



## FACE DETECTION USING DEEP NEURAL NETWORK FOR BEHAVIOR ANALYSIS

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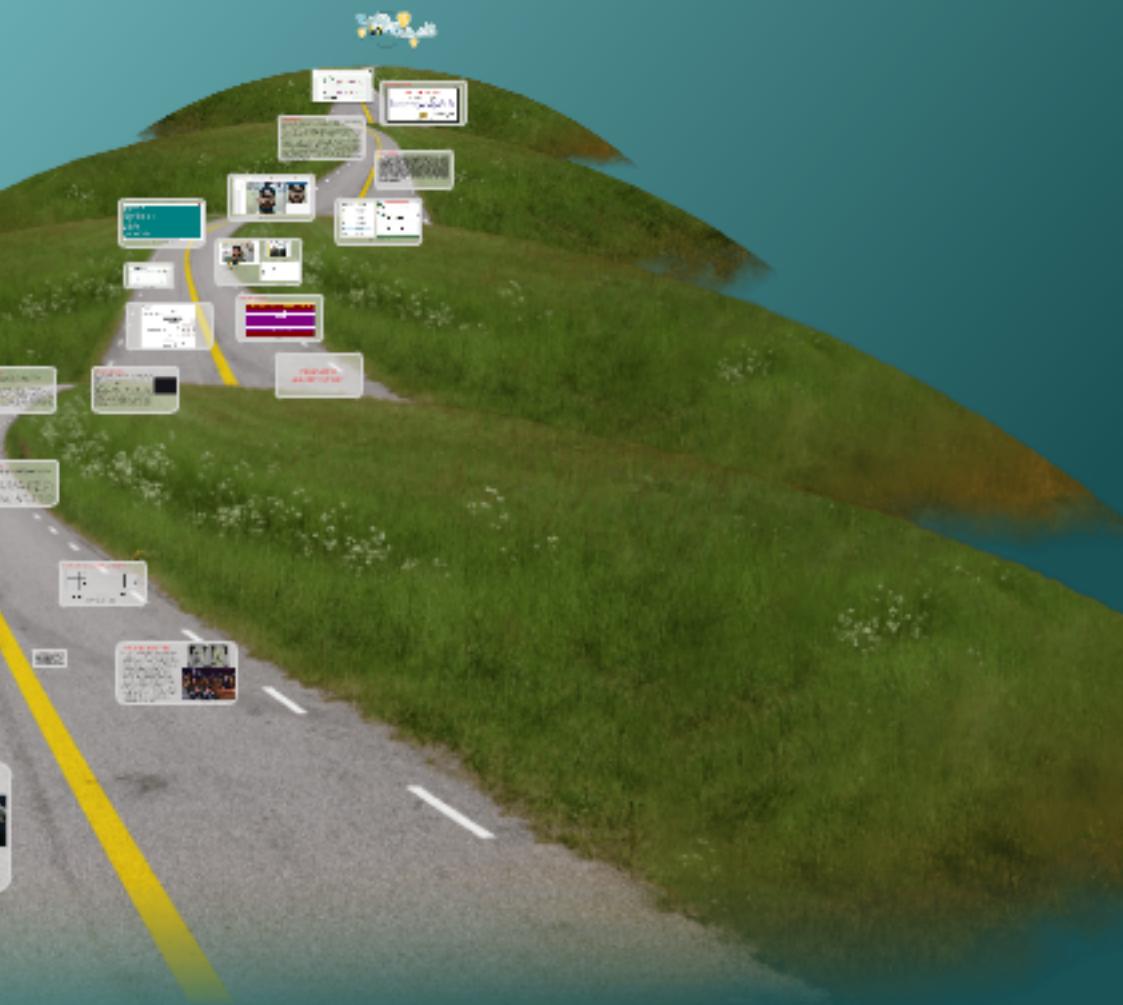
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### OUTLINE

- Introduction
- Face Detection
- Face Recognition
- Convolutional Neural Network
- Literature Review
- Proposed Architecture
- Implementation
- Conclusion
- Reference

### FACE DETECTION

- This document is a computer vision application that performs the task of identifying the location of human faces in input images. This document also covers the implementation of a deep learning architecture, which can detect faces and extract their features to generate a visual representation.



# FACE DETECTION USING DEEP NEURAL NETWORK FOR BEHAVIOR ANALYSIS

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## FACE DETECTION :

- Face detection is a computer technology being used in a variety of applications that identifies human faces in digital images. Face detection also refers to the psychological process by which humans locate and attend to faces in a visual scene.

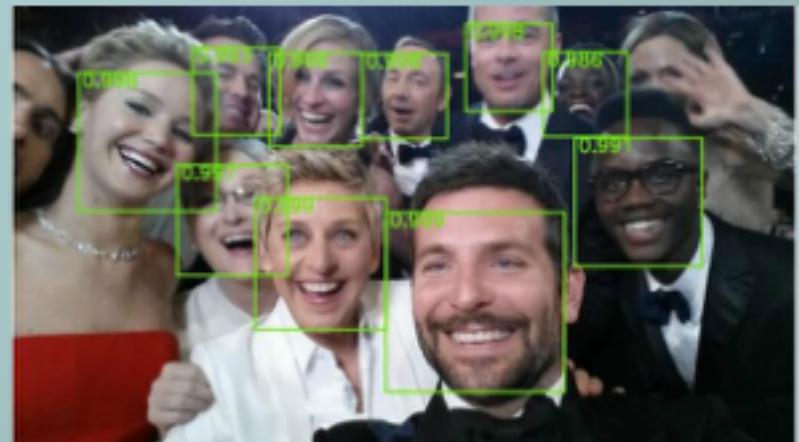


Fig. Face Detection in Images

source : [http://aerometrex.com.au/blog/wp-content/uploads/2013/01/AR\\_aero3dpro-1024x664.jpg](http://aerometrex.com.au/blog/wp-content/uploads/2013/01/AR_aero3dpro-1024x664.jpg)

## FACE RECOGNITION :

- A facial recognition is a technology capable of identifying or verifying a person from a digital image or a video frame from a video source. There are multiple methods in which facial recognition systems work, but in general, they work by comparing selected features from given image with faces within a database.
- Used to identify distinctive features on the surface of a face, such as the contour of the eye sockets, nose, cheekbones, and jaw.



