IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

FACE MASK DETECTION USING YOLO V5

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ABSTRACT: Human lives have been affected in numerous ways by the spread of covid 19. People have been affected physically, psychologically and financially as well. People refuse to wear face masks most of the time, and this allows the virus to spread from human to human via droplets and airborne. The only way to stop this pandemic is by wearing face masks, keeping a safe distance, and taking preventative steps. Wearing a mask in public places would be helpful for reducing this situation. We proposed a face mask detection method using the YOLO V5 algorithm in our paper to ensure everyone is wearing a face mask correctly. YOLO is an acronym for the phrase "You Only Look Once". Real-time detection and recognition of various objects in a picture is performed with this algorithm. A regression problem is used in YOLO to detect the objects and to estimate their probabilities. With its fast and accurate object detection algorithm, it is the state-of-the-art in object recognition. YOLO offers superb speed, enabling fast and accurate recognition. With its speed of more than 11 frames per second, it can process an enormous amount of data fast.

Keywords: YOLO (You Only Look Once), Face Mask Detection, Deep Learning

I. INTRODUCTION

People need to wear face masks and keep their distance from other people in order to keep disease at bay. Unfortunately, most people do not like wearing face masks. The majority of people do not wear a face mask when they gather in public. The imposing of fines and frequent checks for face masks in public places are common practices in such scenarios. Since object detection has become an approachable biometric process, it has been applied to a variety of fields including security, surveillance, and autonomous driving. As deep learning technologies become more sophisticated, object detectors are highly suited for developing social distance and face mask detection to administer crowds via CCTV and surveillance cameras.

Real-time application for detecting and recognizing faces with the use of the YOLO method. YOLO is a proven object detection algorithm with state-of-the-art features. According to the results of the experiments, yolo-based face detection is more robust and faster at detecting faces. Excellent detection accuracy is ensured even in complex settings. The detection speed and real-time detection requirements can coexist simultaneously. [1] This is a relatively trivial problem that can be solved by human beings and by classical feature-based techniques like the cascade classifier. A recent study on a standard benchmark dataset for face detection revealed state-of-the-art results from deep learning techniques.

Among the many kinds of convolutional neural networks, the Multi-task Cascade Neural Network is one of the best examples.

II. RELATED WORK

The detection of faces has been achieved using a variety of deep learning methods. [2] Liu, et al. introduced work on the YOLO through their paper. The purpose of this work was to implement the traditional image processing techniques in order to effectively portray noise, blurring, and rotating filter in real-world scenarios. After training a robust model using the YOLO algorithm, they improved the detection of traffic signs. As an alternative, Yang and his colleagues [3] were able to detect the face in real-time with high accuracy and a short detection time with the use of the YOLO algorithm. While in [3] the YOLO algorithm was improved to detect the face in a video sequence and was compared to the traditional approach, in [4] the YOLO algorithm was substantially improved. As part of the training process, the FDDB dataset was also used. Zhao and colleagues developed an improved YOLO model [5]. By leveraging real-time saliency through surveillance cameras and extracting feature details of distinguishing features they improved YOLO model to detect pedestrians. Over 9000 object categories were detected using the YOLO V2 method, which improved the YOLO method. An innovative multi-scale method of training was implemented in this version [6]. In addition to the YOLO-V2 image recognition test bench, Kim and his team designed other CNN accelerator test benches. Redmon, et al., laid out the YOLO V3 algorithm in less than two years, but despite a slightly larger architecture, it is three times as fast as prior versions [8]. It had two parts, the first model, YOLO V3 involved the identification and intercepting of workers' videos, then it had two parts, a model of workers with and without helmets. As described in [8], Alexey, et al. developed the YOLOv4 with optimal speed and accuracy [9]. Using the YOLO V4 algorithm, researchers have developed a face mask detection system forpreventing COVID-19, based on the state of the art and the results which have already been tested. Instead of detecting the object using the YOLO v3 algorithm [8], part of the YOLO v4 algorithm will be used to detect the face mask to be the object [7].

