Capstone Project-5

Project Title

Live Class Monitoring System (Face Emotion Recognition)

TEAM MEMBERS

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Introduction:

- For the past ten years, the Indian education system has been undergoing rapid changes due to the expansion of web-based learning services, specifically education platforms.
- During a lecture in a physical classroom, the teacher can see the students' faces and gauge their mood, and adjust their lecture accordingly, whether they are going fast or slow.
- They can identify students who want additional attention, but they are unable to see all students or access the mood in digital classrooms due to the usage of a video telephony software application (ex: Zoom). Students are unable to focus on content due to a lack of supervision as a result of this issue.
- Physical monitoring is limited on digital platforms, but they do come with the power of data and machines that can work for you. Deep learning algorithms may be used to examine its data, which not only solves the surveillance problem but also eliminates human bias from the system.

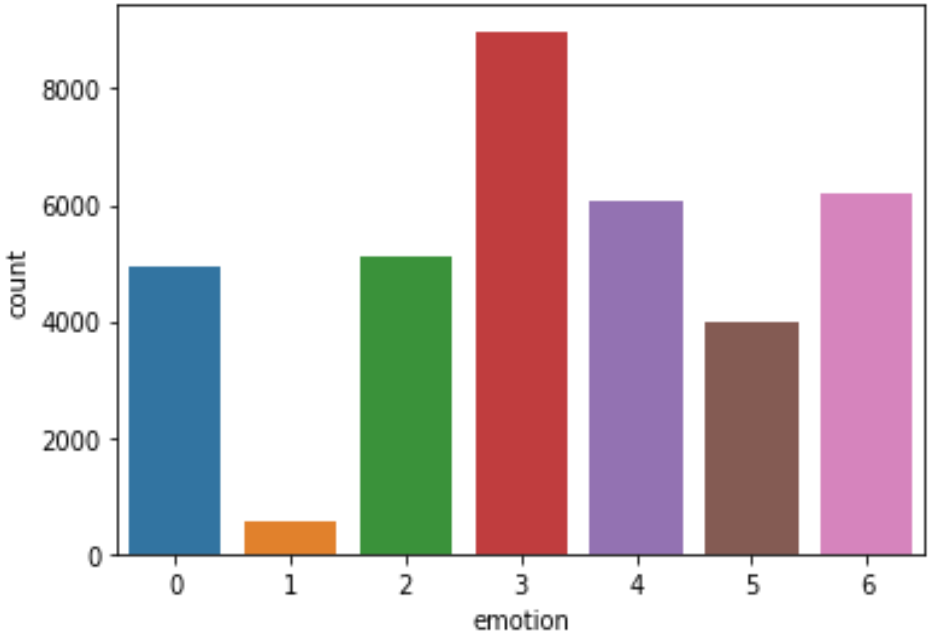
Problem Statement:

- The aim of the project is to create a Facial Emotion Recognition System (FERS) that can detect students' emotional states in e-learning systems that use video conferencing.
- This technology instantly conveys the emotional states of the students to the educator in order to create a more engaged educational environment.
- Our results supported those of other studies that have shown that in e-learning systems, it is possible to observe the motivation level of both the individual and the virtual classroom.

Data summary:

Dataset link:- https://www.kaggle.com/deadskull7/fer2013

Labels	Emotions
0	Anger
1	Disgust
2	Fear
3	Happiness
4	Sadness
5	Surprise
6	Neutral



