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RESEARCH PAPER

A Survey to Raise the Awareness of Road Accidents Due to Not-Wearing Helmet

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ABSTRACT
Nowadays, two-wheeler vehicles are regarded as the best mode for transportation in crowded cities. However, using such vehicles involves a relatively high risk of injury due to lack of protection and security. This paper aims to propose an approach to automatically detect whether or not riders wear helmet without any manual intervention. In case a bike rider is identified without wearing hamlet, then its corresponding plate number is read and recorded. Data records of every lawbreaker who does not wear helmet are automatically saved into a database. A database is consequently generated, consisting of records used to accurately identify the lawbreaker. This paper aims to explain the ways of automatic detection of motorcyclists without helmet and sending messages to the detected individuals. The proposed system in this study aims to extract the vehicles' plate numbers from the RTO website, using the vehicles' plate numbers by means of captured images. After getting the required information, the corresponding mobile numbers that embody the needed details of the detected people are used. The proposed system maintains a database that includes the number of detections of particular vehicle plate numbers and sends the details of the detected location.

KEYWORDS: *Automatic detection; Captured images; Detecting location; Protection, Database.*

1. Introduction

In many countries, motorcycle accidents have been rapidly increased in recent years. Although motorization has made our lives easier by facilitating transportation, it poses its own risks. The total death rates resulting from road accidents are considerably high even in developed countries [1] that bring about uncalled-for social and economic costs. In developing countries, more than 80% of all deaths and 90% of disabilities are due to accidents happening on roads [1]. According to statistics, the data provided to the lower house, i.e., the parliament, by the Ministry of Road Transport and Highways, India, about the fatal accidents in 2008 showed that 119860 people died as a result of road accidents. Nearly half of these accidents occurred on national and state highways. This number increased to 126896 in 2009 and 133938 in 2010, which entailed almost 5.5% more deaths than previous year. In India, Tamilnadu, Andhra Pradesh, Maharashtra, Karnataka, and Rajasthan had recorded 11.5%, 10.5%, 7.1%, and 6.8% of the total road accidents [1].

According to a study conducted in the United Nations, if motorcyclists wear helmet, 15000 lives can be saved. In 2017, at least 98 motor cyclists without helmet died daily in 2017, as shown in Fig. 1. According to statistics, in 2017, almost 91% of pillion riders did not wear helmet in India [1].

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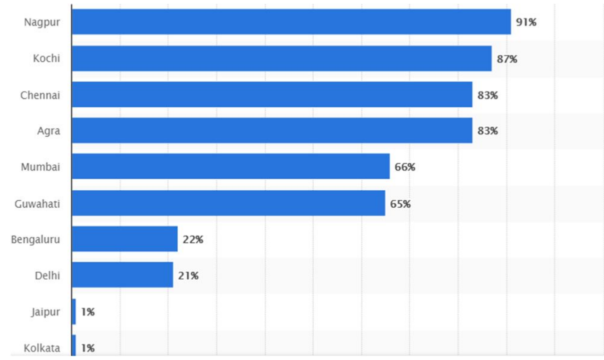

Fig. 1. Share of Indian pillion riders who did not wear helmets in 2017 in some cities

2. Literature Survey

Pradeep Maiya et al. [1] proposed a structure to detect the traffic rule-violators in real time who rode two-wheelers without using helmet and those who rode bikes having three people on board by using surveillance cameras in real time. The proposed structure, first, identifies bicycle riders using background subtraction, object segmentation techniques, and HOG which is an object classifier used for classifying the traffic violators. The vertical projection of binary image is used for calculating the number of riders. The proposed structure can also prolong the detection and report the total plate numbers of traffic violators by combining this system with autonomous license plate recognition system and synchronizing the multiple-view cameras. Moreover, advanced tracking algorithms can be used to handle occlusion. Night vision cameras can also be utilized in detection systems in the absence of daylight.