Fig. Face Recognition

# **CONVOLUTIONAL NEURAL NETWORK**

- A CNN is composed of an input layer. However, for basic image processing, this input is typically a two-dimensional array of neurons which correspond to the pixels of an image. It also contains an output layer which is typically a one-dimensional set of output neurons.
- Convolution is a technique that allows us to extract visual features from an image in small chunks. Each neuron in a convolution layer is responsible for a small cluster of neurons in the preceding layer. It contains filters or kernel that determines the cluster of neurons.
- Filters mathematically modify the input of a convolution to help it detect certain types of features in the image Pooling, also known as subsampling or down sampling reduces the number of neurons in the previous convolution layer.

# CONVOLUTIONAL NEURAL NETWORK

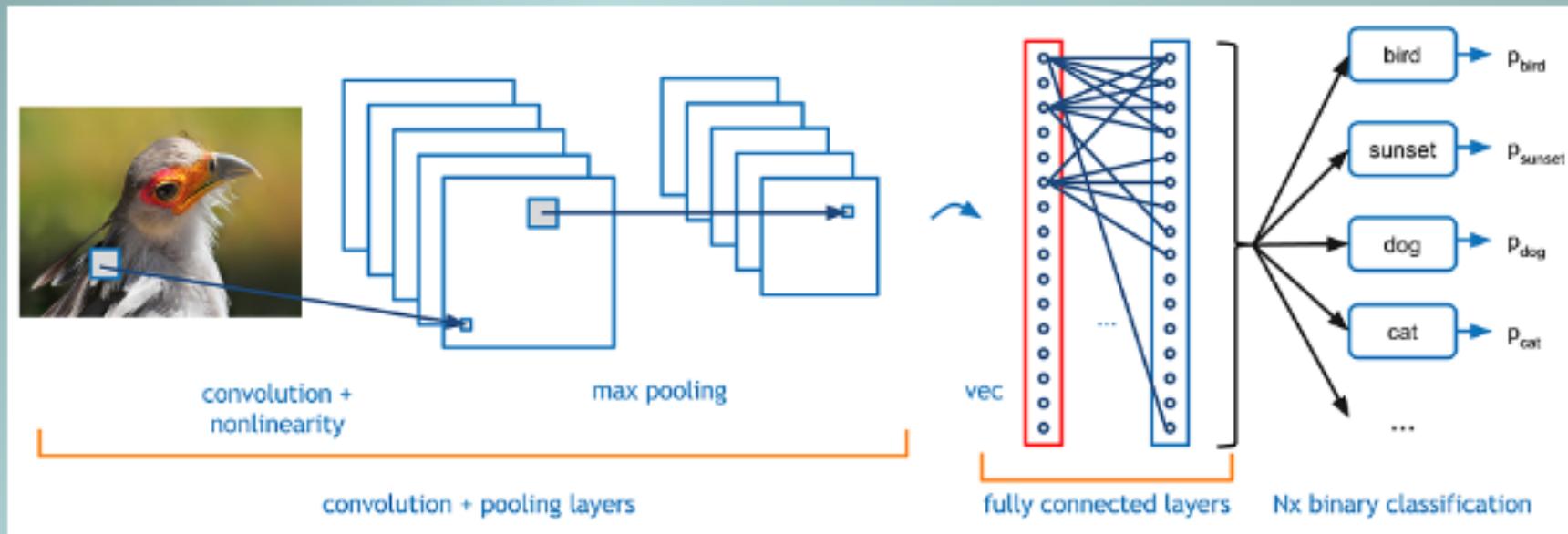


Fig : CNN Architecture

# CONVOLUTIONAL NEURAL NETWORK

Input Image

0	0	0	0	0	0	0
0	1	0	0	0	1	0
0	0	0	0	0	0	0
0	0	0	1	0	0	0
0	1	0	0	0	1	0
0	0	1	1	1	0	0
0	0	0	0	0	0	0



## Feature Detector

0	0	1
1	0	0
0	1	1

## Feature Map

0	1	0	0	0
0	1	1	1	0
1	0	1	2	1
1	4	2	1	0
0	0	1	2	1

## Convolutional Layer

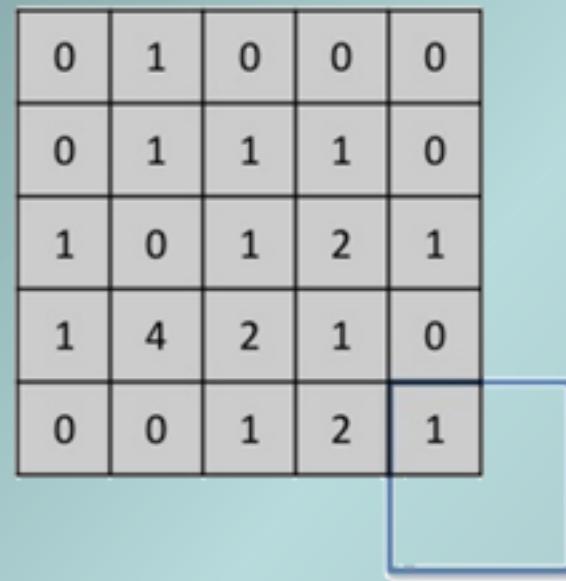
1	1	1	0	0
0	1	1	1	0
0	0	1 <sub>x1</sub>	1 <sub>x2</sub>	1 <sub>x3</sub>
0	0	1 <sub>x4</sub>	1 <sub>x5</sub>	0 <sub>x6</sub>
0	1	1 <sub>x1</sub>	0 <sub>x2</sub>	0 <sub>x3</sub>

