DETECTION AND CLASSIFICATION OF VEHICLES IN TRAFFIC BY USING HAAR CASCADE CLASSIFIER

EKREM BAŞER, Yusuf ALTUN

1,2 Department of Computer Engineering Duzce University Turkey
E-mail: 1ekrebaser@duzce.edu.tr, 2yusufaltun@duzce.edu.tr

Abstract- Because of increasing of vehicle usage throughout the world, the safety driving in traffic is gaining importance. There are many automatic auditing mechanisms to decrease the number of traffic accidents. In a public road that has lanes, possibility of a traffic accident caused by drivers who uses the wrong lane or changes the lane frequently or changes the lanes when it is forbidden is fairly high. In this study, image processing techniques are applied to detect vehicles that changes lanes hazardously and uses different lanes from its lane to go according to its classified vehicle type.

Index Terms- Haar cascade classifier, vehicle detection and classification

I. INTRODUCTION

With the increasing of the vehicles around the world, the possibility of being an accident in traffic increases dramatically. The countries all over the world take precautions to prevent the accidents. Many automatic auditing systems are developed for precaution. The faulty drivers that endangers the traffic safety are identified and punished.

To identify the faulty drivers, the images taken from the traffic surveillance cameras are used. The officers control the cameras to watch the traffic and identify the faulty drivers.

In this study, the image and video processing techniques are implemented to detect the faulty drivers on the video records taken from the traffic surveillance cameras. The proposed method is based to detect traffic violations. These are identifying the drivers that goes on wrong lane and changes the lanes when it is forbidden. In order to classify the vehicles in traffic it is needed to use a classifier on video records. We use Haar Cascade classifier that takes wide place in the literature.

There are many studies in the literature that uses Haar Cascade classifier. In [1], a real time eye gaze tracking system is developed with this classifier and results of this study shows that this classifier achieves a good rate of accuracy. In [2], the detection of faces in an image taken from camera is realized and depending on this, the fullness of the medium is figured and high accuracy rate is achieved. In [3], car detection is performed by using panoramic car images and the system achieves good rates of accuracy. In [4], also face detection is carried out by using this classifier and Convolutional Neural Networks (CNN). These methods have competitive results on detection accuracy. In [5], [6] also eye and people detection system is developed with classifier. These and other studies about Haar Cascade classifier focuses on the detection of something on an image or a video.

II. PROPOSED TECHNIQUE FOR FAULTY VEHICLE DETECTION

A. Used Technologies and Dataset

We use OpenCV (Open Computer Vision) that is developed from Intel, can run on Windows, Mac OS X, PSP (PlayStation Portable) platforms and written in C language. It has C, C++, Java and Python interfaces. As programming language we use Python language. For detecting car and training classifier BIT-Vehicle dataset is used. It has 9850 vehicle images. All the vehicles in dataset are divided into six categories: Bus, Microbus, Minivan, Sedan, SUV, and Truck in Figure 1 [7].

![Fig.1. BIT-Vehicle dataset][8]

B. Proposed Algorithm

The block diagram of the proposed system is shown in Figure 2. The system takes the video from the traffic surveillance camera and tries to find faulty drivers in the video. The training images captured from the top and front of the vehicles. For finding the vehicle types of vehicles in the video xml files are used. Xml files are created after training the classifier.

The vehicles which are going on wrong lane according to their vehicle type are detected from their horizontal and vertical coordinates. For an instance a truck which is going on left lane instead of right one is a faulty vehicle in our system. Similarly, a vehicle which is going on the lane strips is a faulty driver in the system. System draws rectangles to the vehicles according to their vehicle type.
C. Haar Cascade Classifier

Haar Cascade is a classifier which is created by the authors of the [9] for detecting and tracking the objects in the image.

For training the classifier positive images which contain the wanted object in the image and negative images which don’t contain the wanted object are needed. The classifier scans the features (shown in Figure 3) on the positive images and creates specific target values by using the sum values of black areas and the white areas in the features. Classifier tries to create most optimized target values for detecting and tracking the object by the changing the sizes of the features. Features are the weak classifiers. Because they can’t be a correct classifier with alone. In an object there are many features and a place where they are collected contains the wanted object in the image. Using a lot of positive and negative images facilitates the detection of the object in the image. Classifier runs as mentioned above basically. Its speed of finding the objects in the image depends on training method of the classifier and the number of positive and negative images.

D. Training the Classifier

For training the classifier positive and negative images are used. Some positive images are shown in Figure 4. They are taken from the BIT-Vehicle dataset. We train the classifier with giving the positive images separately according to their vehicle type. Some of the negative images that doesn’t contain any vehicle are shown in Figure 5.

The positive images are resized to 24*24 pixels and converted to vector file with a script. After them, the number of positive images that will be used in training is determined. For determining this number (x) Equation (1) is used.

\[
x \leq \frac{(\text{Number of Pos Img} - \text{Number of Neg Img})}{(\text{Number of Stages} - 1) \times (1 - \text{minhitRate})}
\]

In this equation, number of stages indicates that in how many stages the classifier reaches to the result and the minhitRate indicates the minimum hit rate in every stage.

Other parameters to train the images are maxFalseAlarmRate and mem. First of them represents the acceptable maximum false alarm rate for the training section of object. The second one represents the memory that allocated for training the classifier. For this study, the parameters are selected as numStages:17, minhitRate:0.995, maxFalseAlarmRate:0.25, mem:1024.
III. RESULTS

After the training section, the xml files are created for the each vehicle types. By using this files the objects can be detected and tracked. For an instance Figure 6 represents a detected faultless vehicle that is type of “Sedan”. Similarly Figure 7 represents two faultless vehicle with different vehicle types.

In Figure 8, there is a faulty vehicle which is going on the lane strips.

In Figure 9, there is a faulty vehicle which is a truck and going on the left lane instead of right one. This vehicle violates the rules that we defined in the system and detected as faulty car.

According to the results that shown on the Table 1 and Figure 10, a high accuracy rate is obtained which reaches to the 92 percent.

<table>
<thead>
<tr>
<th>TABLE 1. VEHICLE DETECTION ANALYSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyzed work</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Truck</td>
</tr>
<tr>
<td>Bus</td>
</tr>
<tr>
<td>Sedan</td>
</tr>
<tr>
<td>Microbus</td>
</tr>
<tr>
<td>Minivan</td>
</tr>
<tr>
<td>SUV</td>
</tr>
<tr>
<td>Faulty vehicle</td>
</tr>
</tbody>
</table>
Detection And Classification Of Vehicles In Traffic By Using Haar Cascade Classifier

CONCLUSION

In this study, images processing techniques are applied for detecting and tracking faulty drivers in a highway traffic. For detecting the vehicles Haar Cascade classifier is used. The axes coordinates of the detected vehicles in the image are evaluated and faulty vehicles are tried to detect according to these axes coordinates. System accuracy rate reaches a very good values. This study shows that Haar Cascade classifier is a good candidate for object detection.

REFERENCES


★★★