FACE MASK MONITORING AND NOTIFICATION SYSTEM USING COMPUTER VISION AND DEEP LEARNING

UNDER THE GUIDANCE OF

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PRESENTATION OUTLINE

- PROBLEM STATEMENT
- INTRODUCTION
- MOTIVATION
- LITERATURE SURVEY
- PROJECT FLOWCHART
- WORK OUTLINE
- CONCLUSION

PROBLEM STATEMENT

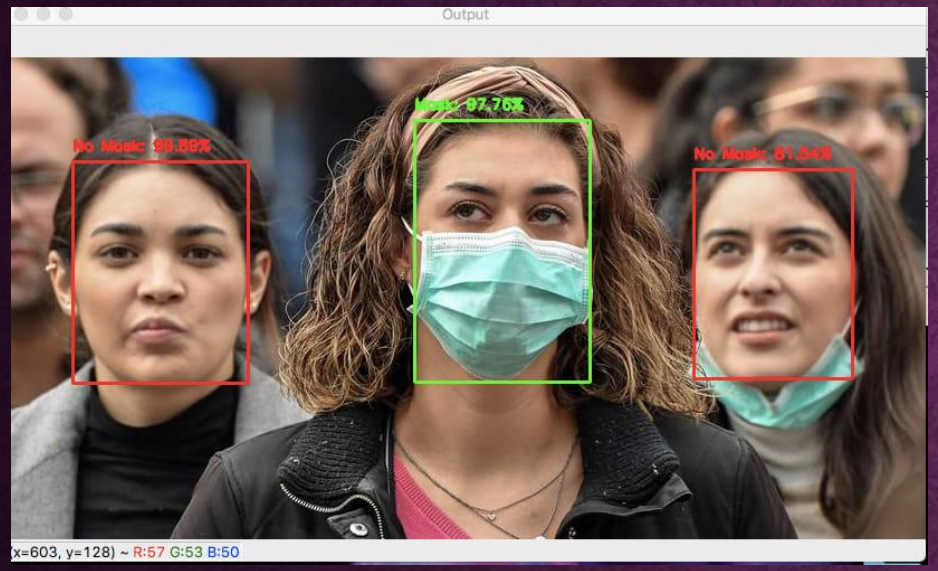
Model structure of face mask monitoring and notification system using computer vision and deep learning.

INTRODUCTION

The corona virus covid-19 pandemic is causing a global health crisis so the effective protection methods is wearing a face mask in public areas according to the world health organization (WHO). The covid-19 pandemic forced governments across the world to impose lockdowns to prevent virus transmissions. Reports indicate that wearing facemasks while at work clearly reduces the risk of transmission. We are using the dataset to build a face mask detector with the help of Computer Vision using python, OpenCV, Tensorflow and Keras. In our proposed system we will use live video stream and finally in output it marks the person who is not wearing face mask. Our aim is to find whether the person is wearing a face mask or not with the help of Computer Vision and Deep Learning. If the person is not wearing the mask then a SMS alert is sent to the person's mobile.[1]

MOTIVATION

We all know that because of the covid-19 in 2020 we have faced a lot of problems. So it's a need of the day that we must wear mask while going anywhere and also ensure that everybody wear mask. That's why these kind of algorithm have been developed with the passage of time and many researchers are also working on it such that in order to deploy these kind of deep learning architecture on the surveillance camera so that if anyone among the crowd is not wearing the mask so he/she can be identified.[2]


Output
No Mask: 99.89%
Mask: 97.76%
No Mask: 81.04%
(x=603, y=128) ~ R:57 G:53 B:50


