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COVID-19 Social Distance Violation and Face Mask Detection in Workplaces

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Abstract: Social distancing is a suggested arrangement by the World Health Organization (WHO) to limit the spread of COVID-19 in broad daylight places. Most of governments and public wellbeing specialists have set the 2-meter physical removing as a compulsory security measure in retail outlets, schools, and other covered regions. In this exploration, we foster a conventional Deep Neural Network-Based model for mechanized individuals' identification, following, and between individuals' distances assessment in the group, utilizing basic CCTV surveillance cameras. The proposed model incorporates a YOLOv4-based system and opposite viewpoint planning for exact individuals' identification and social removing checking in testing conditions, including individual's impediment, incomplete perceivability, and lighting varieties. We additionally give an online danger appraisal conspire by factual examination of the Spatio-transient information from the moving directions and the pace of social removing infringement. We distinguish high-hazard zones with the most noteworthy chance of infection spread and diseases. This may assist specialists with updating the design of a public spot or to play it safe activities to relieve high-hazard zones. The effectiveness of the proposed approach is assessed on the Oxford Town Center dataset, with prevalent execution as far as precision and speed contrasted with three bests in class techniques.
Keywords: Social distancing, human detection, distance estimation, neural networks, crowd monitoring and face mask detection..

I. INTRODUCTION

The tale age of the Covid sickness (COVID-19) were accounted for in late December 2019 in Wuhan, China. After a couple of months, the infection was hit by the worldwide flare-up in 2020. On May 2020 The World Health Organization (WHO) declared the circumstance as the pandemic1, 2. The measurements by WHO on 26 August 2020 affirms 23.8 million contaminated individuals in 200 nations. The death pace of the irresistible infection additionally shows a startling number of 815,000 individuals. With the developing pattern of patients, there is still no compelling fix or accessible treatment for the infection. While researchers, medical care associations, and specialists are consistently attempting to deliver suitable drugs or antibodies for the dangerous infection, no unmistakable achievement has been accounted for at the hour of this exploration, and there is no sure medicines or proposal to forestall or fix this new sickness. Thusly, safeguards are taken by the entire world to restrict the spread of disease. These unforgiving conditions have constrained the worldwide networks to search for elective approaches to diminish the spread of the infection. The health authorities are working hard on ensuring that these businesses follow all the protocols for keeping the employees safe. They are conducting regular inspections and even shutting down these establishments if they keep violating the safety protocols. Many of these establishments are working towards the automation of detecting such violations, thereby reducing the time and labor spent for the same. The main aim of this project is to detect violations such as not wearing a mask or not following social distancing in a workplace and notify the officials through an Android app. Technology has advanced tremendously over the past century, everything starting from the Internet of Things (IoT) (Raj, 2021) to machine learning and deep learning. CNN is used in various fields like medical (Duran-Lopez, 2019), marine science (Sung, 2017) and many other applications (Hansen, 2017) and has become a prominent domain of machine learning. This project was implemented using Keras and TensorFlow where the CNN (Convolutional Neural Network) model was trained for face mask detection and the YOLO Object Detection was used for social distancing detection. An android app named "StaySafe" was developed with the help of Firebase which is the backend service implemented for pushing notifications and storing these detected images, from where the user will be able to view them on their app. The rest of the paper is arranged as follows: Section 1 gives a brief introduction to the project. Section 2 reviews some work related to this project. Section 3 explains the methodology and implementation of the project. Section 4 talks about Social Distance violation detection. Section 5 talks about conclusion and future work part and at last Section 6 with references.

II. THE RELEATED WORK

This section reviews some of the related works that implements CNN with the help of TensorFlow, Keras and YOLO Object detection and improvements in object detection. One of the projects developed a model that detects whether a person is wearing a helmet in real time thereby, detecting any violations. This project was also implemented with the help of TensorFlow, Keras and OpenCV. Their proposed model showed major improvements when compared to some previous models that gave wrong predictions whenever a rider wears clothes over their face. They achieved an overall accuracy of 98% when tested.

S Chen et al. (Chen, 2020) implemented a model with the help of TensorFlow to identify ID card numbers. With the help of OpenCV the image of an ID card is preprocessed and the number on the ID card is recognized and given as output with the help of a trained CNN model. When tested it was observed that training speed is fast and the accuracy is high.

