Social Distancing and Face Mask Detection By Using Deep Learning

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ABSTRACT

COVID-19, also known as the Corona Virus, caused drastic changes in culture, eventually leading to a pandemic. We suggest a deep learning-based method for detecting facial masks in videos in this paper. Using YOLO object detection on video recordings and photographs in real time, this paper focuses on a solution to help implement proper social distancing and wearing masks in public. The paper describes a tool for detecting social distancing using deep learning to assess the gap between people in order to reduce the effect of the coronavirus pandemic. The detection tool was created to warn people to keep a safe distance between them.
The open-source object detection pre-trained model based on the YOLOv3 algorithm was used to detect pedestrians using the video frame from the webcam as input.

Keywords— Public Safety, social distancing, Deep learning, Mask detection using AI,Convolutional Neural Networks (CNNs),OpenCV, COVID-19.

I. INTRODUCTION

The word "social distancing" has taken the world by storm and is changing the way we live. Holding a secure distance between yourself and other people who are not from your household is known as social distancing, also known as "actual distancing." Maintaining social distance has become a key issue as the country has begun to unlock amid rising COVID-19 cases. The most serious concern about the COVID-19 situation is how easily the infection spreads from one person to another by touch or even being in close proximity to someone who is infected. Social Distancing is here to stay longer than expected to fight Covid-19. As a result,it is necessary to create an AI model to detect social distancing while still wearing masks. So, here's an example of the model's production. We can derive useful insights from video clips using deep learning and OpenCV. The person is in close proximity to another person if the bounding boxes are red, and the person is maintaining social distance if the bounding boxes green . We also have different bounding boxes for determining whether or not the individual is wearing a mask. The face mask detection process starts from the image acquisition using a camera.
 The detection of the mask is done using   a convolutional neural network (CNN). The prediction model identifies the mask and provides an alert to the system.

A CNN based Image Classification model to classify people with and without masks. A pilot project of Face mask detection. During the times of COVID-19, covering our face with a mask and maintaining social distancing is essential.
With advancements in the field of Deep Learning, now we can easily train a model and check if someone is earning a mask or not.

II. LITERATURE SURVEY

This section of the literature review finally shows the following facts based on a careful examination of several authors' work:

[1] A virtual social distancing model was evaluated to assist people who are being warned in public places. They used a graphic to represent four different forms of spacing: intimate space, personal space, social space, and public space. The spaces are calculated using a distance measurement law.

Two-dimensional people detection and multiple-angle people Social Distance Monitoring and Face Mask Detection Using Deep Learning ..

[2] A deep learning model is used to propose a technique for detecting social distancing. The gap between people can be measured using computer vision, and any noncompliant pair of people will be marked with a red frame and a red line. A video of pedestrians walking down a street was used to validate the proposed process.The visualisation results revealed that the proposed method is capable of determining social distancing measures between individuals, and that it could be further adapted for use in other settings such as the workplace, restaurant, and school.Furthermore, by
optimising the pedestrian detection algorithm, incorporating other detection algorithms such as mask detection and human body temperature detection, increasing the computational power of the hardware, and calibrating the camera perspective view, the work can be improved even further.

[3] Social distancing has been suggested as a way to prevent the spread of infectious diseases like COVID-19. This article contains a thorough examination of how technology can allow, encourage, and enforce social distancing.
To begin, we discussed social distancing in general. addressed the technology's role in the current COVID-19 pandemic, as well as a variety of practical social distancing situations in which it could be used. We then went through a range of wireless technologies that can be used to facilitate and encourage social distancing and discussed

them.We gave a summary of each technology, looked at the state-of-the-art, and explored how it could be used in various social distancing scenarios.