No Mask
No Mask
No Mask
No Mask

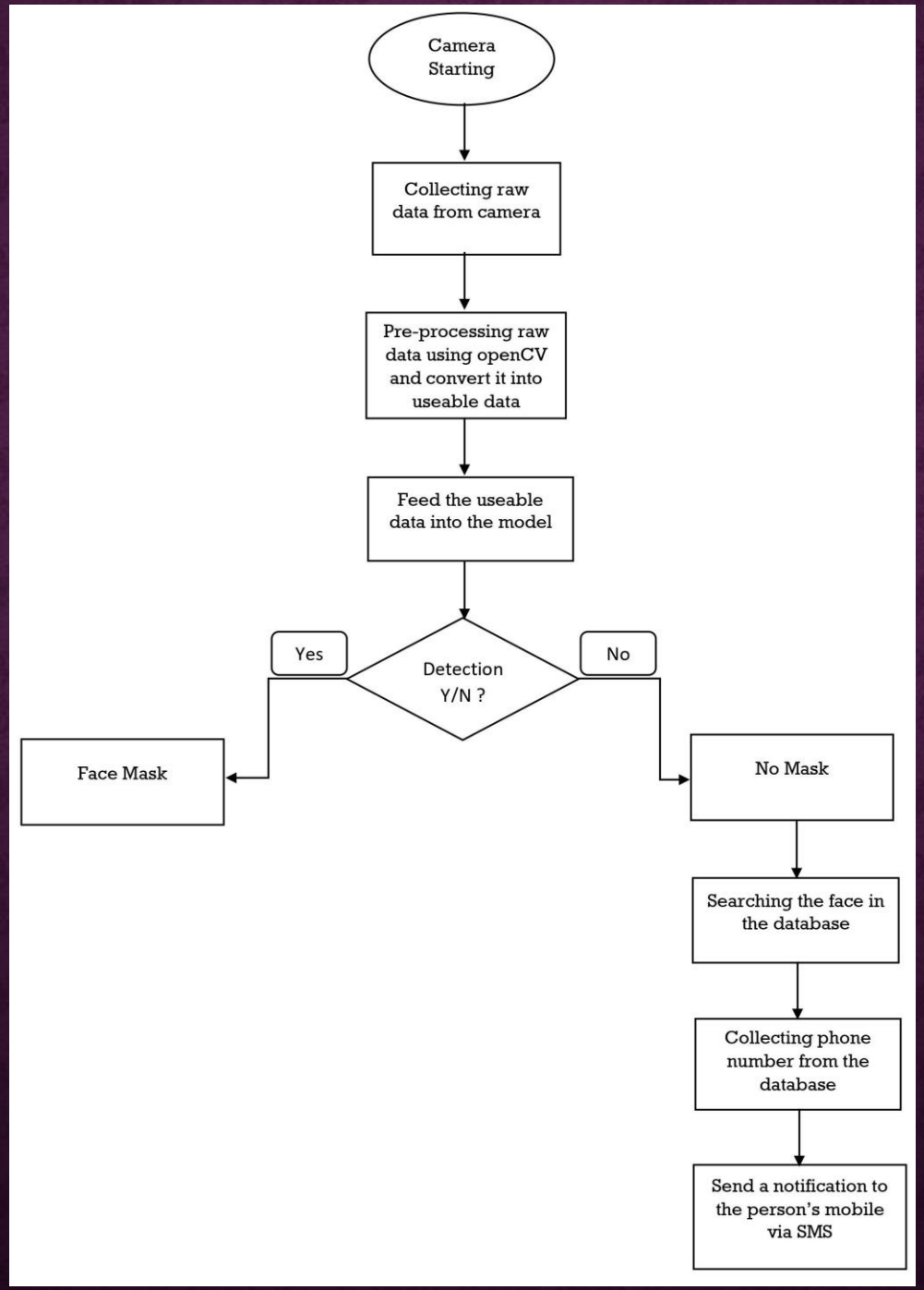

NO MASK
DETECTED
SPA

LITERATURE SURVEY

The Face Mask Detection Model is based on computer vision and deep learning. The model is integrated with deep learning and classical Neural Network Architectures using OpenCV, Tensorflow and Keras. We introduced a comparison between them to find the most suitable architecture that achieved the highest accuracy and consumed the least time in the process of training and detection.

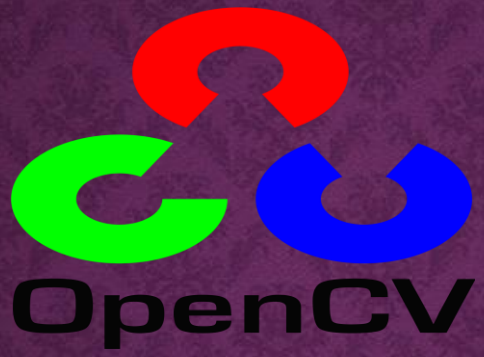
There are several approaches that are used for facial masks detection. For instance, [3] used electromagnetic and radiometry techniques for facial masks detection. [4] employed deep neural networks (ANN) using machine learning techniques in facial masks detection. [5] neural networks are used to exacted information from ultrasound to classify the abnormal lesions. [6] presented a face feature detection method based on ultrasound RF time series and SVM classifier. The characteristics curve of 0.86 using Support Vector Machine and 0.81using RF classification algorithm on 22 subjects was determined.

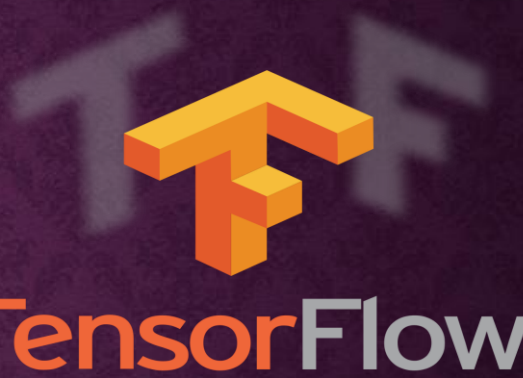
FLOWCHART OF THE PROJECT


Camera Starting
Collecting raw data from camera
Pre-processing raw data using openCV and convert it into useable data
Feed the useable data into the model
Detection Y/N ?
Yes
No
Face Mask
No Mask
Searching the face in the database
Collecting phone number from the database
Send a notification to the person's mobile via SMS

TECH TOOLS


python


OpenCV


TensorFlow


Google colab


IBM Cloud

WORK OUTLINE

1. IMAGE PROCESSING & DATA PREPARATION
2. MODEL MAKING : >> MODEL_0 (DENSE_NET ARCHITECTURE)

   >>MODEL_1 (MOBILE_NET ARCHITECTURE)

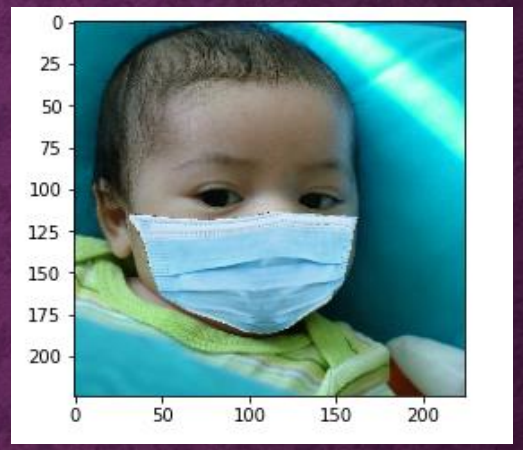
   >>MODEL_2 (RES_NET ARCHITECTURE)

   >>MODEL_3 (NAS_NET ARCHITECTURE)
3. MODEL PREDICTION

IMAGE PROCESSING & DATA PREPARATION

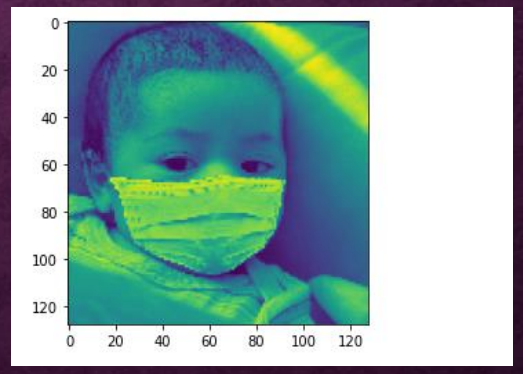
ORIGINAL IMAGE

IMAGE PIXEL SIZE = 1024 x 1024



MODIFIED IMAGE (RGB)