Kang Li et al. [2] introduced an original useful safety helmet wearing identification technique to find out whether workers wore safety helmet. To determine the motion objects in power substation, the ViBe background modelling technique was applied. Depending on the outcomes of the motion objects segmentation, the real time human sorting framework C4 was employed in order to locate the pedestrians quickly and exactly in the power substation accurately and quickly. According to the results of the pedestrian detection, the safety-helmet-wearing identification was applied by using head location, colour space transformation, and colour feature discrimination.

P. Wonghabut et al. [3] established a computer program for identifying two-wheeler riders without helmets through CCTV cameras. The software was developed using C++ language and Open CV library utilized two dissimilar angles of observation in CCTV cameras. Video frames logged by the broader angle CCTV camera were utilized to identify the bike riders. If a biker without wearing helmet is identified, narrow angle CCTV will be triggered to take the image of the law-breaking biker and bike number plate dynamically in the real time. Captured images are managed by database using MySQL for ticket issuing.

Kunal Dahiya et al. [4] proposed a structure for dynamically detecting the traffic rule violators in real time who rode bike while not wearing helmet. This could also help the traffic Police identify those violators under odd environmental conditions. Using this approach, the traffic Police, first, identifies bicycle riders using background subtraction, object segmentation techniques, and HOG which is an object classifier used for classifying the traffic violators. The vertical projection of binary image is used for totalling the number of riders. In other words, they provide the performance judgement. Histogram of Oriented Gradients (HOG), Scale-Invariant Feature Transform (SIFT), and Local Binary Patterns (LBP) are employed for classification. The described system is utilized to identify and report plate numbers of violators.

Andres F. Suarez et al. [5] proposed the Helmet Tracking System (H.T.S) that included a Bluetooth module allowing the user to synchronize an iPhone or Android cell phone to the system so that it would give the rider the ability to receive phone calls and listen to music while wearing the unit. The system tracks the helmet location 24/7 and stores this information so that it can text the position of the rider (longitude / latitude) to an emergency contact in case of an accident.

Maharsh Desai et al. [6] proposed an approach to detecting fall and helmet detection of a two-wheeler driver runtime. To this end, the proposed system would inform the nearby hospitals, family members, and law enforcement agencies in case of emergency. Hence it ensures the drivers' safety while driving. This system is expected to utilize the background subtraction technique and optical character recognition for fall identification and use the background subtraction and Hough transform descriptor for headgear identification.

Kavyashree Devadiga et al. [7] calculated the number of traffic offenders in an area. They developed a system that generated a database of all the bike riders without wearing a helmet, along with a snapshot for proof. They used several open and free technologies such as tensorflow, OpenCv, and Tesseract, all making use of the software relatively less expensive.

Vinayak Mudhomath et al. [8] introduced a technique for autonomous identification of two-wheeler riders without helmet via dynamic surveillance cameras in real time. The proposed system first identifies two-wheelers from surveillance videos through cross correlation analysis. Then, it specifies whether the rider wears a helmet using kurtosis characteristics and k-NN classifier. This system also helps the traffic Police identify such traffic violators.

There are some specialised sensors [6] which are fixed to motorcycles to find whether or not the rider is wearing helmet. A majority of people do not prefer to fix these sensors at their motorcycles. The accuracy of these sensors is under question. Moreover, these techniques used in these systems are highly expensive [6].

3. Proposed System

The main objective of the proposed system is to install the automatic detection techniques on public roads. Studies showed that one third of the people could save their lives by wearing helmets and 30 to 40% people survived the accidents. The number of two-wheeler riders has increased 20 times more than the increase in human population in India. In the proposed system, there is an approach to collecting automatic helmet information from number plate information. In addition, it maintains the number of times the vehicle was detected.

4. Methodology

Contour-based models, feature-based models, and region-based models are regarded as various object training techniques.

4.1. Contour- based object-tracking model

In this modelling technique, the outlines of an object are dynamically tracked and updated in successive frames. This model utilizes the distinct version of this method which enjoys the benefits of point distribution model in bounding the shape [11]. This complex algorithm for beginning the tracking process is used to autonomously initiate tracking.

4.2. Region-based object-tracking model

In this model, objects are tracked based on colour. Its computational effectiveness decreases when different objects pass together in sequences of the image. This model cannot track accurately when multiple objects are moving [12]. When the object information is missing, tracking depends on the background model.

