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Helmet Detection on Two Wheeler Riders using Machine Learning and Automatic Licence Plate Recognition for Identification

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ABSTRACT

Motorcycle accidents are growing throughout the years in all the countries, as there is a difference in social, economical and the transport conditions differ from place to place. The motorcycle is one of the prominent means of transport used by middle-class people. Wearing a helmet is the main safety equipment of motorcyclists, which might not be followed by all drivers. The existing video surveillance-based methods are passive and require significant human assistance. In general, such systems are infeasible due to the involvement of humans, whose efficiency decreases over a long duration. Automation of this process is highly desirable for reliable and robust monitoring of these violations as well as it also significantly reduces the number of human resources needed.

This project aims at the prevention of accidents by automatically identifying the drivers not wearing helmets and storing their respective License Plates for future investigation. For this, we are using a classifier based on FasterR-CNN object detection architecture.

Keywords : Faster R-CNN, Motorcycle, OpenCV, Tensorflow, Object Detection

I. INTRODUCTION

Two-wheel drive is a popular means of transportation in almost every country. However, there is a high risk involved due to limited protection. To reduce the risk involved, it is highly desirable for cyclists to use a protective helmet. Recognizing the use of helmets, governments have made it a crime to punish those who ride bicycles without a helmet and to use hand-to-hand tactics to catch criminals.

However, existing video viewing methods do nothing and require significant personal assistance. Often, such programs are not possible due to human involvement, whose performance decreases over time. The automation of this process is highly desirable in reliable and robust recognition of these violations and greatly reduces the amount of human resources required. Also, many countries use systems that include surveillance cameras in public places. Therefore, the solution is to find offenders using existing infrastructure and save money.

II. METHODS AND MATERIAL

Both of these algorithms (R-CNN & Fast R-CNN) use selected search to find regional suggestions. Selected search is a slow and time-consuming process that affects network performance. Therefore, Shaoqing Ren et al. came up with an acquisition algorithm that removes the selected algorithm and allows the network to read regional suggestions.

Similar to Fast R-CNN, the image is provided as an inclusion in a convolutional network that provides a convolutional feature map. Instead of using the selected search algorithm on the feature map to identify regional suggestions, a different network is used to predict regional suggestions. The predicted regional proposals are then reconstructed using the RoI integration layer used to separate the image in the proposed region and to predict the offset values of the binding boxes.

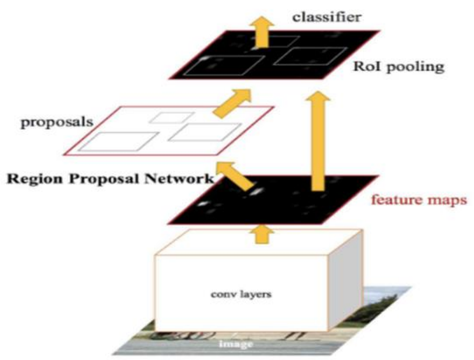

Figure 1: Working of Faster R-CNN

III. METHODOLOGY

Gathering Images
Label Images
Generate Training Data
Create Label Map and configure training
Run the training
Export Inference Graph

Gathering Images (Creating Data Sets)

Finding a bike rider with or without a helmet and license number. We need a lot of pictures of bike riders with helmets, bike riders without helmets and bike license plates. For this project, I use 627 images. Insert 20% of the images in the test guide and the remaining 80% in the train guide.

Figure 2 : Data Set

Label Images

Label the all images inside the test directory and train directory with the help of LabelImg tool. In this project, BikeRider, Helmet, WithoutHelmet and LicensePlate four classes were created with the help of LabelImg tool. Create a .xml file corresponding to each image with the above following categories of classes.

Generate Training Data

With labeled images, it's time to make TFRecords serve as a data entry in the TensorFlow training model. This tutorial uses xml_to_csv.py and generates_tfrecord.py documents from Raccoon Detector Dat Tran databases, with some minor modifications to work with our document framework. First, .xml image data will be used to create .csv files that contain all train and image data for testing. From the folder \ object_detection, uninstall the following command from Anaconda Prompt.

This creates a train_labels.csv and test_labels.csv file in the \images folder.

Create Label Map and Configure Training

Label Map

The label map tells the trainer what each object is by defining a mapping of class names to class ID numbers.

Configure Training

Finally, the object detection training pipeline must be configured. It defines which model and what parameters will be used for training.

- Change num_classes to the number of different objects you want the classifier to detect.
- Change fine_tune_checkpoin to the path of the .ckpt file.
- change input_path and label_map_path.

Run The Training

If everything has been set up correctly, TensorFlow will initialize the training. The initialization can take up to 30 seconds before the actual training begins.

