IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

VIDEO BASED FACE MASK DETECTION AND FACE RECOGNITION USING CNN,YOLO AND GOOGLE FACENET

[1]Prof. Pritam Ahire, [2]Dhvani Fajalia, [3]Rushikesh Satkar, [4]Abhijeet Jejurkar

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

[1]Computer Engineering,

[1]D. Y. Patil Institute of Engineering and Technology, Pune, India

Abstract: Globally Covid-19 has affected a large number of people. Covid-19 caused disruptions to many aspects of normal life. This also caused an increase in the death rate and Tension and Fear among the people. To avoid and overcome all these challenges WHO asked people to follow safety measures to avoid the spread of the virus. Wearing a mask is one of the safety measures among this. Mainly sometimes people gather at public places like offices, banks, airports, bus stops, etc. Considering this condition, we have designed a system that helps in mask detection in the various surveillance system at such places, also it helps in the face recognition of those people who have not worn the mask.

Previous Sytems were either only doing face recognition or face mask detection we came forward with this new approach by combining these two algorithms. All This is Possible by Using Artificial Intelligence which helps in Image Processing and Machine learning. Algorithms Like CNN, YOLO, and Google FaceNet were used for the same.

Using this System, we got 97% Accuracy in Detecting a Face mask by using CNN. This System helps in classifying with mask and without mask person in the video and also help to identify the person who has not worn a mask which helps to send a notification to that person who violates the rule.

Keywords **- Convolutional Neural Network, Artificial Intelligence, Machine Learning, you only look once.**

I. INTRODUCTION

Do you know Globally, as of December 2021, there have been Cases 27.1 Crore confirmed cases of COVID-19, including 53.1 Lakh deaths, reported to WHO? Coronavirus disease is an epidemic in the current date that forced an international health emergency. In recent times, the dangers and fears of Coronavirus are still great. Covid19 is broad group of viruses that spread diseases that range from flu to deadly diseases like MERS (Middle East Respiratory Syndrome) that is viral respiratory illness that is new to humans and SARS (Severe Acute Respiratory Syndrome). Many people are unable to protect themselves and their environment from the pandemic. Coronavirus spreads mostly from person to person through airborne transmission, mainly through close contacts. WHO has come with various Preventive measures to avoid the Spread of Covid 19.

II. MOTIVATION

Wearing a face mask is one of the main Preventive measures among them. Wearing a Mask too frequently can reduce the risk of COVID-19 transmission. However, it is difficult to expect that everyone is able and prepared to wear a mask.

To Overcome this above challenge Many Artificial Intelligence Researchers come with a solution to classify people with masks and without a mask. This helped Government and Health Workers to Identify the Violated Zones in their area and also to find out people who came in contact with covid19 Positive patients. This helped Lot to avoid the spread of Covid19 patients.

III. PROBLEM STATEMENT

Public places are quite filled with crowded people sometimes. The increased crowd consists of Lots of faces in Video Surveillance. This makes things complex to identify each and every face in the video. Increased faces make things delayed. Which might Increase the spread of Coronavirus fast.

In 2020 Jingxiao Zheng and his team came with a new Research Paper at IEEE entitled "An Automatic System for Unconstrained Video-Based Face Recognition" [1]. The Paper has research on real-time face recognition in video streams. This helps in identifying

the face where the Target frame is motion fade, bad video quality, occlusion, constant frame changes, and unconstrained frame recording conditions.

Considering the above-mentioned problems in mind we decided to design a system that will help to classify the people with masks and without a mask and also will recognize and notify the people who are not wearing masks. This will reduce the spread of coronavirus in public places which are under CCTV surveillance.

IV. LITERATURE SURVEY

Haar cascade frontal face is an Object Detection Algorithm used to identify faces in an image or a real-time video [2]. The Haar cascade Object Detection Algorithm uses line or edge identification features presented by Viola and Jones in their research paper " Rapid Object Detection using a Boosted Cascade of Simple Features" published in 2001 [2].