4.3. Feature point-based tracking algorithm

This model comprises 3 steps as shown in Fig 2. The first step is to recognize and track the object by mining elements. In Step 2, objects are divided into higher level features. Finally, the mined features are compared with consecutive frames. Feature mining and feature communication are the most valuable steps in this model. The main problem in this feature correspondence is that a feature point in one image may have several comparable points on the other image which results in feature correspondence uncertainty.

Step 1: Foregrounds object detection

In this procedure, first, the objects of inters in the video categorization are detected and then, the sequence of objects are clustered**.** A majority of these methods focus on detecting the moving objects since they are the primary sources of information. Object detection is achieved through following techniques such as frame differencing, optical flow, and background subtraction, etc.

Frame deficiency

Frame deficiency is a common method for identifying the moving objects. In this method, a moving object is identified following a series of sequential frames collected from a fixed camera. This method aims to identify the difference between the existing forms to reference frames of a moving object [13], [14]. These techniques use pixel-based difference in order to identify moving or passing object.

Moving object tracking

This is regarded as a usual method for detecting the moving objects in that a moving object is detected from an order of frames collected from a fixed camera. The main objective of this method is to identify the difference among the existing forms used as the reference frames of a moving object. This technique utilizes the pixel-based difference to identify moving objects.

Optical Flow

It shows the trend and time rate of pixels in a period sequence of 2 consecutive images. A 2D velocity vector with direction and velocity as dimensions is allotted to every pixel of the picture. The real world 3D objects are transferred to a 2D case, described as a 2D dynamic illumination function of time and locality, for feasibility of computation [15].

Step 2: Background model

Background subtraction or foreground identification is a method of properties for processing an image and computer vision where the image foreground is utilized for additional processing. After image processing, localisation of objects is required using this method; the same method is used for identifying moving or passing objects in videos [16]. Some of traditional techniques use frame differencing, mean filter, etc.

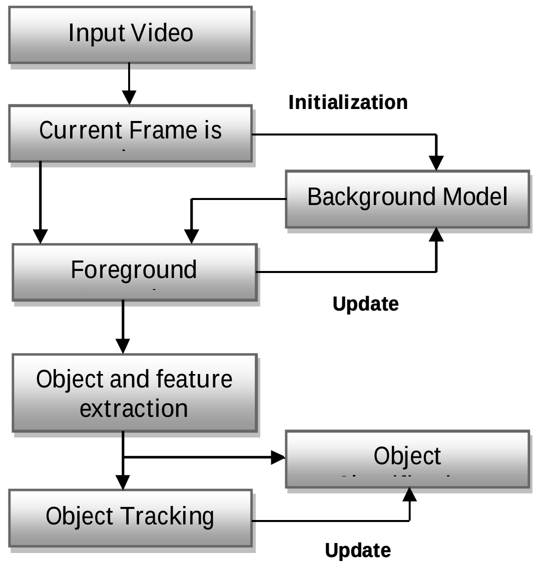

Fig. 2. Shows the steps required for Feature Point-Based Tracking Algorithm.

Step 3: Feature descriptor

Colour features:

Colour features are used to increase the discriminative power of intensity. The captured power circulation of illumination and reflectance properties of the surface primarily influence the apparent colour of an object. Although RGB colour universe is utilized to describe the colour information of an object, it is not an insightfully unvarying colour universe. While L*a*b and L*u*v are considered insightfully unvarying colour universe, HSV is a roughly unchanging colour space.

Gradient features:

These feature are significantly useful for human identification in videos.

i. Edge features

Object boundaries strongly influence the change in image intensities. To identify the instant changes, the edge detection technique is used. Edge features of illumination changes are less sensitive compared to colour features. Canny edge detector is mostly used for edge detection. Roberts's operator, Sobel operator and prewitt operator are utilized for edge detection.

ii. Texture features

Texture features are required for generating descriptors unlike colour and edge features. The best effective texture feature is Local Binary Patterns (LBP). LBP is delivered via an investigation operator known as a greyscale invariant texture measure inherited from usualdescription of texture in confined neighbourhood. It is known for tolerance against illumination changes.

