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Face Mask Detection using CNN

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ABSTRACT: Face Mask Detection is an emerging area of research during pandemic times in such situations we need to ensure proper mask-wearing to avoid the spread of infection and reduce the number of COVID positive cases on the medical facilities. In this paper, we discuss various methods and algorithms to detect face masks by reviewing various papers, the methods used for taking images and videos as input for detection. The methods discussed in this paper use Machine learning, MTCNN, YOLOv3, FaceNet and many more such algorithms for helmet detection, face detection and mask detection. Using all these methods it will be easy to differentiate among people wearing a mask and not wearing a mask.

KEYWORDS: YOLOv3, CNN, Deep Learning, Face Detection, Mask Detection

I. INTRODUCTION

COVID-19 is spreading at an alarming rate across the globe leaving everyone in despair. The world is tussling with an issue of large scale and massive human impact due to the COVID-19 pandemic. The WHO is working together with many countries to implement a comprehensive approach to educate, empower, and engage communities to slow down the spread. It is reducing the loss of lives and buying time for the development of vaccines and treatments. The governments around the globe are educating people about the virus. And to minimize the spread of virus they have announced some guidelines, like wearing face masks, hand sanitization and social distancing. Being citizens of this country we should follow the guidelines. However, in spite of implement the regulations, there are some nefarious citizens who might not obey them. This report aims at understanding if people are wearing face masks or not while going out in public places and making a system that will scan a person's face and tell whether he/she is wearing a mask; If yes then allowing people to enter a building otherwise, sending an alert message to the security personnel so they can take the necessary steps. This would help in reducing the spread of the virus and would be beneficial in flattening the curve.

II. RELATED WORK

[1] A realistic method has been presented, which involves first recognising facial features such as eyes, nose, and mouth. A Multi-Task Cascaded Convolutional Neural Network was used to solve the obstructed face identification problem (MTCNN). The Google FaceNet embedding model is then used to extract facial traits. Finally, the classification task with the Support Vector Machine (SVM) is completed. Experiments show that this method performs exceptionally well on masked face recognition. Furthermore, its effectiveness has been tested in a variety of facial masks, with positive results. Finally, for a better understanding, a correlative study was conducted.

[2] This study presents a framework for detecting one or more riders who are not wearing helmets while riding a motorbike. Motorcycle riders are spotted in the suggested technique at the initial stage using the YOLOv3 model, which is an improved version of the YOLO model, the state-of-the-art method for object detection. In the second stage, a Convolutional Neural Network (CNN)-based architecture for detecting motorbike riders' helmets has been presented. In comparison to existing CNN-based approaches, the suggested model is evaluated on traffic surveillance, and the findings are encouraging..

[3] This research proposes a new helmet detection technique. To improve detection rates, the methodology combines two algorithms for helmet detection. Face detection employing a haar-like characteristic for distinguishing between no helmet and full helmet, and circle through transform for distinguishing between no helmet and half helmet are the two techniques. They devised a quick algorithm for recognising helmets in colour photographs in the first module of the

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technique. To recognise helmet zones, the programme employs haar-like properties. The face, nose, mouth, left eye, right eye, and face/nose/mouth detection method is unable to distinguish between full and partial helmets. As a result, the circle hough transform, the second module of the approach, is used for detection. Due to the implementation of the novel algorithm, our technique has obtained excellent detection rates and low false positives in image trials.

[4] The authors of this study present a method for masked face detection that involves four steps: calculating camera distance, eye line detection, facial part detection, and eye detection. The ideas employed in each of these processes are outlined in the paper, as well as the use of popular algorithms for people and face detection. This novel approach to the problem has resulted in a method that is simple in complexity and can be implemented in real time. The algorithm's performance on test video sequences provides important insight on how to improve masked face detection performance..

III. PROPOSED WORK

There are two algorithms which are used in order to implement this project which are as follows:

1. YOLO (YOU ONLY LOOK ONCE)

In a different way, the YOLO framework[5] (You Only Look Once) is related to object detection. It calculates the bounding box coordinates and class probabilities for these boxes using the entire image as a single instance. The most significant benefit of adopting YOLO is its speed; it can process 45 frames per second. YOLO is aware of the concept of generic object representation. This is one of the best algorithms for object detection and has shown a substantially similar performance to the R-CNN techniques.

