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# Deep Learning Approach for Automated Helmet Detection

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**ABSTRACT:** To identify motorcycle riders who are not wearing helmets in real time is an essential task to prevent accidents. This project is designed to identify people who are not wearing helmets in real-time. The problem is more challenging because the computational resources are limited. This custom dataset was compiled to help develop an automated helmet detection algorithm. The proposed system uses a HAAR Cascade classifier to identify helmets. We present an algorithm to classify people with and without helmets, based on a deep complex neural network, we use the YOLO v3 model.

**KEYWORDS:** HAAR Cascade Classifier, YOLO v3

## I. INTRODUCTION

In later times head protectors have been made obligatory for both people in bicycle. Activity mishances in India have expanded year by year. As per Section 129 of Motor Vehicles Act, 1988 it is compulsory that the rider ought to wear protective cap which is of ISI standard. In India drink and drive case could be a criminal offence agreeing to Motor Vehicle Act 1939. Which states that the bicycle rider will get rebuff. In spite of this bicycle rider effectively get gotten away from law.

As is well known, an observation framework is impressive critical for control substation safety. Over the past decades, a few counterfeits brilliantly procedures like computer vision and machine learning with developing advance has been broadly connected in brilliantly reconnaissance in power substation. It cannot as it were dodge time-consuming labour-intensive assignment, but too point out the power equipment blame and labourer illicit operation in time and precisely against mishaps.

## II. RELATED WORK

Kasturi[1] According to research in most surveillance situations, computer vision systems have been created and deployed to enable humans to perform tasks more effectively. In the installation, a human observer needs to watch the video monitor at the same time. Studies show that human ability to monitor simultaneous signals has serious drawbacks. Here, this method is evaluated for human surveillance performance in situations that meet the demands of real-world surveillance. A computer monitor contains 9 display cells or 4 display cells. Each cell contains a stream of 2-4 moving

objects. Manpower is instructed to signal when a target event occurs and one of the objects enters the small square Id of the bidend load quart area in the center of the display. Target events individually Departure. It can occur in two groups or it can occur in two groups. The results show that the observer missed most targets (60%) when needed.

Limitations:

It does not support for detection of person wearing helmet or not.

The Accuracy is obtained less than 70%.

X. Wang [2] Intelligent multi-camera video surveillance is a multidisciplinary field related to computer vision, pattern recognition, signal processing, communications, embedded computing, and image sensors. The following paper provides an overview of the recent development of all technologies from the human perspective of computer vision and pattern recognition. Topics include multi-camera calibration, computation of camera network topology, multi-camera tracking, object re-identification, multi-camera activity analysis, and cooperative video surveillance both with active as well as static cameras in connection with cameras. Detailed descriptions of their technical challenges and a comparison of all the different solutions are provided. It emphasizes the connection and integration of all the different modules in numerous environments and use cases. According to the recent works, some of the problems can be solved similarly to improve performance, efficiency, etc. to improve with the immediate development of surveillance systems, the scales and complexities of camera networks are increasing and the monitored equipments are becoming more and more complicated and messed up. The paper discusses how to face the emerging challenges.

Limitations:

It is used to video surveillance.

It is not suitable for detection of person wearing helmet or not.

S. Aslani [3] Automated motion detection and tracking is a difficult task in traffic surveillance. In the following paper, a system is developed to collect all the useful information required from still cameras to detect moving objects in digital videos. The moving detection and tracking system is mainly developed on the basis of optical flow estimation along with the application and combination of all different image processing and computer vision technologies Related to process enhancement. The object type restrictions are set using blob analysis, which is the most recent type of analysis.

Limitations:

It is used to detect and track moving objects but accuracy is less than 65%.

Rubin V L [4] Gender bias within artificial intelligence driven systems is currently a trending topic and is one of many areas where the data used to train, validate and test related machine learning algorithms is being scrutinized more than ever before. In the following paper, if discovered, there is a difference between nonverbal deception and deception generated separately by men and women through the use of automated deception detection systems. Experiments were conducted on three variations of the dataset, all men and all women, to make it easier and more detailed to see if the differences in clues generated by men and women lead to differences in the accuracy and performance of machine learning algorithms. Categorize their behavior mixed in order so that they can be examined. The results show the difference in nonverbal cues between men and women. Both genders are restricted if treated by a classifier trained in both genders rather than a classifier specifically trained for each person. limit: There are more complicated steps. More than 60% accuracy.