## Image

4	3	4
2	4	3
2	3	4

## Convolved Feature

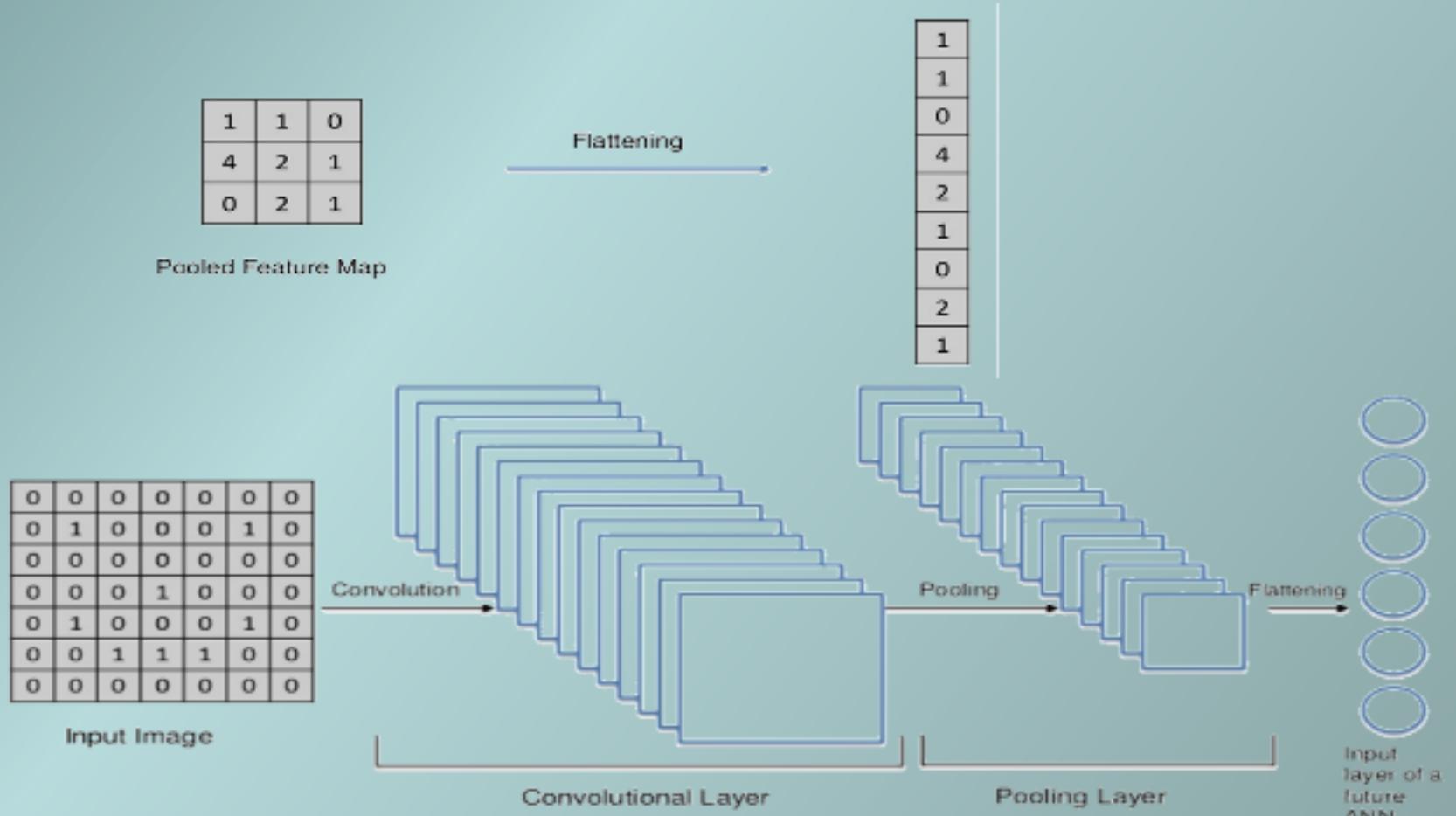
# CONVOLUTIONAL NEURAL NETWORK



1	1	0
4	2	1
0	2	1

Pooled Feature Map

Max Pooling Layer



## LITERATURE REVIEW

### **Paper 1 : DeepFace : Closing the Gap to Human-Level Performance in Face Verification**

Authors :~ Yaniv Taigman, Ming Yang, Marc'Aurelio Ranzato, Lior Wolf

Year :~ 2014 IEEE

Description:~

In this paper author states that, how this DeepFace algorithm is helpful for face recognition. DeepFace is a deep learning facial recognition system created by a research group at Facebook. It identifies human faces in digital images. It employs a nine-layer neural net with over 120 million connection weights, and was trained on four million images uploaded by Facebook users. The system is said to be 97% accurate, compared to 85% for the FBI's Next Generation Identification system.

In modern face recognition, the conventional pipeline consists of four stages: detectalignrepresentclassify. They revisit both the alignment step and the representation step by employing explicit 3D face modeling in order to apply a piecewise affine transformation, and derive a face representation from a nine-layer deep neural network.

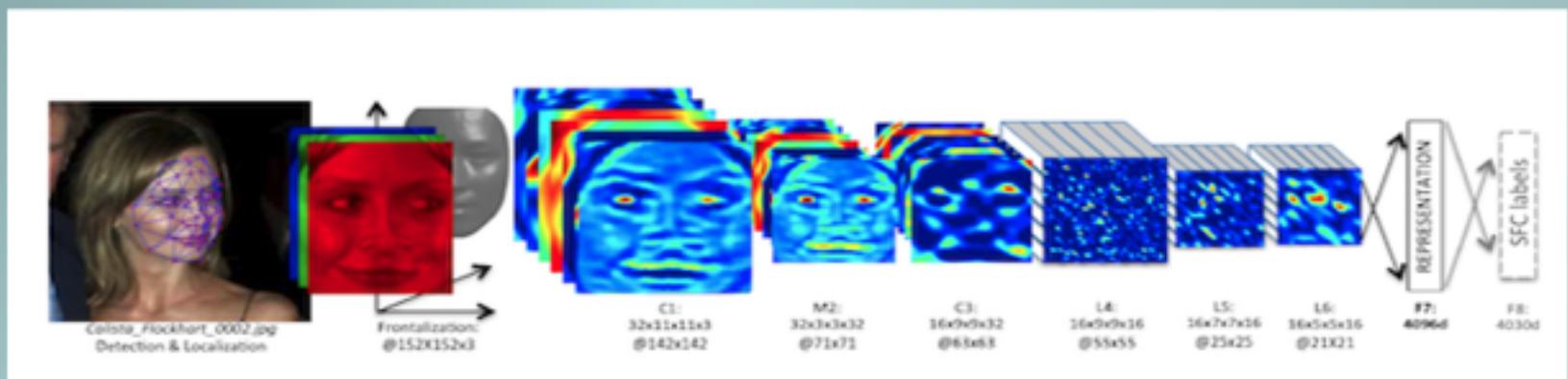
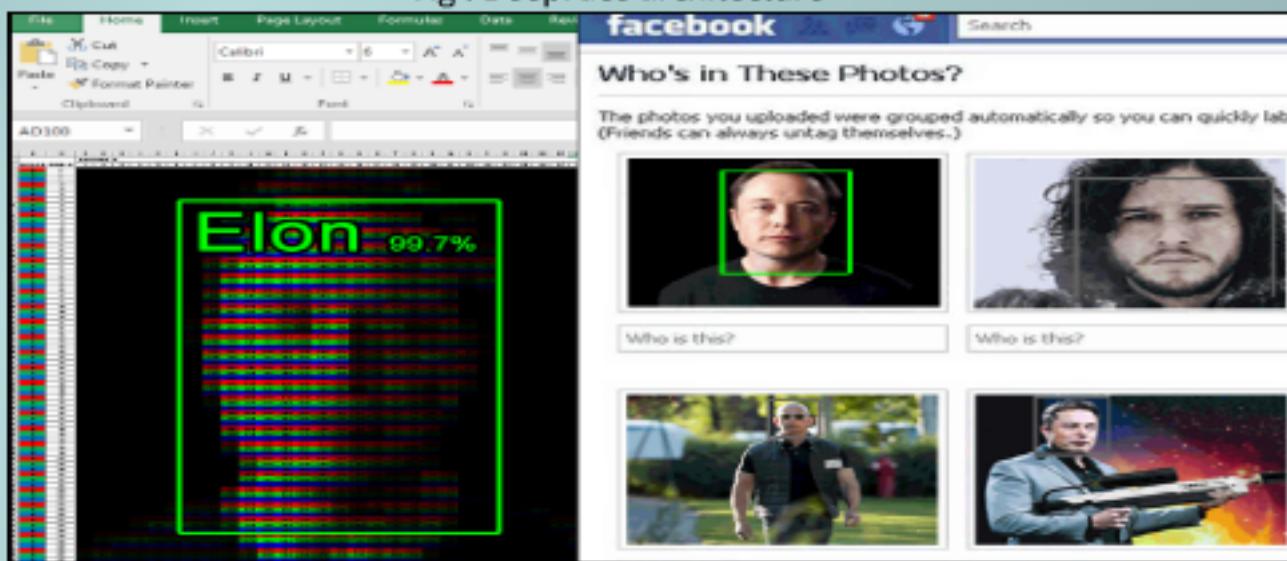