III. PROPOSED SYSTEM

The proposed framework is a deep learning solution that trains the model using OpenCV and TensorFlow. We use a triangular similarity technique to calculate distance between persons detected by camera in real time in video streams and combine the deep learning MobileNetV2 modal with the SSD system for a fast and efficient deep learning solution for real-time human detection in video streams.
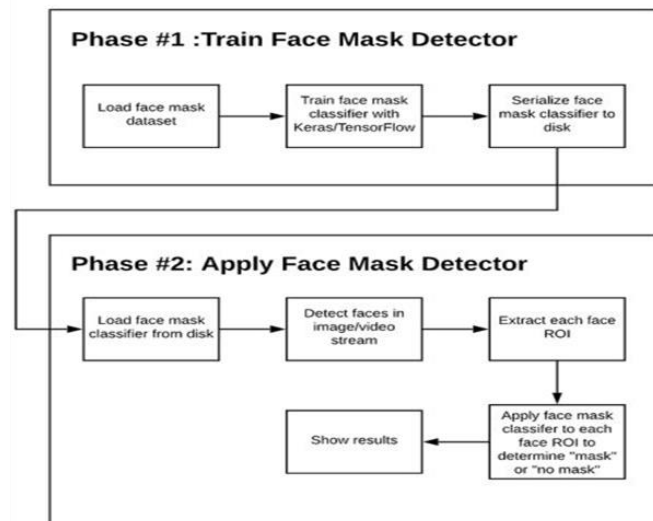

Figure : Phases and individual steps for building a COVID-19 face mask detector with computer vision and deep learning using Python, OpenCV, and TensorFlow/Keras.

Training: Here we'll focus on loading our face mask detection dataset from disk, training a model (using Keras/TensorFlow) on this dataset, and then serializing the face mask detector to disk.

Deployment: Once the face mask detector is trained, we can then move on to loading the mask detector, performing face detection, and then classifying each face as with_mask or without_mask.

IV. METHODOLOGY

Data Collection and Preparation

The first video, obtained online from YouTube4 and provided by BriefCam5, and the other video footage of the Oxford Town Centre6 are used in this study work. The first dataset features CCTV footage of pedestrians strolling on the sidewalk, while the second dataset has a video of people walking in Oxford, England's bustling downtown district. Multiple research initiatives have made use of the Oxford Town Centre dataset. These are open datasets that can be utilised for a variety of development and research projects in the fields of object identification, facial recognition, and a variety of other topics. This dataset is unique in that it incorporates video footage from a public CCTV camera that was installed for public safety purposes. The pedestrians in this film are seen strolling or acting in an unrehearsed and natural manner. These pedestrians are

simply ordinary people going about their daily lives on the road or pathway. Although these people were unaware of the research programmes, they were aware that they were being watched by cameras, and this dataset was developed with their cooperation, thereby avoiding any ethical difficulties.

Data Pre-processing

This study begins by downloading video footage from the internet. A fixed camera in the video clip detects people in a region of interest (ROI) and estimates their distances in real time without collecting any data. Furthermore, this study presents a novel method for identifying people and determining whether or not they are breaking any social distance rules.

While determining the interpersonal distances between the participants in the video, their faces are recognised using facial detection to determine if they are wearing a mask or not.

V. IMPLEMENTATION

Object Detection and Tracking

Although the phrases Image Classification and Object Detection are frequently used interchangeably, they are not the same thing. While Image Classification identifies things in photos, Object Detection identifies objects in images as well as their position.

Merkulova, Shavetov, Borisov, and Gromov (2019) use both of these phrases frequently in computer vision tasks. They can be employed in just about every industry, including healthcare, defence, sports, and a variety of others.

The following question is whether Object Detection and Tracking are interchangeable terms. Yes, in terms of how they work, Object Detection and Tracking are extremely similar. They're practically the same thing, but with a few little differences.

Object Detection detects items in a single image or numerous photos where the object is immobile, but Object Tracking detects things in movies by keeping track of the subsequent object recognised as it is moving. Because a video is made up of a series of fast-moving frames, Object Tracking is used to identify the objects and their locations in each frame.
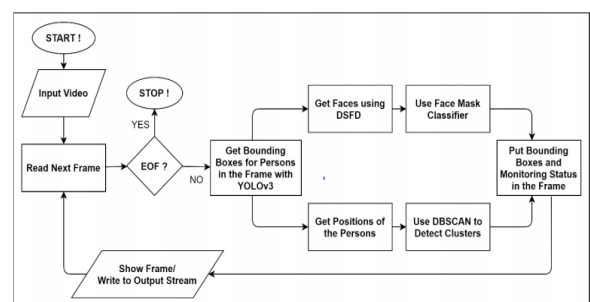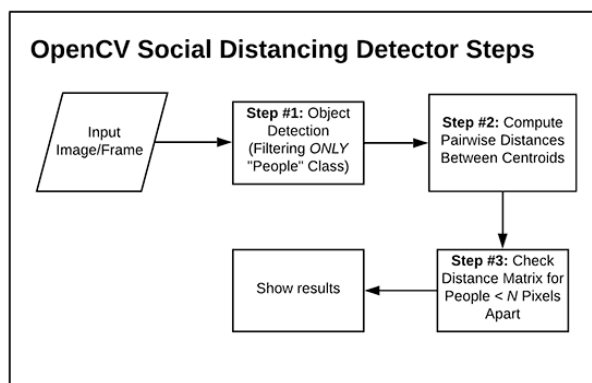

