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Helmet Detection and Number Plate Recognition using Machine Learning

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***Abstract*: The major form of mobility for motorcycles in poor countries has traditionally been the bicycle. Recently, the number of motorcycle accidents has risen. One of the most common causes of motorcycle-related deaths is that the rider is not wearing a helmet. In order to ensure that motorcyclists wear a helmet, traffic police patrol road junctions or review CCTV footage and penalize individuals who are spotted without a protective device. Human intervention and effort are required to make this happen. As a result, this method proposes an automated technique for detecting and obtaining motorcycle number plates from CCTV video footage of riders who are not wearing helmets. Motorcyclists and non-motorcyclists are first categorized by the system. The classification of a motorcyclist's head is based on whether or not he or she wears a helmet. At long last, the OCR algorithm can decipher the number plate of the motorcycle driven by the rider who was not wearing a helmet.**

***Keywords*: OCR, Yolo, Machine Learning, AI.**

1. Introduction

Major cities and major highways have seen a significant rise in motorcycle-related fatalities in recent years. The lack of helmet wear is a major contributor to these deaths. Detecting motorcycles without helmets is essential for improving safety on the road and minimising the frequency of incidents. Automated detection of these riders by analysing traffic surveillance video is essential in road safety measures.

Surveillance camera footage of traffic shows hazy images of high-speed cars. As a result, it is nearly impossible to detect high-speed motorcycles in real-time surveillance video. Motorcycles come in a broad variety of designs, colours, and sizes, which makes identifying them much more difficult. Real-time surveillance footage must be used to identify rulebreakers, such as motorcycle riders who aren't wearing their helmets.

Traditional image processing approaches have been utilised in the past to identify things by extracting features from photos. When it comes to object detection in computer vision, the most sophisticated method is Convolutional Neural Networks (CNNs). In this case, CNN's automated feature extraction with more accuracy is the best option. *A helmet is weared by a motorcycle rider or not* is the focus of this research.

Motivation:

Motorcycle accidents have been on the rise in several countries over the past few decades. Helmet wear is mandatory for all motorcyclists, however many drivers don't follow this simple rule of safety. To keep the driver's head safe in the event of an accident, helmets are essential. If the rider fails to employ the safety equipment in the event of an accident, it could be fatal. It is also impossible for traffic police to keep a close eye on every motorcycle and detect whether the rider is wearing a helmet or not. Because of this, an automated system was needed to determine whether or not a person was wearing a helmet, as well as their license plate number, and penalize them if they were not.

Problem Definition:

In India road accidents are increased very rapidly and lots of deaths are occur due to head injuries because number of peoples not wearing helmets, so to avoid the system that automatically detects the peoples who are not wearing helmet and also detect number plates of the motorcycles to penalize that persons networks.

2. Related Work

Helmet use among motorcycle drivers and passengers in Thika and Naivasha was assessed through systematic observations at randomly selected locations in the two districts between August 2010 and December 2014. Roadside KAP surveys were administered in both sites to motorcyclists in areas where they stopped, including motorcycle bays, petrol stations and rest areas near the helmet observation sites. Secondary analysis of trauma registries was also used. Negative binomial regressions were used to assess trends of helmet wearing among motorcyclists over time, and logistic regressions were used to analyze associated risk factors as well as association with health outcomes among those admitted to the four hospitals [1].

We trained a large, deep convolutional neural network to classify the 1.2 million high-resolution images in the ImageNet LSVRC-2010 contest into the 1000 different classes. On the test data, we achieved top-1 and top-5 error rates of 37.5% and 17.0%, respectively, which is considerably better than the previous state-of-the-art. The neural network, which has 60 million parameters and 650,000 neurons, consists of five convolutional layers, some of which are followed by max-pooling layers, and three fully connected layers with a final 1000-way softmax. To make training faster, we used

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nonsaturating neurons and a very efficient GPU implementation of the convolution operation. To reduce overfitting in the fully connected layers we employed a recently developed regularization method called "dropout" that proved to be very effective [2].