Fig : DeepFace architecture



## LITERATURE REVIEW

Paper 2: FaceNet: A Unified Embedding for Face Recognition and Clustering

Authors :~ Florian Schroff, Dmitry Kalenichenko, James Philbin

Year :~ 2015 IEEE

Description :~

FaceNet is a Deep Learning architecture consisting of convolutional layers based on GoogLeNet inspired inception models. FaceNet returns a 128 dimensional vector embedding for each face. Having been trained with triplet loss for different classes of faces to capture the similarities and differences between them, the 128 dimensional embedding, returned by the FaceNet model, effectively clusters faces. Hence this vector would be closer for similar faces and farther apart for dissimilar faces. This FaceNet architecture is trained over a dataset with a very large number of faces belonging to numerous classes. Of course, you won't be re-training this architecture every time you have a new class of faces being added!!

## LITERATURE REVIEW

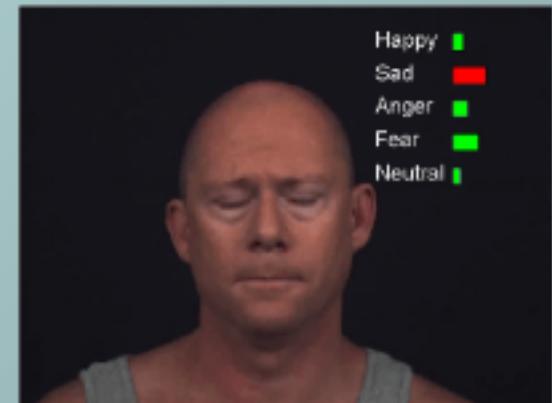
Paper 3 : Emotion Recognition using Deep Convolutional Neural Networks

Authors :~ Enrique Correa Arnoud Jonker Michael Ozo Rob Stolk

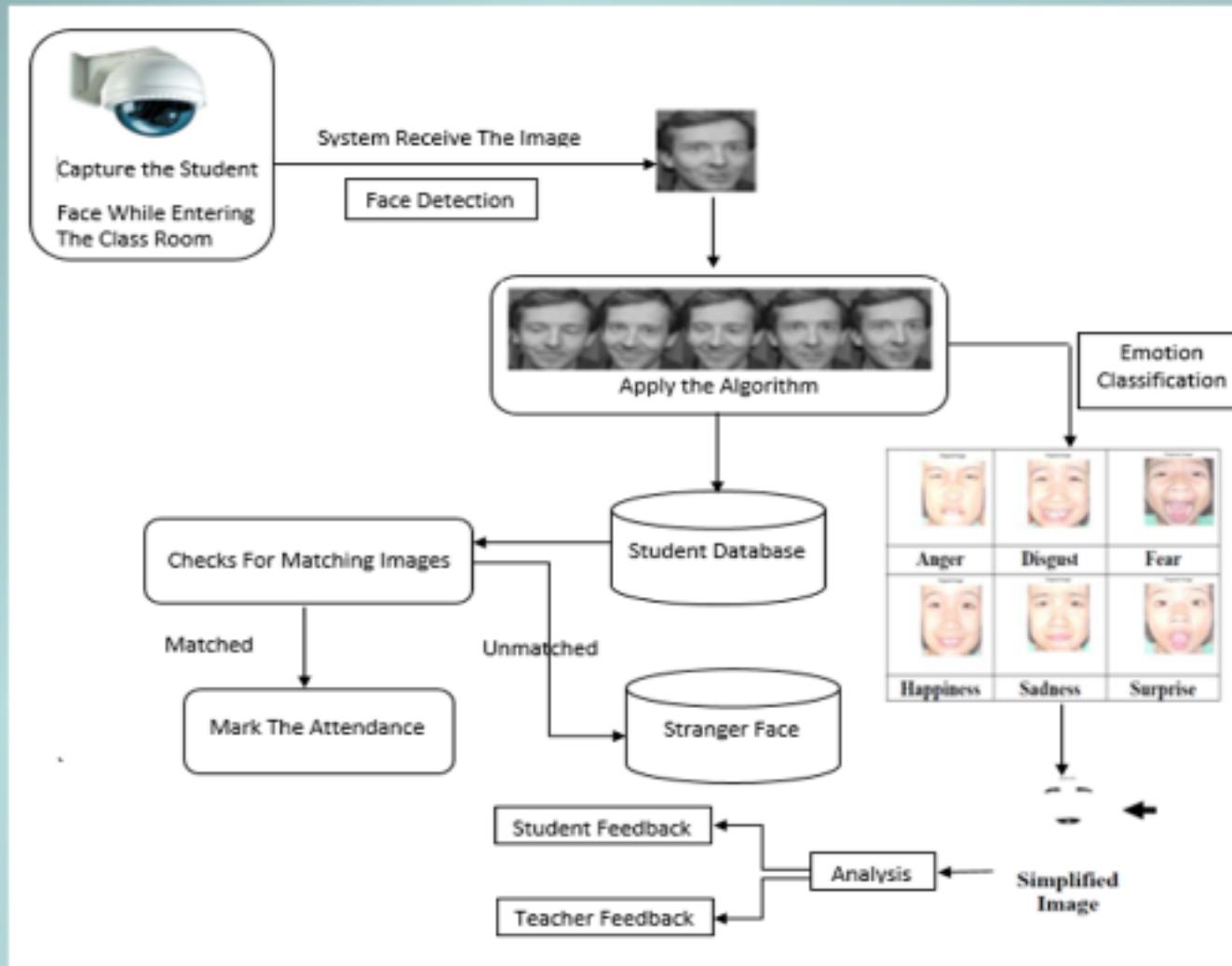
Year :~ June 30, 2016 IEEE

Description :~

In this research paper, In this paper author present the design of an artificially intelligent system capable of emotion recognition through facial expressions. Three promising neural network architectures are customized, trained, and subjected to various classification tasks, after which the best performing network is further optimized. The applicability of the final model is portrayed in a live video application that can instantaneously return the emotion of the user.



