

A Hybrid Approach for Helmet Detection for Riders Safety using Image Processing, Machine Learning, Artificial Intelligence

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ABSTRACT

Now-a-days two wheelers is the most preferred mode of transport. It is highly desirable for bike riders to use helmet. This paper presents image processing technique by which motorcyclists without helmet can be detected. In this moving vehicles can be detected by thresholding and then classified into motorcyclists and non motorcyclists by area and aspect ratio. If in case motorcyclist is detected without a helmet, the number plate of motorcycle is read and noted. A simple algorithm is designed that can help to recognize number plates of motor cyclists using images taken by camera. The recognition of number plate algorithm has five parts: image procurement, preliminary processing, fringe detection and segmentation, feature extraction and recognition of character number plates using suitable machine learning algorithms. A database will be generated with the records to identify every offender accurately and arrest of suspect's vehicle, imposing helmet violation fines, the system implements pure machine learning in order to identify ever type of helmet that it comes across with minimum computation cost.

General Terms

Machine learning algorithms, Image processing techniques

Keywords

Artificial Intelligence, Image processing, Machine learning

1. INTRODUCTION

According to transport ministry, in 2016 about 28 two wheeler riders died daily because of not wearing helmet. In 2017, 31 out of 100 people died in road accidents which shows increased rate from 21.6death per 100 accidents in 2005. Each year there are 1.4 million Traumatic Brain Injuries (TBI's) in INDIA. About \$76.5 billion dollars is spent in treatment related to these injuries. More than 50,000 individuals die from TBI. This proposal aims at the security and safety of motorcyclists against road accidents while also providing them with luxurious comfortable two wheeler experience. Once installed this system will provide a completely free of cost solution .An overall software cost is equal to zero as the software is built using free and open source technologies. Hence given that every rider not wearing helmet is prosecuted, there will be an increased awareness in public .A database will be generated with record to identify every offender accurately and arrest of suspect's vehicle, imposing helmet violation fines, system implements pure machine learning algorithms in order to identify every type of helmet that it comes across with minimum computation cost. The database consists of images of motorcycles. Existing techniques only deal with vehicle in fixed view. However, in video, rotation is occurred and it decreases the performance of recognition. An image rectification methods showed that it

assists to increase accuracy in case of picture vehicles in rotated views

Amit Verma et al. [1] proposed approach where image was stored in the form of matrix and the output was displayed in the form of detected numbers. The overall work was to use Sobel Fringe detection technique. The result showed that it was the simplest of all and with lesser complexity to detect the number

2. BACKGROUND AND RELATED WORK

The existing work that solves the problem by image processing solutions use technologies like HOG, LBP, WT [2][3][4]. The system proposed isolates the bikes from the images by approximation crops the most probable area where helmet might be present and then feeds it to the feature abstraction and matching system. Chiverton [2] proposed the use of circular arc to identify helmet in a video feed it has very low accuracy. On the other hand given the number of vehicles on the speed at a given instance, the computation that required is very heavy and consumes lots of resources. This method will determine any circular object around the bike rider as helmet.

According to Sorin draghici et al., [5] an artificial neural network based artificial vision system is able to analyze the image of a motorcycle given by camera, locate the registration plate and recognize the registration number of the motorcycle. The system proposed by Sorin draghichi et al., has designed using a modular approach which allows easy upgrading and /or substitutions of various sub modules thus making it potentially suitable in large range of vision applications. The proposed algorithm consists of three major parts:

- i) Extraction of plate region
- ii) Segmentation of characters
- iii) Recognition of plate characters.

For extracting the plate region, Fringe detection algorithms and smearing algorithms are used in segmentation part, smearing algorithm filtering and morphological algorithms are used also finally statistical based template matching is used for recognition of plate characters. The performance of proposed system algorithm has been tested on real images.

3. METHODOLOGY USED

The technique is of automatic helmet detection is as shown in Fig.2.The input of the proposed system is either a recorded video or video stream through web cam. The entire system can be divided into four sub parts.