YOLO stands for You Only Look Once. YOLO is an effectual real-time object recognition algorithm. YOLO was first Presented in the seminal 2015 paper by Joseph Redmon [3]. YOLO work on neural network for giving us real-time object detection.

Among these, both YOLO algorithm is in demand because of their accuracy and speed. YOLO is used in several fields to detect Buses, people, traffic signs, speed limit signs, and animals. So, we decided to move with YOLO for face detection.

After Detecting the face, we use CNN to classify the face with facemask and Without facemask. We studied 3 Pretrained CNN namely VGG-19, Inceptionv3 (GoogLeNet), resnet50. VGG-19 is a convolutional neural network. VGG-19 has 19 layers of convolutional neural network. VGG-19 has 1 SoftMax layer, 3 fully connected layers, 5 MaxPool layers, and, 16 convolution layers. Inceptionv3 was a CNN with 48 deep layers. ResNet50 is a form of the ResNet model. ResNeet50 is 48 Convolution layers deep. ResNet50 has 1 Max-Pool and 1 Average Pool layer. ResNet50 includes $3.8 * 109$ Floating points operations. To Reduce Computational Power for the Proposed System we will be using deep convolutional neural networks based on VGG-19 pre-trained for object detection tasks on the ImageNet dataset.

Table 1 Literature Review

Sr. No.	Name of Paper	Authors	Publication Name	Published On	Approaches
1.	"Artificial Intelligence based Smart Door with Face Mask Detection [4]."	Baluprithviraj.K.N , Lokeshwaran.P, Bharathi.K.R.	IEEE	March 27 2021	In this AI based smart device is proposed in this paper which identifies weather a person is wearing face masks and gives us an alert message via mobile app.
2.	"Covid-19 Monitoring System using Social Distancing and Face Mask Detection on Surveillance video dataset [5]".	Sahana Srinivasan, Revathi SA, Rujula Singh R, Ruchita R Biradar.	IEEE	March 5-7, 2021	It comprises an effective solution to perform person detection, social distancing violation detection, face detection and Face mask classification using CNN [5].
3.	"Real-time Face Mask and social distancing violation detection system using YOLO [6]"	Krishna Bhambani, Tanmay Jain, Dr, Kavita A. Sultanpure.	IEEE	December 31 2020	It focuses on a solution to help enforce proper social and wearing masks in public using YOLO object detection on video footage and image in real time [6].
4.	"An automatic System for unconstrained video-based Face recognition [1]"	Jingxiao Zheng, Rajeev Ranjan, Ching-Hui Chen, Jun-Cheng Chen, Charlos D Castillo and Rama Chellappa.	IEEE	July 3 2020	It is video-based face recognition which is composed of modules for face detection, face association methods, specifically for multishot videos [1].

V. PROPOSED SYSTEM

In this Project, Python Framework and Machine Learning Will be used. Python will be used in frontend as well as in backend. Python Will also be used for machine learning task and which will help in using TensorFlow library for machine learning. TensorFlow will help in building CNN architecture by using keras module inside it. First of All, we will take video from CCTV. Each frame of video will be taken. Processing of Frame will be done. Later on, the frame will be shared with yolo algorithm for face detection. Once we get the co-ordinate of face, we will detect masks and classify them in two classes. The classes are with mask and without mask. The faces with masks will be skipped then. And faces without mask will go under face recognition phase. Face Recognition will use Google FaceNet Algorithm for Identifying face which are stored already inside system database. After recognizing face, the email notification will be sent to that person whose face is identified. Which will notify him for wearing mask or action against him will be taken.

