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PERSONAL PROTECTIVE EQUIPMENT DETECTION

[1]Pratik U. Haribhakta, [2]Shubham B. Raut, [3]Bramhadev G. Garud, [4]Priti Chorade

[1]Student, [2]Student, [3]Student, [4]Asst.Professor

[1]Computer Department,

[1]VPSCET, Lonavla, India

Abstract: This study focuses on the example of segregation of personal items in high-risk sectors such as clothing and personal protective equipment. We propose using biometric objects from Open Images V5 and DeepFashion2 datasets for pre-training mask segmentation networks for recognition and segmentation of personal protective equipment in the workplace. The preliminary results of our proposed model achieve a mean average precision with modest optimization, which results in extremely effective segmentation of welding masks, high visibility vests, construction helmets, and ear protection in the workplace. The results of this research can be applied to improve workplace safety in high-risk industries by providing a way to ensure that personal protective equipment (PPE) is used appropriately while protecting employee privacy**.**

Index Terms **- Computer Vision, Yolo, Personal Protective Equipment, Data Pre-processing, Safety Equipment, Object Recognition.**

I. INTRODUCTION

Nowadays, real-time object recognition is used to automate a wide range of tasks in industrial settings. Ensuring that personal protective equipment (PPE) is properly used in hazardous locations is a critical task that can significantly improve worker safety.In this case, PPE use is usually assessed in real time by a surveillance system that watches the security camera feed. To raise awareness and vigilance, an automated visual or audio alert is triggered when an employee fails to wear the appropriate personal protective equipment (PPE). Most of the solutions that have been implemented so far rely on cloud-based systems; images from the sites are periodically moved to the cloud for analysis. due to its network bandwidth and centralized architecture, which enable the video feeds to be sent over a stable internet connection. It is essential to apply health and safety rules to all individuals. In Indonesia, business is one of the most important factors. The application of PPE is arranged according to occupational health and safety. These are safety instruments that need to be worn by employees, and each workplace has different standard for them. Company’s standards that have limit what workers are permitted to wear. When they work in a private place, they need to be equipped with personal protective equipment. Companies with a certification in health and safety ought to have standards that prioritize health and safety.

II. LITERATURE REVIEW

1.Real-time personal protective equipment monitoring system Author links open overlay panel Santiago Barro-Torres, Tiago M. Fernández-Caramés, Héctor J. Pérez-Iglesias, Carlos J. Escudero Departamento de Electrónicae Sistemas, Universidade da Coruña Campus de Elviña, s/n, Facultade de Informática, 15071 A Coruña, Spain

2.Realtime Multi-Person 2D Pose Estimation using Part Affinity Fields Zhe Cao, Tomas Simon, Shih-En Wei, Yaser Sheikh Accepted as CVPR 2017 Oral.

3. Aphinya Chairat, Matthew Dailey, Somphop Limsoonthrakul, Monkol Ekpanyapong, and Dharma Raj KC. Low Cost, High-Performance Automatic Motorcycle Helmet Violation Detection. In Proceedings WACV, pages 3560– 3568, 2020

4.Francois Cholletetal Keras. https:keras.io, 2015. Deep learning for humans.

5. Kunal Dahiya, Dinesh Singh, and C. Krishna Mohan. Automatic detection of bike riders without helmets using surveillance videos in real-time. In Proceedings of IJCNN, pages 3046–3051, 2016

6.Computer Vision System Based for Personal Protective Equipment Detection, by Using Convolutional Neural Network Faishal Zhafran1, Endah Suryawati Ningrum2, Mohamad Nasyir Tamara3, Eny Kusumawati4 Departement of Mechanical and Energy Engineering.

III. PROBLEM DEFINITION

Inconsistent usage of Personal Protective Equipment (PPE) indeed poses several significant challenges across various environments, including safety risks, privacy concerns, and efficiency issues. Let's see each of these challenges:

Safety Risks: In workplaces such as construction sites, manufacturing plants, or laboratories, inconsistent usage of PPE can lead to increased risks of accidents and injuries. For instance, failure to wear helmets, safety goggles, gloves, or other protective gear in hazardous environments can result in severe injuries or even fatalities. Detecting non-compliance with PPE usage is crucial for preventing such accidents.

Privacy Concerns: Implementing PPE detection solutions involves the use of technologies such as cameras, sensors, or wearable devices to monitor individuals' adherence to safety protocols. However, this raises concerns regarding privacy infringement and surveillance. Employees may feel uncomfortable or perceive it as an invasion of their privacy if they are constantly monitored for compliance. Balancing the need for safety with respecting individuals' privacy rights is essential in deploying effective PPE detection solutions.

