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Helmet Wear Detection for ATM Security

[1]K. Kasi Rao, [1]K. Jeevan Kumar, [1]P. Gowtham, [1]K. Aditya, [2]Ch. RajaShekara Rao

[1]Student, Department of Electronics and Communication Engineering, Aditya institute of technology and management college, Tekkali, Srikakulam, Andhra Pradesh, India, 532201

[2]Professor, Department of Electronics and Communication Engineering, Aditya institute of technology and management College, Tekkali, Srikakulam, Andhra Pradesh, India, 532201

ABSTRACT:

The Cash Machine (ATM) is a convenient way to withdraw cash and access other banking services, however because of the significant danger involved, security is recommended. The ATM Center's video surveillance system typically records every customer action; however fraudsters frequently use disguises to avoid being seen. Due to the occulted face caused by helmets, it is difficult to examine and locate them. As a result, our technology will automatically identify helmets in surveillance footage and send out SMS messages. In this article, we presented a system for detecting occulted faces caused by helmets in surveillance footage. To detect the person and helmet, we used the object detection weight of the yolo model. Initially, background subtraction was employed to remove unwanted video content. The skin-color ratio and LBP characteristic will then be extracted. After detection of person then the sms message is send to respective bank manager.

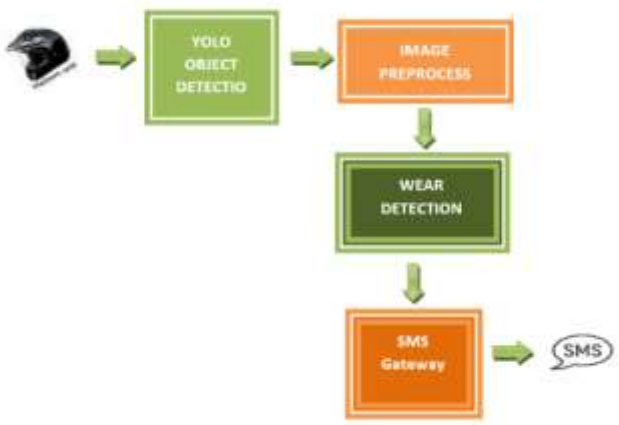
Key Words: Machine Learning**,** CNN**,** Image Processing. Object detection model, CNN algorithm, YOLO.

I. INTRODUCTION:

As is well known, automatic teller machines (ATMs) are crucial to current economic activity. It offers a quick and simple way to handle cost-effective transactions between banks and their clients. Unfortunately, it also gives thieves a simple means to obtain illicit funds. A customer will be required to enter their bank card information and a password when using an ATM. Additionally, each ATM has a surveillance system that records the consumer's face information for security purposes. However, when a fraudster uses an ATM to conduct an illicit transaction, they typically cover their faces with helmets, face masks, or other items to prevent the surveillance system from capturing their facial information. Therefore, it won't fulfil the purpose of the surveillance system.

In the past, the usage of ATM services grew quickly because they provided clients with a more convenient option to withdraw money at any time (24 hours a day, 7 days a week). The banking industry has adjusted to the rise of digital transactions. However, a lot of security issues plague the ATM service, which has an impact on the entire banking industry. Due to ATM crimes such card skimming, cash trapping, and shoulder surfing, secure financial transactions are not guaranteed. The rate of theft and robbery is rising every year, according to a new report. Due to a lack of protection, frauds occur frequently at ATM centres. According to historical data, 5500 fraud cases are reported annually.

The implementation of automatic helmet detection in CCTV footage at ATM Center is suggested despite difficulties with video quality, lighting, and occlusion. In the back, significant work has been done in the fields of tracking and moving object detection with CCTV surveillance applications.



Direction Flow

The main objective of the proposed effort is to deploy surveillance cameras in ATM outlets to identify people wearing safety helmets. Combining deep learning models with machine vision makes this possible. The used model is YOLO's pre-trained object detection, which can identify over 3000 different object classes. Through the use of Region Based Convolutional Neural Networks (R-CNN), this model was pre-trained. The system receives data from a live surveillance stream. A SMS alert message is sent to the control room or monitoring team when a person is observed to be wearing a helmet. The primary goal of the work is to prevent suspicious behaviour or ATM robberies.