# **PROPOSED ARCHITECTURE**



# IMPLEMENTATION

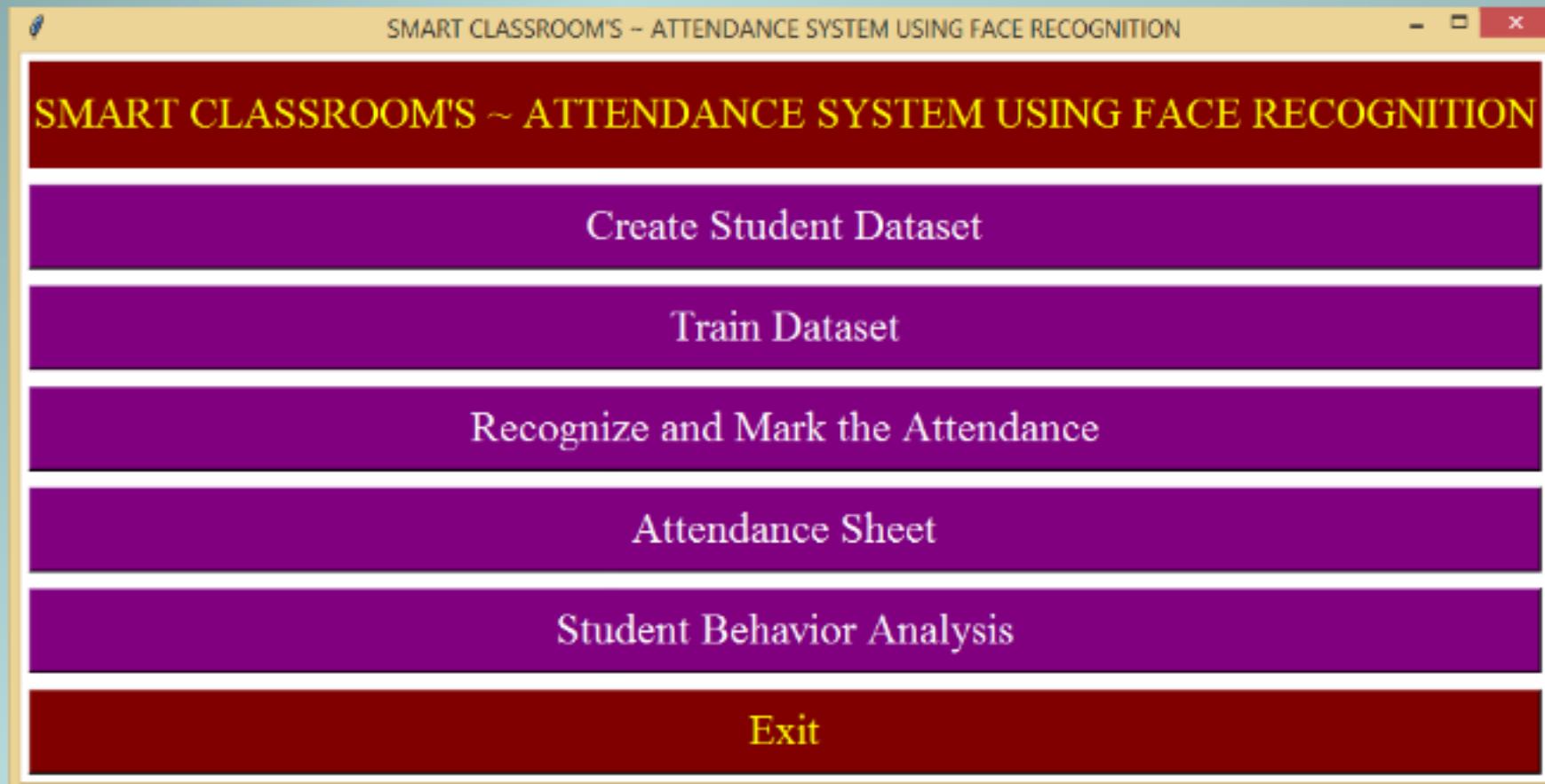


Fig. UI of System

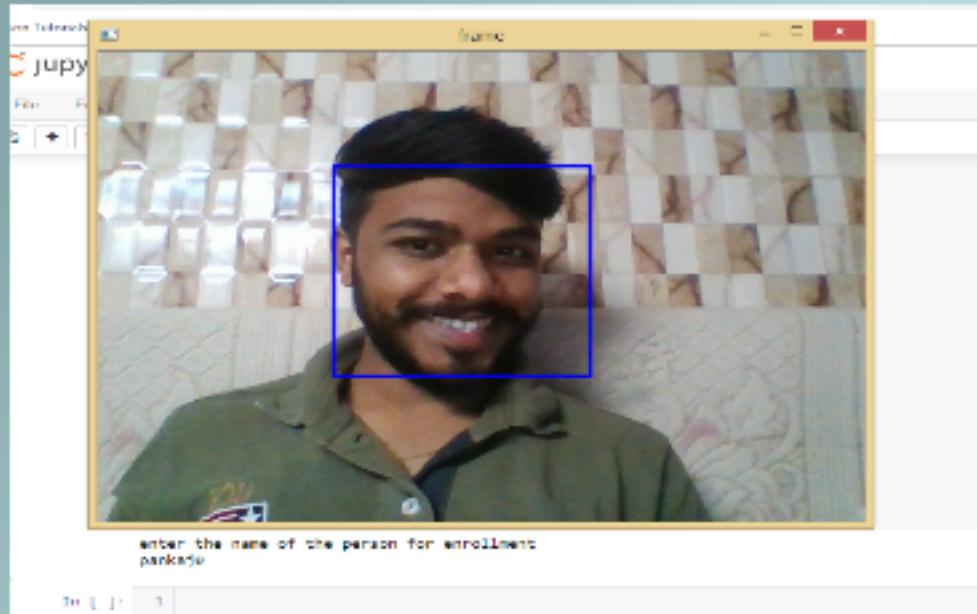


Fig. Creating Student Dataset

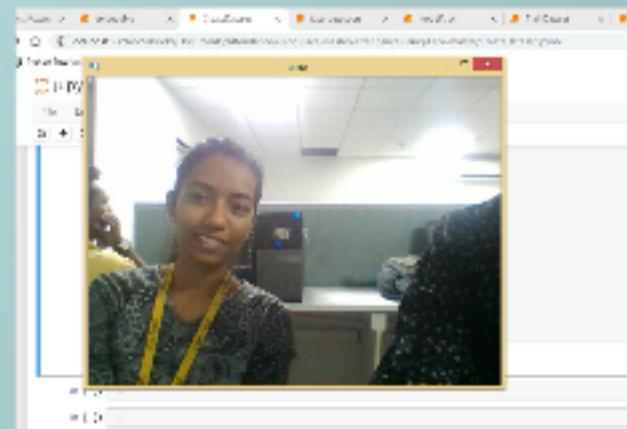


Fig. Creating Student Dataset

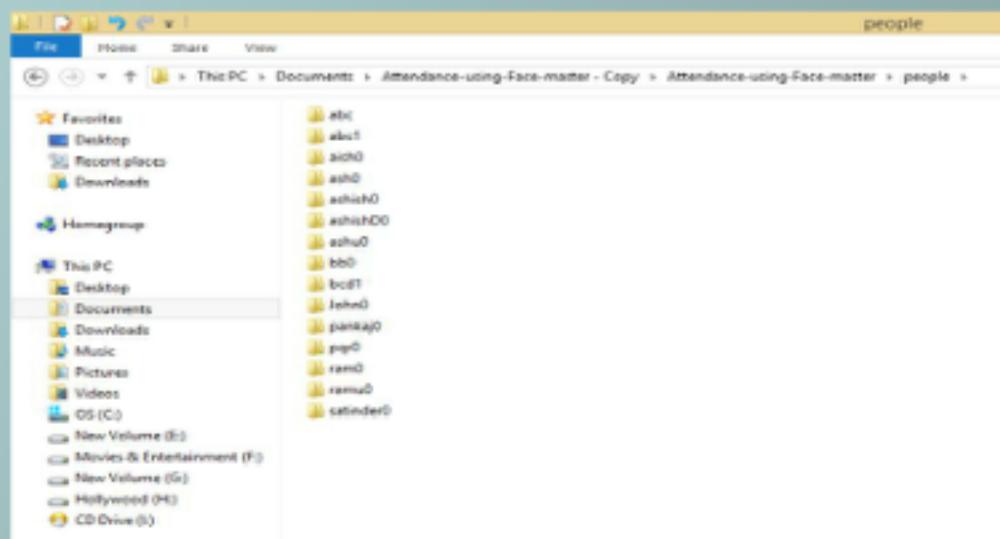


Fig. Face Dataset

```
235/235 [=====] - 8s 400us/step - loss: 1.4886 - acc: 0.8255 - val_loss: 1.3197 - val_acc: 0.9250
Epoch 13/27
235/235 [=====] - 8s 388us/step - loss: 1.4783 - acc: 0.8511 - val_loss: 1.4551 - val_acc: 0.7487
Epoch 14/27
235/235 [=====] - 8s 422us/step - loss: 1.4796 - acc: 0.8511 - val_loss: 1.3627 - val_acc: 0.7487
Epoch 15/27
235/235 [=====] - 8s 405us/step - loss: 1.4786 - acc: 0.8553 - val_loss: 1.3384 - val_acc: 0.7487
Epoch 16/27
235/235 [=====] - 8s 408us/step - loss: 1.4712 - acc: 0.8598 - val_loss: 1.3341 - val_acc: 0.7487
Epoch 17/27
235/235 [=====] - 8s 370us/step - loss: 1.4728 - acc: 0.8553 - val_loss: 1.3838 - val_acc: 0.7487
Epoch 18/27
235/235 [=====] - 8s 370us/step - loss: 1.4741 - acc: 0.8511 - val_loss: 1.3777 - val_acc: 0.7487
Epoch 19/27
235/235 [=====] - 8s 388us/step - loss: 1.4745 - acc: 0.8488 - val_loss: 1.3141 - val_acc: 0.9250
Epoch 20/27
235/235 [=====] - 8s 413us/step - loss: 1.4726 - acc: 0.8511 - val_loss: 1.3556 - val_acc: 0.7487
Epoch 21/27
235/235 [=====] - 8s 417us/step - loss: 1.4717 - acc: 0.8553 - val_loss: 1.3585 - val_acc: 0.7487
Epoch 22/27
235/235 [=====] - 8s 409us/step - loss: 1.4745 - acc: 0.8255 - val_loss: 1.3382 - val_acc: 0.7487
Epoch 23/27