Emily Caveness et al. (Caveness, 2020) developed TensorFlow Data Validation (TFDV) which offers a scalable solution for data analysis and validation for machine learning. It is deployed in production which is integrated with TensorFlow Extended (TFX), which isan end-to-end ML platform. Their system has gained a lot of traction ever since they open sourced their project. Other open-source data validation systems such as Apache Spark were also heavily inspired from their project. Apache Spark packs with built-in modules for streaming and has a fast, easy to use system for big data processing.(Nair, 2018)

Yonghui Lu et al. (Lu, 2020) proposed an efficient YOLO Architecture, YOLO-compact for a real time single category detection. As we know in most practical applications, the number of categories in object detection is always single and the authors aimed to make detections faster and more efficient for these scenarios. By performing a series of experiments, the authors were able to come up with an efficient and compact network with the help of YOLOv3. It was observed that YOLO- compact is only of 9MB size, about 26 times smaller than YOLOv3, 6.7 times smaller than tiny-yolov2 and 3.7 times smaller than tiny-yolov3.

The average precision of YOLO-compact is 86.85% which is significantly higher than other YOLO models.

M. B. Ullah (Ullah, 2020), proposed a CPU-based YOLO object detection model that is intended to run on non-GPU computers. In the proposed method, the author optimized YOLO with OpenCV in a way that real time object detection can be much faster on CPU based computers. Their network architecture comprises 2 Convolutional layers each followed by pooling layers and 3 fully connected layers. Their model detects objects from videos in 10.12 to 16.29 FPS with 80-99% confidence in CPU- based computers.

III. THE METHOD AND IMPLEMENTAIONS

This section briefly describes the solution architecture and how the system functions in an integrated manner to achieve the objective of ensuring safety of workers at our manufacturing plants. The social distancing monitoring module resides as part of the model layer in the solution. In case any video feed records any recurring violations lower than the threshold distance value for minimum specified duration, an alert is triggered to the AE. The alert is subsequently handled by the AE to trigger the necessary mechanism. This can also enable audit traceability by linking all associations between infected individuals. This module detects workers in a given frame and then calculates the inter-se distance between each worker.

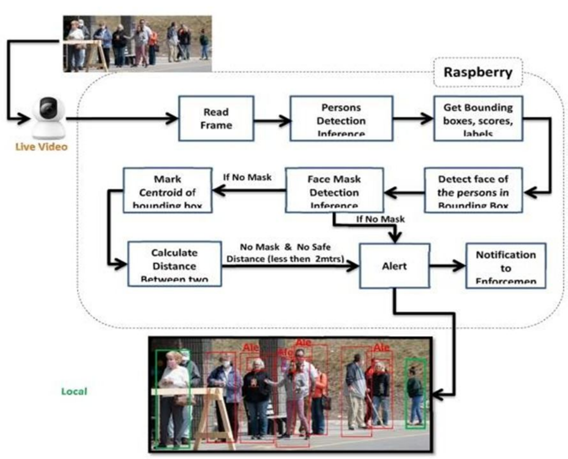

Figure-1: Solution Architecture Diagram

The above Figure -1 shows the overall structure of the Stage 1. The objective is to develop a model to detect humans (people) with various types of challenges such as variations in clothes, postures, at far and close distances, with/without occlusion, and under different lighting conditions.

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TensorFlow is an open-source platform that is used for Machine Learning, created by the Google Brain team. It is explicitly used for complex numerical computation, that packs together a bunch of machine learning anddeep learning models and algorithms. It can be used for a variety of applications such as classifying handwritten digits, object detection, image recognition, natural language processing by training and running deep neural networks.

Keras which acts as an interface for TensorFlow is an open-source library that provides an efficient way of implementing neural networks. It consists of useful functions such as activation functions, and optimizers.

The neural network takes in the input image as a frame from the video, processes it and classifies it under two categories: mask and no mask. The model was trained using 3800 images, 1900 images each for “with mask” and “without mask” categories.

The data is then flattened by converting it to 1- dimensional array which is passed as the input to the final output layer. To help prevent overfitting, the network ignores a certain percentage of neurons during training. In this case the network drops out 50% of neurons. These units are not considered during some forward or backward pass.

The final output layer takes the values and transforms them into a probability distribution, this is achieved with the help of softmax function. This function is helpful when it comes to classification problems or when dealing with multi-class classification problems. The final predicted class is the item in the list whose confidence score is the highest.

$$\frac{e^{z_i}}{\sum_{j=1}^{K} e^{z_j}}$$

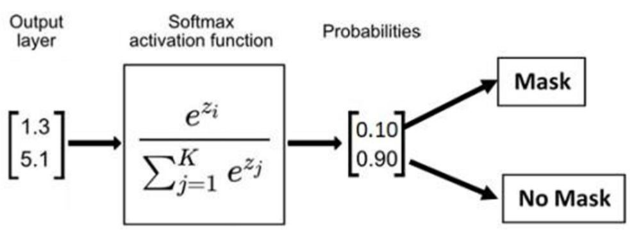


Figure-2: Mask Detection Function

The final prediction will be based on the class that has the highest probability. The model was then compiled using Adam optimizer and trained for 20 epochs with a learning rate of 0.001 and an accuracy of 96.35% was observed on the validation set.