Three main steps make up the work's implementation. The first one is applying the YOLO model to find the Helmet object and segmenting it for further analysis. The segmented image is then used to determine whether the user in the ATM outlet is wearing a helmet by looking for the skin tone inside the detected object. If a person is found at the last stage, an SMS alert is sent to the monitoring team.

II. RELATED WORK:

An summary of the literature review is provided in this chapter. Some of the researchers' pertinent work is represented in this chapter.

Researchers have explored several of the currently used strategies for ATM monitoring systems; a few of them are covered below.

1.The conventional state-of-the-art image processing algorithms available for occluded and covered face detection, human abnormal behaviour analysis, and illegal object detection may not work for ATM having different environment, abnormal gestures, and crime devices, according to Sikandar's paper "ATM crime detection using image processing integrated video surveillance: a systematic review" published on 2018.

2.In his paper "Automatic Detection of Bike-riders Without Helmet Using Surveillance Videos in Real-time" published in 2016, Dahiya provided a framework for the automatic detection of bike-riders without helmet utilising surveillance videos in real time. The suggested method initially uses backdrop removal and object segmentation to identify bike riders in surveillance video.

3.In his study "Helmet Violation Processing Using Deep Learning" published in 2018, Dharma Raj suggested using deep convolutional neural networks (CNNs) and image processing to identify motorbike riders who are not wearing helmets. The system includes motorbike detection, a classification of riders wearing helmets or not, and motorcycle licence plate identification.

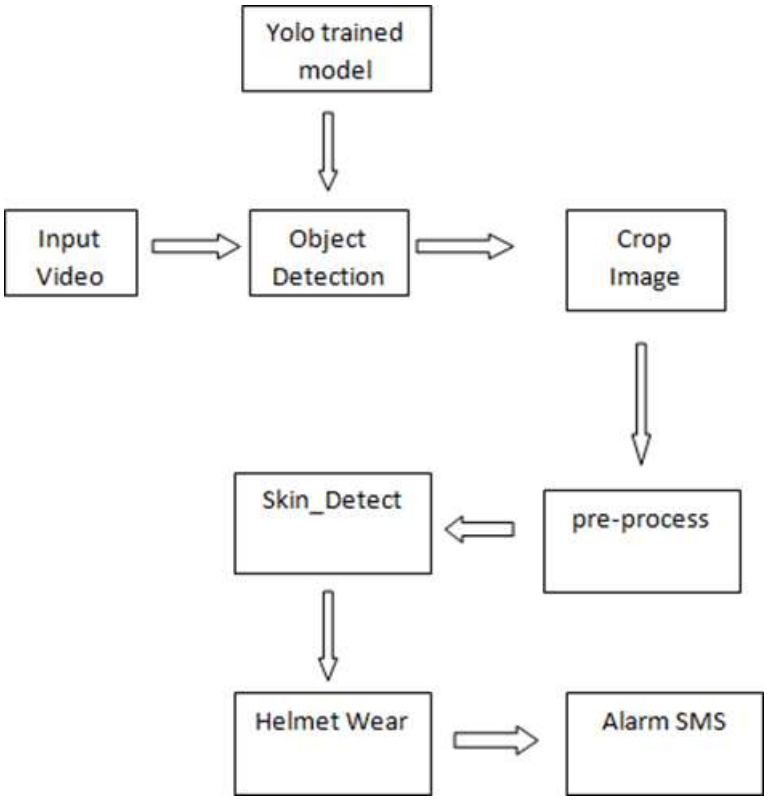
4.In his work "Helmet Detection on Two-Wheeler Riders Using Machine Learning" published in 2018, Ramesh Babu presented a system that would use machine learning and image processing to identify two-wheeler riders who were not wearing helmets.