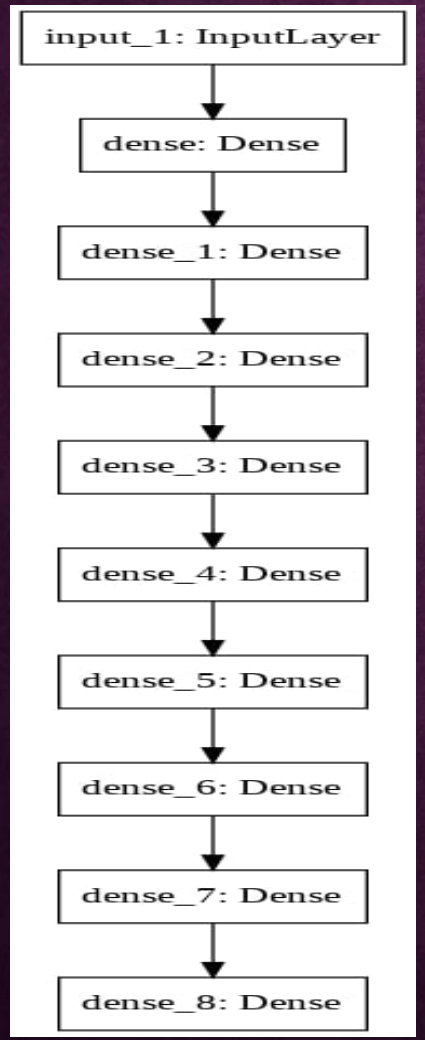
IMAGE PIXEL SIZE = 224 x 224



MODIFIED IMAGE (GRAY SCALE)

IMAGE PIXEL SIZE = 128 x 128

DENSE_NET ARCHITECTURE

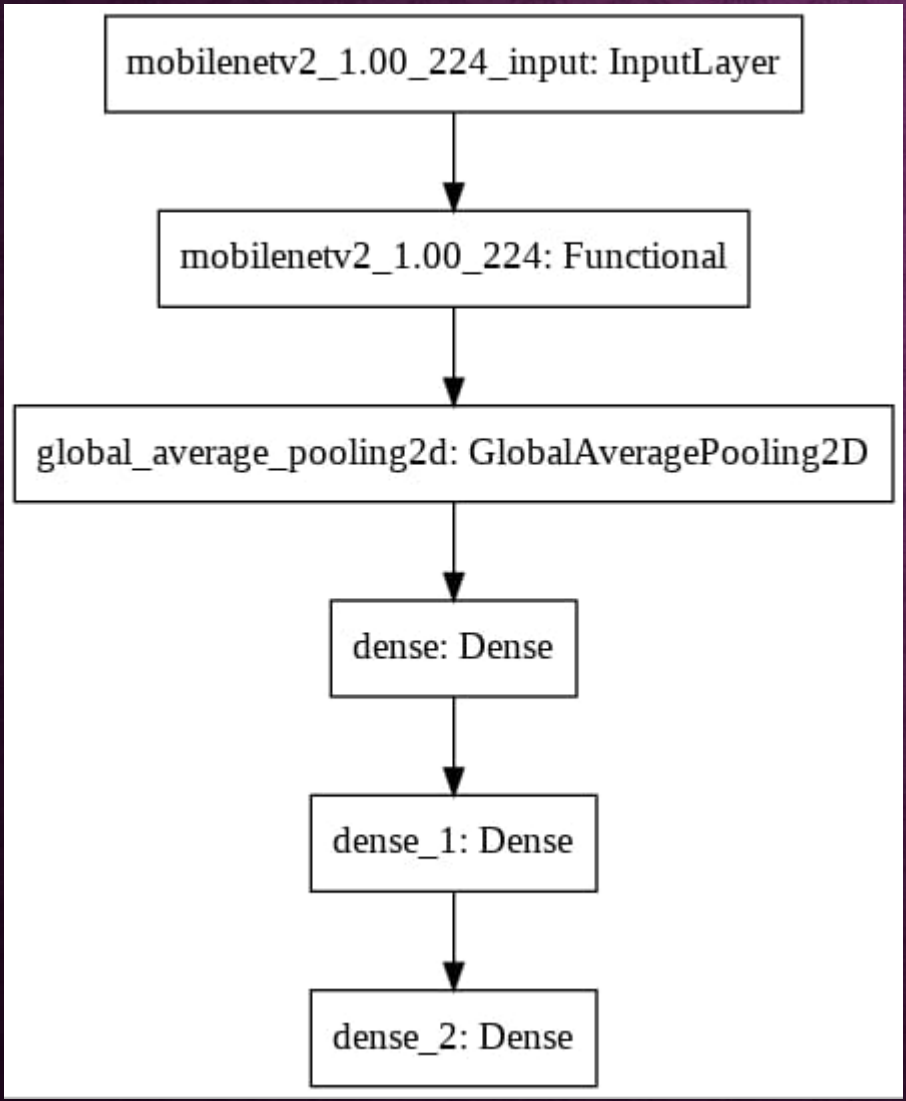


NAME – MODEL_0

A Dense Network is a network in which the number of links of each node is close to the maximal number of nodes. Each node is linked to almost all other nodes. The case in which one node is exactly connected to the other is called a completely connected network.[7]

