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A System to Monitor the Adherence to the Standard Covid 19 Protocols

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Abstract: *Following COVID-19's wave of transmission, there was a considerable emphasis on limiting and lowering cases. When regular life resumes, the public must follow a set of principles to limit the risk of infection. Manually doing this process is time-intensive and fraught with infection hazards due to the general population's presence. Separating oneself from others by wearing masks and thoroughly cleansing one's hands before entering public locations is part of the ritual. A computer vision-based technique that focuses on real- time automated people monitoring in public spaces to identify both safe social separation and face masks is critical for generating safe surroundings that contribute to public safety. In this project, systems are employedto determine whether or not the COVID-19 protocols are being followed. This is being implemented in 5 phases.The first phase provides the functionality for setting up a frame at any public area and takes real-time /stored video clip as an input feed through camera. The second phase uses YOLO(You only look once) instead of R- CNN family-based algorithm to detect objects. The Third-phase contains trained face-mask detector in order to detect face-mask on pre identified object. If the protocol is not followed, the command center is alerted. The fourth phase uses Euclidian's Algorithm to get distance between each pre-identified object present in that particular frame. The first four phases comprise one complete operation, which basically provide monitoring and alerting functionality, and results set of outputs. Finally, the Fifth-phase is used to generate statistical information of particular area and uses TensorFlow and Matplotlib in order to predict future outcomes.This system is suitable for usage in a number of places including temples, shopping malls, metro stations, and airports.*
Keywords *- R-CNN ,YOLO, Tensorflow, Euclidian's distance,Covid-19*

I. Introduction

Since COVID-19 has become a pandemic, global efforts are being made to halt the spread of it since it has developed into a pandemic. Maintaining social distance and donning a mask when out and about are the rules of thumb for stopping the spread. The COVID-19 began to spread during late December 2019. In China, the infection begins with the pandemic, which affects all living things. Circumstances all across the world gets worsened. Virusinfection spreads to everyone, but it works in concert with the person who has direct contact with the patients whoare affected. Through the patient's respiratory organs, the virus entered the lung cells directly, where it replicatedthe infection and caused a severe condition in a remarkably short amount of time. Artificial intelligence network is used by the Face Mask Detection Platform to detect personis donning a mask or not. The new IP cameras maybe used with any current application to distinguish between those wearing masks and those who aren't. The camerafor picture capture is the first step in the method of identifying a face mask. TensorFlow and Open-CV programming are used to recognize faces using the picture, gadget, and modules that were developed. Next, checkeveryone's faces to see whether anyone is sporting a face mask. Whensomeone is wearing a mask, the word "safe"is shown in the safe zone as a green rectangle-box. An alert will sound if someone is not wearing a mask. shown in a red box with a phrase that serves as an alert. Social distance detection will identify 2 or more in a single framewith a social distance of at least 0.80 metres. The Euclidean Distance approach may be used to determine whetherpeople are maintaining or adhering to the WHO's standards for social distance.

Figure 1. Examples of images in the facemask database

II. Research Background

YOLO

Joseph Redmon et al. developed YOLO, a method for real-time object identification. YOLOv1 was released in 2016, YOLOv2 was released in 2017, and YOLOv3 was launched in 2018 .[13] The YOLO technique has been shown to work in a variety of object identification applications, including vehicle detection , aerial target detection, pedestrian detection , and so on. Darknet-53 is the name of the YOLOv3 feature extractor, which has 53 convolutional layers. This is a cross between the old network v2 and the current network v1. A Darknet 53 serves as the foundation for feature detection in the YOLO-v3 algorithm. Convolutional, residual, and up- sampling layers are among the 106 layers that make up the whole YOLOv3. To find objects in a single- input image, YOLO technique just requires one forward propagation pass through. Because the up-sampling layer can maintain the finegrained properties of the minute object YOLOv3 is better at recognizing small things. Preprocessing, face detection, and mask detection are the three phases in the proposed technique for face mask identification.

The input image quality is improved using auto white balancing and edge improvement with the unsharp filter in the preprocessing stage. The auto white balance ensures that the input image frames are color consistent over a wide variety of color temperatures. The unsharp filter is then applied to the input photos to enhance the edges. Image augmentation has been shown by certain researchers to improve item detection accuracy by 2-5 percent.[13]

The first stage in the face detection process is to identify the facial region. To detect the facial region, we use theHaar cascade classifier described by Viola-Jones. This classifier employs the Haar Wavelet approach to extract features with a 24x24 window size, AdaBoost to eliminate redundant features, and cascade classifiers to recogniseobjects. The Haar cascade classifier's discovered face areas are then fed into the YOLOv3 algorithm's input data to find face mask regions.The final stage is to use the YOLOv3 algorithm to detect subject is wearing the mask ornot. [13]

