

# MASKED FACE RECOGNITION MODEL

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# INTRODUCTION

- In recent years, face recognition technology has made great breakthroughs in both theoretical progress and practical applications.
- However, the recognition problem of occluded face images, such as mask, hairstyle, sunglasses, and hat occlusions, often appears in the process of face processing. These occlusions greatly interfere with the correct recognition of human faces.
- We have proposed a model which can recognize human faces even with mask on.

# MOTIVATION

- Last year, as people began to increasingly wear masks around the world, the prevailing view was it represented a huge challenge to facial recognition. It seemed obvious - algorithms designed to analyse faces would be less accurate if part of the face was concealed. So there was a need for a model which can recognize human face with even a mask on.
- During the pandemic period of COVID-19, wearing a mask to take delivery is a common application scenario, which makes the implementation of a masked face recognition algorithm greatly significant.

# DESCRIPTION OF EXISTING METHODS

Various research is still going on this field to improve the accuracy of masked face recognition. We have studied a few research works, the description of methods used in them is given below:

1. Masked face recognition with latent part detection: This paper collected two datasets for masked face recognition MFV and MFI. It proposed a latent part detection method to extract discriminative facial features which in turn is fed to a CNN model for facial recognition.
2. Implementation of principal component analysis on masked and non-masked facial recognition: This paper proposed PCA for masked and non-masked face recognition. ORL face dataset was used for this purpose.

3. MFCosface: A Masked-Face Recognition Algorithm Based on Large Margin Cosine Loss :In this research, A high-recognition-accuracy masked-face recognition algorithm was proposed by the author. They employed the recognition of essential facial traits to cover face photos with common mask templates to build related datasets to address the problem of insufficient masked-face images. They introduced an attention method to make the model focus on effective regions to extract more relevant feature information because the mask eliminates some of the face feature information.

4.Efficient Masked Face Recognition Method During Thecovid-19 Pandemic:To address the problem of masked face recognition,A reliable technique based on discard masked region and deep learning-based features was proposed in this study. Removal of The masked facial region was done at beginning and then the best characteristics from the collected regions are extracted using pre-trained deep Convolutional neural networks (CNN) (mostly eyes and forehead regions).

Finally, the Bag-of-features paradigm is used to map the features of the final convolutional layer in order to quantize them and to obtain a small representation when compared to the fully connected layer of a traditional CNN. Finally, the classification process is carried out using Multilayer Perceptron (MLP). The Real-World-Masked-Face-Dataset results reveal a high level of recognition performance using the suggested techniques.

5. Cropping and attention based approach for masked face recognition: Two ways were suggested in this study to address the mentioned issues: An attention-based approach and a cropping-based approach. In an attention-based method, the CBAM attention module is used to focus on the area around the eyes, which outperforms the other attention modules on masked face recognition. The integration of the optimal cropping and CBAM module achieves the best recognition accuracy for Masked Face Recognition.

# SUMMARY OF PROPOSED PLAN

- The proposed model makes use of convolutional neural network for masked face recognition.
- In our model we are making use of CNN ResNet34 architecture to solve the problem of masked face recognition. Deeper neural networks are more difficult to train so we have proposed a residual learning framework to build our model .

# DESCRIPTION OF DATASET

- There are two closely related applications of face masks, one is face mask detection and the other one is face mask recognition. Face mask detection task needs to detect the face, whether a person is wearing a mask or not. On the other side, Face mask recognition task needs to detect a mask and then to recognize the person.
- The dataset consists of multiple images of different celebrities. There are 8 classes in our dataset and the images are separated into different folder according to their class names. Each person has about 100 images.



# EXPERIMENTAL SETUP

- To build this project we require a system that has python3 installed. Since we were working in a group google collaboratory will be used.
- Different python libraries such as fastai, matplotlib, opencv, pandas, numpy etc have been used in the implementation.

# METHODOLOGY

The proposed model consists of the following steps:

- Dataset preparation
- Data preprocessing
- Face recognition

# DATASET PREPARATION

To make our dataset to be used for masked face recognition we will first add masks to the images of the people present in the dataset and put them under their respective class folder. To perform this task we will be making use of openCV inbuilt models. Thus we will have a dataset of specific persons wearing and not wearing masks, we will use this newly created dataset in further model formulation.

# DATA PREPROCESSING

Pre-processing splits our base dataset into training and testing sets. We have splitted our dataset in the ratio of 80:20.

