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Automated Inspection of Face Mask and Social Distancing Using Artificial Intelligence

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***Abstract* - According to the data obtained by the World Health Organization, COVID-19, and the global pandemic has severely impacted the world and infected more than hundreds of million people worldwide which includes more than three million deaths. This global pandemic enforced governments across the world to impose lockdowns in order to prevent the virus transmissions. Reports indicate that wearing face masks and following safe social distancing are two of the enhanced safety protocols need to be followed in public places in order to prevent the spread of the virus. To ensure the public safety in environment, we propose an efficient Computer Vision based approach that focused on the real-time automated monitoring of people to detect both safe social distancing and face masks in public places by implementing the model to monitor the activity and detect violations through camera. After detection of breach, the system sends to control center at state police headquarters and also give alarm to public. In this proposed system, modern deep neural network based model have been mixed with geometric techniques for building a robust model which covers three aspects of detection, tracking, and validation. Thus, the proposed system helps the society in saving time and reducing the spread of corona virus. It could be practiced effectively in current situation when lockdown is eased to inspect persons in public gatherings, shopping malls, etc. Automated inspection reduces manpower to inspect the public and can be used in any place to ensure safety.**

Keywords: Deep Learning, Computer Vision, Deep Neural Networks, World Health Organisation, YOLO, Face Mask, Social Distance, public Safety.

1. INTRODUCTION

The spread of COVID-19 has created the most crucial global health crisis all over the world which has had a deep impact on the way we perceive our world and our everyday lives. In December 2019, the spread of severe acute respiratory syndrome corona virus 2 (SARS- CoV-2), emerged in Wuhan, China, and has infected 7,711 people and 170 reported deaths in China before coronavirus was declared as a global pandemic, was named by the World Health Organization as COVID-19 (coronavirus disease 2019).

This has resulted in person-to-person transmission but so far as we know, the transmission of the novel corona virus causing COVID-19 can also be from an asymptomatic carrier with no symptoms. Until now there is no report on any clinically approved antiviral medicine or vaccines which treats COVID-19. WHO recommends that people should wear face masks to avoid the risk of virus transmission and also recommends that a social distance of at least 2m be maintained between individuals to prevent the person-to- person spread of disease since virus spreads rapidly across the world, bringing massive health, economic, environmental and social challenges to the entire human population.

2. CONCEPTUAL STUDY

Our proposed model describes an approach to prevent the spread of the virus by monitoring whether a person is following safe social distancing and wearing face masks in public places in real time. Our approach adopts the combination of lightweight neural network MobileNetV2 and Single Shot Detector (SSD) with transfer learning technique to achieve the balance of resource limitations and recognition accuracy so that it can be used on real-time video surveillance to monitor public places to detect if persons wearing the face mask and maintaining safe social distancing using YOLO object detection on video footage and images in real time. The experimental results infer that the detection of masked faces and human subjects based on YOLO has stronger robustness and faster detection speed.

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Our solution uses deep neural networking models to analyze video streams using Open CV and MobileNetV2.We mix the approach of modern-day deep learning and classic projective geometry techniques which not only helps to meet the real-time requirements but also keeps high prediction accuracy.

3. OBJECTIVES

Our project aims in proposing an efficient AI and Computer Vision based approach focused on real-time automated monitoring of people which can detect faces in real-world videos and perform tasks namely identify if the detected faces are wearing masks or not and monitor if proper social distancing measures are maintained.

