IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

Impact Factor 8.021 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 2, February 2025

DOI: 10.17148/IJIREEICE.2025.13204

FACEMASK INTELLIGENCE ALERT SYSTEM USING DEEP LEARNING

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Abstract: Face detection has grown in popularity as a challenge in image processing and computer vision. Convolutional architectures are being used in many new algorithms to make them as accurate as feasible. These convolutional designs have allowed even pixel information to be extracted. We want to create a binary face classifier that can detect any face in the frame, regardless of alignment. We show how to make accurate face segmentation masks from any input image of any size. For feature extraction, the approach starts with an RGB image of any size and employs Predefined Training Weights of VGG - 16 Architecture.

Keywords: HAAR Cascade, Facial recognition, Deep Learning, CNN.

I. INTRODUCTION

The COVID virus has had a significant impact on the world. According to World Health Organization (WHO) research, the COVID virus is spread mostly through respiratory droplets and personal contact. When an infected individual coughs or sneezes, respiratory droplets are produced. Anyone who comes into close contact (within 2 meters) with someone who has respiratory symptoms (coughing, sneezing) is at risk of infecting respiratory droplets.

In public places, people can use masks as a key kind of protection. COVID is a virus that is easily passed from person to person right now. A healthy individual can contract the infection if they come into touch with respiratory droplets from an infected individual's coughs or sneezes. “COVID is transferred by droplets and fomites during close unprotected contact between an infector and an infected,” according to the World Health Organization (WHO). A fomite is a potentially infectious object or material, such as clothing, cutlery, or furniture. As a result, we can protect our faces from infection transmission. Infected people will experience mild to severe respiratory sickness and may not be able to recover without proper care. People who are older or who already have medical conditions such as cardiovascular disease, diabetes, chronic respiratory disease, or cancer are at a higher risk of developing serious illness.

Because the COVID virus can be transmitted by contact, password or fingerprint-based unlocking techniques are insecure. Face Recognition without touching is significantly safer, but current face recognition solutions are no longer reliable when wearing a mask. To overcome the aforementioned challenges, Existing face recognition algorithms that significantly rely on all Facial feature points. must be improved so that identity verification may be conducted consistently even when faces are partially revealed. The goal is to limit transmission by delaying the peak of the epidemic, minimizing the size of the peak, and spreading cases out over a longer period of time to relieve burden on the healthcare system. Facial recognition systems operate in a variety of ways, but in general, they compare chosen facial traits from a given image with faces in a database. One of the most essential biometric characteristics is the face. Face recognition is one of the most prominent image analysis applications, having grown in prominence over the last few decades. It's also known as a Biometric Artificial Intelligence- based application that analyses patterns based on a person's facial features and form to uniquely identify them. Automated gender recognition is useful in a variety of fields, including human-computer interaction, biometrics, surveillance, and demographic data.

II.BACKGROUND STUDY

A. Convolutional Neural Network

A Convolutional Neural Network (CNN) is a kind of feed-forward artificial neural network where the individual neurons are tiled so that they react to covering districts in the visual field. Fukushima's [1] work first registers models dependent on these neighborhood networks among neurons and on progressively coordinated changes of the picture. The output layer is tailored to the application's requirements. The activation function calculates the weighted total and then adds bias to it to determine whether a neuron should be triggered or not. Activation functions such as Rectified Linear Unit (ReLU), Softmax, sigmoid[2], and others are available and can be used based on the task. The instability between the predicted value and the actual label is measured by loss functions such as square loss, hinge loss, generalized smooth hinge loss, logistic loss,cross entropy loss (log loss), categorical cross entropy loss, exponential

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loss, and so on. The spatial density is small by the pooling layer [3] (just width and height, not depth). The features are integrated to form a model using the fully connected layers.

B. HAAR Cascade Frontal Face

Face Location, a broadly famous subject with an immense scope of uses. Cutting edge Cell phones and PCs accompany in-constructed face identification programming, which can verify the character of the client. There are various applications that can catch, recognize, and measure a face progressively, can distinguish sexual orientation of client, and furthermore can apply some truly cool channel.Back to 2001 when Viola and Jones proposed the first-since forever Item Identification System for Constant Face Location in Video Film.

So, what is HAAR Cascade? It is an Item Identification Calculation used to recognize faces in a picture or a constant video. The calculation utilizes edge or line recognition highlights proposed by Viola and Jones in their exploration paper "Rapid Object Detection using a Boosted Cascade of Simple Features[4]" distributed in 2001. The calculation is given a great deal of positive pictures comprising of countenances, and a ton of negative pictures not comprising of any face to prepare on them.