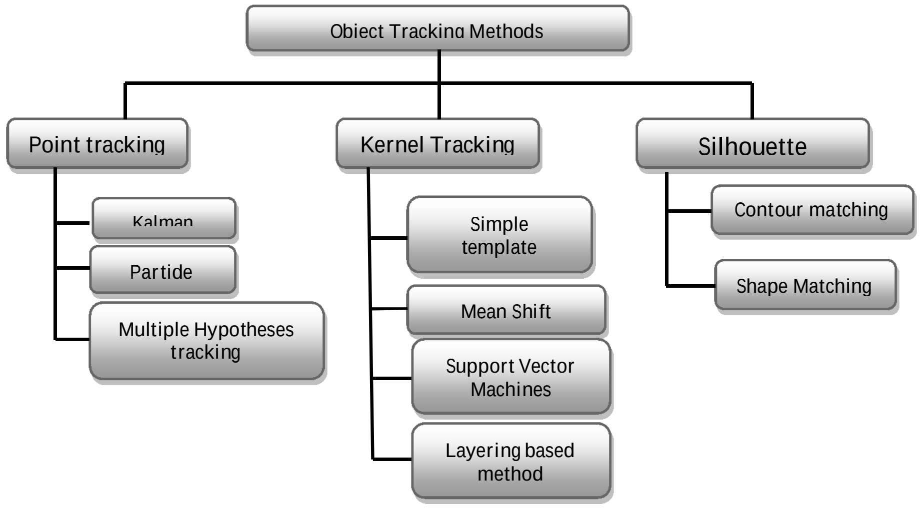

Fig. 3. Object tracking methods

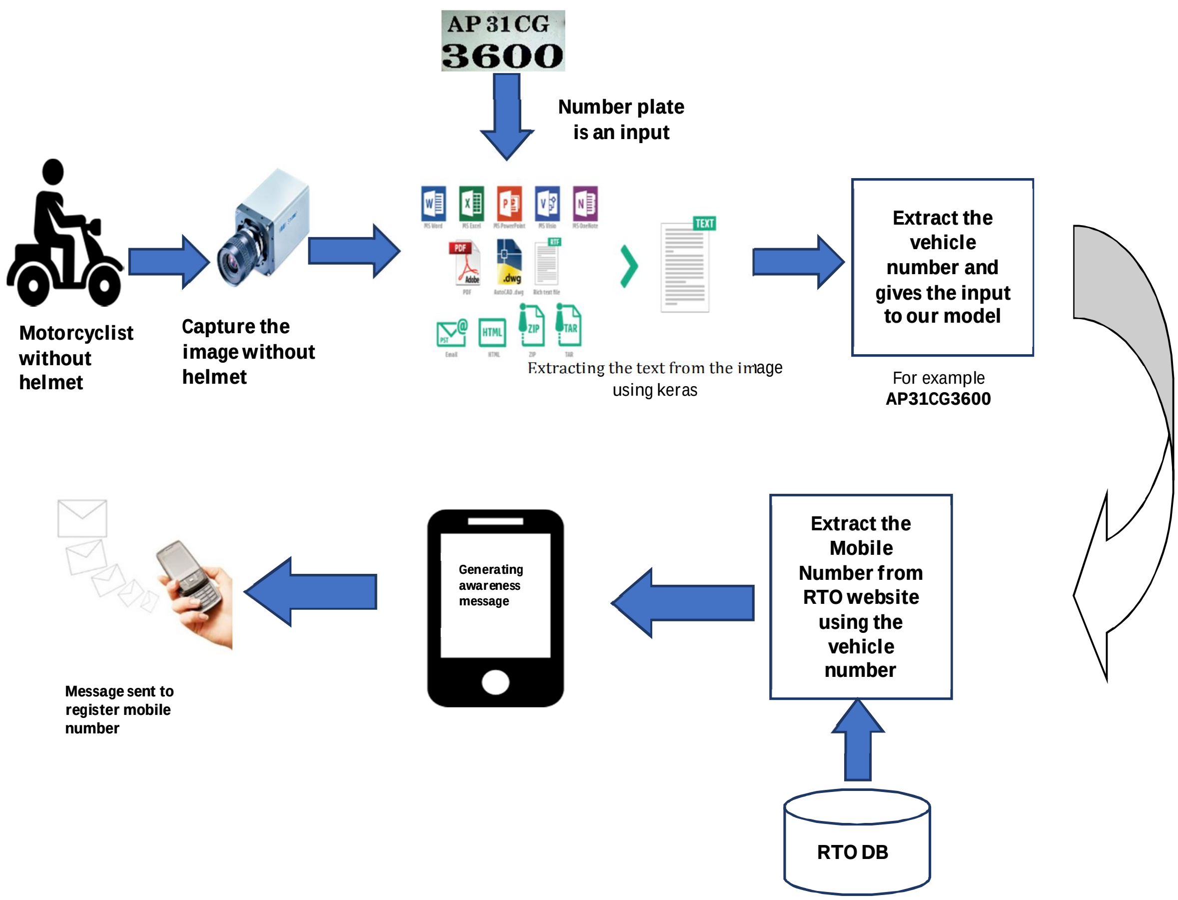

Fig. 4. System model representing aspects of a system and its environment

iii. Optical flow

It is stated by a dense area of translation vector where the transaction of every pixel is recorded. The computational measure for optical flow is brightness constraint, assuming that the illumination of parallel pixel remains unchanged in successive frames. This characteristic is utilized in motion-based object segmentation and tracking application, using video segmentation algorithm.

Spatial temporal features:

These features recognize actions and visual objects and provide visual representation. Noticeable and motion pattern features in videos are collected by local spatial temporal features.

Spatial temporal features deliver comparative illustration of events individually [17]. Spatial temporal shifts and scales of event, background cluster, and many other motions in the section are taken into account while presenting events. In order to display the lower level appearance of an object, some techniques such as pedestrian space time counters are utilized. A 3D distance transistor is used to convert an 1D counter into the 3D space. Biological features are used to describe biological appearances of human beings. Recently, biologically-inspired model features have been emphasized. Human's biological visualisation can also be achieved by the above-mentioned biological features and robust identification can be obtained.

Multiple features fusion:
This technique has attained huge boosting performance in multimedia, computer vision, and audio-visual speech processing, etc.

4.4. Object classification
The mined moving or passing area comprises humans, birds, vehicles, etc. Therefore, the shape characteristics of the motion areas can be Significant. In, object tracking, the objects are classified into shape-based classification and motion-based classification. It is described as the approaching path of an