DETECTING WHETHER THE PERSON IS WEARING MASKS OR NOT

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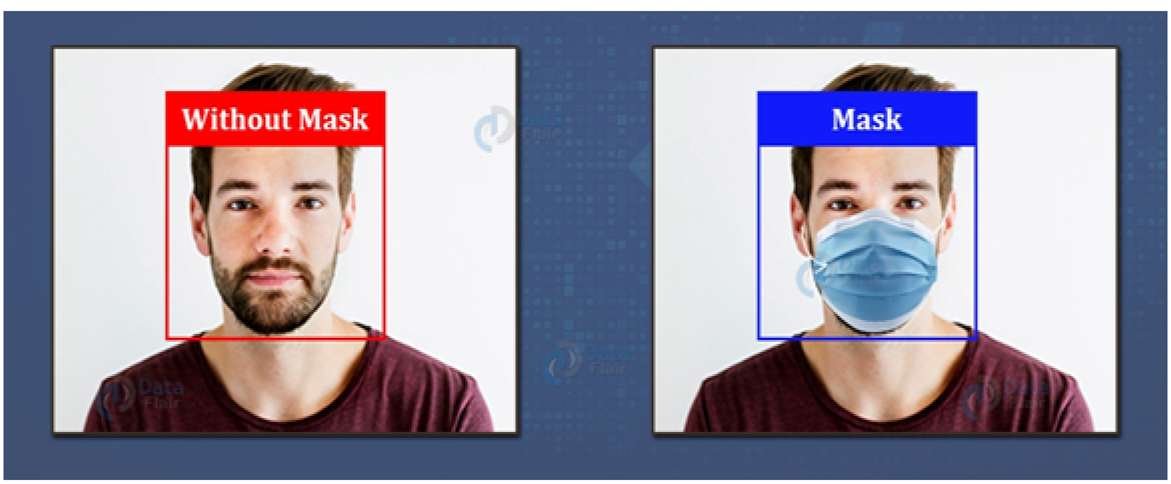
Abstract - Changes in the lifestyle of everyone around the world. In those changes wearing a mask has been very vital to every individual. Detection of people who are not wearing masks is a very big challenge .This project can be used in schools, hospitals, banks, airports, etc. as a digitalized scanning tool. The technique of detecting people's faces and segregating them into two classes namely the people with masks and people without masks is done with the help of image processing and machine learning. With the help of this project, we can detect whether a person is wearing masks or not.

1.INTRODUCTION

Face mask detection means to identify whether a person is wearing a mask or not. The first step to recognize the presence of a mask on the face is to detect the face, which makes the strategy divided into two parts: to detect faces and to detect masks on those faces.

In this project, we will be developing a face mask detector that is able to distinguish between faces with masks and faces with no masks. In this report, we have proposed a detector which employs a neural network to detect presence of a face mask.



Here, we are going to use CNN (Convolutional Neural Network) which is designed to process data through multiple layers of arrays. This type of neural network is used in applications like image recognition of face recognition. The primary difference between

CNN and other ordinary neural networks is that CNN takes input as a two dimensional array and operates directly on the images rather than focusing on feature extraction which other neural networks focus on. The dominant approach of CNN includes solutions for problems of recognition.
A convolutional neural network uses three basic ideas:
• Local respective fields
• Convolution
• Polling

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2. METHODOLOGY

2.1 Data Collection

The dataset which we have used consists of 1376 total images out of which 690 are of masked faces which are labeled as 0 and 686 are of unmasked faces which are labeled as 1. All the images are actual images extracted from "self-built-masked-face-recognition-dataset" dataset.

We need to split our dataset into three parts: training dataset, test dataset and validation dataset. The purpose of splitting data is to avoid overfitting which is paying attention to minor details/noise which is not necessary and only optimizes the training dataset accuracy. We need a model that performs well on a dataset that it has never seen (test data), which is called generalization. The training set is the actual subset of the dataset that we use to train the model. The model observes and learns from this data and then optimizes its parameters. The validation dataset is used to select hyper-parameters (learning rate, regularization parameters). When the model is performing well enough on our validation dataset, we can stop learning using a training dataset. The test set is the remaining subset of data used to provide an unbiased evaluation of a final model fit on the training dataset.

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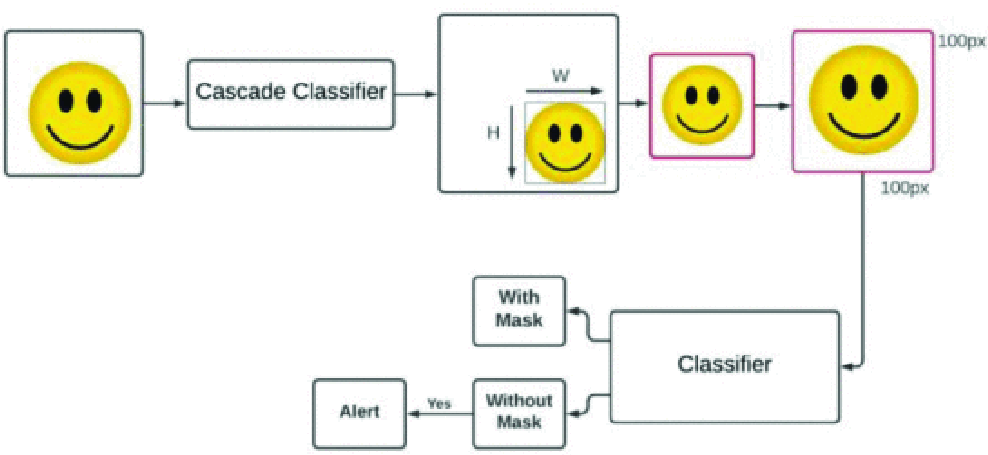
2.2 Pipeline

