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Face Mask Detection Using Deep Learning

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Abstract
The COVID-19 pandemic is causing a worldwide emergency in health maintenance. This virus mainly broadcast through droplets which emerge from a person infected with coronavirus and poses a danger to others. The risk of transmission is high in public places. One of the best ways to stay safe from getting infected is wearing a face mask in open territory as indicated by the World Health Organization. The research study uses deep learning techniques that identify if the person is wearing a facemask or not and check if the persons. A bounding box drawn over the face of the person
Weather the person is wearing a mask or not. This paper presents a simplified approach to achieve this purpose using some basic deep Learning packages like TensorFlow, Keras, and OpenCV. In this paper using cnn method and improve the accuracy.
Key Words*: face mask detection, deep learning, CORONAVIRUS, COVID-19, CNN*

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I. Introduction

The spread of COVID-19 Pandemic Disease has created a most crucial global health emergency of the world that has had a deep impact on humanity and the way we perceive our world and our everyday lives. In December 2019 the spread of severe delicate respiratory syndrome coronavirus 2 (SARS-CoV-2), a new severe infectious gasping disease emerged in Wuhan, China and has infected 7,711 people and 170 reported deaths in China before coronavirus was announce as a global pandemic, was named by the World Health Organization as COVID-19 (coronavirus disease 2019).

According to the World Health Organization as of July 12, 2020 report , the current outbreak of COVID-19, has infected over 13,039,853 people and more than 571,659 deaths in more than 200 countries around the world, carrying a mortality of approximately 3•7%, compared with a mortality rate of less than 1% from influenza.

A novel coronavirus has resulted in person-to-person transmission but as incomparably as we know, the transmission of the novel coronavirus causing coronavirus disease 2019 (COVID-19) can also be from an subclinical carrier with no covid symptoms. Now there is no report about any clinically certify antiviral medicine or vaccines that are effective against COVID-19.

It has unfold rapidly across the world, bringing massive health, economic, environmental and social challenges to the entire human population. At the moment, WHO recommends that people should wear face masks to avoid the danger of virus transmission and also recommends that a social distance of at least 2m be maintained between individuals to prevent person-toperson unfold of disease.

Moreover, many public service providers require customers to use the service only if they wear masks and follow safe social distancing. Therefore, face mask detection monitoring has become a crucial computer vision task to help the global society.

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Face mask detection involves in resolve the location of the face and then determining whether it has a mask on it or not. The issue is nearby cognate to general object detection to detect the classes of objects. Face identification categorically deals with distinguishing a specific group of entities Face detection.It has numerous applications, such as autonomous driving, education, surveillance. This paper presents a simplified approach to serve the above purpose using the basic Deep Learning packages such as TensorFlow, Keras, and OpenCV.

II. LITERATURE SURVEY

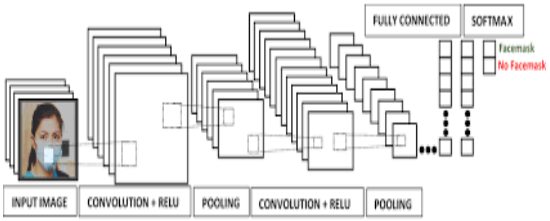
This section provides an in-depth of the main human face recognition approach that apply primarily to frontal faces, as well as the benefits and drawbacks of each approach. Eigen faces, neural networks, dynamic relation architecture, hidden Markov model, geometrical feature match, and prototype matching are among the methods considered. The methods are estimate based on the facial representations they employ. The first building block of the distribution of faces, or the eigenvectors of the autocorrelation matrix of the set of face images, are known as eigenfaces in mathematics. The eigenvectors are organize to reflect varying amounts of difference among the faces. A linear combination of the eigenfaces will precise represent each face. Only the "best" eigenvectors with the large eigenvalues can be used to near it. The appeal of using neural networks may stem from the network's nonlinearity. A single-layer adaptive network called WISARD, which includes a separate network for each store person, was one of the first artificial neural network (ANN) approach used for face recognition. For efficient method for constructing a neural network structure is critical. It is largely determined by the intended application. Some of the other approaches use the pre-trained state-of-the-art deep learning model, InceptionV3. In this approach, the dataset is Simulated Masked Face Dataset (SMFD) using face mask detection. Due to the limited availability of data, the model showed a high accuracy of 99% on the training data set but a fairly low accuracy on the test data set, hence it was overfitted, and hence not suitable for detecting face. It is also very crucial to know that how face recognition approach have evolved and better from the past. Various researchers and professionals have recently fixed on gray-scale face images. Although some were established purely on pattern recognition models, with no prior knowledge of the face model, others depended on AdaBoost, an excellent classifier for training. Real-time face detection became possible thanks to the Viola-Jones Detector, which offered a breakthrough in face detection automation. It had several issues, including the orientation and brightness of the face, which made it demanding to deflect. So, in a compactly, it didn't fit in dark or dim light. As a result, analyst began looking for a new alternative model capable of detecting faces as well as masks on the face. Many datasets for face recognition have been developed in the past to develop a discrimination of face mask detection models. In these datasets, clarify are given for current faces, as argumentative to earlier ones. Large datasets are far more needed for better training and testing data, as well as for performing practical applications in a much more straightforward manner. This necessitates a variety of deep learning innovation that can read faces and masks direct from the user's data. Face Mask detection templates come in a different type of shapes and sizes. These can be classified into many groups. The Viola-Jones face detector, which was mention early in this section, was used to accept boosted cascades with easy haar features in boosting-based recognition. The Viola-Jones detector model was then used to build a Multiview point face mask detector. In addition, decision tree innovation were used to build a face mask detector model. This category's face mask detectors were excellent at detecting masks. Another study employs deep learning approach to behold facial recognition and determine whether or not an individual is wearing a facemask. The dataset collected includes 25,000 images with a resolution of 224x224 pixels, and the capable model achieve with a 96 percent precise rate. However, the test data, as well as for performing practical applications in a much more straightforward manner. This necessitates a variety of deep learning innovation that can read faces and masks direct from the user's data. Face Mask detection templates come in a different type of shapes and sizes. These can be classified into many groups. However, the test precise was also lower in this case. Although it was put into practice in real life, it could be improved.