Export Inference Graph

Now that training is complete, the last step is to generate the frozen inference graph (.pb file).

```
python export_inference_graph.py --input_type image_tensor --
pipeline_config_path training/faster_rcnn_inception_v2_coco.config --
trained_checkpoint_prefix training/model.ckpt-21094 --output_directory
inference_graph
```

Bike-rider Detection Image

Figure 3 : Output Image

IV. LITERATURE SURVEY

Before starting with this project we have done some prior research about existing work that has been done in this field. Below is the mentioned topics along with some level of limitations:

- **Helmet presence classification with motorcycle detection and tracking.**
  J. Chiverton.
  Author proposed an edge histogram based feature to detect motorcyclists. It performs well even in low light or low illumination. But as edge histograms used circular hough transforms to compare and classify helmets, it led to a lot of mis-classification problems.
- **Helmet detection on motorcyclists using image descriptors and classifiers: R. V. Silva, T. Aires, and V. Rodrigo.**
  Authors proposed a method in which a vehicle is tracked using the Kalman filter. It overcame mis-classification and had the ability to continue to track objects even if they were lightly occluded but when there were two or three motorcyclists Kalman failed. It only worked for linear state transition.
- **Automatic detection of bike riders without helmets using surveillance videos in real-time : K. Dahiya, D. Singh, and C. K. Mohan.**
  Authors proposed a system which first uses Gaussians mixture models to detect moving objects. It uses two classifiers in serial, one for separating motorcyclists from moving objects and another for separating without a helmet.
- **Vehicle Number Plate Detection System for Indian Vehicles : Hanit Karwal , Akshay Girdhar.**
  Authors proposed a system for detection of vehicle number plate in which it has used normalized cross correlation for template matching with an aim of addressing the problem of scaling and recognition of characters under

different positions but the drawback of this work was it has used fixed template matching.

- **A novel approach for Automatic Number Plate Recognition : Sahil Shaikh , Bornika Lahiri, Gopi Bhatt, Nirav Raja.**
  Authors proposed a system in which it has used image processing techniques such as edge enhancement, unsharp masking for detecting correctly the edges in an image and (OCR) Optical character recognition.

V. RESULT AND DISCUSSION

In this section we will analyse how the License Plate has been extracted from an image. We will also discuss the challenges we have faced while automating this entire procedure.

License Plate recognition

License plate recognition is one of the methods used for vehicle identification purposes. The sole purpose of this project is to find the most effective way to know the details of the registration in a digital photo (captured on camera). This process usually has three steps. The first step is the localization of the license plate, regardless of the size of the license plate and the shape. The second step is the separation of the characters and the last step is to recognize the characters from the license plate. Thus, this project reveals the basic concept of the various algorithms required to achieve character recognition from a license plate during template simulation.

Steps to follow:

However, these steps are divided into a series of other steps whose effectiveness follows:

- Loading an RGB image
- Grayscale conversion
- Histogram equalization
- Binarization
- Dilation
- Edge detection
- Plate region extraction

All these steps can be carried out using the OpenCV. And after successfully extracting the license plate we will put that entry in our database. Further necessary actions will be taken based on policies of authority.

Challenges

However, in order to adopt such automatic solutions certain challenges need to be addressed:

- **Real-time Implementation:** Processing a valuable amount of information in a timely manner is a challenging task. As such systems include functions such as segmentation, feature extraction, segmentation and compliance, where a certain amount of data needs to be processed in a short period of time to achieve the purpose of real-time implementation.
- **Occlusion:** In real-life situations, powerful objects are often compounded by the fact that something you like may be partially visible. Separation and separation become difficult for these materials in part.
- **Occlusion:** In real-life situations, powerful objects are often compounded by the fact that something you like may be partially visible. Separation and separation become difficult for these materials in part.
- **Temporal Changes in Conditions:** Over time, there are many changes in the natural environment such as lighting, shadows, etc. There may be subtle or rapid changes that increase the complexity of tasks such as creating a background model.
- **Quality of Video Feed:** Typically, CCTV cameras capture low-resolution video. Also, conditions such as low light, bad weather make it even more difficult. Because of such limitations, tasks such as

segregation, segregation and compliance become more difficult. As mentioned, a successful framework for a surveillance application should have useful properties such as real-time performance, fine-tuning, robustness to sudden change and forecasting. Keeping these challenges and desirable structures in mind, we suggest how to automatically get rid of cyclists without protective helmets using feeds from existing, real-time security cameras.

VI. CONCLUSION

The proposed program and project concludes by creating a solution that is able to identify features using transfer learning from custom databases. Therefore, the system demonstrates the possibility of achieving the goal of automating the law enforcement process that enables additional performance such as record keeping while completely eliminating manual input. The main focus of future additions is to increase the accuracy of the system by training it to suit a wide variety of vehicles and to add processing of individual number plates to create a database of non-payers as collected by the system. The whole system provides the need for a comprehensive monitoring and verification system to avoid positive false charges being added to the database.

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