1 . **Data preprocessing**

First we converted all the images into grayscale and resize it into 100*100 pixels since we need a fixed common size for all the images in the dataset . Then we made two arrays named data and target , we stored all the images in the data array and their labels in the target array.

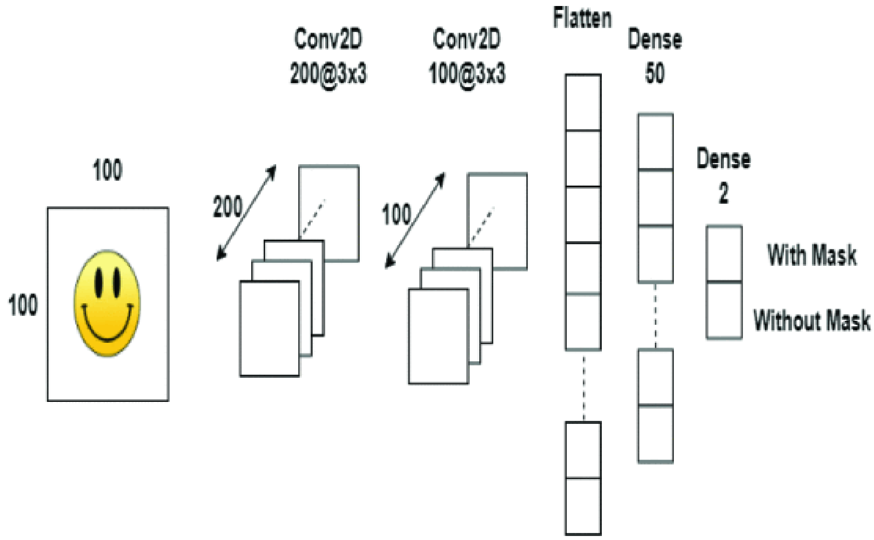


2. **Splitting the Dataset into train and test dataset.**

Split the following dataset using model selection into train_x, train_y, test_x and test_y in 90% and 10% ratio which are further used in classification.

```
train_x,test_x,train_y,test_y=train_test_split(data,target,test_size=0.1)
```

3. **Creating the Convolutional Neural network**



Here first we initialized a sequential model . Then we use two sequence convolutional layers followed by Relu and max pooling layer. Then we added a dropout layer to avoid overfitting , and after that we used two dense layers which finally gives two neurons as output.