Wonghabut [5] Utilizing Wide-angle and Zoom cameras, discovery of the bikers with and without a protective cap is depicted. The wide-angle focal point captures the picture crossing point that recognizes the biker in an outline of width less than 80 and tallness less than 120 utilizing the HAAR calculation, which is the primary step and zoomed lens to distinguish the permit plates. The following step is to confirm all the outlines whether a biker is having helmet or not and makes the boundaries to the head of a biker of stature half of the range and width one-third of the zone of the outline, where the biker is identified. In case the biker needs the protective cap, the zoom lens spots the number plate and stores the related data and pictures within the database, which acts as a proof for activity wing to force fines. The gotten yield is compared with manual results with 0.05 significance.

e Silva [6] By utilizing division, classification of moving objects, and head protector discovery, and a biker is spotted with and without security head protector. Division of moving objects need a background picture, which is transformed by utilizing versatile blend of Gaussians, reduces the handling time and false-positives in classifiers. The gotten result is changed to include vector, which helps in classifying the vehicles like bicycles and non-bikes by utilizing descriptors. At last, helmet identification is done with Locale of Intrigued (LOI) assurance to decrease computational capita and head protector recognizable proof, picture classification utilizing six distinctive classifiers, and extraction of features utilizing three sorts of descriptors. MLP utilizing Hoard gotten the finest result with 0.9137 accuracy.

N. Boonsirirumpun [7] The paper centers on profound learning procedures to classify the bikers with and without a protective cap. The evolution in CNN and SSD able of division and classification of pictures, once in runtime by



making bounding boxes. Classification of pictures with and without a protective cap is done by CNN models like VGG16, VGG19, Versatile Nets, and Google Nets (Inception\_v3). Neural Net is prepared with python TensorFlow and exactness is decided. SSD demonstrate can collaborate with other nets structures such as Google Net and Versatile Nets into one net which builds structure faster. Among the four CNN models, Portable Nets got the most excellent result.

Shine L [8] The completely upgraded real-time structure decides motorcyclists with and without head protectors from vigilance utilizing Hoard as classifier and LBP as a include vector. At first, each outline is considered from footage and extraction of vehicles moving is gotten by killing superfluous regions, then extracted pictures are upgraded by utilizing an versatile Gaussian blend. After performing the required preprocessing steps, the classification is done to play down the capita. Two-stage classification is done to obtain the finest yield and diminish misclassification. At long last, the biker's head is gotten by calculating the ROI of the upper twenty percent of the picture and converted them to grayscale pictures. Fragmented pictures are at that point sent to CNN for the classification of bikers with and without the protective cap.

Kunal Dahiya [9] The first step was to categorise and distinguish between moving and non-moving items. Examples of moving objects include cars (four-wheelers), bicycles (two-wheelers), and people. Non-moving objects include roads, plants, trees, and buildings, which were identified by background subtraction. The classification of bikers who are wearing helmets and those who are not occurs in the next phase. Scale-invariant feature transform (SIFT) classifiers and histogram of oriented gradients (HOG) classifiers are used to classify the data. According to the final report, processing a video with 30 frames per second took 11.58 milliseconds.

Sonoda et al. [10] A moving object was detected using an Adaptive Gaussian Mixture Model (AGMM) to compute the scene background. Moving objects appear at different locations in a series of video frames, so we used a tracking algorithm as the next step. The Lucas-Kanade tracking algorithm, which evaluates whether a car and a person collided, was used. If cars and pedestrians cross the intersection at the same time, the system will sound an alarm. This system has several drawbacks, including a significant potential for false alarms, as pedestrians may change their route after the system sends a warning.

Leelasantham [11] There were five sets of cars. Bicycles, motorcycles and tricycles fall into the first category. Cars and minibuses made up the second collection. The third category consists of minibuses and small cars. Standard-sized trucks and buses made up the fourth group. The fifth group was designated as heavy trucks and trailers. These five categories were classified according to the length and width of the image. The database consists of only 76 pictures, which casts doubt on the reliability of the conclusions. If the same system is applied to different roads, all parameters such as image length and width need to be updated. This is because this method can be easily applied to the road where the photos are recorded.

Amit Adam [12] This paper deals with the low level statistics collected by the multiple local systems. When the current measurement is unusual, an alert sound is generated by the multiple local monitors, later the produced alerts are combined together to check the presence of any unusual events by notifying with the help of alerting system. This algorithm has gained the importance for deploying large scale surveillance system. It is very much user friendly algorithm as it contains very few number of steps for setup and later it performs the task on its own (Automatic). The major drawback noticed in these kind of algorithms was their lack of performance in crowded region or in fast moving objects whereas this algorithm has proved its efficiency by working perfectly in the critical conditions with high accuracy. As this algorithm works on real time, it demands an effective working condition, so it performs by collecting low level observations, with in a minute. This particular algorithm has been cross verified under various practical conditions and the results are evaluated and false-alarm rates are reported.