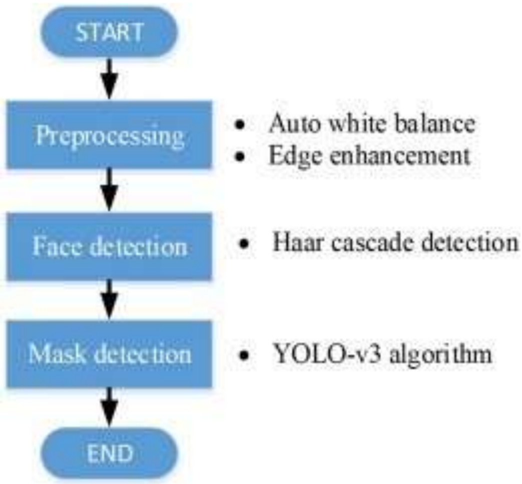

Fig 2 : Flow chart of YoloV3

R CNN AND FASTER R CNN

Faster R-CNN, the most widely used modern variant of R-CNN family. Following elements are frequently included in these networks: a) A technique of region suggestion for determining the positions of potential items in the image, or "bounding boxes." b) The process of creating features for these things, frequently with the aid of a CNN. d) Regression layer to improve the bounding box object coordinates. c) A classification layer to forecast and classify item to class. Fast R-CNN employs a CPU-based selectivesearch method that takes around 2 seconds per image and works on the CPU for region recommendation. By leveraging the Region Proposal Network to generate region recommendations, the Faster R-CNN research resolves the problem (RPN). The output of the CNN is then input into a regressor to create the bounding boxes and a simple SVM classifier to recognise objects in the proposed areas. Due of the requirement to transmit all area proposals via CNN in order to detect objects in a single image. Forecasts generated by R-CNN typically take one minute to process.

The original creator enhanced R-CNN by developing Fast R-CNN [3]. Fast R-CNN provides a substantially quicker run time by skipping recurrent feed-forward feature extraction of regions proposed. The concepts are warped into the similar shape using a unique RoI layer before giving it to fully connected layers. Fast RCNN being simpler to train since the SVM is substituted with a SoftMax layer for classification. The Selective Search method, which becomes the bottleneck in R- CNN accuracy and speed was replaced with a CNN by a developer to improve Fast R-CNN. Instead, the responsibility for recommending regions falls to CNN's Region-proposal Network (RPN). RPN complies with RoIpooling by distributing feature maps produced by the feature-extractor- CNN. Final outcome is a model that runs on a graphics processing unit (GPU) in real time at a rate of 5 frames per second [3]. In order to analyse more data on less expensive hardware and improve the coverage of our automatic face-mask detection system, among other things, we need a faster algorithm.

Mobile-netV2

93.2 percent accuracy, on the test-dataset with 95.6 percent on the training-dataset, MobileNetV2 offers the best combination of performance figures. It features two different sorts of blocks: shrinking blocks with a stride of 2 and residual blocks with a stride of 1. Both sorts of blocks have three levels. 1*1convolution with ReLU6 makes up first layer. Depth-wise convolution is the second layer. Without any non-linearity, the third layer is 1*1 convolution. [14].

Convolution layer C and depthwise convolution layer D are used to represent the architecture in Fig. Result of MobileNetV2 is flattened before sending to two fully connected layers, the first of which has 256 units and a dropout regularisation of 40%, the second of which has 64 units and a single output for binary classification.

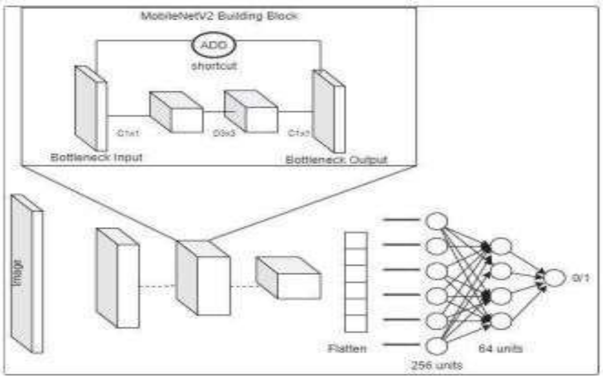

Fig 3: MobileNetV2

To determine presence of mask on the faces discovered, face-mask classification is accomplished using CNN - binary image classification architecture. Several models were created using CNN to classify masks on 128x128 pictures, and their performance comparison is as shown in Table. Due to MobileNetV2's performance in predictiontime and accuracy was chosen, as shown in Fig.

