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Automatic Detection of Bike Riders Without Helmet

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ABSTRACT

As per Indian scenario, motorcyclists break traffic rules very frequently by not wearing helmet and Indian traffic police is not strict to such riders because of their tedious work. Automatic Detection of Bike Riders without Helmet system is an application of computer vision and image processing technology that takes video of vehicles and take the vehicle frame as input image. This paper presents the technique by which motorcyclists without helmet are detected. In this technique moving vehicles are detected by thresholding and then classified into motorcyclist & non-motorcyclist by area and aspect ratio. To detect helmet first ROI is determined and by cascade classifier without helmet are detected. Finally we get the details of the particular bike rider from the database.

Keywords : Helmet Detection, Deep Learning, Convolutional Neural Network.

I. INTRODUCTION

India is the 10th, largest economy in the world, even though standing in 2nd position in the global population. In a highly populated country like India, motorcycles are the most affordable & convenient form of transportation. Helmet is used to protect head which is very delicate part of our body and it should be mandatory for all motorcycle riders. Accidents of motorcycles sometimes lead to severe head injuries and we can save our lives by wearing helmet. To keep an eye on Surat's motorcycle riders, SMC (Surat Municipal Corporation) launched real-time CCTV system for very first time in India in year 2013 with 604 cameras with centralized command & control room. To punish the riders not wearing helmet, SMC even introduced E-Challan System in India.

II. METHODS AND MATERIAL

For developing the system, the steps are given as follows:

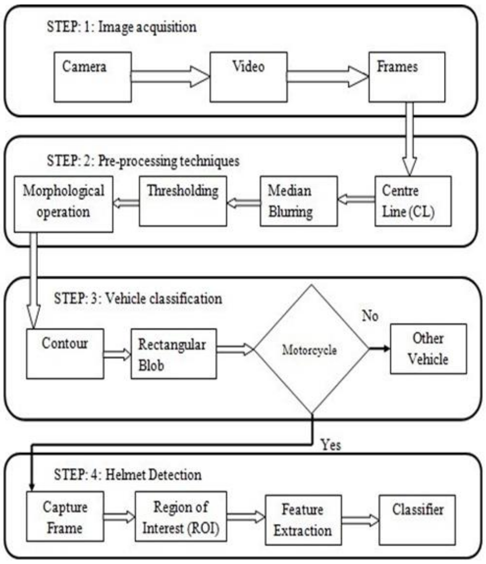


Fig 1. Implementation steps of the system

EXTRACT VEHICLE FRAME

The input for the system is vehicle video. After the input is given continuous screenshots up to a certain limit are been taken and sorted in the file system of the computer using a module. We read the required image from the file system using a read function. Then we use the module to resize the original image for the image processing.

Fig 2. Video dataset for helmet detection in sparse traffic.

The programs for helmet detection are written in Python — 2.7.12 with the help of the various libraries such as OpenCV — for image processing and vision tasks, Keras — 1.1.1 a deep learning library to train Ccomputational Neural Networks(CNN) models, Theano—0.8.2, Scikitlearn—0.18, Numpy—1.11.2 for maths and linear algebra operations. Here, the value of K' the number of Gaussian components for each pixel is kept in between 3 and 5, which is determined empirically. All moving objects are resized to 32 x 32 before giving them input to CNN.

IMAGE PROCESSING :

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing[2] in which input is an image and output may be image or characteristics / features associated with that image. Nowadays, image processing is among rapidly growing technologies. It forms core research area within engineering and computer science discipline too.

Image processing basically includes the following three steps:

- Importing the image via image acquisition tools.
- Analysis and manipulating the image.
- Output in which result can be altered image or report that is based on image analysis.

There are two types of methods used for image processing namely, analogue and digital image processing. Analogue image processing[3] can be used for the hard copies like printouts and photographs. Image analysts use various fundamentals of interpretation while using there visual techniques. Digital image processing techniques[4] help in manipulation of the digital image by using computers. The three general phases that all types of data have to undergo while using digital technique are pre-processing, enhancement and display, information extraction.