- i) **Image procurement:** A camera is used to capture vehicle on road in traffic. It is very first part of any vision system.
- ii) **Preliminary processing techniques:** In this step mainly focus on removal of background noise, enhancing of contrast [7] and binarization of images.
- iii) **Vehicle classification:** By considering two parameters (Aspect ratio and area) of particular vehicle, Motorcycles are classified and processed further.
- iv) **Helmet detection:** After extracting head part (ROI), [11] classifier which is being trained by certain amount of pictures of helmets is provided with features of ROI. By matching ROI and trained features, it will be determined that whether motorcyclists is wearing helmet or not.

4. MACHINE LEARNING

Machine learning is an application of Artificial Intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. Machine learning focuses on the development of computer programs that can access data and use it learn for themselves. Machine learning is a category of algorithm that allows software applications to become more accurate in predicting outcomes without being explicitly programmed

4.1 Image procurement:

Number plate recognition starts procurement of images from an image source, desirably from the surveillance camera. This technique determines the quality of the captured image of the number plate with which the detection algorithm has to work. Better the quality acquired images, higher the accuracy to detect the vehicle

4.2 Preliminary processing:

A method of preliminary processing is to prepare the image for better feature extraction. This stage can be considered as to set up the picture prepared for pattern recognition and image processing. The decision of preliminary processing is an approach to be received on vehicle image that relies upon sort of use for which the image is being utilized

i. *Gray scale conversion:*

Firstly we need to convert image RGB to grayscale. We have only two colors in image it is easy to remove noise in images.

ii. *Noise removal using median filter:*

The mostly noise found in number plate images are salt and pepper noise, speckle noise etc. [6].

Median filters which are more suitable than other. Median filter is a non linear filter which replace the

Grey value of a pixel by the median of the grey values of its neighbors. The aim of this process is to increase and improve the visibility of the image so that we easily perform image processing steps and reach to accurate result.

4.3 Fringe detection and segmentation character

i) *Fringe enhancement:*

The procured pictures require handling and upgrading before the detection operation. The picture should be honed keeping

in mind the end goal to underscore the high complexity between the picture content and foundation. [9]

ii) *Segmentation:*

In this stage images consisting of sequence of characters are decomposed into sub images of individual characters. Each character of the number plate which is being detected to find the number from number plate [8]. There are two types of process which are used to segment character in an image. One is vertical segmentation and other is horizontal segmentation.

4.4 Character recognition:

i *Normalization:*

Normally, the vehicle image contains text of different resolutions/contrast, size mainly due to the number plate pattern [10] and the resolution used while acquiring images. Because of this, the feature Values extracted from such variable size image and resolution produce inconsistent values for input images.

ii *Feature extraction:*

Features extracted from the entire image are also known as the global features and those features extracted from the blocks identified during segmentation are known as local features. They can be separated into a few classes like geometric, textual, component, segment, structural and content based. After resized characters of number plate, next step is features of each character. For this we use six features on the basis we can find out characters and the number plate of vehicles [6] Zonal features are extracted for the entire image based on regional properties namely.

Features:

- i Euler number
- ii Eccentricity
- iii Orientation
- iv Extent
- v Perimeter
- vi Convex

iii *Classification:*

The classification of number plate is required and effective renovating as it decreases the number of searches, simple redesign of vehicle number plate and lessens the mistake rate at distinct faces of processing. Various computational keen architectures, for example artificial neural networks (ANN), Genetic Programming (GP), and Genetic Algorithms (GA) entered for identification of number plate. In any case, these techniques need predefined parameters. The broadly utilized classifier for detection of number plate is adaptive boost and support vector machine, these methods do not.

iv *Recognition:*

In this manner acknowledgement is a specialty of recognizing characters from a picture. Optical Character Recognition (OCR) is programmed pursuing of optically recognized report content picture materials to make an understanding of comprehensible characters to machine significant codes. The Fig.4, states the steps for the number plate detection.