object present in the image plane as it passes or moves across the scene. Its main objective is to produce the path for an object in every single frame of the video. The object is followed for object mining, object identification, and tracking and detecting of activities. Object tracking can be categorised as point tracking, kernel-based tracking, and silhouette-based tracking; point tracks are included in every frame and kernel-based tracking requires identification only when the first object appears in the scene. The tracking methods are divided as shown in Fig 3.
The perceptual content and semantic content are the two major categories of Image content. Perceptual contents are made of colour, textures, shapes, intensities, and their temporal modifications. The semantic content include objects, events, and their relations.

5. Process of Text Extraaction
Region-based methods
Region-based technique utilizes colour characteristics and grey scale properties in the text region or their matching characteristics of the background, depending on the text colour and background colour. The text is obtained by the variation of intensity of text and background colour.

CC method
This is a bottom-up technique in which small components are successively grouped together to get an image. To filter non-text components, geometrical analysis is employed. This method finds text speedily but flops in difficult background.

Edge-based method
This method focuses on edges since they are more reliable, this needs high contrast b/w text, and background edge strength, density, and orientation variance are considered th three different features of text from documents, indoor, and outdoor images.

Texture-based method
In this method, text present images disguised from background by means of textural properties. The textural features of text in the image were detected through Gabor filter, FFt1, etc. It can identify texts in a complex background. The main drawback of this method is large conceptual complexity in texture classification.