IV. THE DETECTION AND RESUTLS

OpenCV was used to capture the video and the trained model was loaded using TensorFlow. A pre-trained model was used to detect faces in a video. The weights were initialized from the configuration file with the help of OpenCV. After getting the bounding boxes for the faces in the frame, that region of interest is cropped out from the main frame, reshaped, and is then passed to the model.

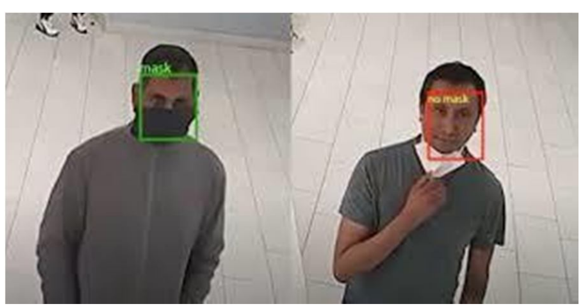


Figure-3: Detecting Face masks

The architecture for this Convolutional Neural Network was inspired from GoogLeNet model that is used for image classification. Just like GoogLeNet their model was implemented using 24 convolutional layers that helps to extract features from the image followed by 2 fully connected layers to predict the output probabilities and coordinates. They also came up with a faster version on YOLO named Fast YOLO that uses a CNN with less layers (9 instead of 24) and less filters for those layers. Other than that, the training and testing parameters were the same between YOLO and Fast YOLO.

In each frame, the people are detected, and boxes are drawn along with their centroids. The centroids for each box were calculated and appended to a list. Red boxes indicate that the person is violating social distancing as shown in Fig. 4 below.

Figure-4: Detecting Social Distance Violations

V. CONCLUSION WITH FUTURE WORK

This task has been created to concoct a proficient route for recognizing and advising when an individual doesn't follow the COVID 19 security conventions in a working environment, business foundations and so on

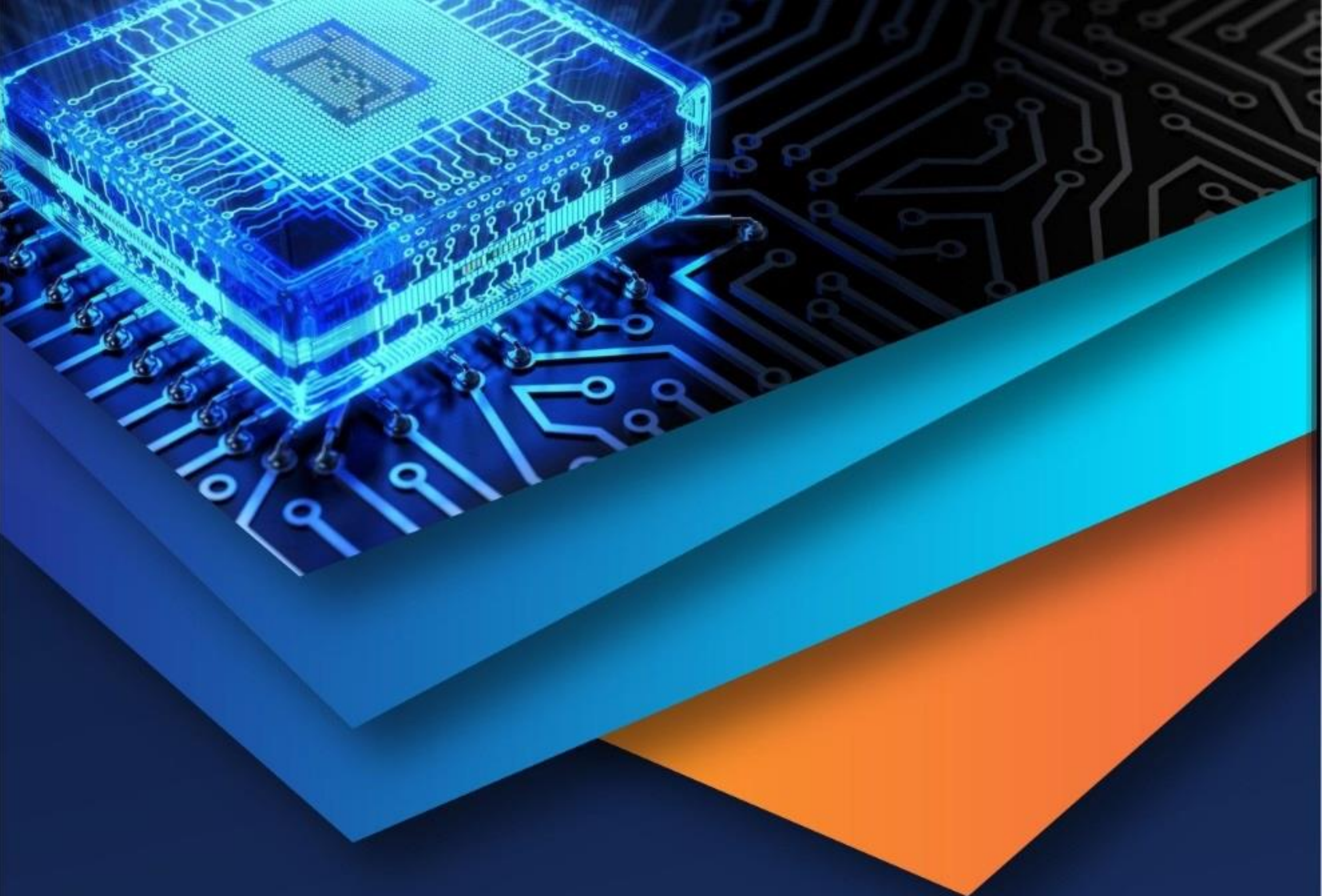
In this work, we have prepared a model for face cover discovery utilizing TensorFlow and Keras and utilized YOLO Object identification for distinguishing social removing. The proposed CNN engineering contains two convolutional layers followed by relu enactment work and a maximum pooling layer.