5. ARTIFICIAL INTELLIGENCE

Artificial intelligence systems are bridging the gap between the real world and digital world. AI and ML systems are performing the task that are considered to be important as well as a difficult task. One such application of AI is automatic helmet detection and number plate recognition.

Number plate recognition detects the motorcycle in camera and captures the license plate image. It will be fully automatic along with the web interface to verify the alerts by the traffic police. From there, it will be connected to the existing Regional Transport Office (RTO) website to generate fines and send notification to the riders.

6. PROPOSED SYSTEM

The main objective of this system to develop a system which detects whether the person is wearing helmet or not and then capture the image of the number plate and generates fines on the riders. Here we are determining it by using the Kstar algorithm.

The Fig.5 explains about the real time vision based monitoring system for motorcycle to detect and track motorcyclists who

break the rules. The proposed system aims to catch the traffic rule violators who are not wearing helmets and report the vehicle number plate violators and generate fines.

7. CONCLUSION

This system gives an idea about the number of traffic offenders in an area. It generates a database of all bike riders driving without wearing a helmet along a snapshot for proof. Use of open and free technologies like tensorflow, OpenCV and tesseract makes the software relatively less expensive. Under fair lighting conditions, this system was tested to give full proof and accurate results. The overall awareness to public will increase the impact of the system.

8. FUTURE ENHANCEMENTS

This project can be further improved by implementing advanced safety measures like to check collision detection, capturing images of vehicles with who breaks the rule by riding with high speed, capturing images of drivers while talking on phone and driving. This lessens the work of traffic police and with affordable cost. Once installed correctly, this system will work and generate databases for greater period of time under proper maintenance.