Morphological based method
This is regarded as topological-and-geographical-dependent method for analysing image and is professionally employed in character recognition and document analysis. It is used to extract important texts and images with any geographical change. Through text colour, the lightings are changed while the text can remain unchanged. This method is robust under different image alterations.

6. System Model
This model represents different aspects of the system and its environment as shown in Fig 4.
Our proposed system model has four phases, including:

1. Proposing an automatic method for motor vehicle detection
2. Introducing a system for automatic identification of drivers of two-wheeler riders without helmet
3. Extracting the mobile number using vehicle number plate from RTO database
4. Sending automatic generated message to the extracted mobile number

An automatic method for motorcycle detection:

In this phase, it is necessary to differentiate motor cycles from bicycles by means of IR and visual light cameras. IR visible identify rides on two-and-three-wheeled vehicles. It distinguishes cars and motorcycles from bicycles and acoustic sensor differentiates the types of cycles such as large motorcycles from mopeds [18]. A multisensory device is used to classify motorcycles using IR light stereo camera. This device focuses on the unique shapes of people to detect pedestrians crossing the intersections. Similarly, riders of two-and-three-wheeled vehicles have different shapes as shown in Fig 7.

A system for automatic detection of motorcyclist without helmet:

In this phase, motor riders may carry helmet within the motorcycle, considered as an input taken from previous states. It identifies who motor wears helmet. If he has helmet, it does nothing; otherwise, it detects the vehicle and extracts the plate number. With this number, the mobile number is easily detected and sent as input to next state.

Helmet detection:

Riders may carry helmet within the bike but do not wear it. In this case, both the rider and helmet are detected. ACNN model is trained such that it identifies every type of helmet available in the market [2].

Detection of helmet:

Identification of helmet takes place in 3 steps, the most important of which is determining the ROI. In this area, having finished searching, it takes less time dedicated to processing and brings about more precise results. ROI is an area of the collected image in vehicle segmentation step. The main objective is to find out motorcyclists who do not wear helmet; therefore, the complete head inside the ROI in upper part of the image is accomplished. The corresponding value is empirically designated to the image. The selected part of the ROI was verified by the database total images, the results of which are given in Fig 5.

Fig. 5. The region bounded by the rectangle corresponds to the RoI Calculation

Extraction of features:

Before computing descriptors, pre-processing is employed to acquire a sub-window that is related to the head part [4]. First, the grey scale index is performed. Then, an ordinary image with a 5*5 neighbourhood provided for the decrease the sound of the image. Finally, the OSTU threshold is determined [19]. The binary image is obtained by applying this threshold to the greyscale. As a result, the image edges are obtained using the sobel method to detect the binary image shown Fig 6. In order to compute the probable circles in the image, CHT is preferred over greyscale images as it is a computational factor with more precision since only the edge are used.

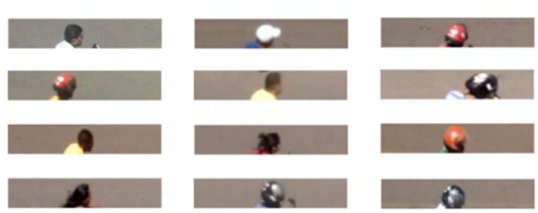

Fig. 6. Examples of RoIs computed from images of motorcyclists that were captured in the object segmentation stage

ROI:

In ROI [5], circular figures related to the head or helmet parts of two-wheel driver are identified [2]. For CMT, the ratio of the desired circles is considered a necessary parameter and is reported to be 50% of ROI circle with the largest CMT accumulator sought. However, this geometrical information is not necessary to obtain acceptable results. Hence, more information is required to distinguish heads from helmets and to decrease the identification area to that of helmet, the sub-window of ROI calculates descriptors to improve the aspects of helmet region [20]. To extract features, the sub-window corresponds to square that restricts gathered peri meter. Then, the descriptor is calculated. For further accurate feature extraction, a hybrid detector is employed which combines CMI and HOG [5, 6] descriptors, integrating various information from the least two descriptor.