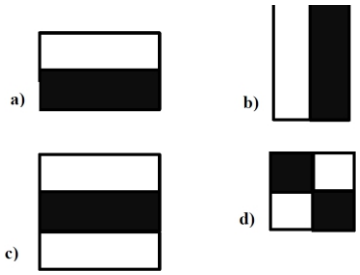

Fig 1 Features

The primary commitment to the exploration was the presentation of the HARR features appeared previously. These features on the picture makes it simple to discover the edges or the lines in the picture, or to pick regions where there is an unexpected change in the powers of the pixels. The above HAAR features run over the image and specify if there is an edge separating those areas. Presently, the HARR features crossing on a picture would include a great deal of numerical estimations. As we can see for a solitary square shape on one or the other side, it includes 18-pixel esteem increases (for a square shape encasing 18 pixels). Envision doing this for the entire picture with all sizes of the HAAR highlights. This would be a rushed activity in any event, for a superior machine.

To handle this the authors came up with an Integral Image. The last pixel at the base right corner of the Integral Image will be the amount of the multitude of pixels in the First Picture.

An Integral Image is defined as

$$s(x,y) = i(x,y) + s(x-1,y) + s(x,y-1) - s(x-1,y-1)$$

Where s(x,y) is the value in integral image and i(x,y) is pixel value in original image. This way independent of window size the computations remains constant i.e. only 4.

Presently there are over 6000 features proposed and it is a tedious task to run all features in each window, so authors came up with Attentional Cascade. In which there is a 24 x 24 window and if one feature fails in a window we don't run remaining features on that instead we move on to other window. This way computation time is reduced. HAAR Course Recognition is one of the most established at this point and incredible face location calculations developed. It has been there since long, some time before Profound Learning got acclaimed. HAAR Highlights were utilized to recognize faces, yet in addition for eyes, lips, permit number plates and so on.

III.RELATED WORKS

Kwon and Lobo [5] published one of the first papers in the field of age estimation using face data. Their approach Essentially consisted of classifying facial photos using anthropometric models and wrinkle patterns. However, anthropometric models may be appropriate for kids, but not for adults[6]. Moreover, the distance returns are employed using 2D facial images that are sensitive to posture. As a result, only frontal faces can be utilized to calculate facial geometries in reality. Geng et al. proposed AGES, an automatic age estimation approach (Aging pattern Subspace). Their main goal was to create a model of age pattern [6], which is a time-ordered series of a person's facial photographs. However, AAM does not construct texture patterns to encode image intensities to use any spatial area. As a result, it's possible that it really doesn't encode face wrinkles in elderly people [6].

Guo et al. [7] used smaller Gabor filters, a linear SVM for age classification, and SVR for age regression. Rather than

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utilizing a predetermined number, they suggested determining the number of bands and orientations based on the task at hand. They also proposed the "STD" [8] operator to encode the ageing of faces. A hierarchical strategy for automatic age estimate was proposed by Hu Han et al. [9]. They conducted an analysis that depicts the effects of ageing on various facial features. They used a component-based representation (forehead, eyebrows, eyes, nose, mouth, shape, and holistic face) to accomplish automatic age estimate with the hierarchical age estimator.

IV.METHODOLOGY

After the text edit has been completed, the paper is ready for the template. Duplicate the template file by using the Save As command, and use the naming convention prescribed by your conference for the name of your paper. In this newly created file, highlight all of the contents and import your prepared text file. You are now ready to style your paper; use the scroll down window on the left of the MS Word Formatting toolbar.

