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Safety Helmet Detection in Engineering and Management

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Abstract— Due to a lack of knowledge about safety helmets, accidents and injuries on construction sites are now increasingly common. Worker supervision by hand is challenging and ineffective. This study is visually checking the construction site to see if anyone is wearing a safety helmet, and then notifying the worker and manager with a sound BUZZER and an SMS if they are. In order to recognise a safety helmet in real time at a building site, we built a deep learning-based technique. Helmet detection was done, and the experimental results indicate that less than 90% of people wore helmets. Compared to previously used methods, our model has an accuracy rate of 92%. The YOLO-V3 algorithm, which is based on convolutional neural networks, is used in the method that is being discussed.

Key Words: Accidents, BUZZER, SMS, YOLO-V3, Deep Learning

1.INTRODUCTION

Currently, complex structures and industries are expanding quickly over the globe, requiring a large workforce on construction sites. Unexpected accidents and injuries are more likely to occur on a construction site because of the complicated environment. In order to prevent these occurrences, safety helmets are required in this region. A significant amount of unstructured image data is available on-site thanks to the video monitoring equipment. According to the State Administration of Work Safety's accident statistics from 2015 to 2019, of the 80 construction accidents that were reported, 57 occurred as a result of improper use of safety helmets by the workers, making up 69 percent of the total. number of mishaps on construction sites, traditional safety helmet wear checking is quite challenging and requires a lot of manual labor. Additionally, using a visual monitor forces inspectors to spend a lot of time staring at the screen, which can be ineffective. On construction sites, researchers create deep learning-based ways to identify safety helmet use, which can help prevent accidents, injuries from false alarms, and reduced accuracy rates. This study used the real-time object detection method YOLO-V3 (You Only Look Once). utilises deep convolution neural network characteristics. Yolo-V3 has the advantage of being a lot faster and more accurate than other networks. The main goal of this study is to use live streaming to monitor the building site, identify any workers who are not wearing safety helmets, and notify them via SMS and buzzer.

2. RELATED WORKS

To prevent injuries to workers at the construction site, it is crucial to keep an eye on the area and be promptly alerted if someone is not wearing a safety helmet. According to physiologic research, people are only capable of monitoring two signals at once with an accuracy rate of less than 70% [1]. A multidisciplinary field related to computer vision, pattern recognition, signal processing, communication, embedded computing, and image sensor is known as intelligent multi camera video surveillance. The scales and complexities of camera networks are growing as surveillance technologies advance quickly, and the monitored environments are getting more complex and denser [2]. A video surveillance application that automatically analyses a motorbike rider's helmet use shows promise because helmets are crucial for preventing brain injuries in traffic accidents. In order to segment the objects, a Gaussian-N mixing model is used (GMM). In order to recognize motorcycles in the foreground objects that have been labelled, the suggested system then adapts a faster region-based convolutional neural network (faster R- CNN) [3]. Recently, it was recognized that employing a Convolutional Neural Network (CNN) or Deep Learning, digital image pattern recognition and feature extraction have been successful over the years. The effectiveness of utilizing a convolutional neural network for feature extraction and pattern detection in digital images. Wearing a helmet before entering the workplace is a requirement for the factory since the environment of the steel industry workshop is complicated and there may be unanticipated dangers. Helmet testing is a crucial component of the intelligent monitoring system for steel plant staff, since it allows for the monitoring of this condition. Accuracy of quicker RCNN algorithms decreases in dim light and complex backgrounds [5]. employing object segmentation and background subtraction in the surveillance footage. Using visual cues and binary classification, it then establishes whether the bike rider is wearing a helmet or not. Results from the experiment show that the accuracy for detecting bike riders and violators is 98.88 percent and 93.80 percent, respectively. A frame is processed on average in 11.58 milliseconds, which is suitable for real-time use [6]. The task of automated motion detection in traffic monitoring is difficult. This study develops a technique to get meaningful data from security cameras for tracking moving objects in digital films. The outcomes demonstrate that the suggested method recognises and tracks moving objects in urban movies with success [7]. The majority of motorcycle riders are seen to drive without wearing helmets. In most cases of vehicle accidents, wearing a helmet can lower the risk of head and severe brain injuries to motorcycle riders. It can only be used to identify helmet wea rings; it cannot be used to detect triple riding on a motorcycle [8].

3. PROPOSED METHODOLOGY

The project has been implemented by dividing the entire project into three modules.

They are:

- Data Collection
- Data Pre-processing
- Detection Of Helmet

A. DATA COLLECTION

In this module we are collecting live face dataset for face recognition for every person we are collection 200 images to train the model. Data collection is the process of gathering information on specific areas with the a I'm of evaluation. In this study each trained color image is converted as gray image.