Bobo Duan [13] The Lane Change Assistant (LCA) incorporates a real-time monocular-based vehicle and two-wheeler monitoring system. In order to accomplish this and obtain acceptable accuracy and robustness, they examine a convoy that includes motorcycles. All the algorithms are implemented on an IMAP (Integrated Memory Array Processor) simultaneous vision board to obtain real-time accuracy rather than visual input and to reduce computer complexity. The evaluation of the findings under various traffic signals demonstrated the work's correctness, robustness, and real-time challenges. In recent years, utilising a driver assistance system to identify vehicles using a vision sensor (DAS). By installing cameras in the signals to continuously monitor, we can use these to track vehicles that are travelling at high rates of speed or overtaking motorcycles in the same lane.

[14] In order to protect a two-wheeler from dying in the event of an accident, helmets are a need. However, encouraging helmet use is a labor-intensive and time-consuming undertaking. A method for automatically identifying and testing helmet-wearing or helmet-less riders. The technique employs a support vector machine that has been trained on histograms that take the head region into account for images or video frames. With the removal of the video's background, the data will be trained and categorised as either helmet-wearing or helmet-less cyclists. A series of tracks in consecutive frames make up each motorbike rider result. Test results demonstrate that the classifier can distinguish

between bikers wearing helmets and still images. Their effective in implementing a vertical histogram projection of the moving object's silhouette to identify the presence of circular object indicate helmet.

[15]The most active areas of computer vision research include visual surveillance, typically for people and automobiles. Applications include entry management in restricted locations, remote identification, analysis of crowd flow and congestion, anomalous behaviour detection, interactive surveillance with many cameras, etc. The stages of this system are as follows: modelling of environments, motion detection, object classification, tracking, comprehension and description of activities, person identification, and data fusion from various traffic cameras. To replace the outdated passive video-based approach to violation identification, intelligent visual surveillance is intended. The capacity of a human operator to oversee them increases as the number of cameras used in a typical system exceeds that amount. The main objective is to replace human eyes with cameras while also automating the monitoring process.

### III. METHODOLOGY

The process begins with taking input video from surveillance camera and captures snapshots, From the snapshots continue with image processing by means subtraction, scaling, channel subtraction and blob creation. Helmet classification and detection by using YOLOv3, HAAR Cascade Classifier algorithms. Later, alerting the traffic controller with the details of motorcyclist for violating traffic and also alerting the motor cyclist with fine for violating rules.

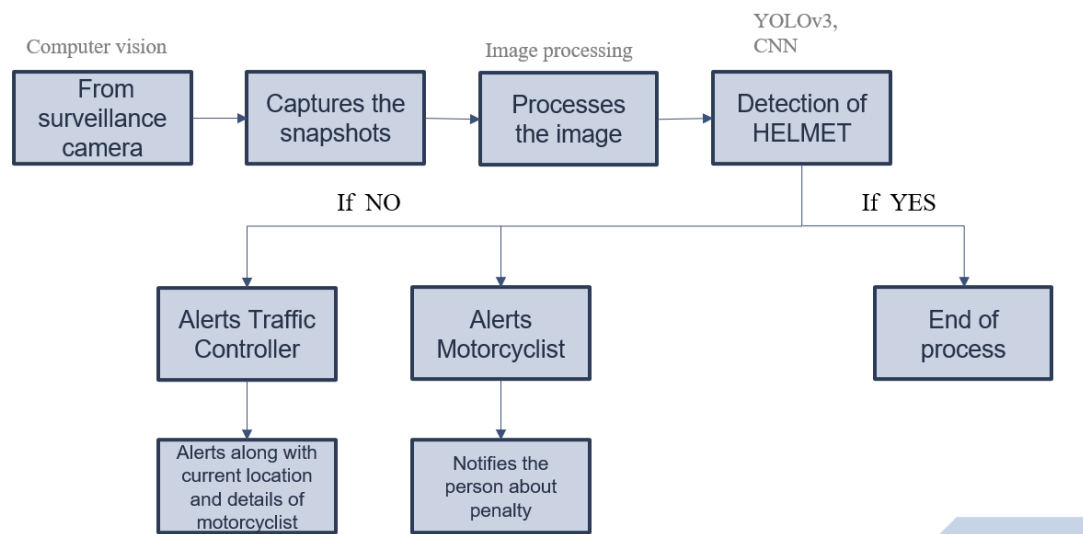


Fig 1: Methodology diagram for helmet detection

### IV. EXPERIMENTAL RESULTS

Figures shows the results of helmet and face detection from an image by using Haar Cascade Classifier algorithm. Figures shows User Interface Design for Helmet Detection, Video of Person to be trained , Shows the rider with helmet detected. In figure 5 the rider without helmet detected with his/her registered ID and Name. Later in Anaconda Prompt, rider without helmet message generated with fine amount.