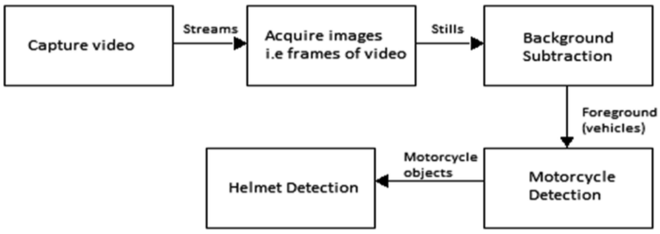


Fig 3. Steps in Image Pre-processing

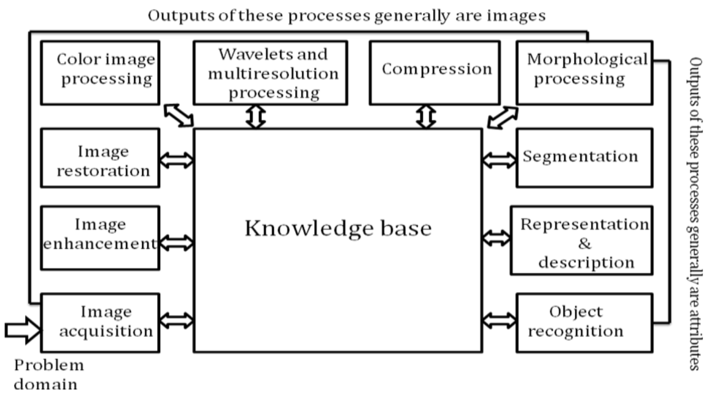


Fig 4. Fundamental steps in Image Pre-processing

Haar – Cascades:

Haar- like features are rectangular patterns in data. A cascade is a series of “Haar-like features” that are combined to form a classifier [14]. A Haar wavelet is a mathematical function that produces square wave output.

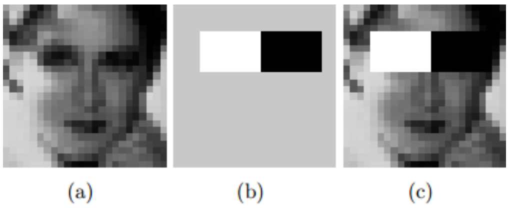


Fig 5. Haar like features

Cascaded Classifier:

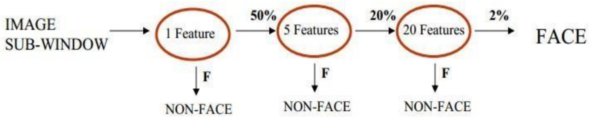


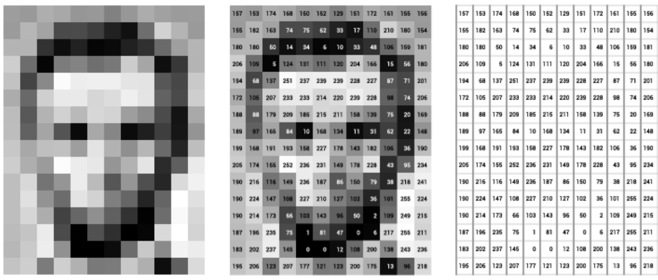
Fig 6. Several classifiers combined to enhance face detection

From above figure 6, a 1 feature classifier achieves 100% face detection rate and about 50% false positive rate. A 5 feature classifier achieves 100% detection rate and 40% false positive rate (20% cumulative). A 20 feature classifier achieves 100% detection rate with 10% false positive rate (2% cumulative).Combining several weak classifiers improves the accuracy of detection.