A. Block Diagram:

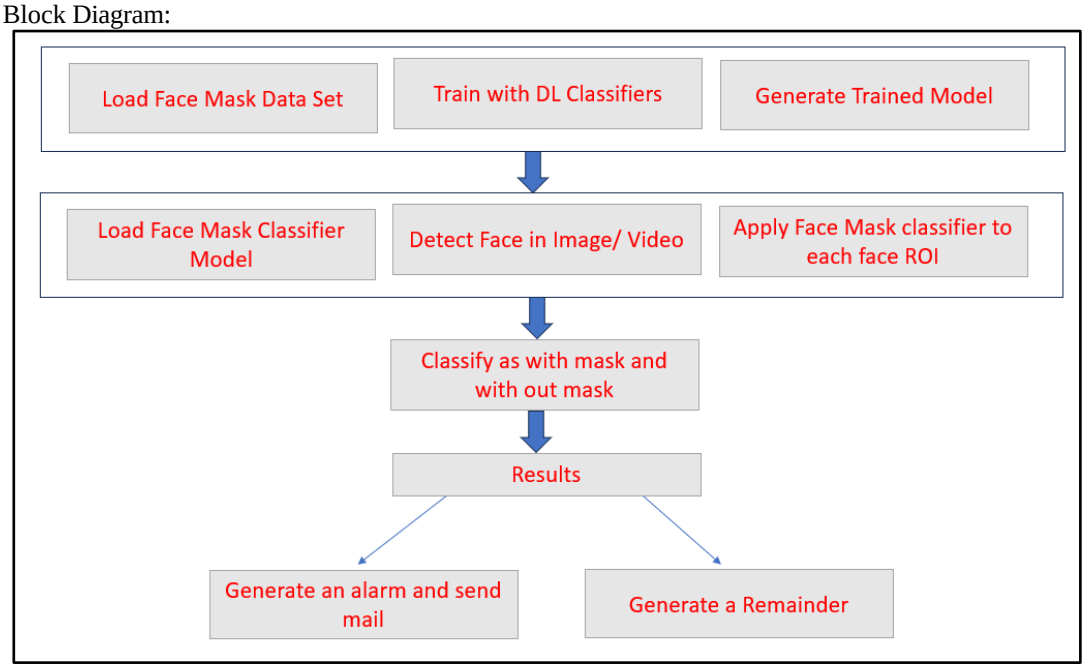

Fig 2. Block Diagram

The picture is caught utilizing the OpenCV library accessible in Python3. From that picture we identify whether there is a face in it. If the face is detected , the Trained CNN model gives the age prediction for the given input picture. The image captured above is given as input to the HAAR cascade frontal face detection model, as discussed priorly it traverses the entire picture by checking all features and yields the picture with a border that includes a face inside it. The implementation here is like that of image capture, but here we need to download the xml file of the HAAR Cascade algorithm and set the path to it in the project. And for further use the cropped image i.e.(face detected) must be stored, so that we can use it as input to the model and desired yields are obtained.

B. Pre-Processing

Genuine information is untidy and is regularly made, prepared, and put away by an assortment of people, business cycles and applications. While it very well might be reasonable for the current reason, an informational index might be missing individual fields, contain manual information mistakes, or have copy information or various names to portray exactly the same thing. Despite the fact that people can frequently distinguish and correct these issues in the line of business, this information should be consequently preprocessed when it is utilized to prepare AI or profound learning calculations.

Our Preprocessing includes resizing the images to 48x48 pixels. Here we used dataset[12] , where in the filename contains the person with or without mask, and then mail the images to authorized mail when a person is found without mask. We also convert the background from BGR to RGB using the OpenCV library accessible in Pythno3. The two lists created are used for training the model and for validating with the same.

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C. Model Definition

The model contains an input layer and 4 convolutional layers where in after each convolutional layer we have an Max Pooling layer and after these 4 layers we have dense layers with ReLU activation function. We have one output i.e., mask or no-mask. The loss metrics used to train the model is mean absolute error.

D. Training

The MSE, MAE, RMSE, and R-Squared are for the most part utilized measurements to assess the forecast mistake rates and model execution in relapse investigation. Here we have used MAE i.e., Mean absolute error which represents the difference between expected yield and original predicted yield.

An epoch in AI implies one complete pass of the preparation dataset through the calculation. This epochs number is a significant hyperparameter for the calculation. It indicates the quantity of ages or complete passes of the whole preparing dataset going through the preparation or learning interaction of the calculation. Here we save the model with 'h5' extension, by using this file we can interface with the face detection as discussed earlier. After each epoch if the loss is improved then it is saved else it is ignored. Now we integrate all the components discussed earlier, firstly capture of picture using OpenCV library, then we move to face detection using the HAAR cascade algorithm. The cropped image is pre-processed and is given to the model, and it predicts mask or no mask.[4] This is written on the image captured using putText method available in cv2 library.

E. Validation

The dataset has around 4229 images, where in we used 25% of that to validate our Trained Model. The optimizers used are Adam and the metrics are Mean Absolute Error.

V.RESULTS

Here we used PyCharm IDE, picture is captured using the OpenCV library accessible in Python. Face detection is carried out by HAAR cascade algorithm and using that window we predicted if any person is without mask as shown in Fig.3. Using the value predicted we can create a content driven access platform which is discussed below.

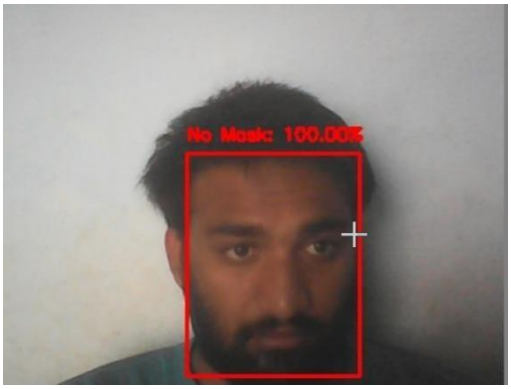

Fig 3 Predicted no-mask

VI.APPLICATION

It is mainly applicable in companies. People who are not wearing the mask are identified and a mail is sent to the authorized mail id. So,t he higher authorities can impose fines or it can make strict rules to not let its employs to get into this list. It ultimately reduces the spread of corona virus, So the people can continue their work in companies.

VI. CONCLUSION

As a result of the Face cover ready architecture, it is possible to identify persons who are not wearing a mask and compel them to do so in order to reduce the transmission of infection.

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