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Analysis on Face Mask Detection

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Abstract: The Outbreak of the Covid-19 Pandemic had witnessed a worldwide crisis. It had already hit the second wave and is on verge of the third wave. Since then it has become a necessity and primary responsibility for every individual to follow government laid rules. One of the most effective solutions is wearing "Face Masks". In this paper, the detailed analysis and complete implementation of the face mask detector are presented. This detector uses the MobileNetV2 model and determines whether a person Is wearing a mask or not. Our work is based on Deep learning, TensorFlow, Keras, and OpenCV. MobilenetV2 architecture as a framework that is also accessible by embedded systems.

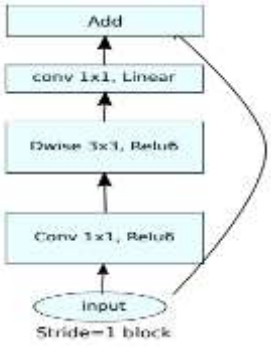
Keywords: Deep Neural Network, MobileNetV2, Covid-19.

I. INTRODUCTION

The covid-19 pandemic has created drastic changes in the world and the number of active cases death rate has also been increasing at an exponential level. The economic status of countries is degrading daily. Governments have been taking measures to save lives as well the economic state of countries. It originally started in Wuhan, China. Though it is treatable it may sometimes leave with some long-term effects on respiratory systems and kidneys. Medical practitioners and health organizations around the world have come up with vaccine but still there exists side effects and providing of vaccines to every corner of the world. It is a proven fact that the droplets can cause the spread of the covid- 19 virus. To overcome these problems every individual should compulsorily follow rules by the World Health Organization (WHO) of Social Distancing and wear masks at all times. Mask Detection has become a crucial role in image processing and it is difficult since the variations in the face have made it a tedious task to recognize and detect various elements in the face and process them with accurate results. Various algorithms and techniques have been developed and tested. Some have proven useful while some resulted from inaccurate predictions. One of the main reasons for inefficiency is the noise present in data. In this proposed system we have preprocessed the dataset of images before classifying the dataset. The dataset goes through the cleaning process and then the dataset is trained. The processed image is passed through various layers of MobileNetV2 architecture and the data is classified into two categories of with mask and without the mask. Deep Learning, Open CV, TensorFlow, Kerus, and Convolutional Neural Network (CNN) are used. The detailed methodology is explained further.

II. METHOLOGY AND IMPLEMENTATION

Our system is based on a convolutional neural network and takes an image as an input. the main advantage of using a convolutional neural network is that preprocessing is much less. CNN is a deep learning algorithm that is used to classify images as a person wearing a mask or not. the input images are differentiated on various aspects related to face images. Mobilenetv2 model is used since its 53 layers deep and can also classify images into 1000 categories. The model's ability to involve low-level to high-level concepts is encapsulated by the inner layers and the encoding of the input and output is done by the bottleneck layers.



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The layers used in this model are:
Convolutional: This layer extracts the features of the images provided.
AveragePooling2D:
In this layer, the features of the patch are down sampled to the average value.
Flatten: One single column is given as output by transforming the entire feature pooled map matrix
Dense: The previous layer outputs are put into neurons and each neuron creates a corresponding output.
Dropout: Then this layer is used to avoid overfitting and get set the input value to 0 on a random basis.
Implementation:
In this model, we mainly focus on detecting images and determine if the person in the image is wearing a mask. Some standard libraries are added to this model like TensorFlow, NumPy, Opencv which help us in the preprocessing of the image.
The phases to build the required model are:
Preprocessing the images.
Training and Testing of the provided dataset.
Classifying the images based on the input given in real-time.
The dataset is obtained from Kaggle where there are 600 images with mask and 600 images without a mask.
The images provided are resized using augmentation with a pixel value of 224*224 and they are down sampled.
These images with the fixed resolution are then converted into the array with NumPy.
This data is then fed o the mobilenetv2 model. the data is divided into 70% of training data and 30% testing data.
Mobilenetv2 model converts the images into system readable values and the values are trained and tested.

III. RESULTS AND DICUSSION

After the successful training of the model then we can apply the trained model for detection of face mask from manual input of images and the dynamic input from a live camera, CCTV, drone, etc . we get the output as follows :-

With image input
To get the output of face mask detection using images we can provide images as input then we get the desired result of the code : The following is a random image we have given as input and get the result that no one is wearing a mask which detected very accurately.

Fig.1 image without a mask

The following image with a mask is given as input then we got the result as follows with accuracy

Fig.2 image with a mask

With Video stream

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With the live stream we get the following output: The following images from the live stream where the user is not wearing a mask and detects that the user is not wearing a mask.

Fig.3 without a mask

The following image from the live stream where the user is wearing a mask and giving output by detecting the mask on the face successfully.

Fig.4 with mask

IV. CONCLUSION AND FUTURE WORK

As proposed the techniques used for preprocessing and classification of the dataset and predicting the categories of people as with mask and without mask using Deep Learning, TensorFlow has been implemented successfully. Deep learning techniques used for image processing and MobileNetV2 for classification can be challenging for future real-time problems. To improve the model further actual images of wearing masks and multiple facial recognizing systems can be developed. Facial recognition and detection of specific parts of the face or facial landmarks can be applications of this model. The current covid-19 pandemic can be handled well with the face mask detection installed on CCTV around the city across malls, colleges, and similar other public places.

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