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Traffic Rules Violation Detection using Machine Learning Techniques

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ABSTRACT--

Due to the growing population and people's need for comfort, more automobiles are being purchased, particularly in urban areas. This can result in heavy traffic, indicating that traffic violations are becoming more dangerous in every corner of the world. As a result, people's awareness decreases, and there are more accidents, which may result in the loss of many lives. These situations necessitate the need to develop traffic violation detection systems to automate traffic regulations and eliminate the unawareness among human population. The proposed traffic violation detector can identify signal violations, and the individuals are informed that they will be apprehended if they break a traffic law. The proposed system is faster and efficient than human, as known already traffic police is the one who captures the image of individuals violating traffic rule but the traffic police will not be able to capture more than one violation simultaneously. The proposed system can detect most common types of traffic violations in real-time through computer vision techniques and it also leverages good results with great accuracy.

I. INTRODUCTION

Due to ever-increasing traffic volume, it is evident that, it is becoming tough to monitor every individual under these conditions and also it is difficult to maintain the road traffic under control as it is demanding more man power. This problem can also lead to accidents, traffic rules violation and other dangerous situations. Hence, this research work proposes an automated system for maintaining these violations under control by developing a system with the help of computer vision, which detects the violations caused by vehicles and identifies the registration number of violated vehicles in order to send an alert to the host. In general, Computer Vision is concerned on how a system can obtain high-level capabilities from the input images or videos. This project entails the process of locating and identifying a certain car's registration number. Further, it uses Convoluted Neural Networks (CNN's), which is a class of Deep learning that comes under deep neural networking are used for analyzing visual imagery. This project is built on TensorFlow and it relies on various libraries to perform the required actions. This system can detect three types of traffic violations.

II. LITERATURE SURVEY

In the existing system, a police officer regulates traffic and captures a photo, which is then used to submit images of vehicles that break traffic regulations to an official website based on the licence number. This process takes more time and also some of the vehicles may escape while capturing photos because it is difficult to control traffic and capture the photos of vehicle that violates traffic rule simultaneously.

III. PROPOSED SYSTEM

- The proposed model necessitates two things in particular -Vehicle detection process
- Graphical User Interface [GUI]

The CCTV camera footage that was recorded from different areas will be sent to the system. Vehicles will be detected from the footage. Whenever the proposed software tests the footage, the violation will be detected. The proposed software supports signal violation by involving the algorithm called R-CNN algorithm. A system flowchart 1 shows how the software works. We use tkinter for Graphical user interface and tkinter is very interactive for the user. Police officer can take care and track the traffic footage and get the details of violation with the captured vehicle image. User can take further action like manually noting license numbers which violates traffic rules and send to nearby police stations to take further actions.

a) System Architecture

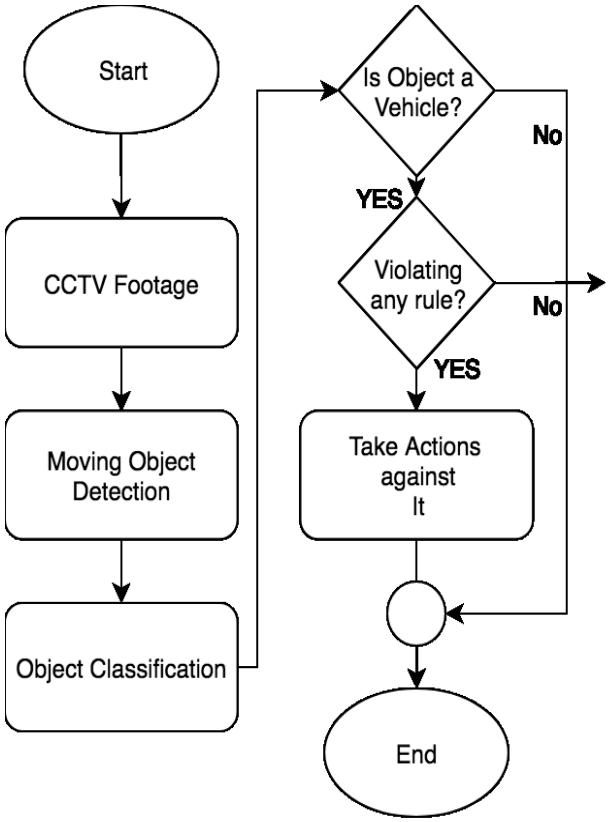

Figure 1: System Architecture

1.1. **Image Processing**:

- **Gray scaling and blurring**
  To get the best accuracy, it is highly required to pre-process the input footage and the video is blurred and gray scaled with the help of Gaussian blur method.
  To remove noise and obtain best accuracy, gray scaling has been used.

- **Background Subtraction**
  To subtract from the reference frame by the current frame, background subtraction has been used and as a result, the required object's area will be obtained.
  Equation (1) shows the method.
  dist(I) = saturate(|frame1(I) – frame2(I)|)

- **Binary Threshold**
  To remove the noise and other disturbances from the input video, the binarization method has been used.
  Holes and noises are removed in this process.
  equation (2) shows how binary threshold process.
  dist(x,y) = MaxVal if frame(x, y) > thresh else

- **Dilation and find the contour**
  When the we get the threshold image, to fill the holes we need to do dilation, according to the image the contour is calculated reform the better image.