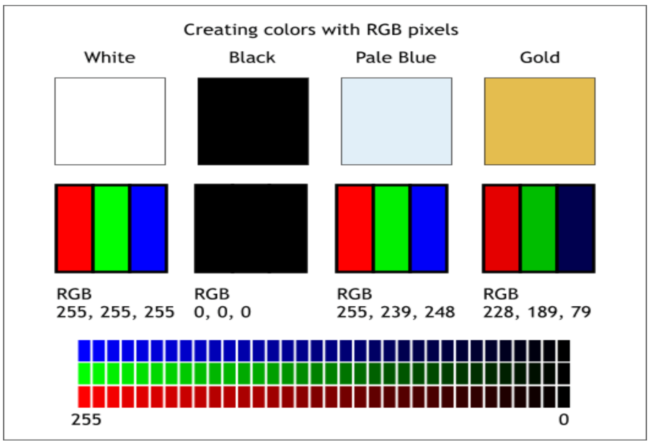
Computer Vision:

Computer Vision is the broad parent name for any computations involving visual content – that means images, videos, icons, and anything else with pixels involved. But within this parent idea, there are a few specific tasks that are core building blocks:

- In **object classification**, you train a model on a dataset of specific objects, and the model classifies new objects as belonging to one or more of your training categories.
- For **object identification**, your model will recognize a specific instance of an object – for example, parsing two faces in an image and tagging one as Tom Cruise and one as Katie Holmes.



Think of an image as a giant grid of different squares, or pixels (this image is a very simplified version of what looks like either Abraham Lincoln or a Dementor). Each pixel in an image can be represented by a number, usually from 0 – 255. The series of numbers on the right is what software sees when you input an image. For our image, there are 12 columns and 16 rows, which means there are 192 input values for this image.



For some perspective on how computationally expensive this is, consider this tree:

- Each color value is stored in 8 bits.
- 8 bits x 3 colors per pixel = 24 bits per pixel.

- A normal sized 1024 x 768 image x 24 bits per pixel = almost 19M bits, or about 2.36 megabytes.

III. RESULTS AND DISCUSSION

Different vehicle video is given as a input to our system. Each video has different background, different car, different color and different colour angle.

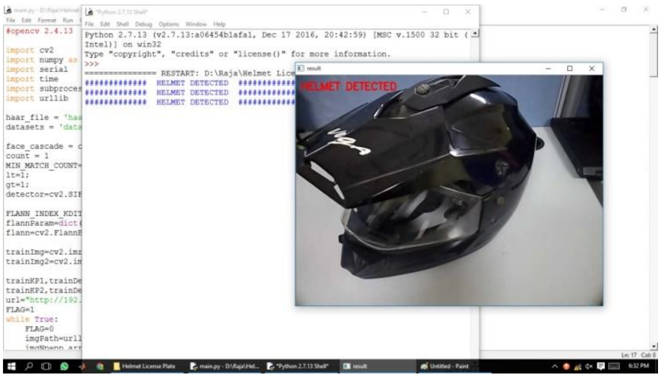


Fig 6. Helmet detected

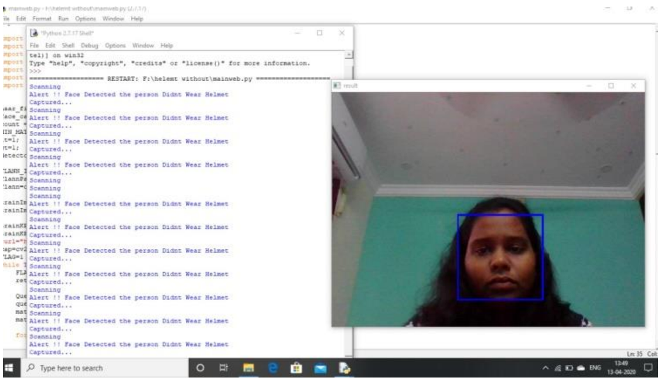


Fig 7. Helmet not detected

IV. CONCLUSION

The proposed framework for automatic detection of motorcyclists driving without helmets makes use of adaptive background subtraction which is invariant to various challenges such as illumination, poor quality of video, etc. The use of the deep learning for automatic learning of discriminative representations for classification tasks improves the detection rate and reduces the false alarms resulting into more reliable system. The experiments on real videos successfully detect = 92.87% violators with a low false alarm rate of =˜ 0.50% on two real video datasets and thus shows the efficiency of the proposed approach.

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