235/235 [=====] - 8s 375us/step - loss: 1.4719 - acc: 0.8553 - val_loss: 1.4189 - val_acc: 0.7487
Epoch 24/27
235/235 [=====] - 8s 370us/step - loss: 1.4721 - acc: 0.8511 - val_loss: 1.4881 - val_acc: 0.7487
Epoch 25/27
235/235 [=====] - 8s 324us/step - loss: 1.4788 - acc: 0.8596 - val_loss: 1.3535 - val_acc: 0.7487
Epoch 26/27
235/235 [=====] - 8s 341us/step - loss: 1.4725 - acc: 0.8383 - val_loss: 1.3808 - val_acc: 0.9250
Epoch 27/27
```

Fig. Train Dataset Result

C:\Windows\system32\cmd.exe - mongo

```
Microsoft Windows [Version 6.3.9600]
(c) 2013 Microsoft Corporation. All rights reserved.

C:\Users\ASH>mongo
MongoDB shell version v3.4.7
connecting to: mongodb://127.0.0.1:27017
MongoDB server version: 3.4.7
Server has startup warnings:
2019-03-24T03:02:53.836+0530 I CONTROL  [initandlisten]
2019-03-24T03:02:53.837+0530 I CONTROL  [initandlisten] ** WARNING: Access control is not enabled for the database.
2019-03-24T03:02:53.837+0530 I CONTROL  [initandlisten] ** Read and write access to data and configuration is unrestricted.
2019-03-24T03:02:53.838+0530 I CONTROL  [initandlisten]
> show databases
admin 0.000GB
local 0.000GB
> use local
switched to db local
> show collections
startup_log
> db.createCollection("pa")
{
  "ok" : 1
}
> db.pa.insert({ "name": "bh", "attendane": 0 })
WriteResult({ "nInserted" : 1 })
> db.pa.insert({ "name": "ashu", "attendane": 0 })
WriteResult({ "nInserted" : 1 })
> db.pa.insert({ "name": "ashish", "attendane": 0 })
WriteResult({ "nInserted" : 1 })
> db.pa.insert({ "name": "ash", "attendane": 0 })
WriteResult({ "nInserted" : 1 })
> show collections
pa
startup_log
```