Figure 2: Social Distancing and Face Mask Detection Pipeline

Pedestrian Detection

You only look once. Version 38 is a cutting-edge, real-time object identification system pre-trained on the COCO9 dataset. It has a resolution of 416*416 pixels and was utilised in this study to obtain bounding boxes of individuals in movies.

There are several methods for finding an individual's position, such as determining the centre of the bounding box, or the midway of the bounding box. OpenCV's bird's eye viewpoint is another alternative. The first method for calculating the distances between individuals is the subject of this endeavour.

To begin, the model recognises people in the frames and their faces. It then draws a red or green bounding box around the person and his or her face to assess whether they are safe or not, and whether or not they are wearing a mask. The sections that do not contain the object can be discarded to lessen the project's complexity. Region Proposals is the process of extracting such regions. These algorithms are presented in order to select Regions of Interest (ROIs). As a result, installing the Region-based Convolutional Neural Network (R-CNN) is one of the finest techniques to ROI (Liaoet al., 2019).

Face Mask Detection

The faces of the participants are detected using a Dual Shot Face Detector in this study. It's a method that comes from SSD and includes a Feature Enhance Module (FEM) that allows you to move original features from a single shot detector to a dual shot detector (Li et al., 2019). Face detectors such as the MTCNN (Xiang and Zhu, 2017) or the HaarCascades (Tej Chinimilli et al., 2017) are commonly used.
DSFD is a bit complicated and takes up a lot of space in the pipeline, but it produces reliable results. It's extensively employed in detections with a larger range of ranged-orientations. Because this study is based on video frames, there is a great chance of seeing blurred faces, and with the help of DSFD, none of them will be missed.
The blurriness could be caused by a variety of factors, such as the face being too close to the camera.
During the video capture, there were any random quick motions or noise that were out of focus.

FUTURE WORK:

The use cases listed above are only a few of the many features that were included in this solution. We believe there are a number of other scenarios that could be included in this approach to provide a more comprehensive sense of security. The following are a few of the features that are currently in development:

1.**Coughing and Sneezing Detection**: According to WHO guidelines, chronic coughing and sneezing is one of the primary signs of COVID-19 infection and one of the main routes of disease transmission to the general public. By improving our proposed solution with body gesture analysis to understand whether a person is coughing and sneezing in public places while violating facial mask and social distancing guidelines, a deep learning-based approach can be useful in detecting and limiting disease spread, and compliance agencies can be alerted as a result.

2.**Temperature Screening:** Elevated body temperature is another main symptom of COVID-19 infection. Currently, thermal screening is performed using handheld contactless IR thermometers, which requires health workers to be in close proximity to the person being screened, making them vulnerable to infection and anyone in public spaces, the proposed use-case can be fitted with thermal cameras-based monitoring to analyse people's body temperatures in public places, which can help law enforcement authorities combat the pandemic more effectively.

CONCLUSION:

The article proposes an efficient real-time deep learning based framework to automate the process of monitoring the social distancing via object detection and tracking approaches, where each individual is identified in the real-time with the help of bounding boxes. The generated bounding boxes aid in identifying the clusters or groups of people satisfying the closeness property computed with the help of pairwise vectorized approach. The number of violations are confirmed Deep learning based approach can be proved handy here to detect & limit the disease spread by enhancing our proposed solution with body gesture analysis to understand if an individual is coughing and sneezing in public places while breaching facial mask and social distancing guidelines and based on outcome enforcement agencies can be alerted.

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