Efficiency Challenges: Manual monitoring of PPE compliance is time-consuming, labor-intensive, and prone to errors. In large-scale environments with numerous workers, such as construction sites or factories, it becomes increasingly challenging to ensure consistent adherence to PPE protocols. Effective PPE detection solutions should streamline the monitoring process, enhance efficiency, and provide real-time feedback to address non-compliance promptly.

To address these challenges, effective PPE detection solutions should leverage innovative technologies such as computer vision, machine learning, and wearable sensors. These solutions can automate the monitoring process, detect instances of non-compliance in real-time, and provide actionable insights to improve safety practices. Additionally, it's crucial to involve employees in the implementation process, address their concerns regarding privacy, and provide adequate training on the importance of PPE usage for their safety and well-being..

IV. PROPOSED TECHNIQUE

We initiate the process by uploading the Video. Then the video is divided into frames. That frames are given as input to our System. Our System Processes the Data (frames) to build the final result out of it. Our System Uses the YOLO V7 algorithm for Feature Extraction, Matching the Extracted features with the features in dataset and after following these steps it produces the final output.

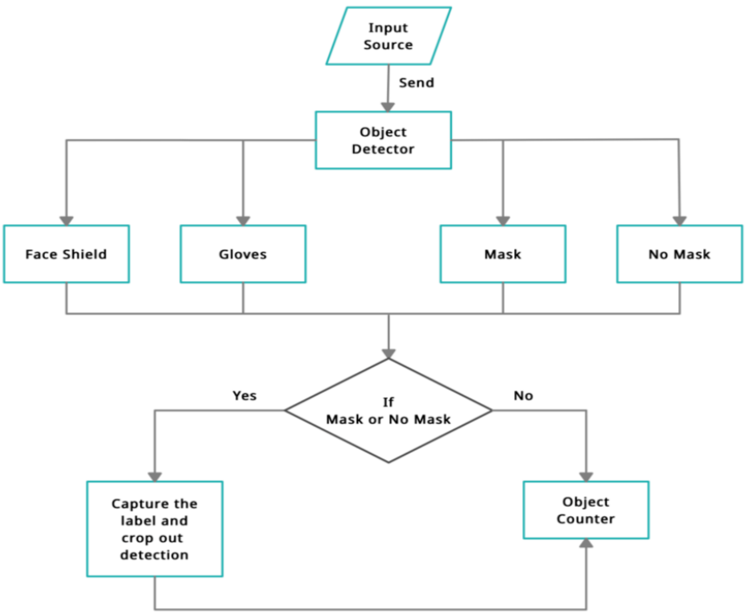


Figure 1. Block Diagram of PPE Kit Detection

The video is uploaded. The video is divided into frames. The frames are treated as dataset and is given as input to our system for further processing. Our system uses the YOLO V7 algorithm. Then the features are extracted from the frames, in our case the features can be Helmet, Gloves, Vests. We have a trained dataset of images with features such as helmet, gloves, vests which is used for comparing the features extracted from the captured images. This task is done by the YOLO algorithm. By using the trained dataset, it produces the final output. The output indicates whether the worker properly wears the personal protective equipment or not.

During training, the dataset and model reside on the training hardware. The training process optimizes the model's weights and biases based on the labelled data. Once trained, the model is deployed to the detection hardware. During detection, video frames are fed into the preprocessing unit, then the feature extractor within the model. The extracted features are fed into the YOLO algorithm, which outputs detections (bounding boxes and potentially labels for different PPE types). The detections might undergo post-processing before being visualized and presented to the user

3.1 DATABASE

In our system we are using SQL – 3 Database. SQL-3 aimed to address some of the limitations of earlier versions of SQL, such as SQL-92. It has various features like Object-Relational features, Enhanced Query Language, Integrity constraints, Triggers and Rules, Security Enhancements. It stores the data about the authentication of student, name, e-mail, password.

3.2 GRAPHIC USER INTERFACE (GUI

In our system we are using Tkinter for the Graphic User Interface. Tkinter is a standard graphical User Interface toolkit for Python. It is based on the Tk GUI toolkit, originally developed for the Tcl programming language. Tkinter provides a set of tools that allow you to create GUI applications easily and efficiently. Tkinter have features such as It is simple to use, Customizable, Supports Cross-Platforms. In Tkinter we can do event driven programming. Tkinter have integration with python and provides widgets for GUI.