TABLE: MobileNetV2 comparison with other models

Models	Accuracy (%)	Precision (%)	Recall (%)	F1-score (%)
Resnet50	47.7	49, 46	48, 57	49, 47
Xception	50.8	51, 51	46, 56	48, 53
MobilenetV2	93.2	94.6, 93.80	95.7, 94.1	95.1, 93.9

EUCLIDEAN DISTANCE

Tensorflow, Keras, Numpy, and SciPy modules are utilised in Both.py to determine the distance between two people using the Euclidean Distance formula. [13] The Minkowski distance metric, seen in fig., generalises the Euclidean distance measure.

$$d(\mathbf{x}, \mathbf{y}) = \left(\sum_{k=1}^{n} |x_k - y_k|^r \right)^{1/r}$$

Where r is parameter. The following are the three most examples of Minkowski distances.

- r = 1. City block (L1 norm) distance. A common example is Hamming distance, which is the number of bits thatare different between two objects that have only binary attribute, i.e., between two binary vector
- r = 2. Euclidean distance (L2 norm)
- r = ∞

Calculate one-dimensional Euclidean distance. The absolute value of the difference between two locations' coordinates is the distance between them in one dimension.[13] This is represented mathematically as |p1 - q1|, where p1 represents the first coordinate of the first point and q1 represents the first coordinate of the second point. Because distance is typically thought to have only a non-negative value, we employ the absolute value of the difference. P and Q are two points in two-dimensional Euclidean space. P will be described using the coordinates (p1,p2), and Q will be described using the coordinates (p1,p2) (q1,q2). Create a line segment connecting P and Q's endpoints. The hypotenuse of a right triangle will be formed by this line segment. Extending the findings fromStep 1, we observe that |p1 - q1| and |p2 - q2| provide the lengths of the triangle's legs. The length of the hypotenuse will then be used to calculate the distance between the two spots. In Step 2, calculate the hypotenuse'slength usingthe Pythagorean Theorem. According to this theorem, c is the length of the hypotenuse of a right triangle, while aand b are the lengths of the other two legs. As a result, we obtain the equation c = (a2 + b2)(1/2)= ((p1 - q1)2 + (p2 - q2)2)(1/2). Therefore, in two-dimensional space, the separation between two points P = (p1,p2) and Q = (q1,q2) is equal to ((p1 - q1)2 + (p2 - q2)2)(1/2). Three-dimensional space should be added to thefindings of Step 3. Then, one may express the distance between points P = (p1, p2, p3) and Q = (q1, q2, q3) as ((p1-q1)2 + (p2-q2)2 + (p3-q3)2)(1/2). Generalize the answer from step four for the n-dimensional distance between two points P = (p1, p2,..., pn) and Q = (q1, q2,..., qn). The formula for this generic solution is ((p1-q1)2 + (p2-q2)2 +... + (pn-qn)2)(1/2).

III. Implementation

Fig 4:Implementation

The first step in the implementation of the proposed project deals with the collection of different data sets containing images, videos and live feed. Following step would be training the machine according to the data set in public sectors such as airports, colleges, malls, etc. specifically at entry points to such public establishments. Based on the type of environment whether it is outdoor or indoor, the model shall be trained accordingly. Image labeling software shall be used for this step. An approach to identifying all the objects associated with and visiblein an image is through image labelling. The technique will identify any number of items included in the photos, including people, objects, cuisines, colours, and even activities. Users may then understand what their image represents, and those seeing the image can understand what is being shown to them.In this the different images that can be labeled can be masks, people, hand sanitization points etc. Parameters would be maintaining social distancing, not maintaining social distancing. Next, a boundary box across the object is made and XML conversions are created. Using a python script, a training model is created and with the existing dataset, the approach is predicted. Using a RTSP link of the cameras, once data of the camera is input, it will predict the results. It will create a live boundary box and give an alarm to the control alarm. The above present flowchart specifies the collection of images and their processing in order to get the final results. TensorFlow elements createTF Records using which the input is trained. The TF record files will be given to the live input stream. This recordfile is nothing but a trained module which is used to detect the object. This trained module will interact with the live stream that is received from the camera. The output is obtained by using various mathematical models whichare used to provide accuracy in the results.

IV. Conclusion

The purpose of this project is to develop an efficient method for detecting when someone violates COVID 19 safety rules in a workplace, company facility, or other location. As a result of the rapid increase in the spread of COVID-19, real-time mask detection, hand sanitization and detection of social distance have become critical in the fight against COVID-19.

The study focuses on gaining in-depth exposure to various advanced Machine learning algorithms and tools. Dueto the technology's potential to help the fight against the virus, implementation of this project would boost publicsafety by saving time and minimizing coronavirus transmission.

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