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Automatic Detection of License Number Plate of Motorcyclists Without Helmet

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Abstract : *Nowadays Vehicles are at a reasonable price and it can economically give by every person this is the reason there is rapid growth in the rate of accidents since most of the motorcyclist does not wear a helmet which has made it an ever-present danger situation to travel by motorcycle. From this year in 2019, the Government has made it a punishable offence to ride a motorcycle without a helmet. The main cause of death is due to the injury caused to the head region of the motorcyclist. According to section 129 of motorcycle vehicle act, Government has made it mandatory for two-wheeler driver to wear a helmet while driving but many of the traffic rule violators do not obey them. So, it is very important to take prompt and strict action against these violators. This project presents a smart surveillance system for automatic detection of two-wheeler driver without a helmet and traces the license number plate of the motorcycle. For detecting motorcyclist with and without helmet we have used Daubechies 8 wavelets transform to extract features of the upper part of the segmented image i.e. motorcycle and these features were fed as an input to the SVM (Support Vector Machine) to train the classifier based upon the features derived. For vehicle number plate detection, we have used image-based template matching. To set up our purpose we have created a database of l images of a motorcyclist with and without helmet taken from different angles. The experimental results show that the system efficiency for classification of helmet and non-helmet is 95%.*

Keywords : *Helmet detection, Daubechies 8 wavelet transform, (SVM) Support Vector Machine, Template Matching.*

I. Introduction

This chapter gives the brief introduction of the current scenario about how traffic cops are tackling with the traffic rule violators not wearing a helmet and the necessity of wearing a helmet. Nowadays, traffic cops in Nagpur are capturing the photographs of the people not wearing helmet using their handy Smartphone cameras and necessary strict action taken against these violators. Dr MC Misra, director and dean of AIIMS says "Wearing a helmet and tying it properly can prevent loss of lives by 90% in motorcycle accident cases. We call it a helmet vaccine." A helmet is safety amour for ahead, just like the skull protects the brain from impacts helmet protects the head. The three magical layers of helmet play an important role, the first layer that is the thermoplastic layer, the second layer expanded polystyrene, and the innermost layer that is inner soft spongy layer protects the brain from traumatic brain injury.

Below chart shows the total number of persons killed in road accidents in India as per users' category in the year 2017.

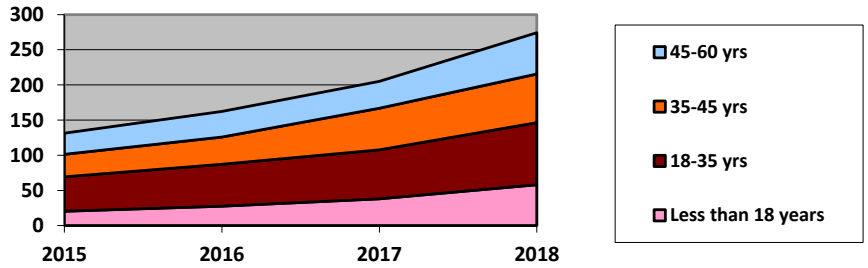


Fig.1. Number of deaths in past years

II. Literature review

Till date several researchers have worked on tracing the traffic rule violators, below we discuss the techniques or the methods used by them. Vishnu et al. have used a convolution neural network to track motorcyclist with a helmet and without a helmet. But in this case, we need to accurately train the CNN to classify between helmet and non-helmet which is a time-consuming task.

1. Dahiya et al. proposed a system in which it has used features of the head region of the motorcyclist to classify between presence and absence of a helmet. Obtained features were then classified using the trained classifier. Here, for feature extraction, they have used (HOG) Histogram of Oriented Gradients and SVM (Support Vector Machine) as a classifier. The accuracy of the system comes out 93%. But the main drawback of this system is the average time taken to process per frame is 11.58ms.
2. Silva et al. propose a system for helmet detection on real-time images using Circular Hough transform and HOG (Histogram of Oriented Gradients) as image descriptors and (MLP) multiplayer perception as a classifier between helmet and non - helmet. In this, the classifier performance gives the lowest result as compared to SVM and due to the use of Circular Hough Transform for locating the head region some other circular objects in the scene were also located as head of the motorcyclist.
3. Doughball et al. use star-like features such as (eyes/ears/ nose/ mouth) and Modified Circular Hough Transform i.e. information related to edges used to classify between the full helmet and half helmet. But in this system, thinking of interested that is the sub-window 24 x 24 chop manually and they obtained 117,000 features for each 24 x 24 sub-window which was far larger than the number of pixels.
4. Chiu et al. used only Circular Hough Transform to detect the presence or absence of helmet in the scene. It classified depending upon companionship any circular object in the scene. But on-road there are many circular objects other than motorcyclist' head which were also classified as a helmet.
5. Wen et al. used Circle arc detection method by taking into consideration the geometric features of the circle like edges, points and curves based on Circular Hough Transform to classify motorcyclist with the helmet. But geometric features are not enough to classify because as head and helmet both are circular in shape sometimes mistaken.

$$Mi,j = \sum_{s} Ci,j$$

6. Suleiman et al. used (OCR) Optical Character Recognition along with Image Processing Technique to segment the characters from the number plate. But it worked on only fixed standard number plate specially designed for Malaysia number plate and it worked only on non-moving vehicles and unable to distinguish between '1' and '7'.