2. CNN(CONVOLUTIONAL NEURAL NETWORK)

The Convolutional Neural Network (ConvNet/CNN) is a Deep Learning method that takes an input image and assigns importance (learnable weights and biases) to various elements / objects in the image, allowing it to distinguish between them. When compared to other classification methods, the amount of preprocessing required by ConvEnt is significantly less. While basic approaches require hand-engineering of filters, ConvNets can learn these filters/characteristics with enough training. The architecture of a ConvNet is inspired by the organisation of the Visual Cortex and is akin to the connectivity pattern of Neurons in the Human Brain. Individual neurons can only respond to stimuli in a small area of the visual field called the Receptive Field. A number of similar fields can be stacked on top of each other to span the full visual field.

In this proposed system, a CCTV camera will be used in order to capture the input stream from its surroundings. When a person enters the frame of the video stream, the YOLO algorithm is implemented which divides the frame into different blocks. Then on each block the YOLO algorithm is implemented which detects the faces in each block and removes the unnecessary data. This cropped data obtained as output from the YOLO algorithm is provided as input to the CNN which helps in determining whether the person is wearing a mask or not. If he is not, then an alert will be sent to the user and he/ she can then take the required precautions.

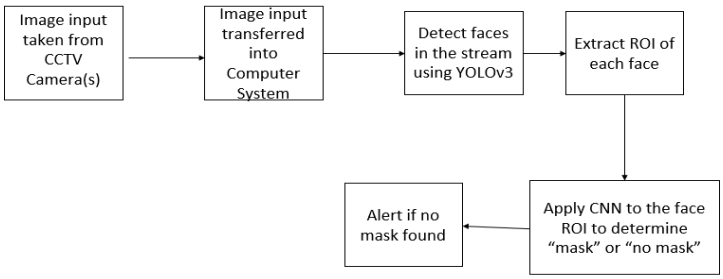

Fig.1. Phases of proposed network

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IV. RESULTS

The System used for testing was a laptop with i3 processor and 8GB RAM. Python 3.8 was used along with opencv and darknet neural network framework and other libraries.The accuracy obtained on the validation data is close to 97%.

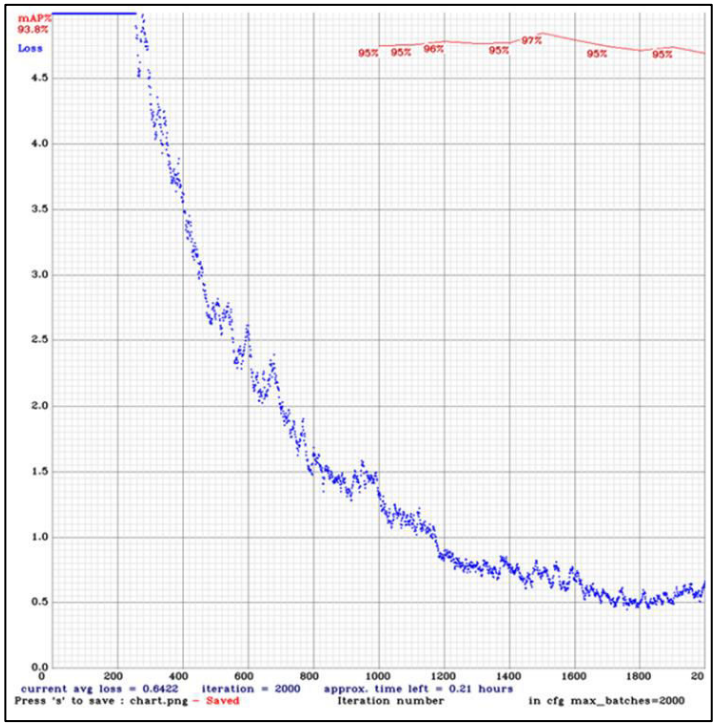

Fig.2. Training Results

V. CONCLUSION AND FUTURE WORK

The Proposed Method is to detect the presence of Face Mask in the video stream and will help in the reduction of people not wearing masks. The average loss during the training was around 0.6 which can be further reduced by increasing the number of iterations. The proposed system works quite well in multiple situations when the person is looking sideways and can be implemented on systems which don't have a lot of resources. The system can be further improved by using a larger dataset and training the model for more iterations and using future versions of the YOLO algorithm.

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