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A DEEP LEARNING BASED APPROACH FOR AUTOMATIC DETECTION OF BIKE RIDERS WITH NO HELMET

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Abstract - *Detection of traffic rule violators is a challenging task. It is a critical part of many applications such as traffic surveillance. Helmet detection plays an important role in the identification of traffic rule violators. A method is developed combining classification and cluster for helmet detection. The proposed method involves Pre-processing, feature extraction, and classification. It is demonstrated by using surveillance traffic videos. Finally, the method will classify whether the person is wearing a helmet or not. After the classification, if the person captured is not wearing a helmet it will send a message with a fine amount to the corresponding person. As far the robustness and effectiveness are concerned, this method is better than existing algorithms.*

Key Words*: *Traffic rule violators, Pre-processing, Feature Extraction, Classification

1 INTRODUCTION

Two-wheeler is the most convenient and easy mode of transportation. It is mandatory to wear a helmet in heavy traffic areas to prevent accidents. By considering the use of helmet, Governments have made it a punishable offense to ride a bike without a helmet and have adopted manual strategies to catch the violators. Image processing means processing the images based on the application with the specific parameters. Pre-processing is the first step to improve the quality of the images. The feature descriptor algorithm is used to extract the exact feature and to differentiate one feature from another. CNN classifier is used to split the images into two groups, one for training data and another for test data to use in classification. A Convolutional Neural Network (CNN) is a class of artificial neural networks used in image processing that is specifically designed to process pixel data.

1.1 OBJECTIVE

The main aim of this project is to detect the bikers with no helmet, without manual interference and also detect the license number plate of the motorcycle. It alerts the person through phone number with fine amount. This will prevent road accidents.

1.2 OVERVIEW

The Helmet detection system is recommended for the identification of a particular person with no helmet. The input to the system is captured video which is then converted into images. Then preprocessing functions are applied to the image such as background noise, enhancing contrast and binarization of images. In order to know the characteristics of the image, the Feature descriptor algorithm is used to extract the exact feature and to differentiate one feature from another. CNN classifier is used to split the images into two groups, one for training data and another for test data to use in classification. After extracting the Region of Interest (RoI), the CNN classifier is being trained by a certain number of pictures wearing a helmet is provided. By matching RoI and trained features, it will be determined whether motorcyclists are wearing a helmet or not. Convolutional Neural Network is used to solve the classification problem efficiently.

1.3 APPLICATIONS

The main application of helmet detection is to prevent accidents in traffic areas. Even though the government takes various measures, it is not properly followed by the motorcyclists, so several smart techniques should be employed. Construction industry and power substation suffer a lot of difficulties because of carelessness in wearing safety helmets. Hence, there is a need for a surveillance system that is capable of detecting helmets and preventing the deaths. A more sophisticated computer vision model that encompasses image processing, machine learning, Convolutional neural networks (CNN), classifiers such as support vector machine (SVM), ViBe background modeling algorithm, Histogram of Oriented Gradients (HOG) features and other techniques will solve the problem.

2. LITRATURE SURVEY

The systems have encountered many reference papers, this work enabled to understand a deep learning-based approach for helmet detection of bike riders with no helmet in a better way.

[1] Felix Wilhelm Siebert et al, "Detecting motorcycle helmet use with deep learning"- Elsevier, 2019.

The helmet detection is performed by Object detection algorithm YOLO9000. It involves annotation for sampling the video clips and RetinaNet.

DRAWBACKS

- It needs more data for helmet detection accuracy in motorcyclists with more than two drivers.
- Diverse video data to be collected according to the camera angle.

[2] Kunal Dahiya et al, "Automatic detection of bike-riders without helmet using surveillance videos in real-time"- International Joint Conference on Neural Networks (IJCNN), 2016.

The detection of a helmet from the bike riders that could be performed in this Automatic detection system by using visual features and binary classifier. Histogram of oriented gradients (HOG), scale-invariant feature transform (SIFT), and local binary patterns (LBP) are the three main performance comparison method.

DRAWBACKS

- Video surveillance-based methods are passive and require significant human assistance.
- It is not an efficient solution due to its requirement of dedicated hardware.