Face Mask Detector

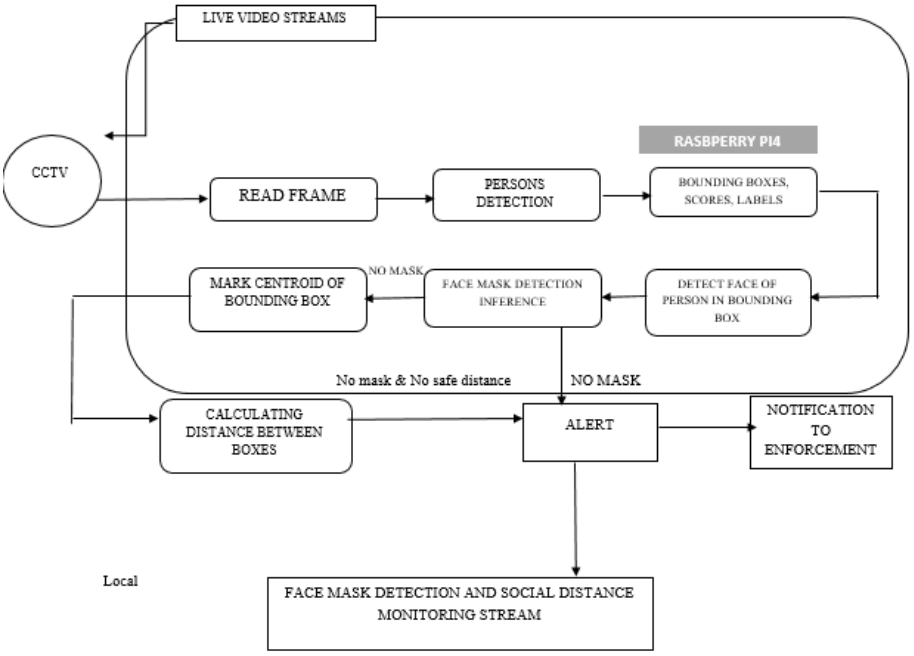

Chart-1: Face mask and Social distance detection flow

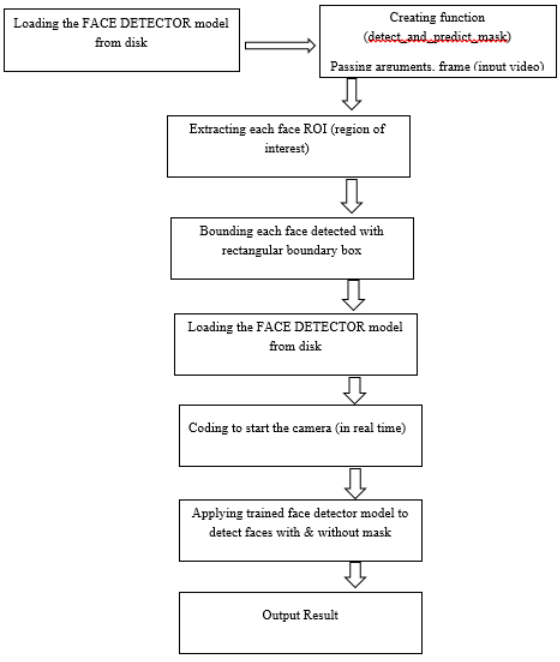

Chart -2: Applying Face mask detector model

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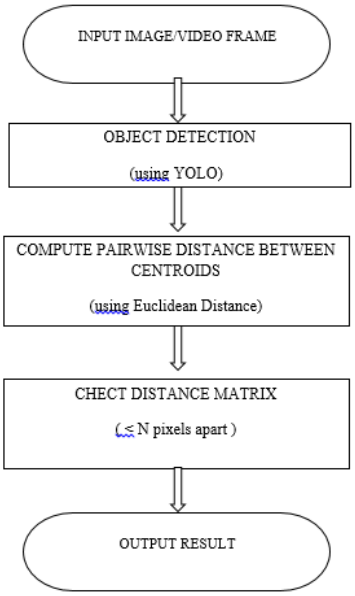
Social Distance Detector



4. DATA PREPROCESSING

The dataset consists of 3165 images to train our proposed face mask detector. Before the custom face mask image dataset is labelled and divided into the training set and testing set. The training dataset should consist of 80% images in order to train the algorithm effectively. Testing dataset should consist of 20% images to test the prediction accuracy of the algorithm. The images in the training data collections are classified into two categories: with mask and without mask. In face mask detection, the following process takes place.

i. Resizing Images – processing images to fit in the same size
ii. Converting Images to Array
iii. Pre-Processing Images for MobileNetV2
iv. One-Hot Encoding using Label Binarizer
v. Using NumPy library to process them in the form of Arrays
vi. Splitting datasets into Train and Test

In social distance detection, the following process takes place.
i. Filtering the person class from detection
ii. Get Bounding box centroid for each person detection
iii. Calculate Euclidean distance between centroids
iv. Checking person boundary box close to each other
v. Creating Green bounding boxes and Red bounding boxes
vi. Risk analysis and recording the risk factors