Fig. Creating Collections / Database in MongoDB

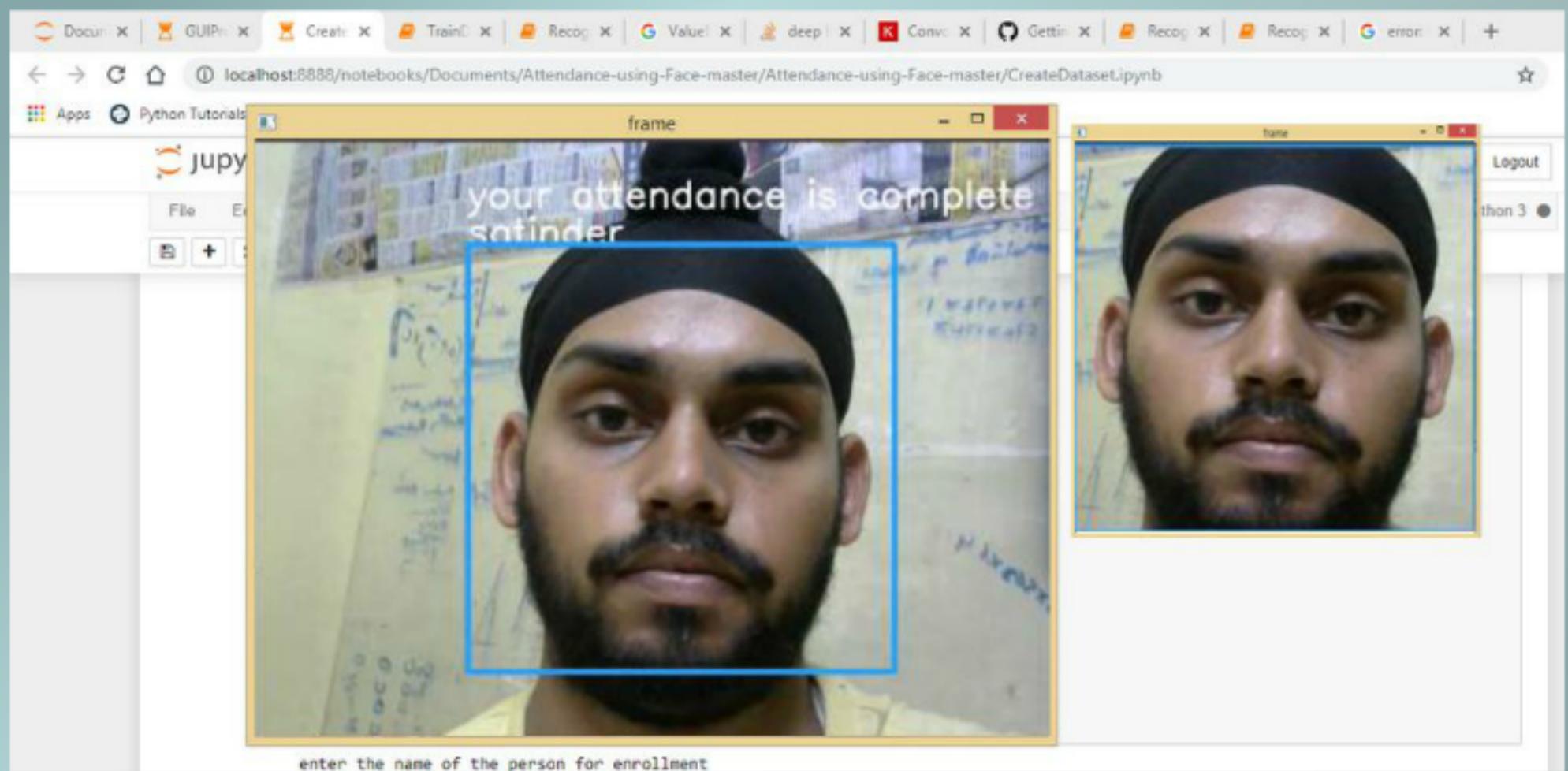


Fig. Final Student Attendance Result

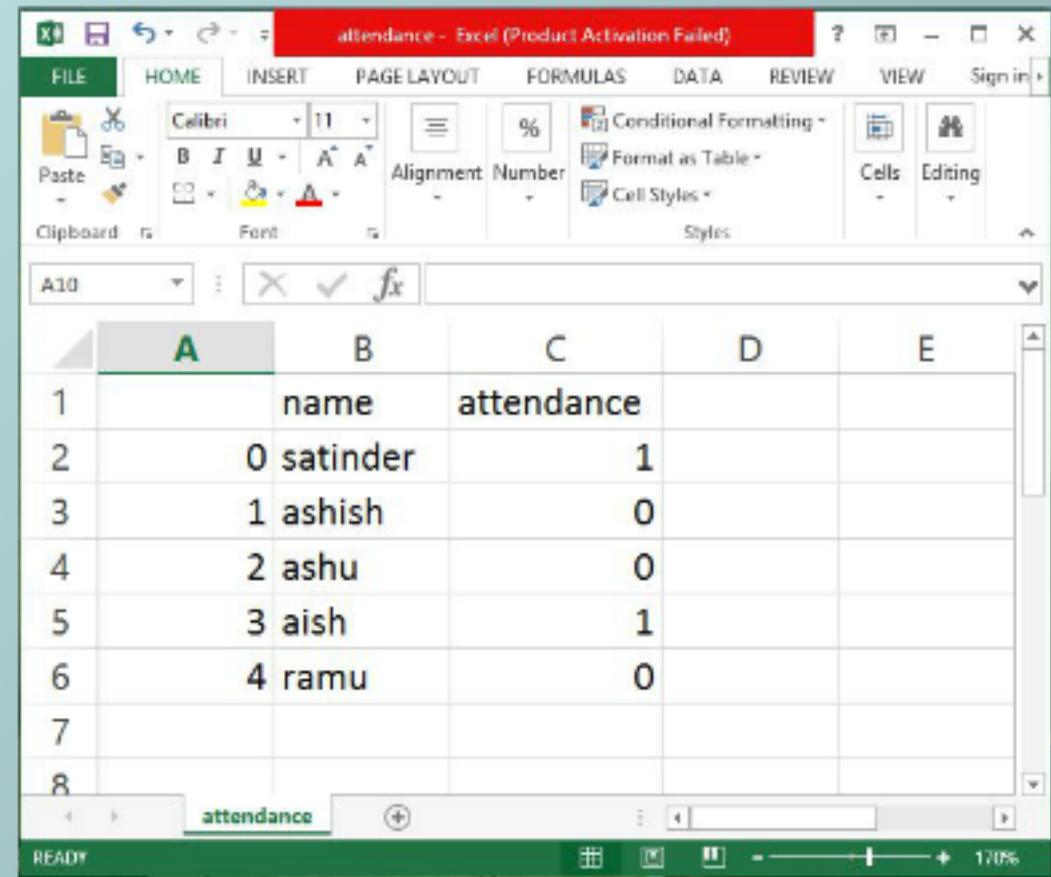
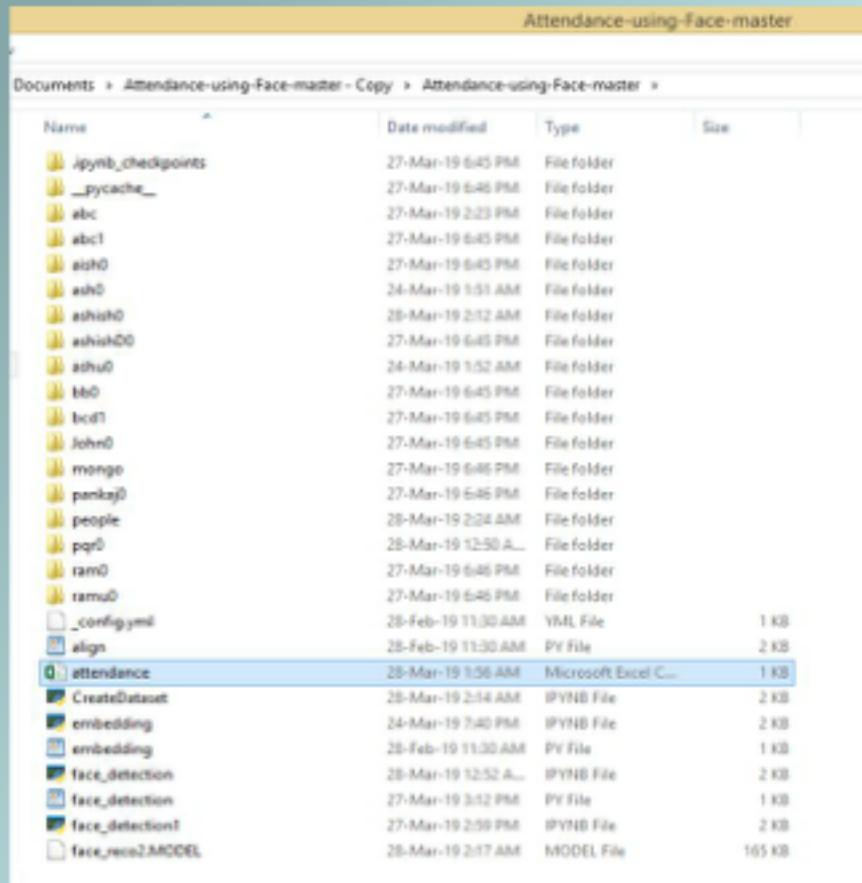


Fig. Phase I - Final Result

## **CONCLUSION**

Based on the literature survey on this topic of Face Detection using Neural Network, different aspects of how face detection & recognition works are studied. Various survey papers are reviewed and analysis is done for each paper. The purpose of this research is to provide an overview of the functionality of Face Detection using Deep Neural Network for Analyzing the Emotion and Behavior of Student. This proposed work can enhance the overall performance of Face Detection process and moreover focus on students behavior thoroughly.

## REFERENCES

- 1) Yaniv Taigman, Ming Yang, Marc'Aurelio Ranzato, Lior Wolf. "**DeepFace: Closing the Gap to Human-Level Performance in Face Verification**", 2014 IEEE Conference on Computer Vision and Pattern Recognition
- 2) Sanun Srisuk, Surachai Ongkittikul "**Robust Face Recognition based on Weighted DeepFace**", 5th International Electrical Engineering Congress, Thailand, 8-10 March 2017.
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- 7) Enrique Correa, Arnoud Jonker, Michael Ozo, Rob Stolk "**Emotion Recognition using Deep Convolutional Neural Networks**", June 30, 2016

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Attendance-using-Face-master.ipynb GUIProject CreateDataset TrainDataset Recognize Copy? × +

C localhost:8888/notebooks/Documents/Attendance-using-Face-master%20-%20Copy/Attendance-using-Face-master/GUIProject.ipynb

Python Tutorials ... Face FaceRecog Scenario "Conv... Logout