YOLOv3 was utilized to identify individuals in a casing and track down the Euclidean distance between them. With the assistance of OpenCV we had the option to catch the video feed from various sources like webcam, video record or an IP camera. An android application was created which will get advised each time an infringement is distinguished,

The distinguished pictures can likewise be seen through the application. As a future report, we can deal with discovering an example to identify or anticipate the time at which it becomes busy the most and the warmth guide can be plotted in a more precise way.

REFERENCES

[1] S. Ge, J. Li, Q. Ye and Z. Luo, "Detecting Masked Faces in the Wild with LLE-CNNs," 2017 IEEE Conference on Computer Vision and Pattern Recognition (CVPR), Honolulu, HI, 2017, pp. 426-434.
[2] GOODFELLOW, I., BENGIO, Y., & COURVILLE, A. (2016). Deep learning. Chapter 6.
[3] Winkler, David. (2018). D`10.1002/9783527816880.ch11_03.
[4] The History Began from AlexNet: A Comprehensive Survey on Deep Learning Approaches, Md Zahangir Alom, Tarek M. Taha, Chris Yakopcic, Stefan Westberg, 2018
[5] Howard, Andrew & Zhu, Menglong & Chen, Bo & Kalenichenko, Dmitry & Wang, Weijun & Weyand, Tobias & Andreetto, Marco & Adam, Hartwig. (2017). MobileNets: Efficient Convolutional Neural Networks for Mobile Vision Applications.
[6] Zhu, X. 2006. Semi-supervised learning literature survey. Computer Science, University of Wisconsin- Madison 2(3):4.
[7] Wu, B.; Lyu, S.; Hu, B.-G.; and Ji, Q. 2015. Multilabel learning with missing labels for image annotation and facial action unit recognition. Pattern Recognition 48(7):2279–2289
[8] Bellinger, Colin & Sharma, Shiven & Japkowicz, Nathalie. (2012). OneClass versus Binary Classification: Which and When?. Proceedings - 2012 11th International Conference on Machine Learning and Applications, ICMLA 2012. 2. 102-106. 10.1109/ICMLA.2012.212.
[9] M. Sandler, A. Howard, M. Zhu, A. Zhmoginov and L. Chen, "MobileNetV2: Inverted Residuals and Linear Bottlenecks," 2018 IEEE/CVF Conference on Computer Vision and Pattern Recognition, Salt Lake City, UT, 2018, pp. 4510-4520.
[10] S. J. Pan and Q. Yang, "A Survey on Transfer Learning," in IEEE Transactions on Knowledge andData Engineering, vol. 22, no. 10, pp. 1345- 1359, Oct. 2010.



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