TEST ACCURACY – 86%

MOBILE_NET ARCHITECTURE

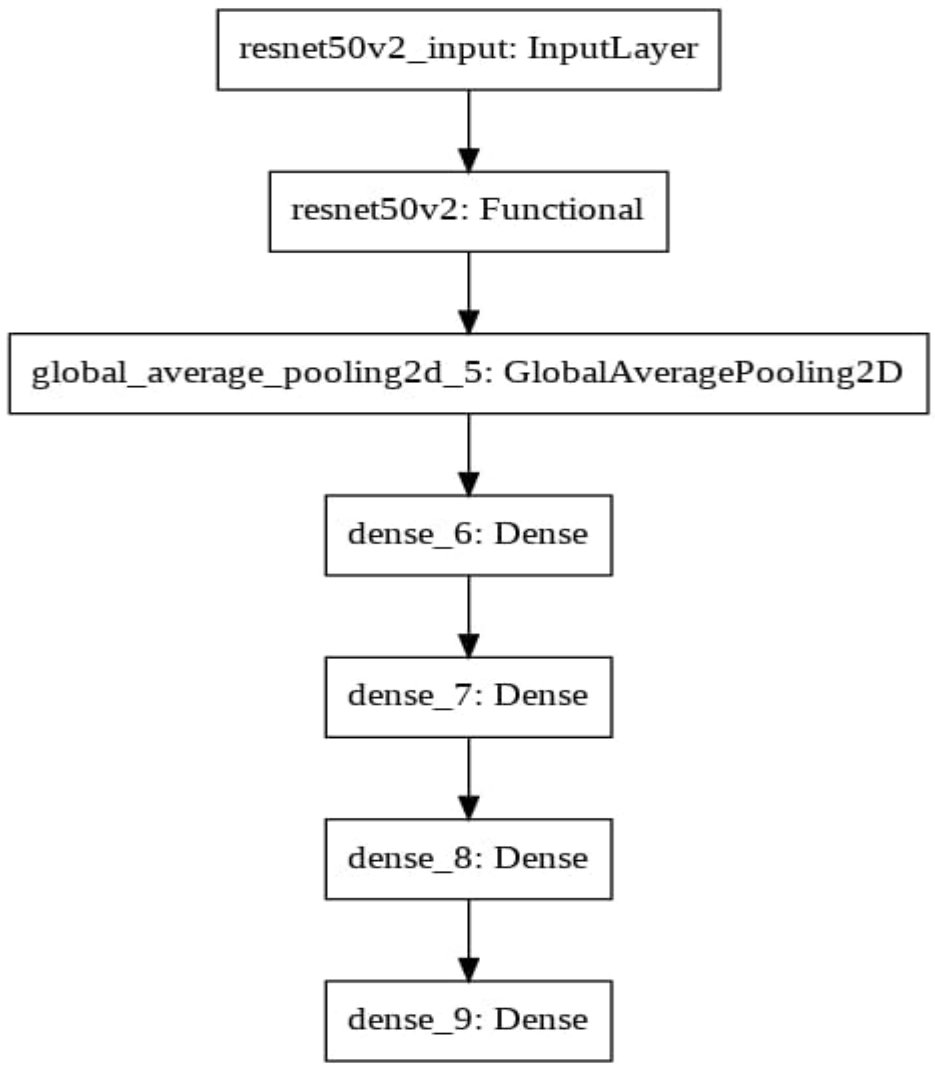


NAME – MODEL_1

The Mobile Net was proposed as a deep learning model by Andrew G. Howard of google research team in their research work entitled "Mobile Nets: efficient convolutional neural networks for mobile vision applications". The model has been proposed as the family of mobile-first computer vision models for Tensor flow which is designed to increase the accuracy while being mindful of the restricted resources for an on device or embedded application.[8]

TEST ACCURACY – 97%

RES_NET ARCHITECTURE

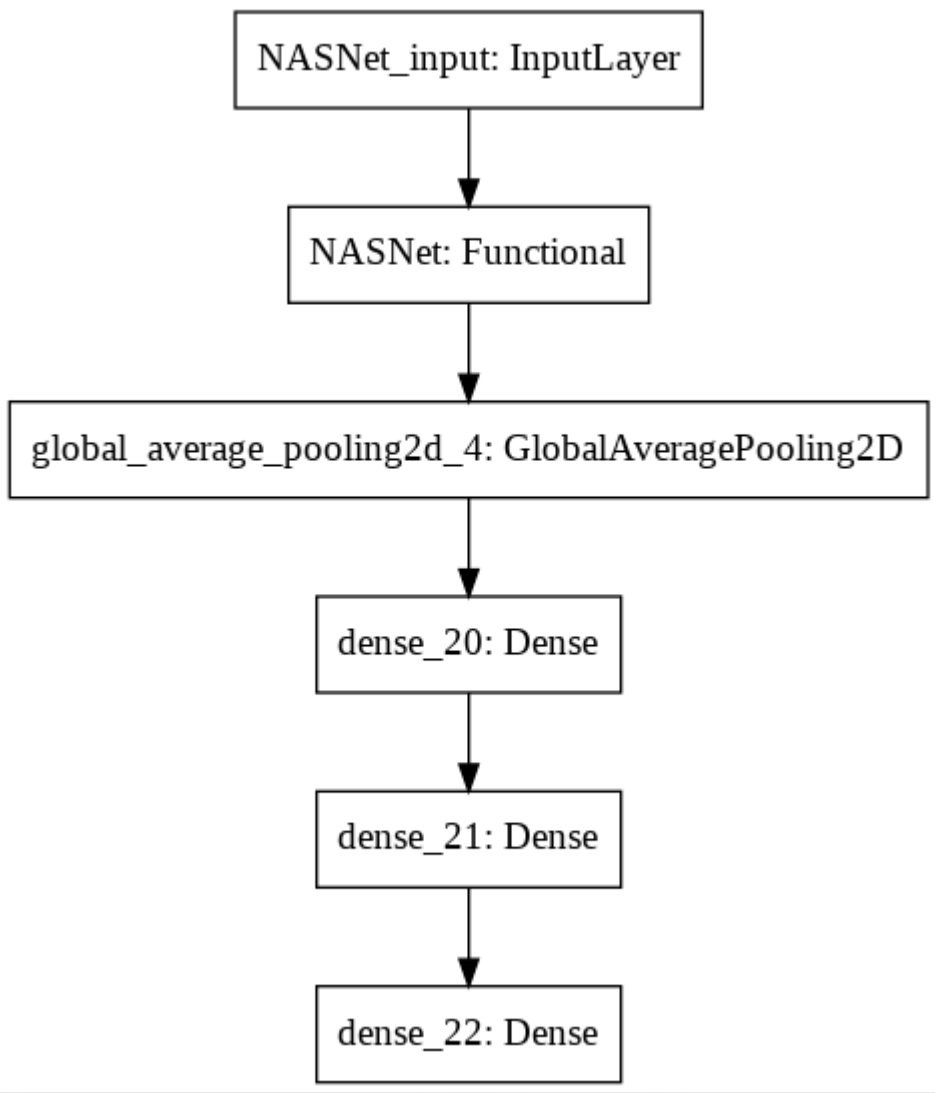


NAME – MODEL_2

A Residual Neural Network (Res Net) is an artificial neural network (ANN) of a kind that builds on constructs known from pyramidal cells in the cerebral cortex. This architecture work by utilizing skip connections or shortcuts to change or jump over layers.[9]