## jupyter GUIProject Last Checkpoint Last Sunday at 12:05 (unseen changes)

File Edit View Insert Cell Kernel Help Trusted Python 3

```
36 #setting title for the window
37 root.title("SMART CLASSROOM'S ~ ATTENDANCE SYSTEM USING FACE RECOGNITION")
38
39 #creating a text label
40 Label(root, text="SMART CLASSROOM'S ~ ATTENDANCE SYSTEM USING FACE RECOGNITION", font=("times new roman",20),fg="yellow",bg="black").grid(row=0,column=0)
41
42 #creating first button
43 Button(root,text="Create Student Dataset",font=("times new roman",20),bg="purple",fg="white",command=function1).grid(row=3,column=0)
44
45 #creating second button
46 Button(root,text="Train Dataset",font=("times new roman",20),bg="purple",fg="white",command=function2).grid(row=4,columnspan=2)
47
48 #creating third button
49 Button(root,text="Recognize and Mark the Attendance",font=("times new roman",20),bg="purple",fg="white",command=function3).grid(row=5,columnspan=2)
50
51 #creating attendance button
52 Button(root,text="Attendance Sheet",font=("times new roman",20),bg="purple",fg="white",command=attend).grid(row=6,columnspan=2)
53
54 Button(root,text="Student Behavior Analysis",font=("times new roman",20),bg="purple",fg="white",command=function4).grid(row=7,columnspan=2)
55
56 Button(root,text="Exit",font=("times new roman",20),bg="maroon",fg="yellow",command=function5).grid(row=8,columnspan=2,sticky="ew")
57
58
59 root.mainloop()
```



Thank you!





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### FACE DETECTION

- Face detection is a computer vision task that aims to detect the location of a human face in input images. This is done using either a pre-trained detector or training a detector to detect a certain class.

