Chapter 11
Face Mask and Social Distancing Detection in Real Time

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ABSTRACT

With the recent outbreak and rapid transmission of the COVID-19 pandemic, the need for the people to follow social distancing and wear masks in public is only increasing. So, the main objective of this chapter is to build a machine learning model based on TensorFlow object detection API and YOLO Objection Detection that will determine a green and red rectangle around the face if the person detected in the camera wears or does not wear a mask, along with an email alert being sent to the authority in charge informing about a person's violation of face mask policy and will return a green or red bounding box accordingly if social distancing is maintained between two people and at the same time alert others by a beep alarm. The accuracy of the model is nearly 97% so it can be used by governments to alert people if the situation turns serious.

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1. INTRODUCTION

The emergence of coronavirus disease (COVID-19), in Wuhan, China (Raghuvir, 2020) in December 2019, has infected about millions of people and claimed many lives globally. The virus is known to transmit from person to person primarily via respiratory droplets. Hence the use of several measures, such as wearing a face mask, physical distancing, etc., have been implemented by the government bodies of most of the pandemic-affected countries to reduce the viral transmission. However, negligence in following rules has been observed both at individual and community levels. Physical distancing, face masks are basic mechanical barriers effective in reducing viral transmission (Advice for the public, n.d.). A few studies have been conducted, which shows the effectiveness of wearing mask and maintaining social distance in controlling the viral spread. Physical distancing has also been an effective measure as it helps avoid any direct contact amongst individuals and assists in reducing any sorts of transmission of the droplets containing the virus. Studies conducted shows that the droplets transfer via human breathing, coughing, talking, sneezing and eating. Here arises the questions like "what is a safe distance to maintain social distancing?" and "what further can stop this transmission?". Other biological, medical and engineering factors also needed to be considered to answer the above-mentioned questions. Finally, it was suggested by WHO that distance for a safe social distance was recommended to be at least 6 feet, that is, 2 meters (COVID-19, n.d.).

Yet, now the distance has been reduced to 1 meter in some of the recovering countries. This research paper proposes an AI based detection system that helps in detecting any kinds of violations. This research intends on building a model that can be applied in real-time systems and thus help in avoiding the spread of the virus. A significant positive change has been observed between the people wearing mask and the others not wearing a mask. The study conducted using a logistic and statistical model has shown that the highest significant control over viral transmission can be achieved with increase in face mask wearing and social distance maintaining habit. On the other hand, low level of community transmission control has been seen in states with self-reported mask-wearing but limited social distancing. So, this proposed AI (Artificial Intelligence) based Face Mask Detection and Social Distancing Detection System can be implemented in public places like the banks, airports, schools, colleges, offices, etc., to monitor physical movements of people and alert people to take necessary steps in case of violations.

2. RELATED LITERATURE

This section previews some of the related research works on Object Detection, Object Recognition, Face detection and identification based on Artificial Intelligence, Convolution Neural network, YOLO Object detection algorithm, TensorFlow Object Detection API, OpenCV package, etc., and implementation of these models in real world applications. Several works have been done successfully in this domain. Many of these significant works have been thoroughly examined to gain knowledge in this field and build the proposed model for our research paper:

Zhong-Qiu Zhao, Peng Zheng, Shou-tao Xu, and Xindong Wu (2019) attempted to provide deep learning-based object detection frameworks in a research paper and compared various object detection methods on three benchmark datasets, including PASCAL VOC 2007 (n.d.), PASCAL VOC 2012 (n.d.) and Microsoft COCO. This paper also focussed on the modifications that can be made to typical generic object detection architectures and also surveyed tasks like face detection, pedestrian deletion etc.