III. METHODOLOGY

Convolutional Neural Networks (CNN)

Our system makes use of Convolutional Neural Networks (CNN) to classification images as having a mask or not. A Convolutional Neural Network is a deep learning algorithm which takes an image as the input. It then maps the various aspects of the image to weights and biases, hence, they become different from each other. The reason we chose CNN for classification over other classification models is because the amount of preprocessing required for CNN is much less. We have propose a model that uses MobileNetV2 for image processing. It is a CNN that is 53 layers deep learning. It can classify images into 1000 categories. It uses depth-wise separable convolutions which constitute as the building blocks. It is the state-of-the-art network for mobile visual recognition which includes classification, object

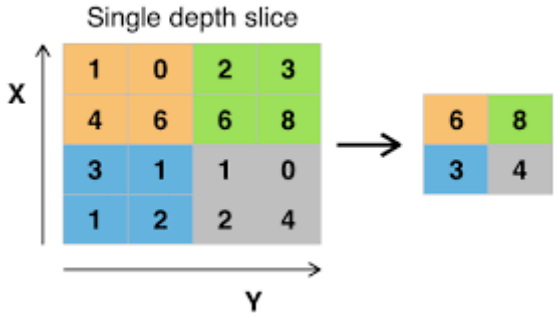
Detection and semantic segmentation. MobileNetV2 is launched as a section of TensorFlow-Slim Image Classification Library.



Pooling

The pooling layer is used to reduce the spatial dimensions of our activation tensor, but not volume depth, in a CNN. They are nonconstant way of doing this, meaning that the pooling layer has no weights in it. Because the following is what you gain from using pooling.Cheap way of summarized spatially related information in an input tensor. By having less dimensional. Information you gain arithmetic performance. You get some translation unchanging in your network However one of the big advantages of pooling that it has no parameters to learn is also its biggest disadvantage because pooling can end up just throwing important information away. After the output pooling is starting to be used less frequently in CNNs now.

We show the most common type of pooling the max-pooling layer used for face mask detection. It slides a window like a normal convolution and then at each location sets the biggest value in the windows as the input.



Fully connected

The layers of neurons that make up the ANNs that we saw earlier are commonly called densely connected layers, or fully connected layers or simply just linear layers. Some deep learning libraries such as cafe would actually consider them just as the dot product operation that might or might not be followed by a nonlinearity layer. Its main parameter will be the output size, which will be basically the number of dendrite in its output.

We created our own dense layer, but you can create it in an accessible way using it layers ,as follow

Dense_layer=tf.layers.dense(inputs=some_input_name,units=1024,activation=tf.nn.relu)

Here we define a fully connected layer with 1024 output, and t will be followed by Relu activation.

It is important to note that the input of this layer has to have just two dimensions so if your input is a dimensional tensor for example an image of shape [28*28*3] you will have to reshape into a vector before inputting it.

reshape_input_to_dense_layer = tf.reshape (spatial_tensor_in, [-1, 28*283])

IV. Conclusion:

In this paper, we propose an approach that uses CNN and MobileNet V2 architecture to help maintain a secure environment and ensure individuals protection by automatically monitoring public location to avoid the unfold of the COVID-19 virus and assist police by minimizing their physical surveillance work in circumscription zones and public areas where surveillance is required by means of camera feeds with cnn in real-time. Thus, this propose system will operate in an efficient manner in the current situation when the lockout is eased and helps to track public places easily in an automated manner.

We have addressed in depth the identification of face masks that help to ensure human health. The implementation of this solution was successfully tested in real-time by deploying model in cnn. The solution has the potential to significantly decrease violations by real-time interpose, so the proposed system would improve public safety through saving time and helping to reduce the spread of coronavirus. This solution can be used in location like temples, shopping complex, metro stations, airports, etc.

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