In this paper, we proposed an improved YOLOv3-based neural network for De-identification technology. The existing YOLOv3 is a network with fast speed and performance recently. Most surveillance system using CCD cameras simultaneously store images from cameras installed in multiple locations. In such an environment, the use of deep learning requires a method of detecting objects through a single inference engine in a plurality of image. If the inference engine hardware is used for each camera channel, the cost of building a surveillance system increases significantly. Therefore, in the field of surveillance systems, a network structure with a high detection speed is required even if the detection performance is slightly degraded [3].

The algorithm uses haar like feature to detect helmet regions. that, face / nose / mouth / left eye / right eye detection method cannot detection between full and half helmet. So, the second module of the technique, the circle Hough transform is applied for detection it [4].

Safety helmet wearing detection is very essential in power substation. This paper proposed an innovative and practical safety helmet wearing detection method based on image processing and machine learning. At first, the ViBe background modelling algorithm is exploited to detect motion object under a view of fix surveillant camera in power substation. After obtaining the motion region of interest, the Histogram of Oriented Gradient (HOG) feature is extracted to describe inner human. And then, based on the result of HOG feature extraction, the Support Vector Machine (SVM) is trained to classify pedestrians. Finally, the safety helmet detection will be implemented by color feature recognition [5].

It is vital for any smart traffic system to include automated detection of traffic law violations. Motorcycles are a common means of transportation in India's major cities, where the population density is extremely high. Most motorcycle riders don't wear helmets when riding in cities or on highways. In the vast majority of motorcycle accidents, the risk of severe head and brain injuries to the rider can be reduced by wearing a helmet. Today, most traffic and safety violations may be spotted by analyzing surveillance camera footage. This study presents a framework for detecting the presence of one or more motorcycle riders who are not wearing helmets. The state-of-the-art method for object detection, YOLOv3, is used in the proposed methodology as an incremental version of the YOLO model at the first stage. Convolutional Neural Networks (CNNs) have been proposed in the second stage for the detection of helmets on motorcycle riders. On traffic videos, the results of the proposed model are promising compared to prior CNN-based techniques [6].

As the number of motorcycles on the road rises, so do the number of accidents and injuries they cause. The motorcycle rider's failure to wear a helmet is one of the most common causes of motorcycle accidents. To catch motorcycles without helmets, one method is to check for them physically at the pavement intersection or using video footage captured by closed-circuit television (CCTV). To identify between a motorbike rider wearing a helmet and one who is not, a computerised machine structure is presented. Based on the extracted characteristic, the system determines the object's class. You Only Look Once (YOLO)-Darknet is a deep learning framework based on Convolutional Neural Networks (CNNs) trained on Common Objects in Context (COCO). It uses a sliding window technique and modifies YOLO's convolutional layers to recognise three distinct groups of objects. Using training data, the map (Mean Average Precision) on the validation dataset attained an accuracy rate of 81% [7].

Using machine learning, this article aims to identify two-wheeler riders who are not wearing a helmet and present them with a user interface to pay their fines. Real-time traffic images are captured, and two-wheelers are identified from the rest of the vehicles on the road. If both riders are wearing helmets, OpenCV is used to determine whether or not. Any of the riders or pillion riders detected not wearing a helmet will have their vehicle number plate scanned using optical character recognition if necessary (OCR). Using the car registration number, a challan will be prepared and sent to the individual affected through email and text message with all of the challan's pertinent information. Users will also be able to pay their challans via an app or website [8].

Accidents can happen for a variety of reasons. One of the most common causes of fatality in car accidents is a failure to wear a helmet. Helmets are not being used properly by many people. Surveillance is needed to keep an eye on this situation. There is currently no traffic control system that does not rely heavily on human intervention. An officer can't monitor all of the traffic and keep an eye out for violators at the same time. It would be a huge undertaking that would necessitate a large number of people to adequately cover all bases. Two-wheelers without helmets will be detected using yolov2, and frames from the video will be captured to extract the number plate and assess a fine for violating traffic laws. This problem may be remedied with our new automated method. Updates to the server will be transmitted to the phone number provided along with the vehicle's licence plate number. Automated traffic surveillance video scavenging, number plate extraction, and construction of an electronic fine management system are all discussed in this study [9].