VI. ALGORITHM

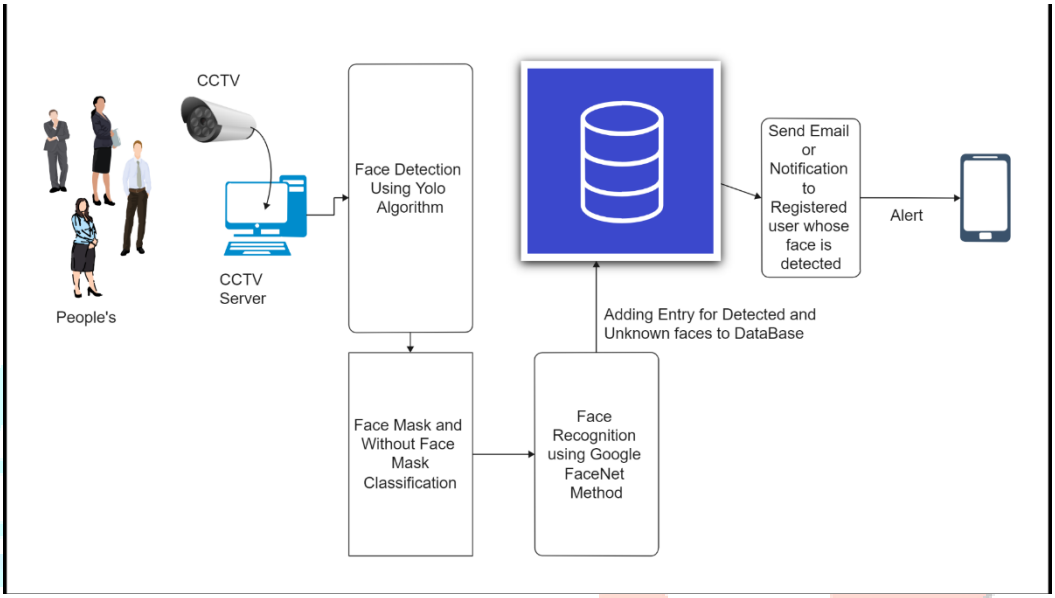

Figure 1-System Architecture

3.1 You only Look Once (YOLO)

You only look once (YOLO) is a modern, real-time object identification program based on Deep learning. Its authors describe how it works: Prior detection systems repurpose classifiers or localizers to perform detection [7]. They use the model in the image in many areas and scales. Highlights of high scoring inside image are considered detection of object [7].

YOLO researchers use a completely different approach. They use a single neural network in the full image. This network divides the image into regions and predicts bounding boxes and probability for each region. These bounding boxes are weighted with predicted Probability [7].

YOLO has a few advantages over category-based systems. It looks at the whole picture during testing so that its predictions are informed by the global context in the image. It also makes predictions on a single network test unlike systems like R-CNN that require thousands of a single image. This makes it much faster, 1000x faster than R-CNN and 100x faster than Fast R-CNN [7].

The original Yolo model can identify up to 80 different classes of objects with high accuracy. We used this model to find only one thing - the face. We will be training YOLO on WiderFace dataset (a dataset containing images with 393,703 face labels). There is also a smaller version of the Yolo algorithm available, Yolo-Tiny. Yolo-Tiny takes less time to calculate by compromising its accuracy. Engati.com says they trained the Yolo-Tiny model with the same database, but the bounding box results were inconsistent [8].

Advantages: Very accurate, flawless. Sooner than MTCNN [8].

Disadvantages: As it has large Deep Neural Network layers, it needs additional computational resources.
Therefore, slow operation on CPU or mobile devices is slow. On the GPU, it takes up more VRAM due to its larger architecture [8].

3.2 Convolutional neural network (CNN)

With Face mask and without face mask classification is performed using CNN's binary image classification method to check the presence of face mask on detected faces. A number of models have been developed using CNN to differentiate With Face mask and without face mask into 224*224 images and their performance in terms of recall, F1 scores, accuracy, and precision compared to class 0 (no mask) and class 1 (masked). VGG19 was selected because of its performance during prediction and accuracy. A pre-trained imagnet model is used in conjunction with VGG19.

3.3 Google FaceNet

FaceNet is the face recognition system. FaceNet was developed by Google Researchers in 2015 [3]. They proposed how to produce a high-quality facial map from photographs using in-depth reading formats such as ZF-Net and Inception. He then used a method called triplet loss as a function of loss to train the Architecture. Let's look at the architecture in more detail.