Data Augmentation is performed using the library provided in fastai. Neural networks require a large amount of data to train properly, data augmentation creates new images from the base dataset and thus also prevents the model from the problem of overfitting. The data augmentation techniques we have used in our model are flipping, rotating vertically, brightness and contrast

# FACE RECOGNITION

This is the phase in which we train our model so that it can recognize persons even with mask on. To train our model we will be using CNN ResNet34 architecture. ResNet34 is a 34 layer convolutional neural network which can be used as a state of the art for image classification problem. We are using fastai pretrained model to solve our recognition problem. This model has been pre-trained on around 100,000+ images and across 200 classes. The preprocessed dataset is loaded and trained using this model for about 6 to 7 epochs. 1 cycle policy is used for finding learning rate.

## Step 1

First the dataset is prepared. Masks are added to images and this is appended to the base dataset. Then data augmentation is performed. Dataset is then splitted into train and test set in the ratio of 80:20.

## Step 2

Now that we have the suitable dataset our first step will be to crop face from the images. This is done using openCV pretrained models. After this we train our RESNET34 model on our train set for about 6 to 7 epochs.

## Step 3

Now that we have trained our model it's time to test our model. The model is then tested using the test set and confusion matrix is built to analyze the model's performance.

## Step 4

Now that we have trained and tested our model, we will provide custom input images to the model to evaluate its performance. The custom input image is first resized and normalized and then fed into the model.

## Step 5

The model returns the name of the person whose image is provided to it in step 4.

# IMPLEMENTATION STEPS

# RESULTS

- After fitting our model we have analyzed the performance of our model. Our model achieved an accuracy of about 77% . Our model successfully recognize the person when we input an image of them wearing masks. We have also plotted the training vs validation loss to check whether our model is trained properly or not. To understand our model's performance we have plotted a confusion matrix.
- For example let us say if we provide the image below as input our model will return Donald Trump.