III. YOLO (YOU ONLY LOOK ONCE)

YOLO is an algorithm that uses neural networks to provide real-time object detection. This algorithm is popular because of its speed and accuracy. It has been used in various applications to detect traffic signals, people, parking meters, and animals. This is an algorithm that detects and recognizes various objects in a picture (in real-time). Object detection in YOLO is done as a regression problem and provides the class probabilities of the detected images. YOLO algorithm employs convolutional neural networks (CNN) to detect objects in real-time. As the name suggests, the algorithm requires only a single forward propagation through a neural network to detect objects. This means that prediction in the entire image is done in a single algorithm run. The CNN is used to predict various class probabilities and bounding boxes simultaneously. The YOLO algorithm consists of various variants. Some of the common ones include tiny YOLO and YOLOv3. YOLO algorithm is important because of the following reasons,

Speed**:** This algorithm improves the speed of detection because it can predict objects in real-time.

High accuracy**:** YOLO is a predictive technique that provides accurate results with minimal background errors.

Learning capabilities**:** The algorithm has excellent learning capabilities that enable it to learn the representations of objects and apply them in object detection.

We are employing Version 5, which was launched by Ultralytics in June 2020 and is now the most advanced object identification algorithm available. It is a novel convolutional neural network (CNN) that detects objects in real-time with great accuracy. This approach uses a single neural network to process the entire picture, then separates it into parts and predicts bounding boxes and probabilities for each component. These bounding boxes are weighted by the expected probability. The method "just looks once" at the image in the sense that it makes predictions after only one forward propagation run through the neural network. It then delivers detected items after non-max suppression (which ensures that the object detection algorithm only identifies each object once). The initial release of YOLOv5 is very fast, performant, and easy to use. YOLOv5 is very user friendly and comes ready to use on custom objects "out of the box". YOLOv5 derives most of its performance improvement from PyTorch training procedures, while the model architecture remains close to YOLOv4. the goal is to produce an object detector model that is very performant (Y-axis) relative to its inference time (X-axis).

