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Social Distancing and Face Mask Detection using Deep Learning

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ABSTRACT: The idea is to plan a face Mask recognition along with identifying social distancing utilizing PC vision methods. The algorithm also produces precise face division veils from any discretionary size input picture. Starting from the RGB picture of any size, algorithm uses predefined training weights with VGG-16 Architecture used to highlight extraction. YOLO one of the pre prepared model available in python libraries has been utilized to recognize the people with the available Database. Models like YOLOv3 and Retina MobileNetv2 are used for social distance and face Mask identification separately. Convolutional Networks has been analyzed to semantically portion out the ROI of face images. Moreover, proposed method has additionally shown incredible observations about perceiving non-front facing faces. Alongside this it is additionally ready to recognize different facial covers in a solitary casing. Tests and examinations were performed on Multi Parsing Human Dataset (MPHD), expecting a precision of 95% and more.

KEYWORDS: Convolution Networks, YOLOv3, Retina MobileNetv2 , MPHD.

I. INTRODUCTION

The available existing utilized face ROI calculations will be generally low to identify the front facing faces. This venture proposes a model for face identification utilizing semantic division in a picture by grouping every pixel as face and non-face that is adequately making a paired classifier and then, identifying that portioned region will be considered as an input to our proposed model [9-13]. Semantic division of human face is performed with the help of a completely convolutional network. The vivacious improvement of the profound learning, in light of the profound investigation of target recognition, has made extraordinary turn of events. There are two sorts of item identification dependent on profound learning: one is the R-CNN series dependent on local recognition: Fast R-CNN, Faster R-CNN and the other is the relapse SSD and YOLO. Based on the district target recognition technique, it contains a wide range of potential territorial producing parts what's more, different element layers [14-19].

CNN based organization models YOLOv3 and Retina MobileNetv2 is used to accomplish the recognition precision. CNN has a profound learning design and contains more improved layers. Preparation of the model will be possible effortlessly when the neural network investigations by using provisions out of a picture. It basically realizes the most ideal approach to extricate highlights from a picture or a video and constructs a model as per requirement [20-26]. We had blended the methodology of advanced profound learning and exemplary projective calculation procedures which not just assists but also helps to meet the continuous necessities, yet additionally keeps high forecast exactness. In the proposed model that the individual recognized isn't following the Coronavirus wellbeing rules, infringement cautions will be also sent to the control the community for making a further move. It permits computerizing the arrangement and authorizes the wearing of the cover and follows the rules of social removing. Model precision expectation around 95% accuracy.

II. BAKGROUND STUDY (Literature)

Generally, most of the paper's which are referred are focusing on face mask detection, for the second objective on maintaining social distance we have less references. The focus is to model a algorithm which are used to detect both face mask and distance between person to person.

In [1] The author proposed a system built using deep learning algorithm. OpenCV, MobilenetV2 for face recognition and SSD for detecting people. SSD is capable of detecting multiple objects in one frame but in this system, it was limited to only one person. By referring [2] Usage of Retina Facemask detector which uses feature pyramid network for high semantic information. A ResNet backbone for achieving accuracy and also attention mechanism which mimics humans for the purpose of focusing on important features in the frame. With the survey of [3] author presented a



system to detect masked and unmasked faces using the OpenCV, CNN, Keras, Tensorflow, PyTorch library along with few machine learning libraries. For extracting more robust features MobilenetV2 is made as the backbone. In [4], the authors have designed a system using computer vision. The CCTV streams to ensure people's safety by triggering alerting engines. By implementing transfer learning approach, the distance was calculated using Euclidian formula. Referred paper[5], has highlighted training on large number of datasets and proposed a face feature-based method to validate wearing masks by a decision-making algorithm. The authors in [6], have been discussed with considering many face recognition techniques such as eigenface, neural networks, fisherface, geometrical feature matching. Out of which neural networks showed 96.2% accuracy proving to be the best face recognizer. In [7], Yolov3 is used, whose speed of detection, robustness makes it an ideal model for detection. Since ROI (Region of Interest) is measured the model outputs accurate result with minimal error which is possible by its effective confidence score. Yonghui [8], proposed a real time object detection model, yolov3 which is light weight and efficient. Two stage CNN comprising features such as bounding box and object classification was made as the backbone for the compact Yolov3 model.