TEST ACCURACY – 99%

NAS_NET ARCHITECTURE

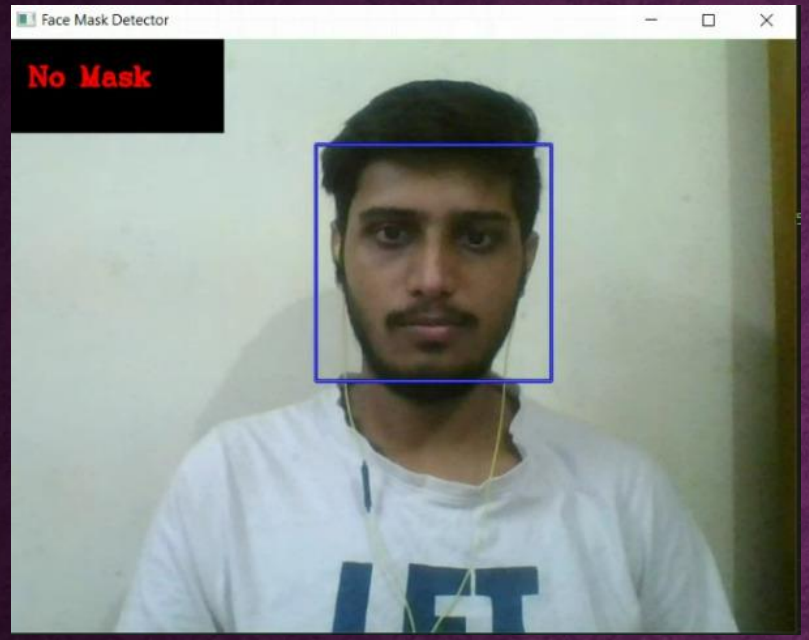


NAME – MODEL_3

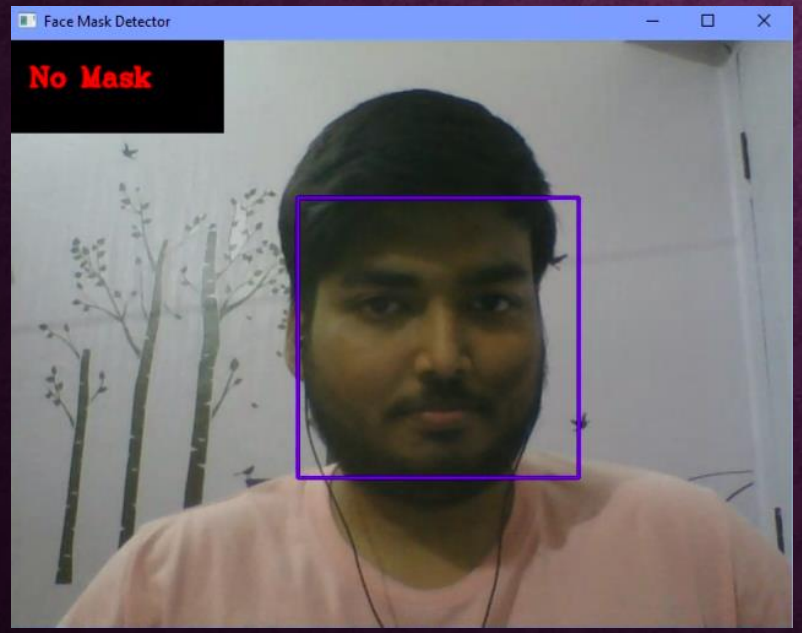
Neural architecture search (NAS) is a technique for automating the design of artificial neural networks (ANN), a widely used model in the field of machine learning. NAS has been used to design networks that are on par or outperform hand-designed architectures. Methods for NAS can be categorized according to the search space, search strategy and performance estimation strategy used: the search space defines the type(s) of ANN that can be designed and optimized. [10]