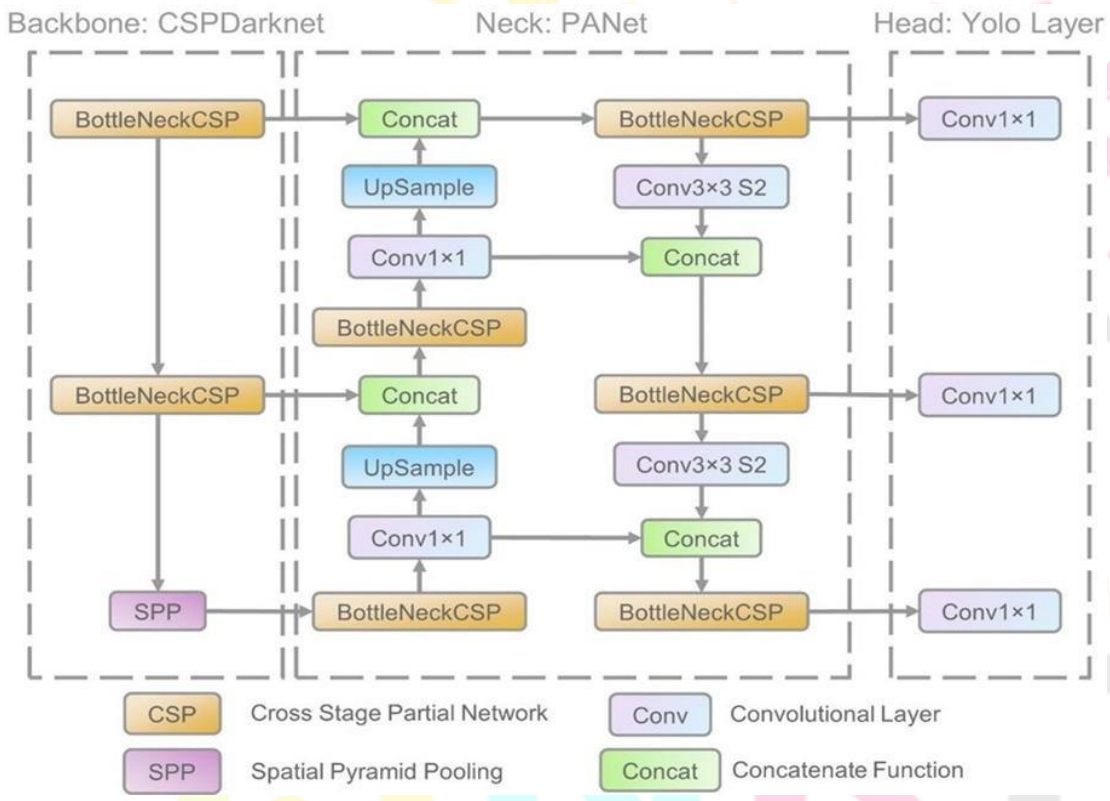

Figure 1 Architecture

YOLO's architecture is illustrated above (Figure 1). Its architecture mainly consisted of three parts, namely-

1. Backbone: Model Backbone is mostly used to extract key features from an input image. CSP (Cross Stage Partial Networks) are used as a backbone in YOLO v5 to extract rich in useful characteristics from an input image.

2. Neck: The Model Neck is mostly used to create feature pyramids. Feature pyramids aid models in generalizing successfully when it comes to object scaling. It aids in the identification of the same object in various sizes and scales. Feature pyramids are quite beneficial in assisting models to perform effectively on previously unseen data. Other models, such as FPN, BiFPN, and PANet, use various sorts of feature pyramid approaches. PANet is used as a neck in YOLO v5 to get feature pyramids.

3. Head: The model Head is mostly responsible for the final detection step. It uses anchor boxes to construct final output vectors with class probabilities, objectness scores, and bounding boxes.

The head of the YOLO v5 model is the same as in the previous YOLO V3 and V4 editions.

Advantages & Disadvantages of YOLO v5-

- It is about 88% smaller than YOLOv4 (27 MB vs 244 MB)
- It is about 180% faster than YOLOv4 (140 FPS vs 50 FPS)
- It is roughly as accurate as YOLOv4 on the same task (0.895 mAP vs 0.892 mAP)
- But the main problem is that for YOLOv5 there is no official paper was released like other YOLO versions. Also, YOLO v5 is still under development and we receive frequent updates from ultralytics, developers may update some settings in the future.

IV. METHODOLOGY

This section will present the experiment results of the face mask detection using YOLO V5 in real-time application. A GUI (Graphical User Interface) will be created by using Tkinter. The Data preparation was first to load face images with and without mask (figure 2), then annotate bounding box of each vehicle in an image and save annotated images and labels. Initializing yolo network and generating training and testing datasets. We are using a publicly available dataset to train our model. Training in Load images and annotated labels, then Train yolo and save trained model. After training, Testing of the datasets can be implemented. Test the Load configuration and weight file of trained yolo and Input image to loaded model. Then Detect mask stratus in the image and shows the result (figure 3).