[3] Archana D et al, "Mission on! Innovations in bike systems to provide a safe ride based on IOT"- 2nd International Conference on Computing and Communications Technologies (ICCCT), 2017.

In case of making machines more sophisticated in their way of learning and making decisions we develop the intelligence application. To increase safety while driving we implemented this method. The bike machine has started only when the person wears a helmet. By making the handlebar vibration to intimate the over speed performed by the user.

DRAWBACKS

- Cost is the major hindrance to the widespread use of safety systems.

[4] Rongbao Chen et al, "An Improved License Plate Location Method Based on Edge detection"- International Conference on Applied Physics and Industrial Engineering, 2012.

In license plate detection, the location of the license place is more important. Using the Prewitt arithmetic operator that identifies the license plate even under different backgrounds and lighting conditions by preprocessed plate image.

DRAWBACKS

- More similar database is needed to compare all edge-based methods.

[5] Sarbjit Kaur et al, "An Automatic Number Plate Recognition System under Image Processing"- International Journal of Intelligent Systems Technologies and Applications, 2016.

Using the computer vision and image processing technology, the number plate that has been detected automatically and also extracts the number plate from the whole vehicle image. The vehicle that can be preprocessed first by iterative bilateral filtering and adaptive histogram equalization.

DRAWBACKS

- Bad weather and hindrances can make automatic license plate recognition systems not completely effective.

3. MODULE DESCRIPTION

(i) INPUT VIDEO DETECTION

The input video has been captured by using either ipcam or webcam. It is then converted into images, from this face of the biker is identified by using the haar cascade classifier algorithm to detect whether the person is wearing a helmet or not.

(ii) IMAGE CLASSIFICATION

Image classification involves converting the captured images into a binary image, grayscale image and colour image for further classification. After the conversion of images, it then compared with trained images in the database for evaluation.

Fig -1: Images stored in greyscale

(iii) CNN CLASSIFIER

Convolutional Neural Network is a part of deep learning neural network. It contains special architecture with a multi-layered neural network to detect complex features in data. CNN contains a feature descriptor called kernel or filter, which converts the images into matrix representation to identify complex features.

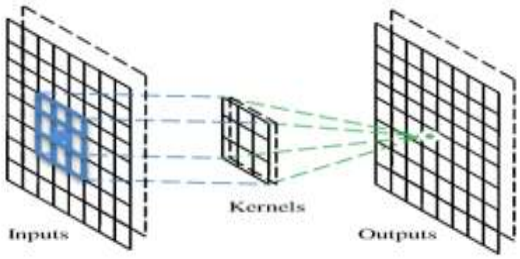

Fig -2: CNN Operation

(iv) RESULT INTERPRETATION

In the final step, after the classification of images and comparison of images with trained images, the system detects whether the person is wearing a helmet or not and shows the result. If the person is not wearing a helmet, it captures the license plate of the bike and generates SMS with a fine amount.

4. SYSTEM DESIGN

In System design, the language used is Python. The backend process is OpenCV and dataset.

4.1 ARCHITECTURAL DESIGN

The proposed system involves feature descriptors and neural networks for helmet detection. The first step is to capture the video input for face detection and then it is converted into images for classification. The second step in the detection process is Pre-processing, which involves enhancing the important features like image contrast, pixel brightness, geometric transformation and removal of distortions for further processing. After Pre-processing the next step is feature extraction in which the various features of the image are extracted using the feature descriptor algorithm. In the final step, the trained images in the database are compared with captured images for further classification. After the final classification, it shows whether the person is wearing a helmet or not.