Number plate identification:

Subsequently dropping unwanted boxes, remaining regions are checked for vehicle number by using optical character resolution using tesseract [2]. This recognised number plate is entered into the database and subsequent frames are processed.

Classification of sub-windows:

There are 2 classes in the image classification task: with helmet, without helmet. In this state, MLP classifier is employed in Fig.8.

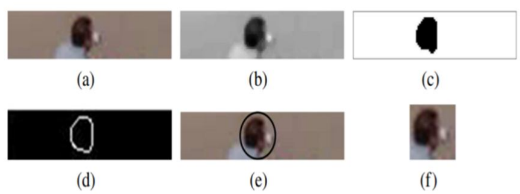

Fig. 7. Steps for the detection of motorcyclists without helmets: (a) RoI; (b) Grayscale image; (c) Binary image; (d) Calculated edges; (e) Best circle obtained by the CHT and drawn on the RoI; and (f) Sub-window

Examples of computed sub-windows:

For each sub-window, a feature vector is obtained. The Hog descriptor is arranged in 9 blocks, each block portioned into 9 partitions called cells. An individual cell generates a characteristic called feature, and a vector is generated consisting of 81 features. Different variations of blocks and cells are used. From the collected results, the best selection is chosen. The MLP classifier is used with hidden layers as shown Fig. 9. By testing the model without testing this layer, it can be concluded that the outcomes are not better than with one layer. Numbers of neurons are very sensitive in MLP classifier. In our study, 50 neurons were employed. This value ensures the best results.

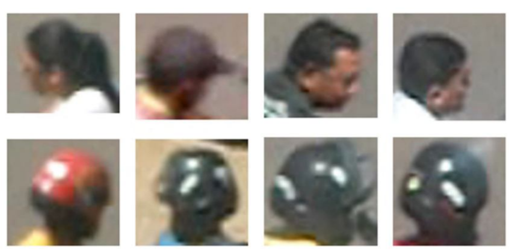

Fig. 8. Examples of computed sub-windows

7. Result

The obtained Results are shown in Figs. 9 and 10. All the boxes except a bike rider not wearing helmet are dropped in the first image [2]. On the contrary, Fig. 10 shows the plate number that is successfully extracted.

Extracting the mobile number using vehicle number plate from RTO database

The RTO database provides all the essential registration data of every vehicle in a particular place at a specific moment. It types the vehicle registration number in the search box promptly, gets the required details like vehicle registration state, city and regional transport office address, phone number, and email. The RTO database entails all the states and union territories present in India.

Fig. 9. ROI Determined

Fig. 10. Number plate extracted

Output:

AP16RK1811

AP registration-Regional Transport Office (RTO) AP-16
Number: AP16RK1811
City: Vijayawada
Phone: 9676355492
E-mail: abc@gmail.com
Address: Vijayawada, Andhra Pradesh

In this case, take the mobile number as an input to our fourth phase in the system model. The mobile number is an input for Text magic API in python. After giving input "the text magic", the API sends a message in a specified format to the given mobile number.

Sending automatic generated message to the extracted mobile number

The text magic API python is a platform for building your own messaging infrastructure. The text magic provides a speedy and worthy path to direct text messages from any of the computers. This package offers modest python API on top of text magic HTTP. API is an interface-based in web for SMS functionality.

Default message format

Dear citizen, your vehicle **"Vehicle Number"** is found at **"Location"** on **"Date"** not wearing helmet. Due to this traffic-related offence, you were fined Rs-**"Amount"** for the first offence. Traffic Police **"Division name"**
Wear Helmet Ride Safely

8. Conclusion

In this study, a novel model is presented to automatically identify riders with/without helmets through fine details to the registered mobile number. The proposed models also extract the mobile number from RTO database and send automatic generated messages to the extracted mobile numbers. The proposed system can also help the traffic Police identify the traffic rule violators. The proposed model is also utilized to identify some traffic trespassing such as overspeed, triple-riding, and not wearing helmet. Automated detection of motorcyclists without helmet can reduce triple-riding, overspeed, and accidents by sending messages to the detected persons using the RTO website, number plates of vehicles, and captured images.

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