Fig.1 Images of riders with and without helmet

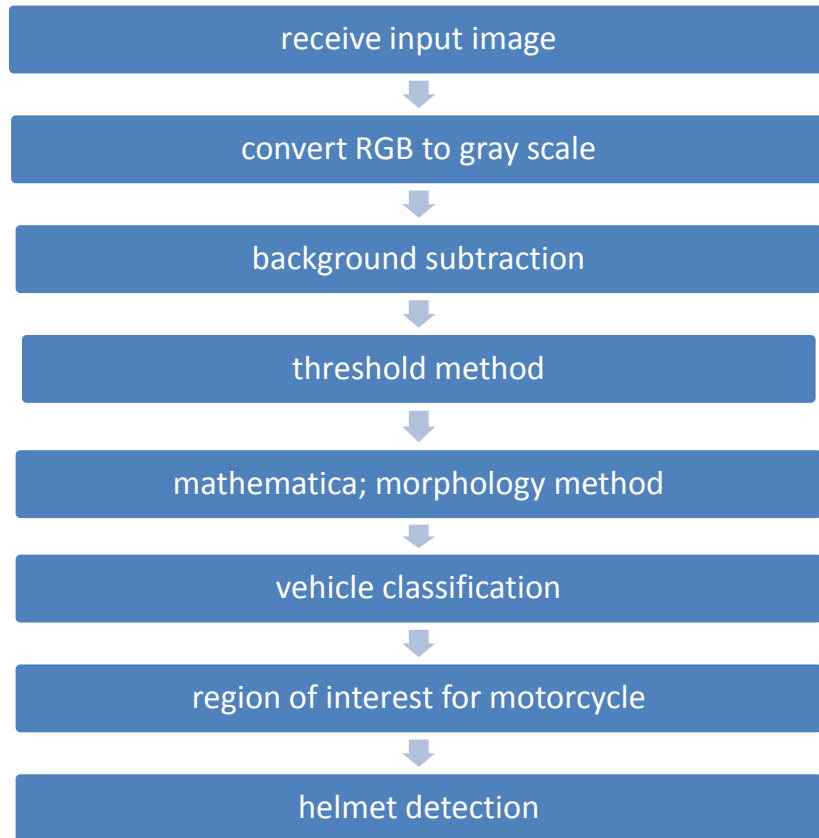


Fig.2 Steps of helmet detection



Fig.3 Captured image

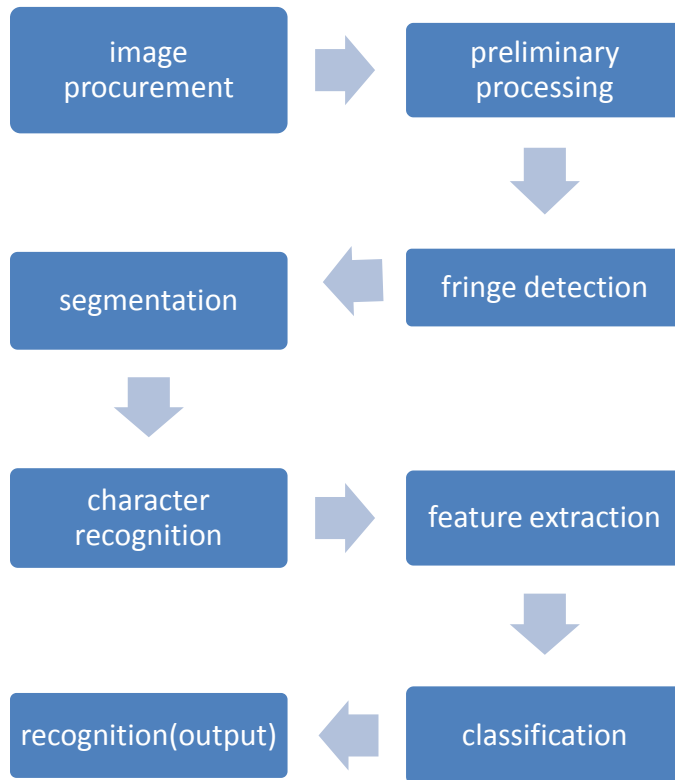


Fig.4 Steps for number plate detection

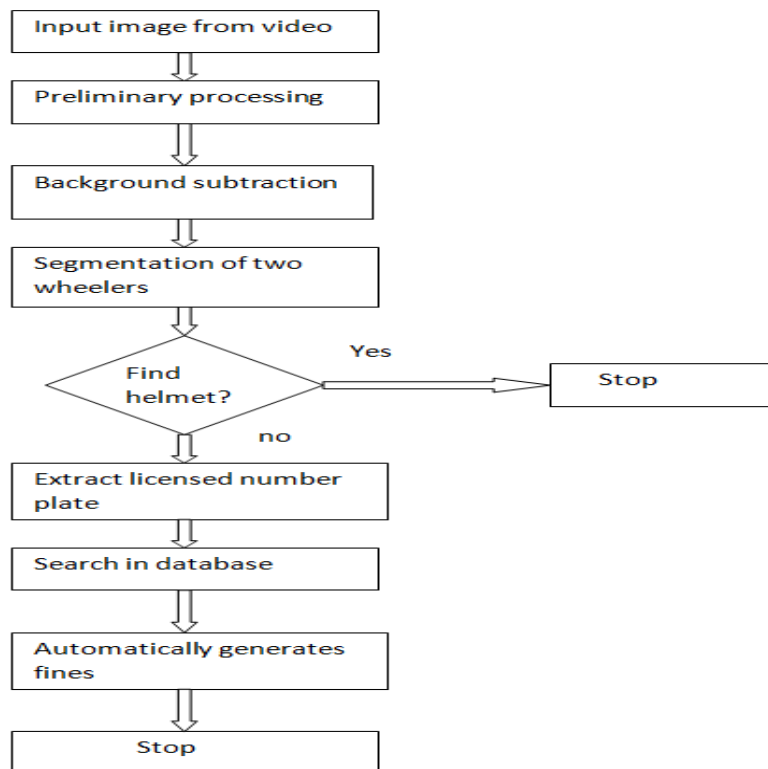


Fig.5 Proposed system

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