5.Jie Li suggested a safety helmet wearing detection approach based on image processing and machine learning in his 2017 work, "Safety helmet wearing detection based on image processing and machine learning". The ViBe background modelling technique is initially used to find moving objects in a power substation's fixed surveillance camera's field of view. The Histogram of Oriented Gradient (HOG) feature is retrieved to describe the

Inner person after acquiring the motion zone of interest.

III. DESIGN METHODOLOGY:

The live stream of video input on the side that is red for detection makes it difficult to identify helmet wear on ATM outlets. The method for fraud detection needs to be swift and effective. This is accomplished by incorporating the machine vision notion into Python.



Architecture of proposed work

System architecture showing all operational modules, including the input from the camera, object detection, picture pre-processing, skin part detection, and modules for helmet wear.

Following the modules below is the helmet wear detecting module.

1.Dataset input

2.Object detection

3.Image pre-processing

4.Helmet wear detection

1] DATASET INPUT:

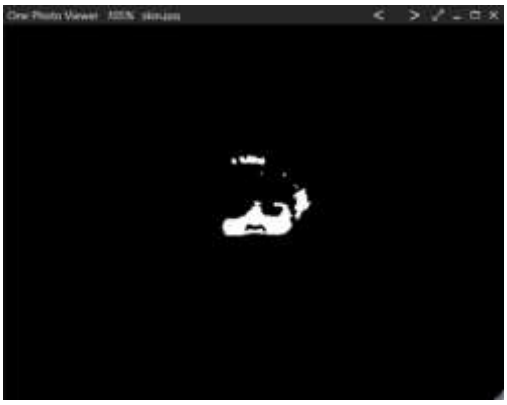
A live stream of webcam video is the dataset being examined for implementation. Since our project's goal is to detect in real-time, live stream video was also proposed as part of the effort.

2] DETECTION OF OBJECTS:

The input of the video stream is taken into account in the object detection module. CNN algorithms are used to find items in the input video stream, and they typically utilise regions to localise the objects inside the image. The network selectively scans those areas of the image that have a higher likelihood of containing an object, not the entire picture.

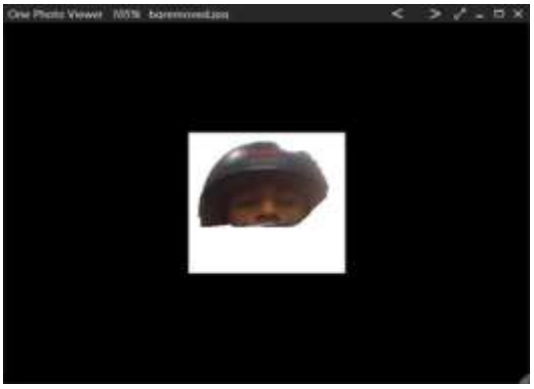
Yolo first pulls an image from the video stream as an input. The supplied image is then divided into grids by the framework. On each grid, image categorization and localization are applied. The bounding boxes and accompanying class probabilities for the object are then predicted by YOLO.We provide the model a picture during the testing phase, and we then execute forward propagation until we receive an output y. The class_object=helmet was specified.

3] PRE-PROCESSING OF IMAGES: Following object detection, the image is saved as image.jpg and pre-processed for the following module. NumPy is used to generate a mask and read the image's height and breadth while also detecting the foreground and background. To obtain the background image, which is saved as background.jpg, the image is subjected to background subtraction.



LOCALIZED OBJECT IMAGE PRE_PROCESSING

After removing the background from the video and separating the person from it, the actual face must be detected with the helmet detected and classified before feature extraction is needed to identify the helmet. Depending on the classification, an alarm will be generated if the detected object is a helmet.



Skin portion detection

4] WEAR OF HELMETS DETECTION:

This module accepts a background-removed image as input, converts the image using the Hue Saturation value, COLOR_BGR2HSV, and detects the skin region. By determining the height and width of the skin region, the threshold is determined to apply regardless of whether the person is wearing a helmet. We set the fixed value for this threshold to be 10. The bank manager's mobile number receives a warning message once the skin region is found in the object.