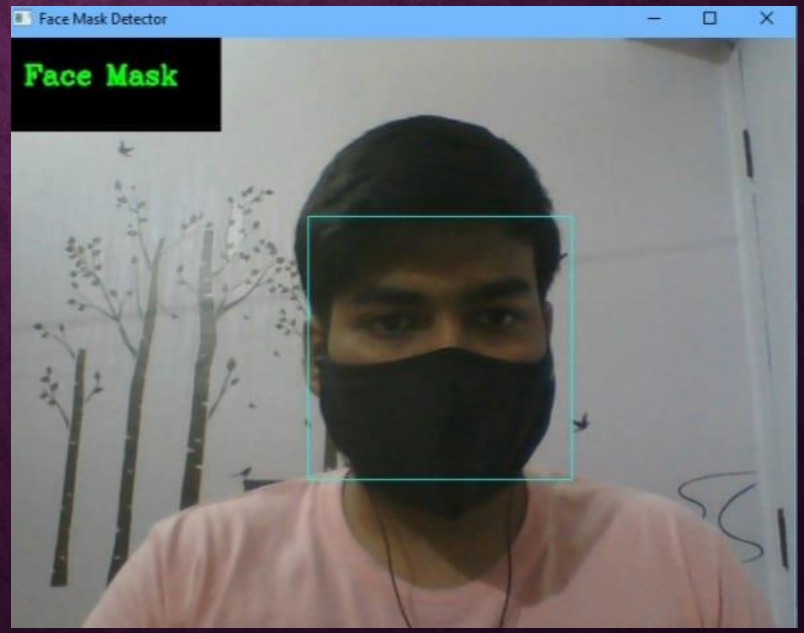
TEST ACCURACY – 84%

OUTPUT


Face Mask Detector
No Mask


Face Mask Detector
Face Mask

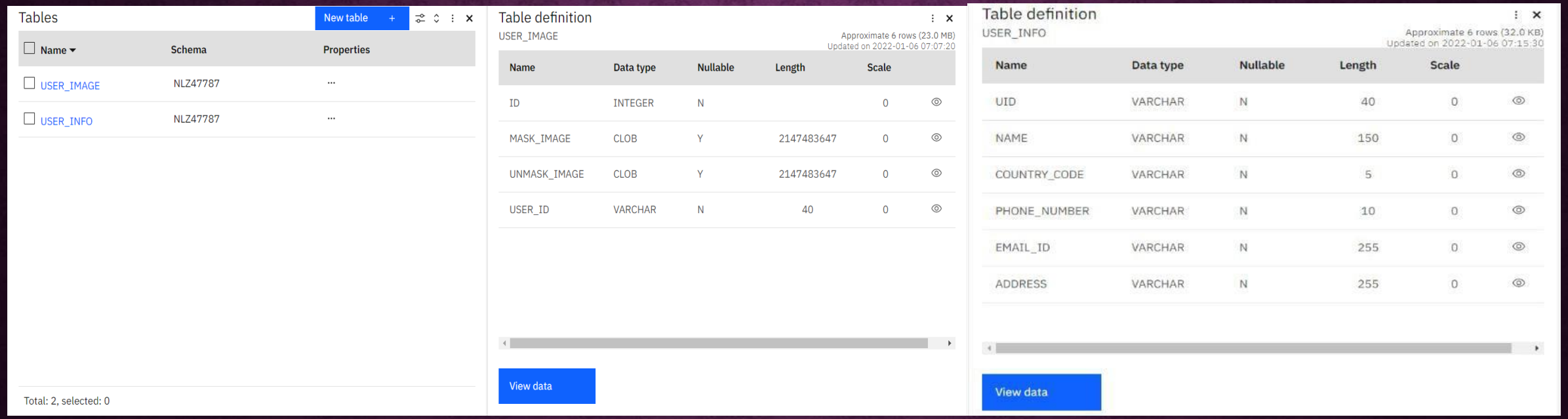

Face Mask Detector
No Mask


Face Mask Detector
Face Mask

MODEL ANALYSIS

POINTS	DENSE_NET ARCHITECTURE	MOBILE_NET ARCHITECTURE	RES_NET ARCHITETURE (Proposed Model)	NAS_NET ARCHITECTURE
Definition	A dense network is a network in which the number of links of each node is close to the maximal number of nodes.	Mobile Net is a streamlined architecture that uses depth wise separable convolutions to construct lightweight deep convolutional neural networks and provides an efficient model for mobile and embedded vision applications.	A residual neural network (Res Net) is an artificial neural network (ANN) of a kind that builds on constructs known from pyramidal cells in the cerebral cortex. This architecture works by utilizing skip connections or shortcuts to change or jump over layers.	Neural architecture search (NAS) is a technique for automating the design of artificial neural networks (ANN), a widely used model in the field of machine learning.
Number of hidden layers	8	154(BASE) + 3(ADDED)	190(BASE) + 4(ADDED)	769(BASE) + 3(ADDED)
Optimization algorithm	Adams algorithm	Adams algorithm	Adams algorithm	Adams algorithm
Test accuracy	86 %	97 %	99 %	84 %
Size	2.45 GB	34.1 MB	120 MB	24.1 MB

IBM CLOUD DATABASE



Tables

New table +

Name	Schema	Properties
USER_IMAGE	NLZ47787	...
USER_INFO	NLZ47787	...

Total: 2, selected: 0

Table definition

USER_IMAGE

Approximate 6 rows (23.0 MB)
Updated on 2022-01-06 07:07:20

Name	Data type	Nullable	Length	Scale
ID	INTEGER	N		0
MASK_IMAGE	CLOB	Y	2147483647	0
UNMASK_IMAGE	CLOB	Y	2147483647	0
USER_ID	VARCHAR	N	40	0

View data

Table definition

USER_INFO

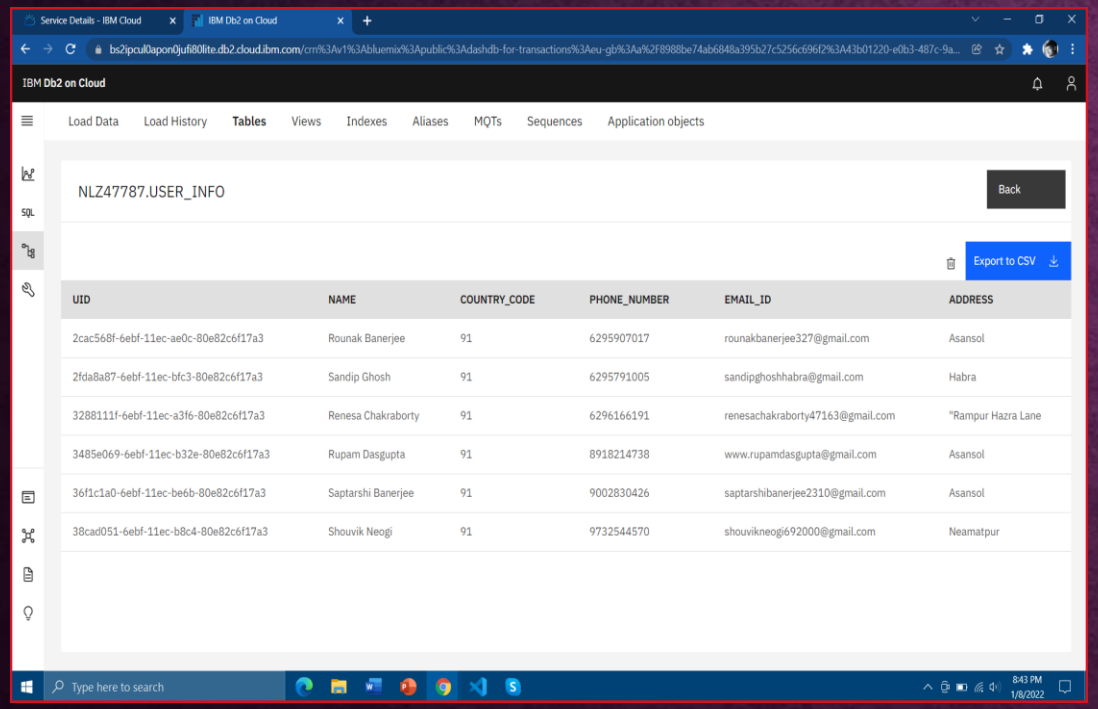
Approximate 6 rows (32.0 KB)
Updated on 2022-01-06 07:15:30