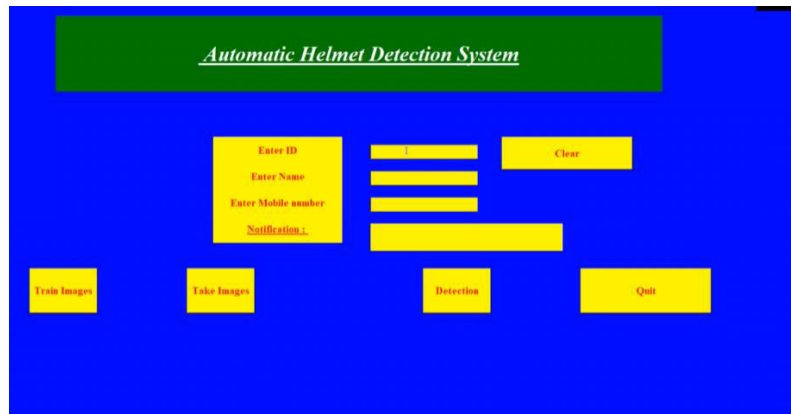


Fig 2: User Interface Design for Helmet Detection



Fig 3 : Take Video of Person to be trained



Fig 4 : The rider with helmet detected.

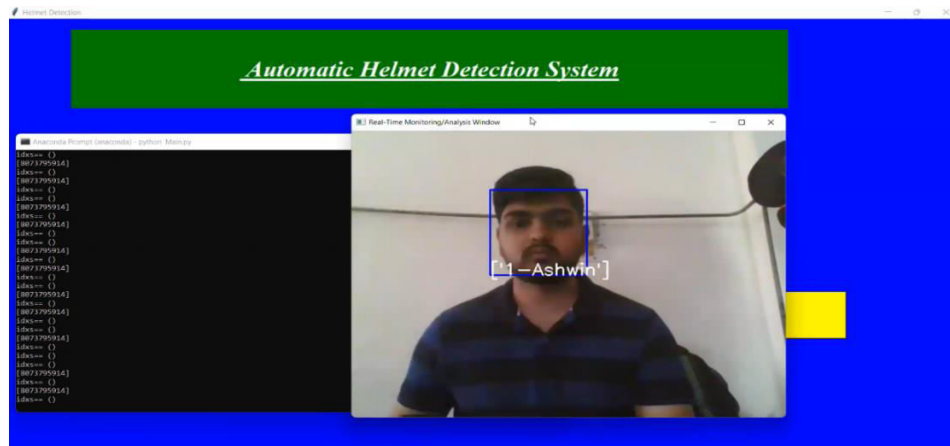


Fig 5: The rider without helmet detected.

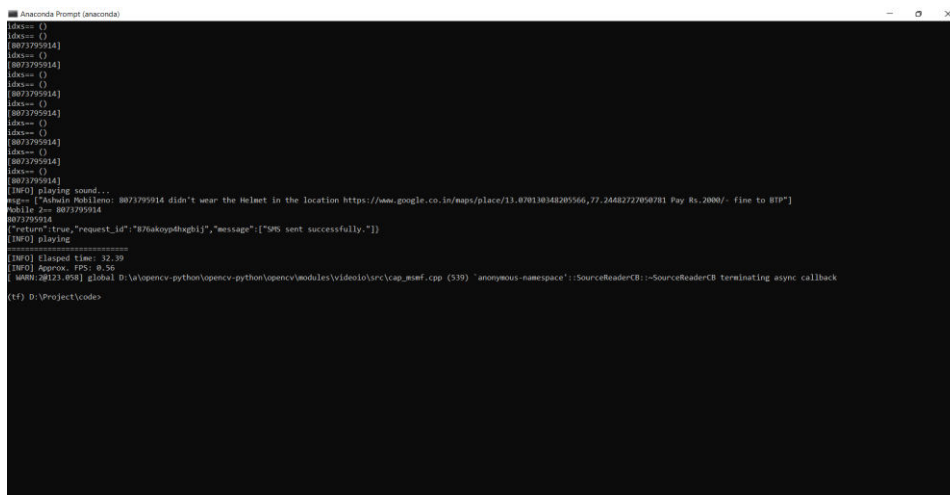


Fig 6: In the Anaconda Prompt rider without helmet message generated with fine amount.

## V. CONCLUSION

The proposed system is very suitable for helmet detection. The system has been tested with various frames and results are obtained with minimal error rates. We developed a deep learning approach for automated helmet detection. We created a desktop application to demonstrate helmet wearing detection.

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