We incorporated the following blocks of code to send SMS messages using fastsms.com.

```
headers = {'authorization': "02SkmHrLIzofa4seCT",'Content-Type': "application/x-www-form-urlencoded",'Cache-Control': "no-cache",}

response = requests.request("POST", url, data=payload, headers=headers)

print(response.text)
```

ALGORITHM: HELMET WEAR DETECTION

Step 1: The trained object model YOLO is taken for object detection and define class value = "Helmet"

Step 2: Web Camera open and taken input frames

Step 3: Detect object based on DNN object detection

if confidence value >= 0.92

detect object

else

no helmet object

Step 4: Crop object and save image and remove background

Step 5: Load the background removed image and check skin through HSV color value

Step 6: define upper and lower boundary values for skin

Step 7: Draw a bounding rectangle and check height and width if height & width >threshold skin detected

Step 8: Send SMS alert for helmet wear detection

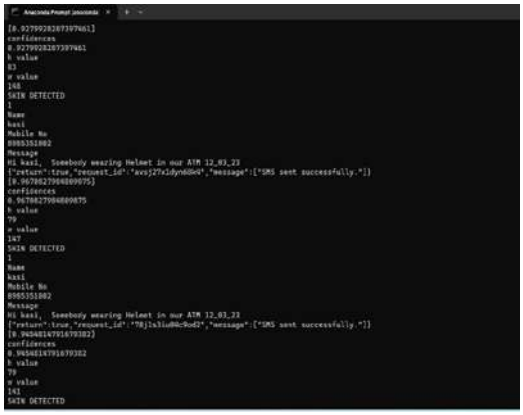
IV. RESULTS AND DISCUSSIONS:

As a real-time monitoring application taking web camera input, safety helmet

wear monitoring for ATM security has been presented. The live video stream is captured as still images, and CNN is suggested for object detection on each image. The only object presented for work is Helmet, which is recognised and extracted with the region of proposal. This may detect several things on input frames. To detect wear, this is analysed further. According to test results, a safety helmet may be detected with reasonable accuracy when someone is wearing one. This application's deployment and maintenance costs are lower than those of competing systems

The application home page is shown in the image above, where users can submit their information to be stored in the application database and used to send alert SMS. This user interface was made to be simple for individuals to use in TK. When the application is launched, a camera window appears and begins to continuously monitor.

The image below shows the application detecting a safety helmet while it is running with input image frame.



When the algorithm finds the helmet with a confidence level of 90 or above, the image is cropped for further processing. The confidence level for object detection for discovering Safety Helmet is reported as 90%. Similar to this, in an experimental investigation, the height and width of the skin region of the proposal are tracked over the course of ten experiments to determine the detection threshold for skin. This accurately validates the helmet-wearing individual.

Detection	**Parameter**	**Value**	**Result**
Object (Helmet)	Confidence	>= 0.92	Helmet detected
Object (Helmet)	Confidence	< 0.92	No detection
Skin Detection	Height X Width	>= 10	Skin detected
Skin Detection	Height X Width	< 10	No Skin detected

Confidence Value for Object and skin detections

When users are wearing the regular model Helmet, safety helmet detection operates better. The infrastructure must be well-built to handle the live video feed with caution, thus the detection latency may increase over time. In additional research, the system latency on the detecting part can be decreased.

Hence after detection of person and helmet and the alerts are send to respected bank manager, screen shot given below.

Screen Shot

V. CONCLUSION:

For a fix on helmet and mask detection for the ATM centre's security, Real-time detection is proposed in the proposed study, using video as the input. Web cameras are used, and OpenCV is used to interpret the data. Yolo objected model, which is a globally accessible trained model for several classes of objects, is utilised in this instance to detect helmets. Following image pre-processing, the skin area is recognised. To identify skin, we shall apply HSV colour conversion and look forward to additional processing. then will determine the skin-color ratio. It is then compared against the threshold, and any changes are notified to the manager. According to the experimental findings, an alert is produced when the height and width of the skin region are equal to or higher than the threshold. The detection alarm message transmitted to the control centre is shown using experimental results.

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