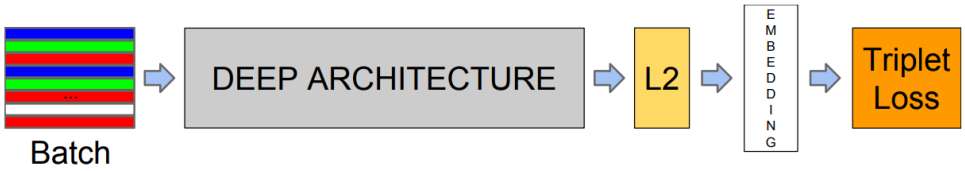

Figure 2 FaceNet Architecture [3]

FaceNet uses end-to-end learning in its construction. It uses ZF-Net or Inception as its basic architecture. Also add a few 1 * 1 convolutions to reduce the number of parameters. These deep learning models outputs an embedding of the image f(x) with L2 normalization performed on it [3]. This is embedded and transferred to the loss function to calculate the loss. The goal of this loss function is to make the square distance between the two images embedded independent of the image state and the shape of the same identity is smaller, while the square distance between the two images of different identities is greater. Hence, Triplet loss is used as a new function. The idea of using a triple loss in our design is that it makes the model force the boundary between the faces of the various identities [3].

The face-to-face combination (photo collection of the same person) from the FaceNet page shows that the model does not change in size, shape, brightness and even age, etc [3].

VII. Conclusion

This report provides an effective solution for monitoring face masking procedures in public places where it is very difficult to monitor by human being. Four different modules were developed for face detection, With face mask and without face mask separation, Face recognition, and Notification through Email. The system works well with 96% accuracy in with face mask and without face mask separation. Here facial detection occurs using YOLO v4. Aside from any addition of time-consuming statistics or image conflicts, this lightweight model is easy to measure and can be used effectively in real time due to 30FPS and good accuracy. Project results indicate the maximum performance of the proposed system.

VIII. Acknowledgment

This paper is supported by many people, some of whom have a direct role and some of them have an indirect way by publishing their research online which helped to understand this concept easily. We express our deepest gratitude, sincere thanks and deep feeling of appreciation to our Project Guide Professor Pritam R. Ahire, his presence at any time throughout the Semester, important guidance, opinion, comment, critics, encouragement, and support greatly improved this project work. We thank the college administration for providing the necessary infrastructure and technical support. Finally, we extend our heartfelt thanks to our friends and family members.

References

[1] J. Zheng, R. Ranjan, C.-H. Chen, J.-C. Chen, C. D. Castillo and R. Chellappa, "An automatic system for unconstrained video-based face recognition," *IEEE Transactions on Biometrics, Behavior, and Identity Science*, vol. 2, pp. 194--209, 2020.

[2] G. S. Behera, "Face detection with haar cascade," December 2020. [Online]. Available: https://bit.ly/3E2mt6p.

[3] GeeksforGeeks, "Facenet – using facial recognition system," [Online]. Available: https://www.geeksforgeeks.org/facenet-using-facial-recognition-system/.

[4] K. Baluprithviraj, K. Bharathi, S. Chendhuran and P. Lokeshwaran, "Artificial Intelligence based Smart Door with Face Mask Detection," *2021 International Conference on Artificial Intelligence and Smart Systems (ICAIS)*, pp. 543--548, 2021.

[5] S. Srinivasan, R. R. Biradar, S. Revathi and R. R. Singh, "COVID-19 Monitoring System using Social Distancing and Face Mask Detection on Surveillance video datasets," *2021 International Conference on Emerging Smart Computing and Informatics (ESCI)*, pp. 449--455, 2021.

[6] K. Bhambani, T. Jain and K. A. Sultanpure, "Real-time Face Mask and social distancing violation detection system using YOLO," *2020 IEEE Bangalore Humanitarian Technology Conference (B-HTC)*, pp. 1--6, 2020.

[7] J. Redmon and A. Farhadi , "Yolov3: An incremental improvement," *arXiv preprint arXiv:1804.02767*, 2018.

[8] Engati, "How will facial recognition systems algorithms work in 2022," 2021. [Online]. Available: https://www.engati.com/blog/facial-recognition-systems.