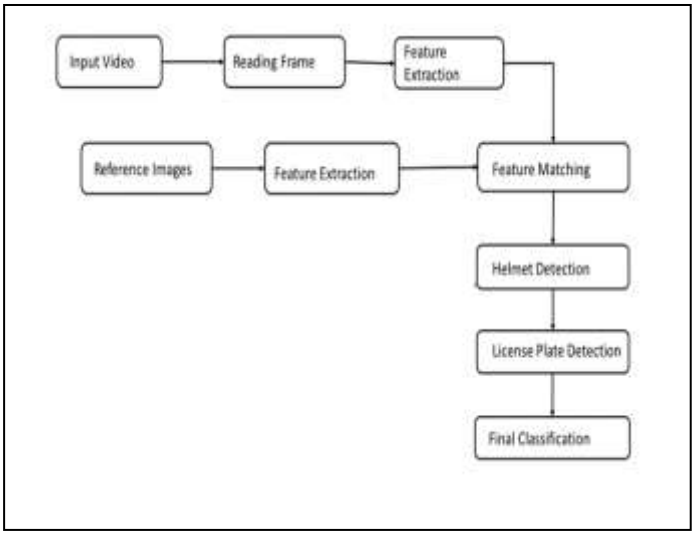

Fig -3: Block Diagram

4.2 PROPOSED METHOD

Image procurement: The input image is captured through ipcam or webcam. It is the major part of any vision system.

Preliminary processing techniques: This step is mainly focused on removal of background noise, enhancing contrastness and binarization of images.

Helmet detection: After extracting the Region of Interest(RoI), classifier which is being trained by a certain amount of picture wearing helmet is provided. By matching RoI and trained features, it will be determined that whether motorcyclists is wearing helmet or not.

License plate detection: If the person didn't wear a helmet, it captures the license plate of the particular vehicle.

SMS generation: After capturing the license plate, it generates the SMS to the person with a fine amount.

CNN Technique

Convolution is the integration of two functions that shows how one function modifies the other. The formula for convolutional function is,

$$(f * g)(t) \stackrel{\text{def}}{=} \int_{-\infty}^{\infty} f(\tau)g(t-\tau)\,d\tau = \int_{-\infty}^{\infty} f(t-\tau)g(\tau)\,d\tau.$$

The three important items in this process are the input image, the feature detector and the feature map. The input image is the image detected from the camera. The feature detector is a 3x3 matrix and is also referred to as a kernel or a filter. The input image is represented in the matrix and it is multiplied element-wise with the feature detector to produce a feature map. The feature map is also known as the convolved feature or an activation map. The main aim of the convolution is to reduce the size of the image and make processing faster.

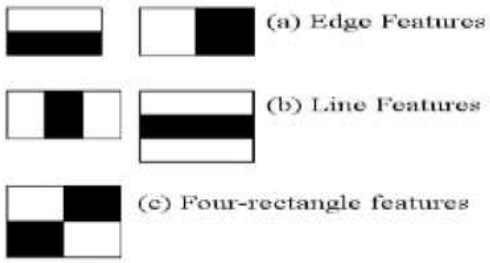

Fig -4: CNN Features

5. OUTPUT

Outputs obtained are as following:

1. Person wearing the helmet is detected.

Fig -5: Helmet Detection Process

2. After detecting the helmet, the following message is displayed.

Fig -6: Helmet Detected Message

3. If the person didn't wear the helmet, the license plate is captured.

Fig -7: License Plate Captured

4. After capturing the license plate, SMS is generated.

Fig -8: SMS alert

5. CONCLUSION

In the proposed system, the existing algorithms such as support vector machine (SVM), ViBe background modeling algorithm, Histogram of Oriented Gradients (HOG) is replaced by CNN techniques. A framework is represented for detection of traffic rule violators who ride bike without using helmet. The proposed system provides efficiency and robustness. Convolutional Neural Network is a part of deep learning neural network. It contains special architecture with a multi-layered neural network to detect complex features in data. CNN contains a feature descriptor called kernel or filter, which converts the images into matrix representation to identify complex features.

5.1 FUTURE WORK

In future, for a more reliable and less complex system the system can be improved by substituting advanced techniques. This application can be implemented in various real-time scenarios like Video Surveillance, Outdoor Object recognition systems, Security Process on Toll Gate etc.

REFERENCES

[1] Felix Wilhelm Siebert et al, "Detecting motorcycle helmet use with deep learning"- Elsevier, 2019.

[2] Kunal Dahiya et al, "Automatic detection of bike-riders without helmet using surveillance videos in real-time"- International Joint Conference on Neural Networks (IJCNN), 2016.

[3] Archana D et al, "Mission on! Innovations in bike systems to provide a safe ride based on IOT"- 2nd International Conference on Computing and Communications Technologies (ICCCT), 2017.

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[5] Sarbjit Kaur et al, "An Automatic Number Plate Recognition System under Image Processing"- International Journal of Intelligent Systems Technologies and Applications, 2016.