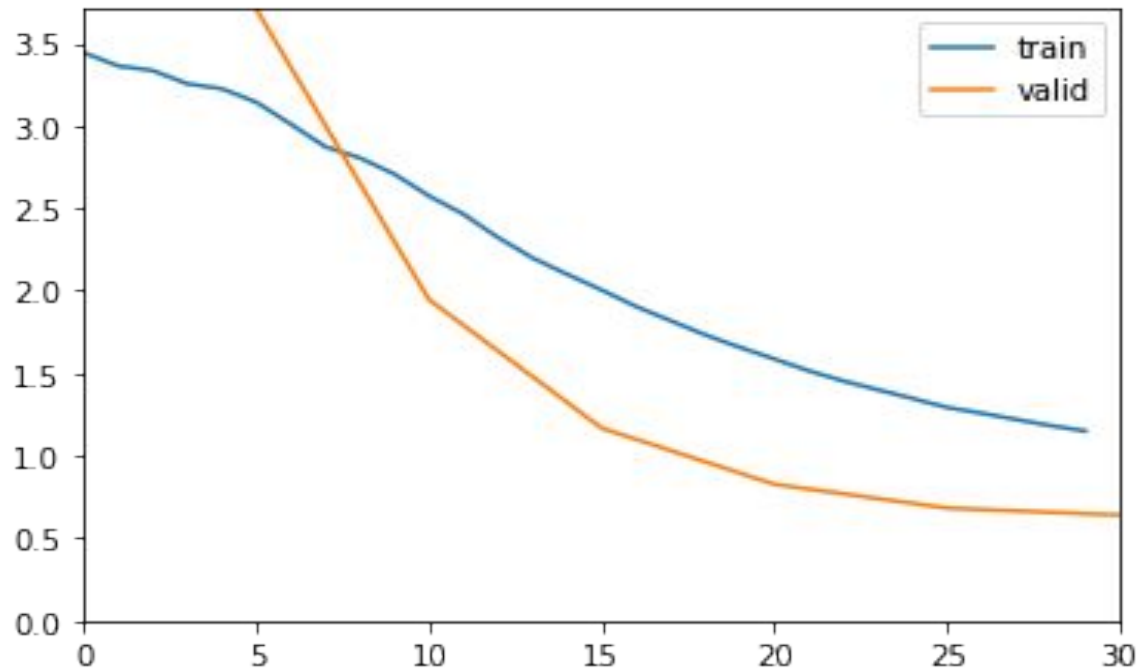


Fig. Train vs Text loss graph



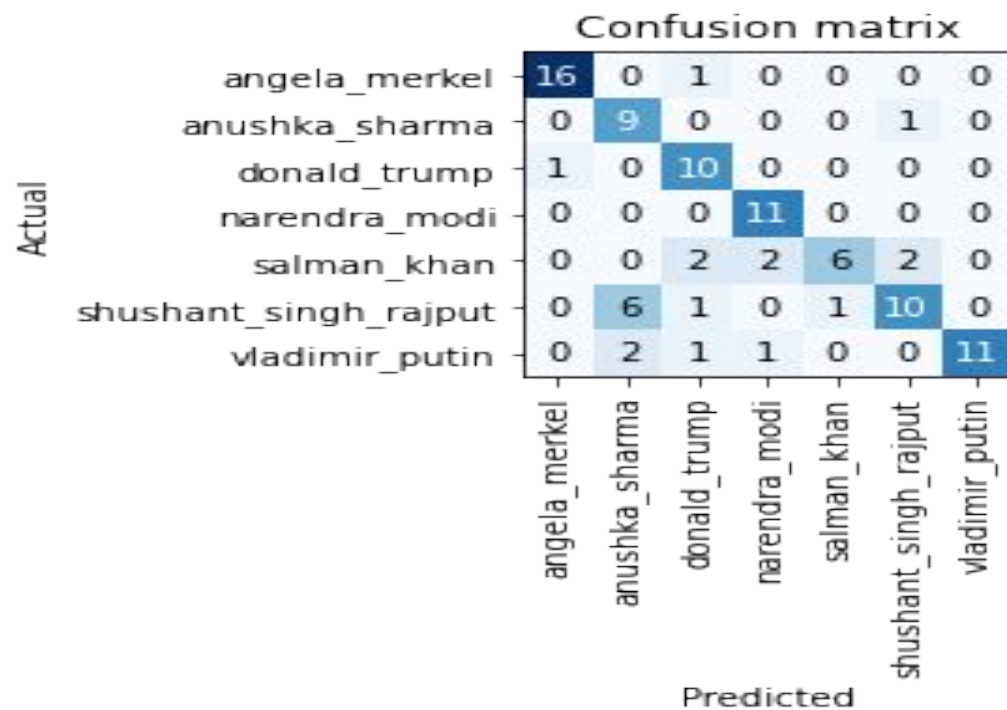


Fig. Confusion matrix

# DESCRIPTION OF CODE AVAILABILITY

- Codes are available for masked face detection on the internet. Various codes available uses opencv ,computer vision and deep learning concepts for masked face detection.
- Some of the examples of available codes on internet is given below:
  1. [https://github.com/Garvit-32/Face-recognition-in-presence-of-Mask/blob/master/.ipynb\\_checkpoints/Untitled-checkpoint.ipynb](https://github.com/Garvit-32/Face-recognition-in-presence-of-Mask/blob/master/.ipynb_checkpoints/Untitled-checkpoint.ipynb):The goal of this project is to match a face picture with no occlusion to a face image that has been masked.
  2. <https://github.com/broutonlab/face-id-with-medical-masks>:

It contains the source code for the face recognition with medical masks.In this they made augmentations that transformed the initial training dataset into persons wearing medical masks

# CONTRIBUTION OF THE GROUP

- We went through numerous research papers published on face recognition from 2016 to 2021. We studied about face recognition methodology from some research papers. We also gathered information how can we actually detect and recognize the masked face.
- We are supposed to train our model as such it gives us the higher accuracy than the existing methods. For this we are exploring various methods for training the model, for example CNN .

# CONTRIBUTION OF INDIVIDUAL MEMBERS

- Raushan Raj - Worked on methodology and dataset part of this project, for this he went through various research papers. Finally, he was able to propose the methodology for the same. He also collected the relevant dataset for this project and collaborated in implementing the code.
- Bindu - Done research on the work done previously on this topic and contributed in the ppt and in code.
- Ayushi Gupta- Done research on the work done previously on this topic ,helped in devising methodology and contributed in the ppt and code.
- Sanjana - Done research on the work done previously on this topic and searched for a relevant dataset and contributed in the ppt.

# LIMITATIONS OF PROPOSED WORK

The main challenges in masked face identification is as follows:

- There is no large scale training and test data with ground truth for masked face recognition.
- Collecting and annotating various masked faces is labour consuming.
- Since most of the facial features are occluded by mask ,it is necessary to learn representations which are both discriminative and robust to mask wearing.

QUESTIONS?



THANK YOU...