Before model training begins, Tensor Flow helps in Data augmentation and downloads pre-trained ImageNet weights to make the algorithm's prediction accurate. After downloading the pre-trained weights and creating new fully-connected head (FC), the SSD algorithm is trained with both pre-trained ImageNet weights and annotated images in the custom dataset by tuning the head layer weights without updating weights of base layers. We trained our model for 1000 steps using the Adam optimization algorithm, the learning decay rate for updating network weights and the binary cross-entropy for mask type classification.

5. MODEL TESTING

Our work on face mask and social distance detection comprises of data collection to tackle the variance in the kinds of face masks worn by the workers. Face mask detection model is a combination of face detection models to identify the existing faces from camera feeds and then running those faces through a mask detection model Thus, social distance detection records the risks indicating by human violations from camera feeds or webcam video and then running the results.

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6. IMPLEMENTATION RESULTS

Face Mask Detection

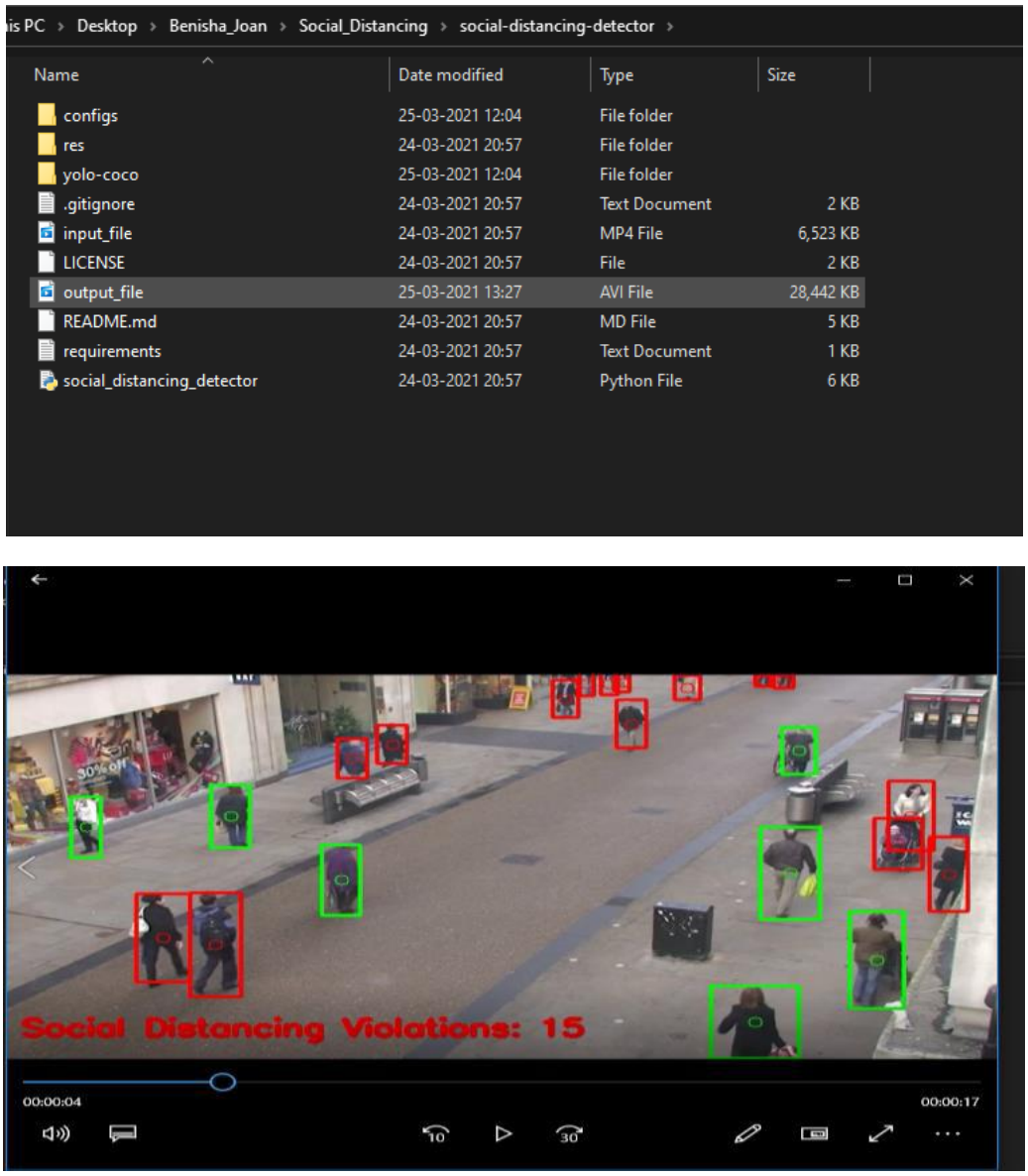

Fig-3: Social Distance Detection showing the violations (webcam videos)

7. CONCLUSION

In this paper, we proposed an approach that uses computer vision and YOLO to help maintain a secure environment and ensure individuals' protection by automatically monitoring public places to avoid the spread of the COVID-19 virus. On the available datasets, some face detectors have achieved extremely high performances and it seems to be somehow difficult to further improve them. However, the current scenarios are much more challenging than expected for containing faces captured at unexpected resolution, illumination and occlusion.

The YOLO technology was evaluated using large and comprehensive datasets and proved a major development in terms of accuracy and speed compared to three state-of-the-art techniques. The extensive trials were conducted with popular object detection model YOLO v4 which illustrated the efficient performance. These applications can be used to analyze for mask detection and social distancing in a public area and perform important moves to higher address the pandemic. Automating the task will lead in effective moves taken in short time hence equipping us better to address the situation. Applications are applicable in

