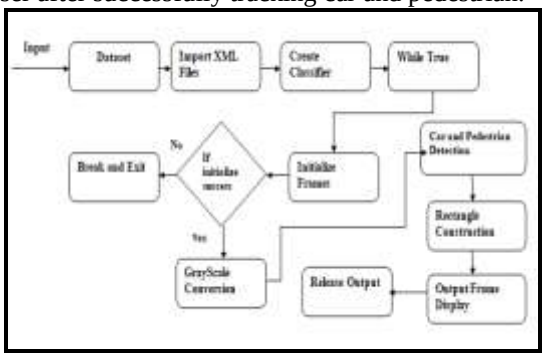

Figure 1. System Architecture and Work Flow

IV. CHALLENGES

Many challenges are faced so as to urge the expected outcomes. Few of the challenges faced are as follows:

1. Storage

A video may contain many faces. Especially during a crowded area, where many of us are present at

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an equivalent time. So as to form the appliance more accurate, every face within the video should be extracted in order that no face is missed by the appliance. Additionally, to the present the dimensions of the videos may vary and a few video could also be large in size. Large video contain sizable amount of frames from which faces are extracted. Thanks to this an outsized number of faces are to be saved. Hence, the dimension of the storage is large.

2. Faces in background

An image frame or video frame can contain different faces in various positions. Some within the front of the scene which appear clear and distinct while some within the back which cannot appear as clear and distinct because the other faces. The features of the faces might not be clear. Hence it becomes difficult to spot the faces present at the rear in any given video.

3. Partial faces

In a particular video frame, sometimes it's going to happen that an individual doesn't enter the video frame completely. The face of the person may appear partially within the video. In such times it becomes difficult to detect the face within the video. It's going to also happen that an individual isn't facing the camera but, is facing sideways. In such cases, it becomes difficult to spot an individual to be the target person only by seeing its side face. Detecting a face leaned sideways then comparing it to the target face is additionally difficult because the orientation of the face may change the values of the eigen vector.

4. Similar looking people

Often, it's going to happen that two people look almost like one another up to some extent. Thus, one person can easily be confused with another then are often their faces. It becomes important that similar looking people are often distinguished with one another to avoid the confusion of identifying the incorrect person because the target person.

5. No training set

As the image of the target person is provided by the user in real time, no training set is out there to coach the model for identifying the target person. We match the face of the target person on to the faces extracted from the videos. It might even be inconvenient to ask the user for multiple images of the target one that is to be found within the videos. Thus, it becomes difficult to spot the faces without a training set.

V. APPLICATION

It is very useful and an advance detection system which is specifically used in Autonomous cars and various other modes of autonomous car such as Self Driving, Lane Centering, Self-Aware, Self-aware traffic cruise control and so on. Pedestrian and Car Detection is one of the main topics in ADAS (Advanced Driver Assistance System).

It can also be used in various Surveillance System, Various Traffic Safety System, Robotics, some information assisting Vehicle counting system, Vehicle Speed Measurements system and some traffic flow system.

There's, also many sensors which is being used to collect the generated traffic information continuously.

VI. RESULT

The system accepts the input from the user in the form of image or video. Then it runs the trained model that is being imported inside the system according to its respective object frame by frame. This trained model then runs all the Haar Features on that video frame to detect the object. Afterwards it checks for the object inside that frame, if the object is successfully detected it draws the particular rectangle with its specified color on that object and display the output after running the trained model on all the video frames of the entire video.

VII. CONCLUSIONS

In the field of computer vision object detection is useful to detect objects such as Pedestrians, Cars and Vehicles etc. It can be used in vehicles to detect the car and pedestrian to avoid and reduce the accidents. Focusing on the available security systems, this project focuses on basic detection methods for detecting objects. This project will increase the efficiency in detecting objects and reducing the time as it takes more time in traditional systems. The system will efficiently detect car and pedestrian from the video frames given by the user to the system.

ACKNOWLEDGEMENT (Optional)

This paper was prepared under the guidance of Prof. B. W. Balkhande. The authors wish to express their sincere gratitude for providing the idea, which

indeed helped us in doing a lot of Research and we came to know about many new features and technology. We would also like to thanks others faculty members who helped us to research and completion of this paper. We also extend our heartiest acknowledge to our parents for encouraging us.

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