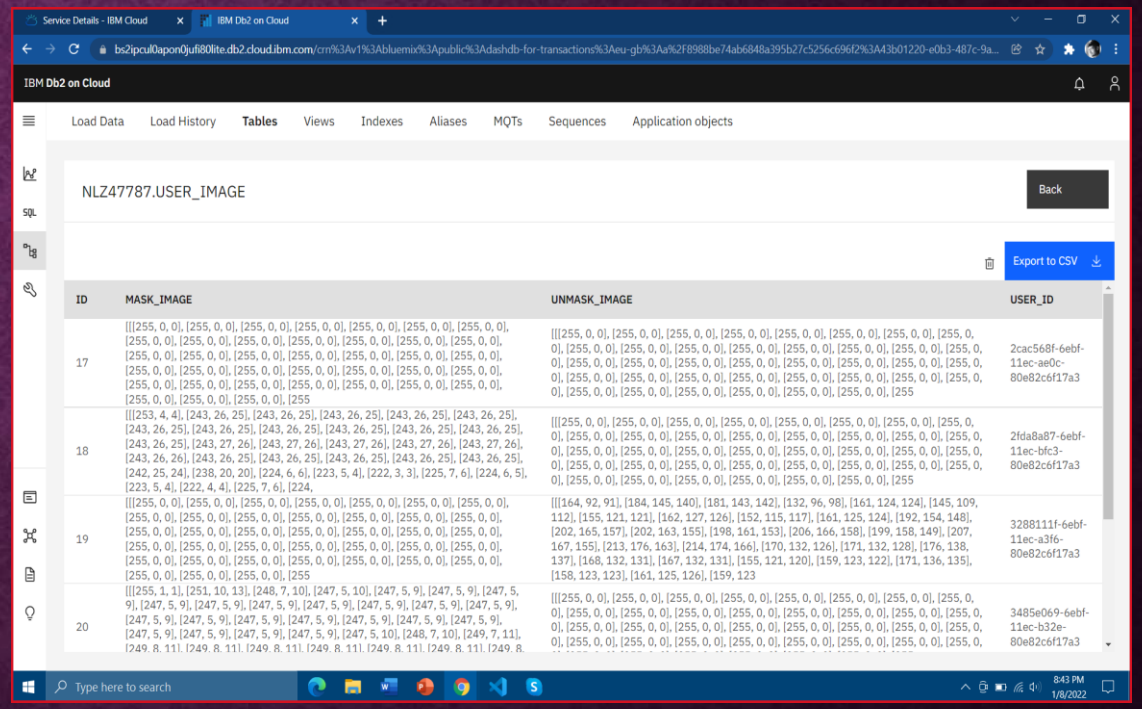
Name	Data type	Nullable	Length	Scale
UID	VARCHAR	N	40	0
NAME	VARCHAR	N	150	0
COUNTRY_CODE	VARCHAR	N	5	0
PHONE_NUMBER	VARCHAR	N	10	0
EMAIL_ID	VARCHAR	N	255	0
ADDRESS	VARCHAR	N	255	0