Research Gap

Distance between individuals is calculated when each individual person (moving /stagnant) are detected clearly. In circumstances of overlap, person recognition will be unsuccessful and the distance cannot be computed. The main gap is identified in existing system is feature extraction for dimensionality reduction and class prediction for face masks. The major drawbacks of existing systems are accuracy, it does not detect the non-frontal faces and multiple faces in single frame.

III. METHODOLOGY

The undertaking proposes technique for acquiring division covers straightforwardly from the pictures containing at least one appearance in changed direction. The information picture of any subjective size is resized to 224 * 224 and took care of to the pre prepared VGG model organization for highlight extraction and expectation. The yield of the organization is then exposed to post handling. At first the pixel upsides of the face and foundation are exposed to worldwide thresholding. Post handling activity must be performed on the aftereffects of face cover and individual discovery utilizing PC vision methods. For guaranteeing the social removing among the recognized people, Geometrical (shape) highlights like region, edge, major and minor hub must be determined and estimated the distance of every single individual recognized. The proposed framework assists with guaranteeing the security of individuals at public places via naturally observing them whether they keep a protected social separation, and furthermore by distinguishing whether and individual wears face veil. The framework utilizes an exchange learning way to deal with execution streamlining with a profound learning calculation and a PC vision to consequently screen individuals openly put with a camera coordinated with a raspberry pi4 and to recognize individuals with cover or no veil.

The proposed system has an effective architecture consisting of four modules:

1. Training module : trained on appropriately large datasets containing images labelled "with mask" and "without mask".
2. face mask detection on images and videos : trained separately by providing the facemask dataset to the Retina Facemask detector which is a MobilenetV2 model, a basic variant of CNN classifier.
3. social distance detection on videos: built using the YOLOv3 model which is pre-trained on the coco datasets. YOLO upscales images or videos at every detection layer. Here YOLO detects the class "person" and outputs confidence score that tells how certain the predicted bounding box actually encloses some object. It always looks for greater than 50% confidence before making any prediction.
4. integrated face and social distance detection module: integration is done with a suitable activation function by utilizing the TorchVision from the PyTorch library.

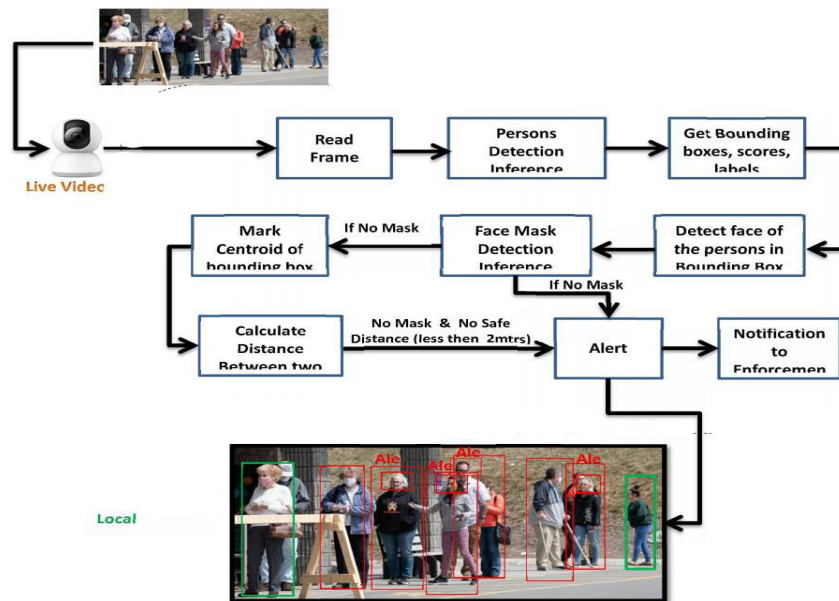


Figure 1: System Architecture

IV. IMPLEMENTATION

Yolov3 for ensuring the social distance with its mechanism of SSD will divide the image into convenient grid cells that predicts bounding boxes. The image is fed into the darknet architecture which is an Open-source neural network framework present in Yolov3 and the backbone being CNN. Since the n number of middle layers present in the CNN is traversed more features are extracted and hence the model's confidence score is increased. The model outputs only when the confidence score is 50% and above. Geometrical (shape) features like area, perimeter, major and minor axis are calculated for measuring the distance between each and every person detected. The admin monitoring can easily visualize the safe and unsafe count by setting up a threshold.