1.2. **Object Detection**:

Regions with CNN features. Three-stage approach: -

a. By using support vendor machine (SVM), we can extract the objects from images.

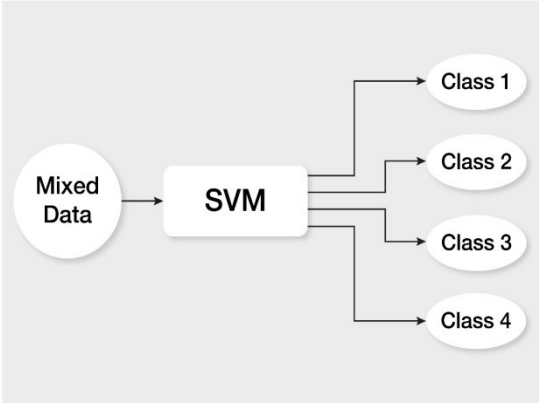

Figure 2: Algorithm used

b. By using convolutional neural network (CNN) we can extract the features from each region of image.
c. Classify and categorize each region using SVMs.

1.3. **Object Classification**:

After preprocessing method, the moving objects are obtained from the image. A vehicle classification model classifies the moving objects into four categories – 4-wheeler, 2-wheeler, 3-wheeler non-vehicle.
This is built on neural network model.

Type / Stride	Filter Shape	Input Size
Conv / s2	3 x 3 x 3 x 32	224 x 224 x 3
Conv dw / s1	3 x 3 x 32 dw	112 x 112 x 32
Conv / s1	1 x 1 x 32 x 64	112 x 112 x 32
Conv dw / s2	3 x 3 x 64 dw	112 x 112 x 64
Conv / s1	1 x 1 x 64 x 128	56 x 56 x 64
Conv dw / s1	3 x 3 x 128 dw	56 x 56 x 128
Conv / s1	1 x 1 x 128 x 128	56 x 56 x 128
Conv dw / s2	3 x 3 x 128 dw	56 x 56 x 128
Conv / s1	1 x 1 x 128 x 256	28 x 28 x 128
Conv dw / s1	3 x 3 x 256 dw	28 x 28 x 256
Conv / s1	1 x 1 x 256 x 256	28 x 28 x 256
Conv dw / s2	3 x 3 x 256 dw	28 x 28 x 256
Conv / s1	1 x 1 x 256 x 512	14 x 14 x 256
Conv dw / s1	3 x 3 x 512 dw	14 x 14 x 512
Conv / s1	1 x 1 x 512 x 512	14 x 14 x 512
Conv dw / s2	3 x 3 x 512 dw	14 x 14 x 512
Conv / s1	1 x 1 x 512 x 1024	7 x 7 x 512
Conv dw / s2	3 x 3 x 1024 dw	7 x 7 x 1024
Conv / s1	1 x 1 x 1024 x 1024	7 x 7 x 1024
Avg Pool / s1	Pool 7 x 7	7 x 7 x 1024
FC / s1	1024 x 1000	1 x 1 x 1024
Softmax / s1	Classifier	1 x 1 x 1000

shows how the neural network architecture is designed.

1.4. **Violation Detection**:

Our project mainly focuses on one violation that is signal violation.

Signal violation: On road we have some predefined lines, so we draw those predefined lines on the screen wherever required, whenever the vehicles cross those lines at wrong time or while the traffic signal is red, then the vehicles are violating traffic rules.

Those vehicles pictures are captured and license number is extracted.

IV. RESULT

When the signal violation detection system was executed on the input video which is gathered from CCTV footage, the input is preprocessed and after drawing predefined lines the output of the system is: wherever the violation of traffic rule occurs system takes a photograph from the CCTV camera, then subtract unnecessary image from it, which provides the features of the vehicles in the image that is required by the RCNN. The RCNN is used to detect whether the vehicle in the picture violates the traffic rule or not. Lastly, when the vehicle violates traffic rule the system crop image of the vehicle violators almost like the image shown. Later through the OpenCV we can recognize the license plate number of the vehicle which violate the traffic rule.