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various environments using CCTV surveillance cameras. This two applications are very useful in many areas like Hot-spot areas, in offices, colleges, hospitals, airports, railway stations, public places like banks, ATM, Government offices, etc.

REFERENCES

[1] Lin, Tsung-Yi, PiotrDollár, Ross Girshick, Kaiming He, BharathHariharan, and Serge Belongie, "Type Pyramid Networks for Object Detection," IEEE Conference Proceedings on Computer Vision and Pattern Recognition, pp. 2117-2125. 2017.

[2] Z. Wang, G. Wang, B. Huang, Z. Xiong, Q. Hong, H. Wu, P. Yi, K. Jiang, N. Wang, Y. Peiet al., "Masked face recognition dataset and application," arXiv preprint arXiv:2003.09093, 2020.

[3] Z.-Q. Zhao, P. Zheng, S.-t. Xu, and X. Wu, "Object detection with deep learning: A review,"IEEE transactions on neural networks and learning systems, vol. 30, no. 11, pp. 3212–3232, 2019.

[4] Kumar, A. Kaur, and M. Kumar, "Face detection techniques: a review," Artificial Intelligence Review, vol. 52, no. 2, pp. 927–948, 2019.D.-H. Lee, K.-L. Chen, K.-H. Liou, C.-L. Liu, and J.-L. Liu, "Deep learning and control algorithms.

[5] Glass RJ, Glass LM, Beyeler WE, Min HJ. Targeted social distancing architecture for pandemic influenza. Emerging Infectious Diseases. 2006; 12:1671–1681

[6] S. Ge, J. Li, Q. Ye and Z. Luo, "Detection of Masked Faces in the Wild with LLE-CNNs," 2017 IEEE Conference on Computer Vision and Pattern Recognition (CVPR), Honolulu, HI, 2017, pp. 426-434.

[7] S. S. Mohamed, N. M. Tahir and R. Adnan, "Background modelling and background subtraction efficiency for object detection," 2010 6th International Colloquium on Signal Processing & its Applications, Mallaca City, 2010, pp. 1-6, doi: 10.1109/CSPA.2010.5545291.

[8] S. S. Farfade, M. J. Saberian, and L. Li. Multi-view face recognition using deep convolutional neural networks. In ACM ICMR, pages 643– 650, 2015

[9] C.Fu, W.Liu, A.Ranga, A. Tyagi, A. Berg, "DSSD: deconvolutional single shot detector model," arXiv preprint arXiv:1701.06659, (2017).

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