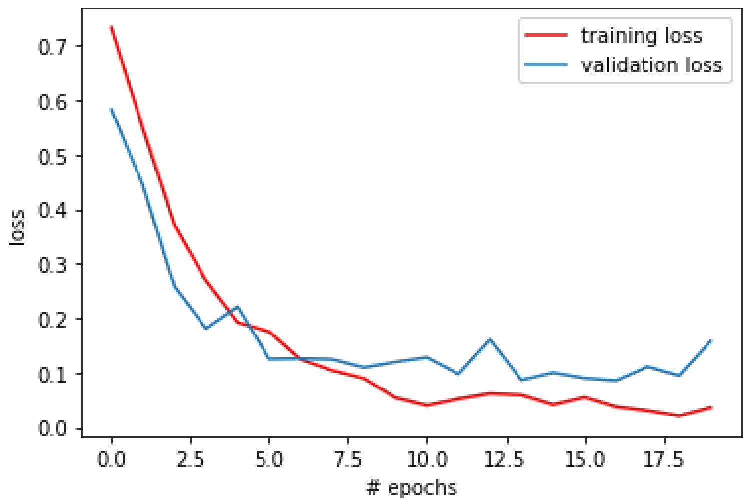
A densely connected layer provides learning features from all the combinations of the features of the previous layer . Dropouts layers are used for regularization that is used to prevent overfitting in the model. Dropouts are added to randomly switching some percentage of neurons of the network. This is done to enhance the learning of the model.

```
990/990 [==============================] - 93s 94ms/step - loss: 0.3708 - accuracy: 0.8354 - val_loss: 0.2568 - val_accuracy: 0.9032
Epoch 4/20
990/990 [==============================] - 95s 96ms/step - loss: 0.2679 - accuracy: 0.8970 - val_loss: 0.1807 - val_accuracy: 0.9476
Epoch 5/20
990/990 [==============================] - 93s 94ms/step - loss: 0.1917 - accuracy: 0.9303 - val_loss: 0.2207 - val_accuracy: 0.9315
Epoch 6/20
990/990 [==============================] - 93s 94ms/step - loss: 0.1749 - accuracy: 0.9343 - val_loss: 0.1249 - val_accuracy: 0.9597
Epoch 7/20
990/990 [==============================] - 95s 96ms/step - loss: 0.1238 - accuracy: 0.9576 - val_loss: 0.1258 - val_accuracy: 0.9637
Epoch 8/20
990/990 [==============================] - 94s 95ms/step - loss: 0.1037 - accuracy: 0.9616 - val_loss: 0.1243 - val_accuracy: 0.9516
Epoch 9/20
990/990 [==============================] - 94s 95ms/step - loss: 0.0893 - accuracy: 0.9687 - val_loss: 0.1095 - val_accuracy: 0.9556
Epoch 10/20
990/990 [==============================] - 94s 95ms/step - loss: 0.0540 - accuracy: 0.9828 - val_loss: 0.1193 - val_accuracy: 0.9597
Epoch 11/20
990/990 [==============================] - 92s 93ms/step - loss: 0.0399 - accuracy: 0.9899 - val_loss: 0.1278 - val_accuracy: 0.9677
Epoch 12/20
990/990 [==============================] - 93s 94ms/step - loss: 0.0518 - accuracy: 0.9818 - val_loss: 0.0974 - val_accuracy: 0.9718
Epoch 13/20
990/990 [==============================] - 96s 97ms/step - loss: 0.0615 - accuracy: 0.9778 - val_loss: 0.1604 - val_accuracy: 0.9274
Epoch 14/20
990/990 [==============================] - 97s 98ms/step - loss: 0.0589 - accuracy: 0.9828 - val_loss: 0.0863 - val_accuracy: 0.9597
Epoch 15/20
990/990 [==============================] - 94s 95ms/step - loss: 0.0411 - accuracy: 0.9808 - val_loss: 0.0998 - val_accuracy: 0.9677
Epoch 16/20
990/990 [==============================] - 81s 82ms/step - loss: 0.0547 - accuracy: 0.9747 - val_loss: 0.0899 - val_accuracy: 0.9556
Epoch 17/20
990/990 [==============================] - 79s 80ms/step - loss: 0.0372 - accuracy: 0.9889 - val_loss: 0.0855 - val_accuracy: 0.9637
Epoch 18/20
990/990 [==============================] - 78s 79ms/step - loss: 0.0301 - accuracy: 0.9879 - val_loss: 0.1107 - val_accuracy: 0.9556
Epoch 19/20
990/990 [==============================] - 89s 90ms/step - loss: 0.0206 - accuracy: 0.9919 - val_loss: 0.0947 - val_accuracy: 0.9677
Epoch 20/20
990/990 [==============================] - 94s 95ms/step - loss: 0.0358 - accuracy: 0.9899 - val_loss: 0.1575 - val_accuracy: 0.9476
```

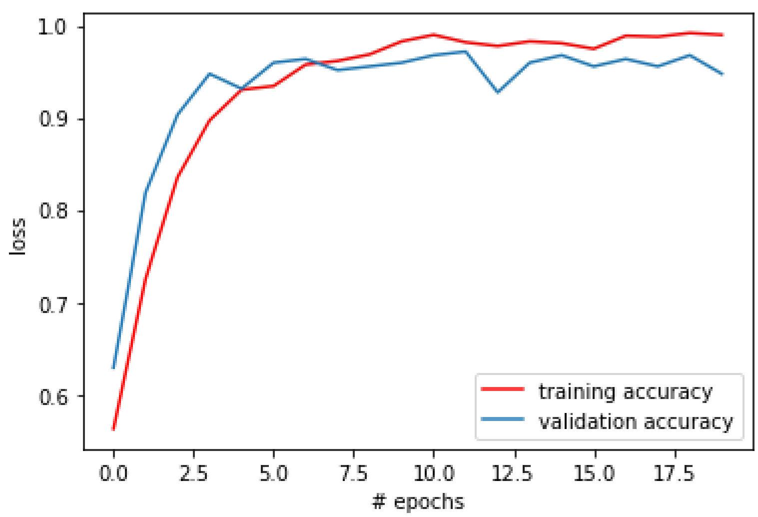
Then we used Adam optimizer and categorical cross entropy to fit the model. After which the accuracy came out to be 96.3%.

Conclusion :

Training Loss curve of face mask detection dataset



Training accuracy curve of face mask detection dataset



As the technology is blooming with emerging trends the availability of new face mask detectors which can possibly contribute to the public health care department. The architecture consists of CNN classifier and ADAM optimizer as the backbone it can be used for high and low computation scenarios. Our face mask detection is trained on CNN models and we use TensorFlow, Keras and python to detect whether a person is wearing a mask or not . The accuracy of the model is achieved and the optimization of the model is a continuous process. This specific model could be used as a use case of edge analytics. Here the accuracy came out to be 96.3%

Contribution :

Yogesh Nema (B19EE092) - image and data preprocessing .

Utkarsh singh (B19EE102) - training the model

Report and other work done together.