View data

SCHEMA OF DATABASE

DATA STORE





INFO TABLE

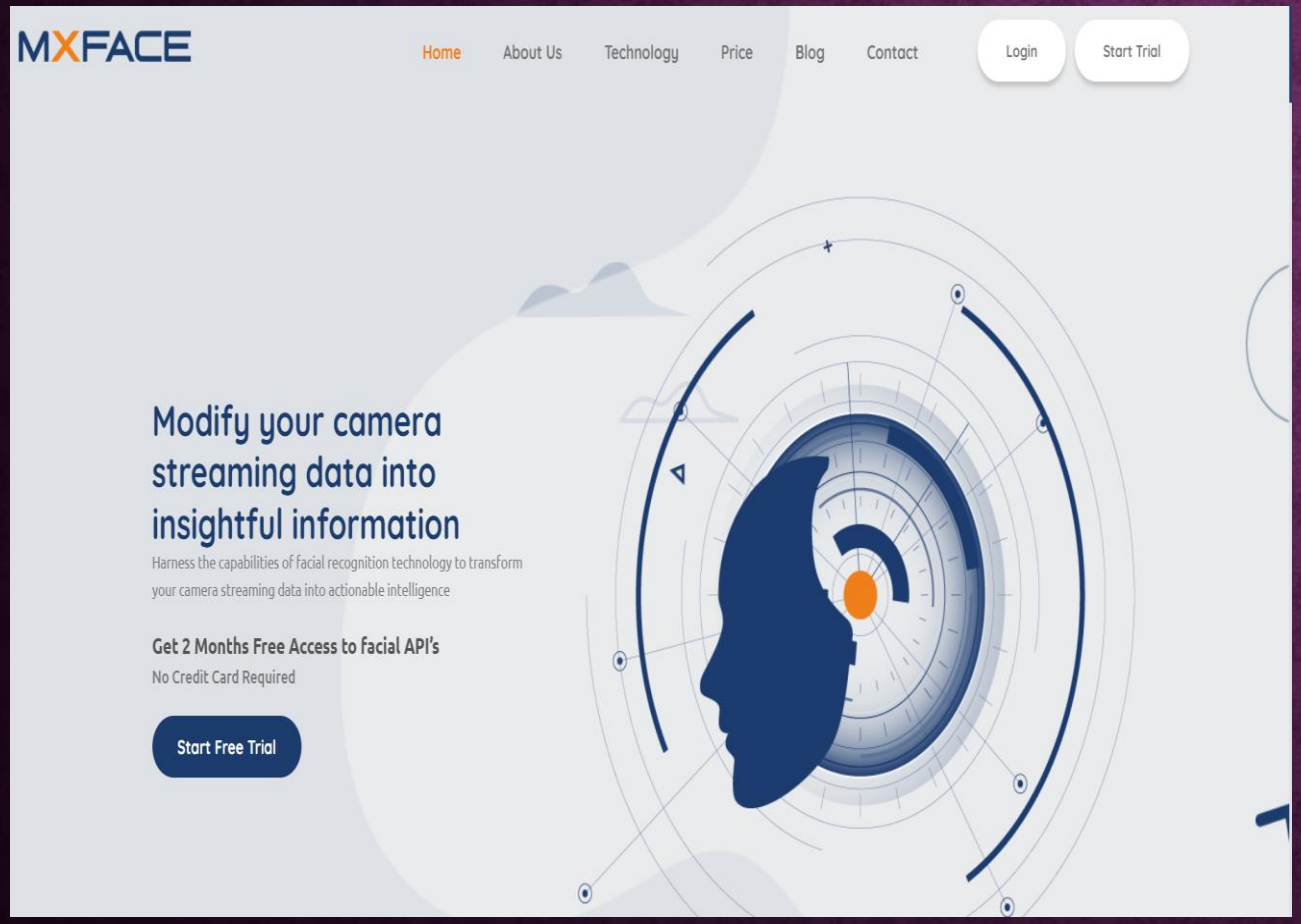
USER_IMAGE TABLE

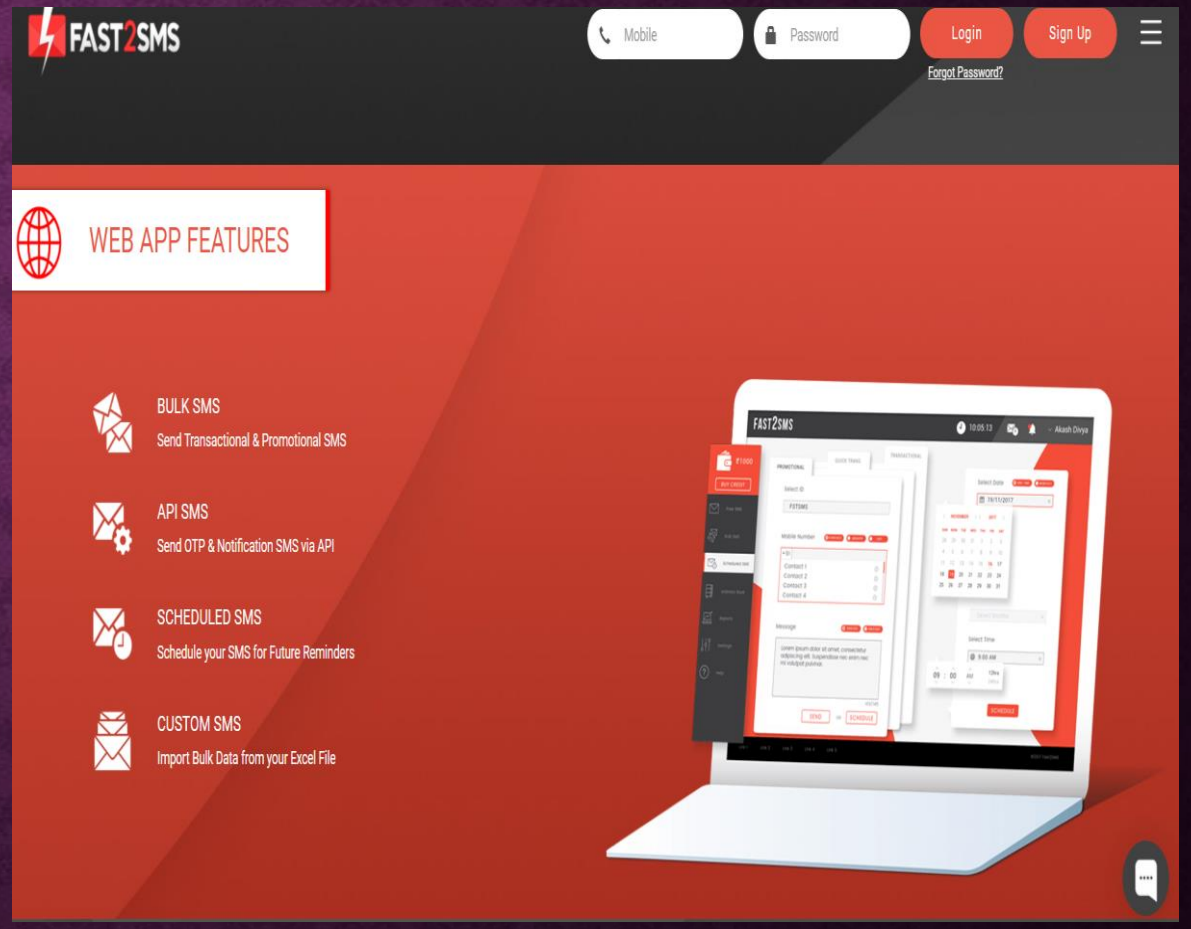
FETCHING RESULTS

```
36f1c1a0-6ebf-11ec-be6b-80e82c6f17a3 Saptarshi Banerjee 91 9002830426 saptarshibanerjee2310@gmail.com Asansol

38cad051-6ebf-11ec-b8c4-80e82c6f17a3 Shouvik Neogi 91 9732544570 shouvikneogi692000@gmail.com Neamatpur

2cac568f-6ebf-11ec-ae0c-80e82c6f17a3 Rounak Banerjee 91 6295907017 rounakbanerjee327@gmail.com Asansol

2fda8a87-6ebf-11ec-bfc3-80e82c6f17a3 Sandip Ghosh 91 6295791005 sandipghoshhabra@gmail.com Habra

3288111f-6ebf-11ec-a3f6-80e82c6f17a3 Renesa Chakraborty 91 6296166191 renesachakraborty47163@gmail.com "Rampur Hazra Lane
3485e069-6ebf-11ec-b32e-80e82c6f17a3 Rupam Dasgupta 91 8918214738 www.rupamdasgupta@gmail.com Asansol
```

WORK IN PROGRESS

INTEGRATING API INTO OUR APPLICATION





CONCLUSION

Upto the first part of our project , RES NET architecture can successfully predict the face wearing a mask or not. Raw data is collected through the camera, then pre-processing raw data using OpenCV is converted into usable data and then is fed into the models. The various architectures used are DENSE NET, MOBILE NET, RES NET. Since, RES NET architecture is giving us 99% accuracy, so this particular model is preferred. And then we have integrated the database which consist of personal as well as facial information of users for their identification.

REFERENCES

[1]https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200816-covid-19-sitrep-209.pdf?sfvrsn=5dde1ca2_2

[2]https://www.paho.org/en/news/2-6-2020-social-distancing-surveillance-and-stronger-health-systems-keys-controlling-covid-19

[3] kepenekci, b., and akar, g. b. (2004, april). face classification with support vector machine. ieee 12th signal processing and communications applications conference, 2004. (pp. 583-586). ieee

[4] h. anandakumar and k. umamaheswari, a bio-inspired swarm intelligence technique for social aware cognitive radio handovers, computers & electrical engineering, vol. 71, pp. 925–937, oct. 2018. doi:10.1016/j.compeleceng.2017.09.016

[5] r. arulmurugan and h. anandakumar, early detection of lung cancer using wavelet feature descriptor and feed forward back propagation neural networks classifier, lecture notes in computational vision and biomechanics, pp. 103–110, 2018. doi:10.1007/978-3-319-71767-8_9.

[6] vu, n. s., and caplier, a. (2010, september). face recognition with patterns of oriented edge magnitudes. (pp. 313-326). springer, berlin, heidelberg.

[7] https://keras.io/api/layers/core_layers/dense/

[8] https://keras.io/api/applications/mobilenet/

[9] https://keras.io/api/applications/resnet/

https://www.mygreatlearning.com/blog/resnet/

[10] https://keras.io/api/applications/nasnet/

https://iq.opengenus.org/nasnet/

THANK YOU