III. Proposed Work

1.1 Classification of motorcyclists with and without a helmet.

· For the helmet, detection reputation segmented for the object of interest i.e. the motorcycle from the reputation as road environment has many objects other than a motorcycle. Here for segmentation of object saliency map. For this saliency map used because of its decision-making ability by the nervous system similar to the human brain. After segmenting object of interest, no presence of interest that is the head region of the motorcyclist required. Assuming that the head of the motorcyclist is mostly in the upper part, the upper part of the segmented image extracted. From this extracted upper part features are extracted using Daubechies 8 wavelets transform these derived features fed as an advice to the Classifier to distinguish between Helmet Vs None Helmet. The steps for classification of a motorcyclist with and without a helmet are as follows:

1.2 The object of interest segmentation using Saliency Map

Saliency is determined by local contrast of image pixels concerning its neighbouring pixels at various scales. This is evaluated by the distance between the average feature vector of the pixels of sub-region of an image with that of neighbouring pixels. This gives a combined feature map at a given scale by using feature vectors for each pixel

Contrast based saliency value C(i,j) of the image pixel is determined by the distance between the average value of the pixel feature of region R1 to that of region R2.

$$Ci,j = D\left[\left(\frac{1}{N1}\sum_{p=1}^{N1} Vp\right)'\left[\left(\frac{1}{N2}\sum_{q=1}^{N2} Vq\right)\right]\right]$$

where N1, N2= Number of pixels in R1, R2 respectively

V = vector corresponding to pixel and D is the Euclidean distance given by,

$$D=\|V1-V2\|$$

The final saliency map is calculated as the sum of salient values across scale S,

1.3 Region of interest segmentation**.**

To reduce computation and to increase the accuracy of the system region of interest that is our motorcyclists head part is extracted because here we are assuming that the helmet presence and the head region of the motorcyclists are in the upper part.

1.4 Feature extraction using Daubechies 8 wavelet transform.

Wavelet transform is an extension of Fourier transforms rather the fact that Fourier transforms works on a single scale (time or frequency) and Wavelet transforms works on multi-scale and also addresses the problem of non - stationary signals. Wavelet transform is a mathematical tool for decomposing a signal into time and frequency in a set of an orthogonal waveform and it has two functions wavelet function and scaling function. To decompose the signal in different scale Discrete wavelet transform (DWT) has two filters low pass filter (LPF) and high pass filter (HPF). The output coefficient of a low pass filter is called as approximate and that of high pass filter is called as detailed. There are various families of wavelet we have used Daubechies (db8) wavelet due to its highest accuracy as compared to other wavelets.

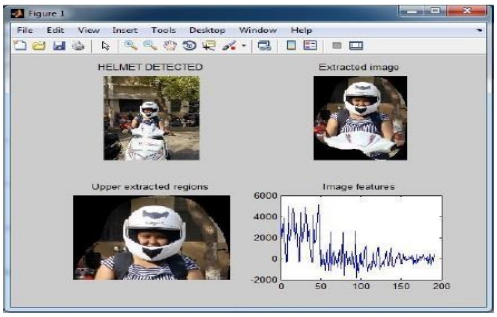
1.5 Classification.

Now, in the classification step, the 192 features extracted using Daubechies 8 wavelet from the upper part of motorcyclists will be fed as an input to the classifier to classify between Helmet Vs Non- Helmet based on the features. Here, the classification step is divided into two phases.

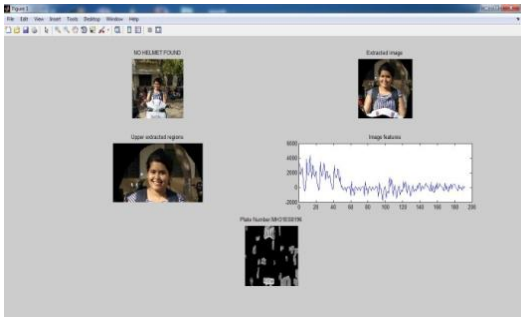
- Training Phase:
  During the training phase system was trained with 60 images of the dataset. The SVM classifier is used for classification in this project.
- Testing Phase:
  During the testing phase, the unknown image which was not given for training is given to the classifier to test the performance of the system. In this, the classifier classifies the unknown image based upon the features. Same (SVM) Support Vector Machine is used for classification.

IV.IMPLEMENTATION RESULT

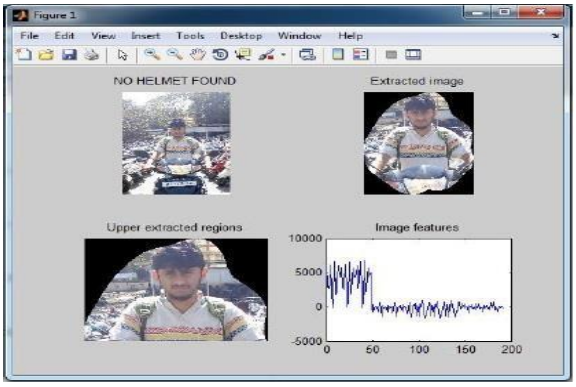
A. PRESENCE OF HELMET



B.ABSENCE OF HELMET



C. ABSENCE OF HELMET THEN LICENSE PLATE DETECTED



V. Conclusion

The proposed system was able to cope up with certain challenges while detecting the motorcyclists with and without helmet such as poor quality of the image, brightness, slight changes in angle, etc. Due to the use of db8 wavelet which gives almost noiseless information to the classifier to predict the correct output our system accuracy is better as compared to other methods. In future, the proposed system can be extended to automate the process of tracking the traffic rule violators such as crossing the red signal, driving a vehicle with speed and to automatically send challan to the respective motorcycle owner. Deep learning techniques can be used to increase accuracy.

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