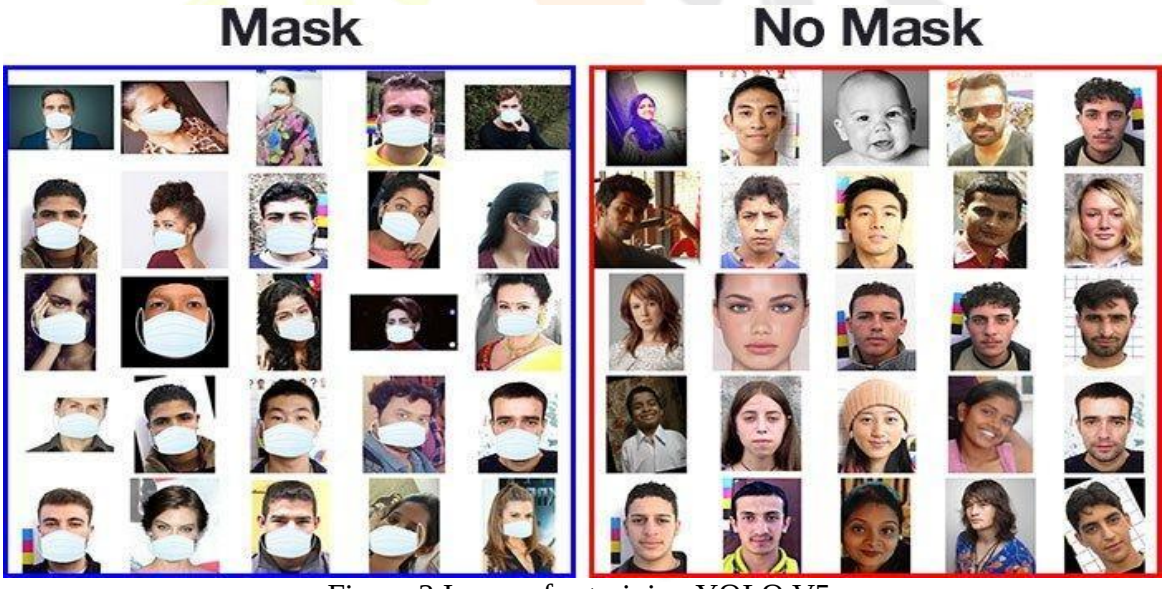

Figure 2 Images for training YOLO V5

4.1 Hardware requirements

The hardware includes for our project is Processor: i5 or i7 (i7 is better) and RAM having 12GB Minimum. Hard Disk having 500GB or above. A mouse and keyboard also include.

4.2 Software requirements

The software that required to implement our project is, the Tool used Python IDLE and the version is 3. The operating system used is windows 7 or later versions. The front end used is python tkinter and the backend is python.

Figure 3 Result Output

V. CONCLUSION

This work developed the face mask detection by using YOLO V5 algorithm. The YOLO V5 algorithm consists of deep learning method which is able to detect the object properly. From the experiment results, the algorithm is able to detect and distinguish a non-wearing and a wearing-mask precisely with any condition of surrounding environment. this device is also installed in other crowd area which need face mask detector. In the future, we will add the thermal detection on this device to help the guard's work easier.

ACKNOWLEDGEMENT

We would wish to thank everyone who had contributed to the successful completion of this project. We would like to express our gratitude for project guide Mr. Sivakumar.R, Assistant Professor in Computer Science and Engineering Department who gave valuable suggestions for our project. We express our deep felt gratitude to beloved HOD, Dr.Ramani.K, Head of the Department for providing necessary information regarding the project and also her support in completing it. We also thank our Project Coordinator, Mr.Jithin Jacob, Assistant Professor who gave expert supervision, encouragement and constructive criticism amidst his busy schedule throughout the project. We also greatfull to all the authors of books and papers which have been referred to publish this paper

REFERENCES

[1] W. Yang and Z. Jiachun, "Real-time face detection based on YOLO", *2018 1st IEEE International Conference on Knowledge Innovation and Invention (ICKII)*, pp. 221-224, 2018.

[2] C. Liu, Y. Tao, J. Liang, K. Li and Y. Chen, "Object detection based on YOLO network", *2018 IEEE 4th Information Technology and Mechatronics Engineering Conference (ITOEC)*, pp. 799-803, 2018.

[3] D. Garg, P. Goel, S. Pandya, A. Ganatra and K. Kotecha, "A deep learning approach for face detection using YOLO", *2018 IEEE Punecon*, pp. 1-4, 2018.

[4] C. Zhao and B. Chen, "Real-time pedestrian detection based on improved YOLO model", *11th International Conference on Intelligent Human-Machine Systems and Cybernetics (IHMSC)*, pp. 25-28, 2019.

[5] J. Redmon and A. Farhadi, *YOLO9000: Better Faster Stronger*, 2016.

[6] C. Kim et al., "Implementation of Yolo-v2 image recognition and other testbenches for a CNN accelerator", *2019 IEEE 9th International Conference on Consumer Electronics (ICCE-Berlin)*, pp. 242-247, 2019.

[7] S Susanto, FA Putra, R Analia..,"The Face Mask Detection For Preventing the Spread of COVID-19 at Politeknik Negeri Batam"-2020 3rd International …, 2020 - ieeexplore.ieee.org.

[8] J. Redmon and A. Farhadi, YOLOv3: An Incremental Improvement, 2018.

[9] A. Bochkovskiy, C-Y. Wang, and H-Y. M. Liao, YOLOv4: Optimal Speed and Accuracy of Object Detection, 2020.