INPUT:

Figure 3: Initially captured picture

OUTPUT:

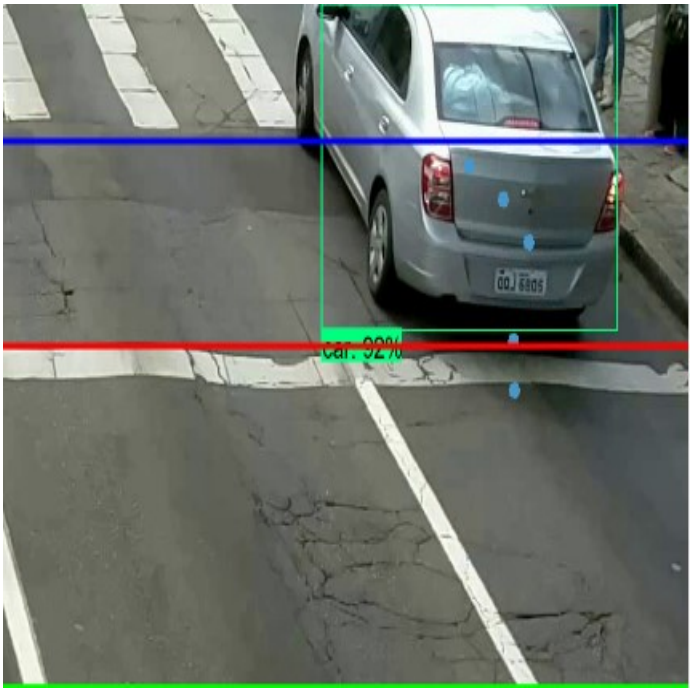

Figure 4 : Final output image which is cropped

Signal Violation:

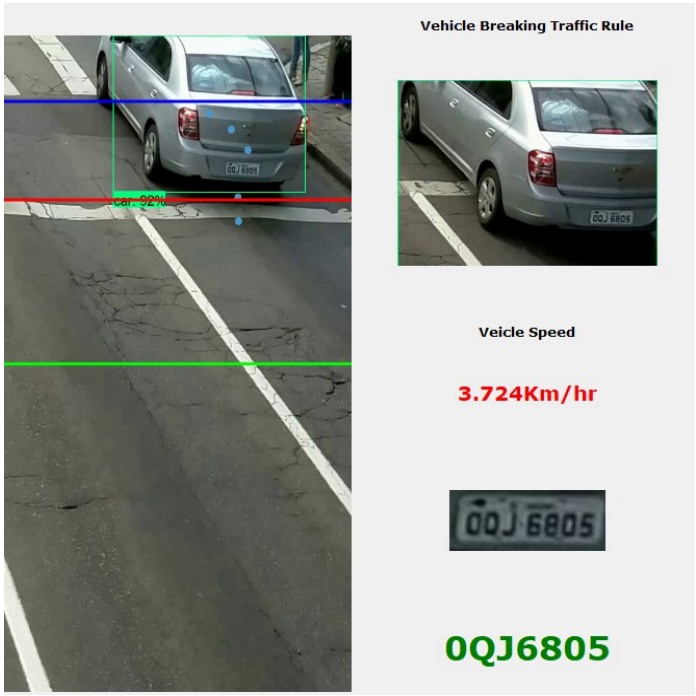

Figure 5 :Can extract speed and license number of vehicle.

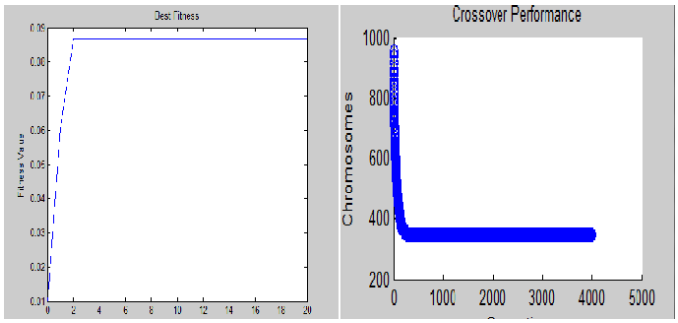

Figure 6: Best Fitness Plot and Crossover Performance

Shown in image 1 Initially whole image is captured from the CCTV camera. Executing the system given in Image 1 as input obtains an output cropped picture shown in Image 2. Finally the runtime of the whole executing process is 6.55 seconds.

V. CONCLUSION

The designed algorithm which is used can ready to detect the sort of violation mentioned on this project which is denying traffic signal that is signal violation. The goal of the project is to decrease the work for traffic police officers and automatically detects the violation in the absence of traffic police and to make it easy for the traffic police department to control and observe the traffic and take measures against the violated vehicle owner in a quick and effective way. To reduce the work for the traffic police and avoid accidents. To create awareness, so that it is important for each and every individual to follow the traffic rules.

VI. FUTURE WORK

When a signal is violated, the proposed system detects it. Further, the program runtime can be improved by using a computer with high-speed processor specifications or GPU. Future research about the software of the designed algorithm can also utilize other advanced image processing techniques. In future, we can add penalty points, where we can detect which vehicle has more challan. Due to ignoring the not required steps at backend we can boost the program runtime of the system. A computer vision algorithm used instead of providing more intelligence in the system. Our future plan is to implement the number plate detection with OCR and penalty points, support to make this system more robust. We are going to implement all the traffic rules violation detection and all we will come with the concept called penalty points, when ever the license plate is detected, on top of the vehicle we will able to find penalty point, Penalty point of vehicle is the number of challans till now the vehicle didn't paid, This concept can make easy to police officer while going through camera and can take immediate action on vehicle which has more penalty points.

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