B. DATA PREPROCESSING

In this module we are applying image resizing and normalizing the image using OpenCV. And building the various LBPH algorithm for face recognition.

Pseudo code:

Procedure Building Model ()

Input: Cleaned Data

Output: Pre-Trained Model

Step 1: Read the dataset using CV2

Step 2: Extract the face features

Step 3: Convert into Numerical Array

Step 4: Build model

Step 5: Train Model using data

Step 6: Save the pre-trained model

C. DETECTION OF HELMET

In this module we are taking input camera and loading the yolov3 model to identify the people and count the persons inthe frame then find out they are wearing helmet or not, if they are not wearing helmet system will send a lert SMS and make BUZZER.

Pseudo code:

Procedure Helmet Detection ()

Input: Camera frame

Output: Alarm if no helmet

Step 1: Read frame

Step 2: Load pre trained model

Step 3: Count person

Step 4: For all the person

Step 5: Detect the helmet

Step 6: If helmet detected continue

Step 7: else

Step 8: Identify the face and send alert sms

Step 9: Return result

D.ALGORITHM

The classifier YOLO-V3 In contrast to YOLOv2, the pooling layer is cancelled in the YOLOv3 network, which only has a convolutional layer. The size of the output feature map can be altered by varying the convolutional layer's step size. The YOLOv3 network employs the DARKNET53 feature extraction network. YOLOv3 employs a tiny feature map and incorporates the concept of a "pyramid feature map" (FPN). The usage of large feature maps allows for the detection of large objects. The rationale for this strategy is that the higher-level network features include richer semantic information while the lower-level network features have more accurate location characteristics. The YOLOv3 prediction layer is able to precisely find the object and correctly classify it because to the feature map's combination of accurate location information from low-level network feature maps and rich semantic information from high-level network feature maps. The feature map's output dimension is N N [3 (4 + 1 + M)], where N N is the number of output grids, each of which has three anchor boxes, a 4-dimensional prediction value box with the values tx, ty, w, and th, a 1-dimensional object prediction box with the confidence level, and M dimensions of object category numbers. YOLOv3 predicts the categories during training by using a binary cross-entropy loss function and numerous logical classifiers in place of SoftMax to classify each box.

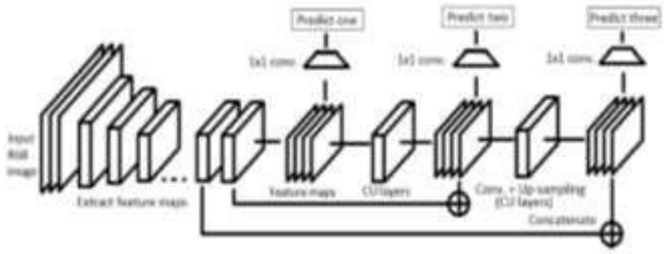

Fig 1. YOLO V3 Architecture

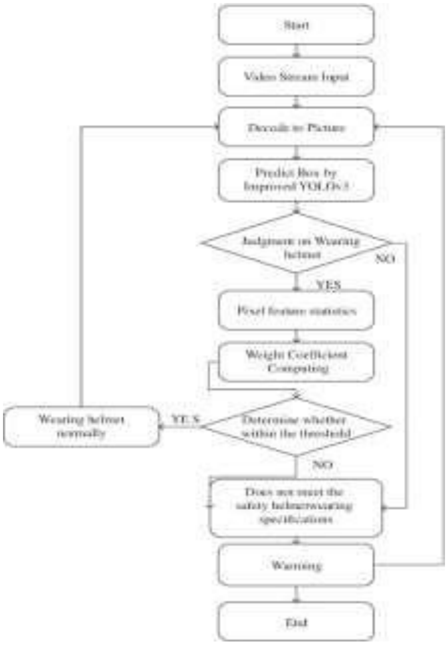

Fig 2. Architectural Design

3. RESULT AND DISCUSSION

Several prior related studies were used to evaluate the performance of the proposed systems. The accuracy ranges of the previous research are between 96.8 percent and 66.3 percent.

Fig 4. Labor Registration Page

Fig 5. Helmet Detection Page

4.CONCLUSION

The approach for identifying helmet use proposed in this research is based on the upgraded YOLO-v3. It performs the helmet wearing detection test using data from the construction site video and web crawler images. Then, to ensure more accuracy, enhance the YOLO v3 network utilising target frame dimensiona l clustering and multi-scaling techniques. The task of helmet wearing detection in the actual industrial environment may be completed with accuracy and in real-time thanks to this system's high speed. We used a web camera to complete this research, which will allow us to increase the accuracy of detection in low light situations in the future.

5.REFERENCE

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