3.3 YOLO ALGORITHM

The basic idea behind YOLO is to split the input image into a grid of cells and estimate the probability of the object being present and the object's bounding box check for each cell. The YOLO process can be divided into several steps:

1. View the image and extract the features of the image from CNN.

2. These features are then put through a fully integrated process that envisages class capabilities and container integration.

3. The image is divided into a grid of cells, and each cell is responsible for estimating the probability of a set of bounding boxes and classes.

4. The output of the network is a group set of bounding boxes and class probabilities for each cell.

5. The bounding boxes are then filtered using a post-processing algorithm called non-max suppression to remove overlapping boxes and select the box with the highest possible value.

6. The final output is a combination of predicted bounding boxes and class labels for each object in the image.

One of the main advantages of YOLO is that it processes the entire image in single pass, making it faster and more efficient than two-phase detectors such as R-CNN and its variants.

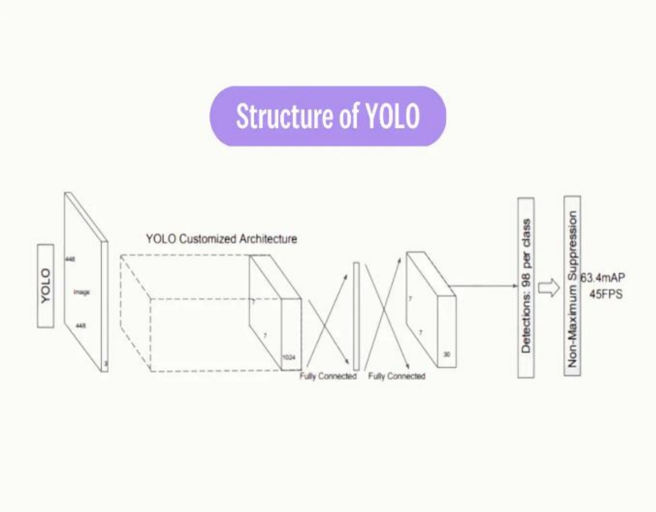


Figure 2: Structure Of YOLO

3.4 YOLO V7 VS YOLO V4

YOLO v7:

YOLOv7 is the latest version of the YOLO object detection algorithm, released in July 2022.It introduces several improvements over previous versions, including better accuracy, faster inference speed, and support for additional tasks like instance segmentation and pose estimation.

Some of the key features of YOLOv7 include the use of efficient backbone networks like Efficient, advanced data augmentation techniques, and advanced training strategies like Self-Adversarial Training (SAT). YOLOv7 achieves state-of-the-art performance on various object detection benchmarks, such as MS COCO, with increased accuracy and faster inference times compared to previous YOLO versions.

YOLOv4:

YOLOv4 was released in April 2020, bringing significant improvements over YOLOv3.It introduced several new features, including a new backbone network (CSPDarknet53), advanced data augmentation techniques (Mosaic and Mixed Training), and efficient use of multiple anchor box scales.

YOLOv4 achieved improved accuracy and faster inference speeds compared to YOLOv3, making it a popular choice for object detection tasks at the time of its release. However, with the release of newer versions like YOLOv5 and YOLOv7, YOLOv4 has been surpassed in terms of overall performance and features.

In summary, YOLOv7 is the latest and most advanced version of the YOLO object detection algorithm, offering state-of-the-art performance, additional features, and improved efficiency compared to older versions like YOLOv4. However, YOLOv4 was a significant improvement over YOLOv3 and may still be a viable choice for certain applications or resource-constrained environments.

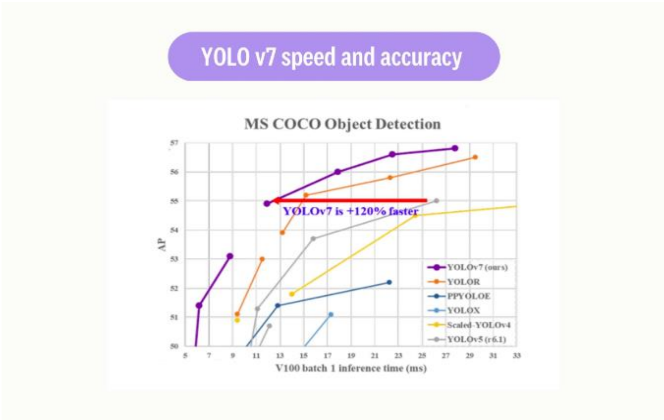


Figure 3: YOLO V7 Speed and Accuracy

V. RESULTS

The output produced can be positive or negative. If it detects that the worker is not wearing the PPE kit properly then it alarms the bell or take appropriate actions, if it detects that the worker is wearing the PPE kit properly then it does not ring any bell or not take any action