In the last few years, the field of intelligent transportation has received a lot of attention. ANPR is the answer to the growing need for a vehicle plate recognition system that is fast, accurate, and resilient for use in traffic control and law enforcement. OCR-based license plate recognition utilizing neural network trained datasets of object features is the focus of this paper. Blended algorithms for license plate recognition are presented and compared to existing methods in order to enhance accuracy. All of the components of the system may be broken down into three main categories: License Plate Localization, Plate Character Segmentation, and Plate Character Recognition. The system is tested on 300 LP photos of automobiles from throughout the world, and the results show that the primary criteria is met [10].

3. Proposed System

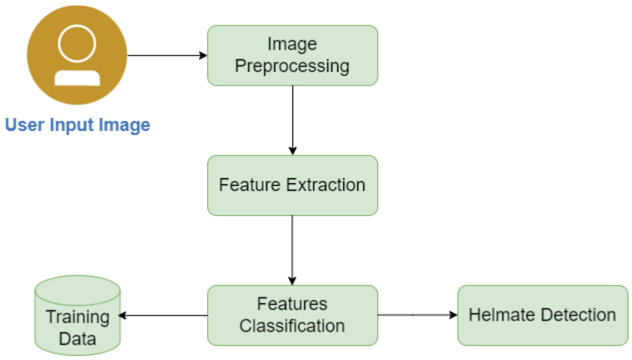

Fig. 1. System architecture

1) Input Image

Here we can upload the Input Image.

2) Image Pre-processing

In this step we will apply the image pre-processing methods like grey scale conversion, image noise removal.

3) Image Feature Extraction

In this step we will apply the image pixel extraction methods to remove the image features from image.

4) Image Classification

In this stage we will apply the picture classification methods to distinguish the contaminated region and safe area from features.

5) Result

In this step will show the final result detection result.

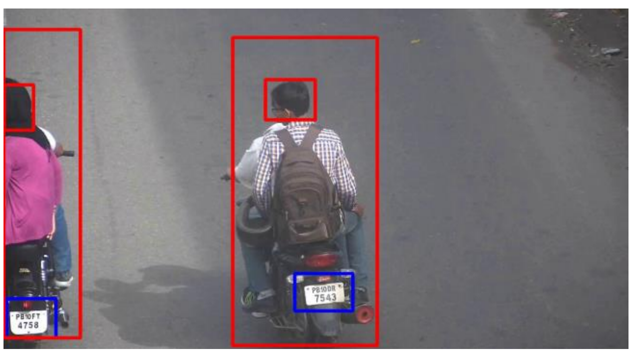

Fig. 2. Result

Algorithm:

Convolution Layer:

Convolution is the first layer to extract features from an input image (image). Convolution preserves the relationship between pixels by learning image features using small squares of input data. Convolution of an image with different filters can perform operations such as edge detection, blur and sharpen by applying filters i.e., identity filter, edge detection, sharpen, box blur and Gaussian blur filter.

Pooling Layer:

Pooling layers would reduce the number of parameters when the images are too large. Spatial pooling also called subsampling or down sampling which reduces the dimensionality of each map but retains important information.

Fully Connected Layer:

In this layer Feature map matrix will be converted as vector (x1, x2, x3, …). With the fully connected layers, we combined these features together to create a model.

Softmax Classifier:

Finally, we have an activation function such as softmax or sigmoid to classify the outputs.

4. Conclusion

In this project we have described a framework for automatic detection of motorcycle riders without helmet from CCTV video and automatic retrieval of vehicle license number plate for such motorcyclists. The use of Convolutional Neural Networks (CNNs) and transfer learning has helped in achieving good accuracy for detection of motorcyclists not wearing helmets. The accuracy obtained was 98.72%. But, only detection of such motorcyclists is not sufficient for taking action against them. So, the system also recognizes the number plates of their motorcycles and stores them. The stored number plates can be then used by Transport Office to get information about the motorcyclists from their database of licensed vehicles. Concerned motorcyclists can then be penalized.

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