V. RESULTS

The graph in figure 2 signifies model's training accuracy after number of epoch testing done. As its evident that low accuracy gets better results with repeating number of tests. Figure 3 represents the CCTV live stream detection of people and their distance between each other along with safe and unsafe count and also total number of people detected. If this count crosses certain threshold count, the admin will be alerted. Figure 4 depicts accurate detection of frontal and non-frontal face masks. Figure 5 signifies detection of individuals standing in queue who are bounded with red and green boxes indicating violation and non-violation of the guidelines respectively.

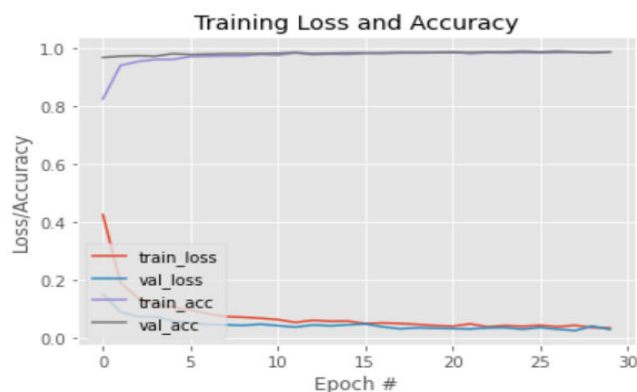


Figure 2: Model training accuracy/lose curves.

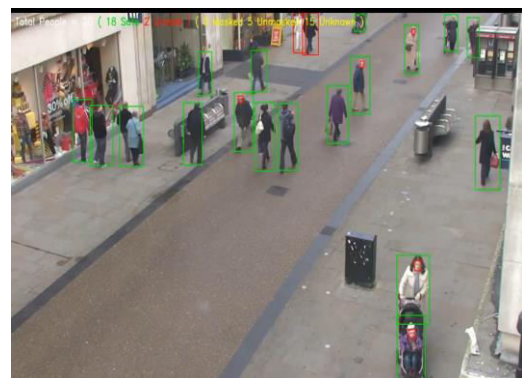


Figure3: Detection from CCTV live streams.



Figure 4: Detection of frontal and non-frontal face masks.

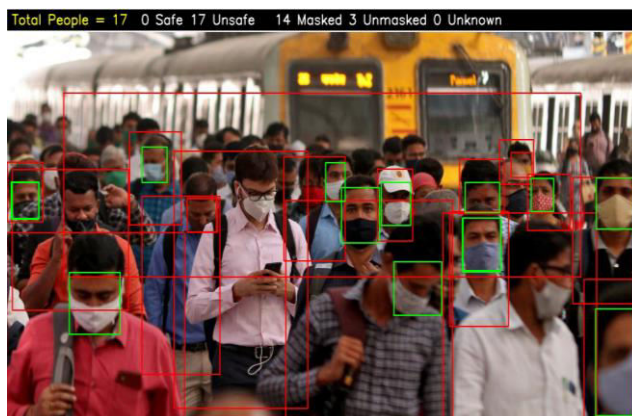


Figure 5: Detection of people in crowded places.

VI. CONCLUSION

Proposed model with the detection of face mask & social distancing safeguards every individuals and monitor people in public places to avoid the spread of novel coronavirus. Face mask detection and social distance is a challenging problem in many fields. Thus, we use Retina MobileNetv2 model for face mask detection and YOLOv3 for social distance detection with the help of CCTV surveillance integrated in public areas. The admin monitoring the CCTV can easily notice the number of people violating the norms by setting up a threshold. The model has the potential to pointedly reduce violations by interventions in real-time. Hence, the proposed system would advance community safety through saving time and helping to lessen the blowout of coronavirus. It also gives high prediction accuracy of above 95% even though semantic segmentation still remains a challenge. Identifying the frontal and non-frontal faces has always been erroneous, but it is mitigated from the proposed model. This model is favorable and flexible to be used in places like airports, hospitals, industries, schools, banks, shopping malls, etc.

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