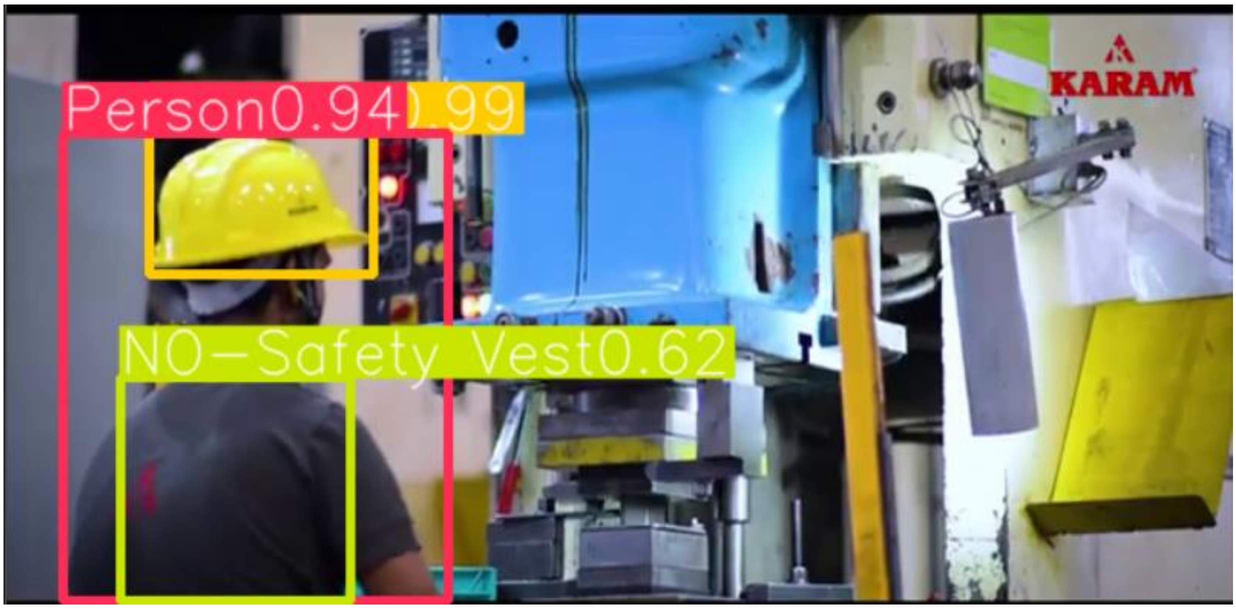
1.Home Page

2.Login Page:

3.Registration Page:

4.Upload Video Page:

4. Detection of PPE Kit:



VI. CONCLUSION

This project provides a real-time PPE detection method based on deep learning and video stream analysis.. Based on the edge computing idea, the system analyses images from a dangerous area in real-time using an embedded device to detect if workers are wearing protective gear, such in our example, a helmet, vest, and glove. The proposed real-time PPE detection system offers a practical solution for enhancing workplace safety by leveraging deep learning and edge computing. By deploying an embedded device near hazardous work areas, the system continuously analyzes video streams to monitor if workers are wearing required personal protective equipment like helmets, safety vests, and gloves. The implementation utilizes state-of-the-art object detection algorithms, optimized for low-latency inference on edge devices.

VII. REFERENCES

1.Santiago Barro-Torres, Tiago M. Fernandez-Carma's, ´Hector J. Perez- Iglesias, and Carlos J. Escudero. Real- time personal protective equipment monitoring system. Computer Communications, 36(1):42–50, 2012

2. Zhe Cao, Tomas Simon, ShihEn Wei, and Yaser Sheikh. Realtime Multi-Person 2D Pose Estimation using Part Affinity Fields.

3. Aphinya Chairat, Matthew Dailey, Somphop Limsoonthrakul, Monkol Ekpanyapong, and Dharma Raj KC. Low Cost, High-Performance Automatic Motorcycle Helmet Violation Detection. In Proceedings WACV, pages 3560– 3568, 2020.

4.Francois Cholletetal Keras. https:keras.io, 2015. Deep learning for humans.

5. Kunal Dahiya, Dinesh Singh, and C. Krishna Mohan. Automatic detection of bike riders without helmets using surveillance videos in real-time. In Proceedings of IJCNN, pages 3046–3051, 2016