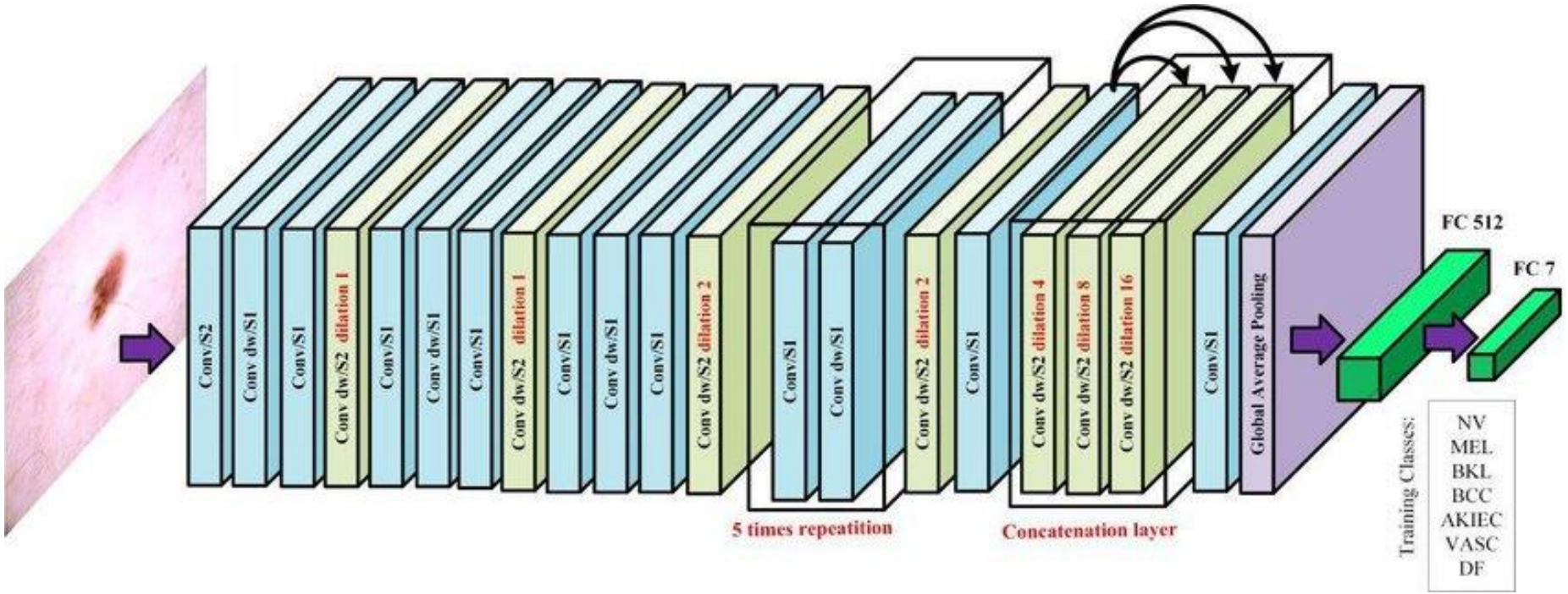
- After looking at the bar plot, we can see that the bulk of the classes are 3: Happy, 4: Sad, and 6: Neutral, while 1: Disgust and 5: Surprise are less common, and 0: Anger is also common.

Data Summary Cont.

This dataset contains 35887 grayscale 48x48 pixel face images with seven emotions.

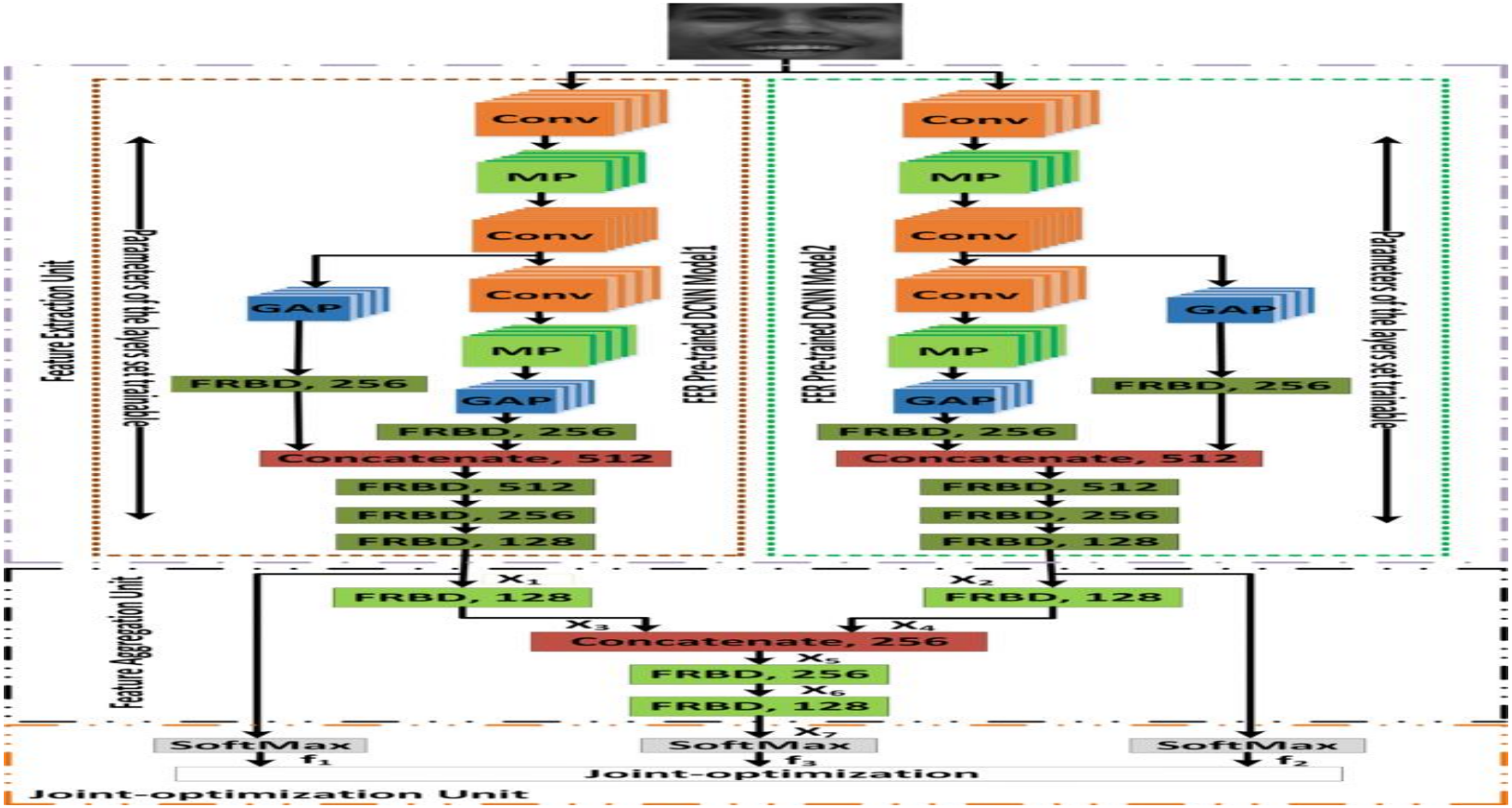
Model Overview:

1] MobileNet Model:-

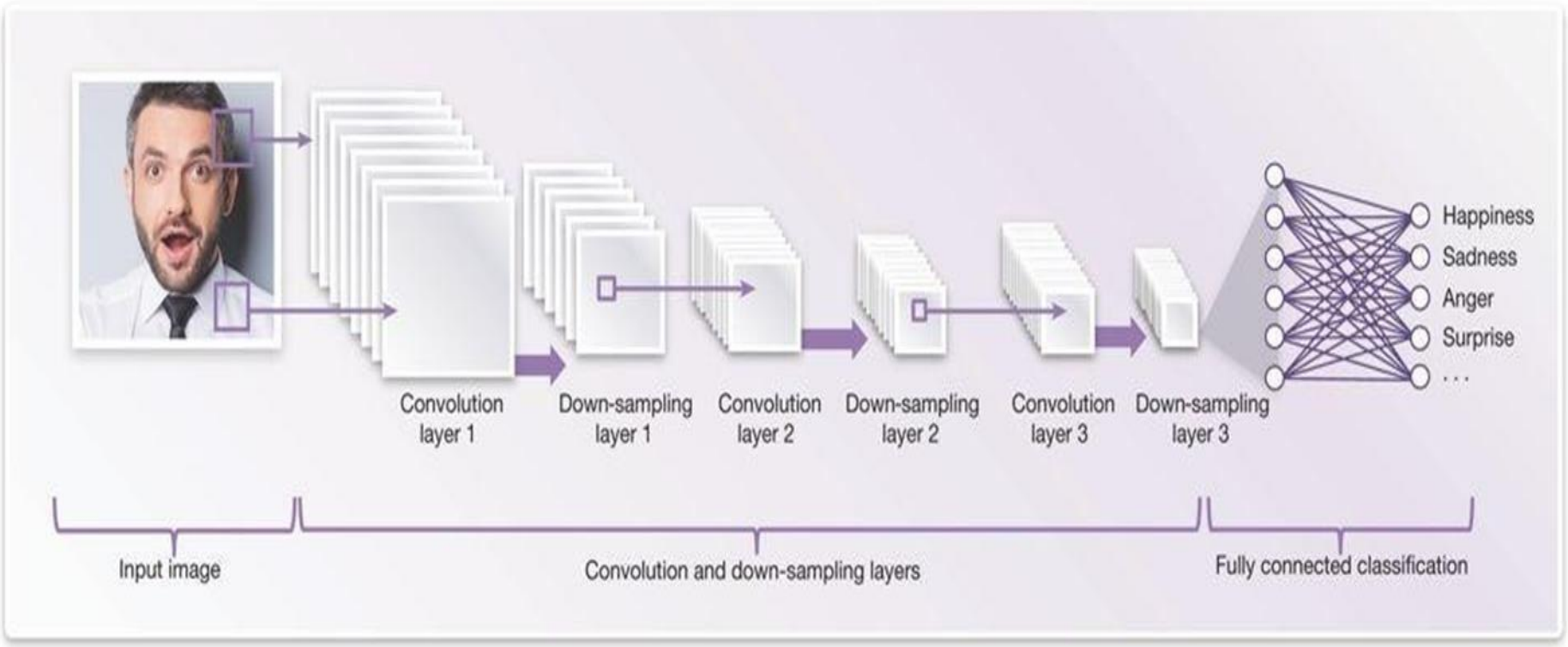


Model overview cont.

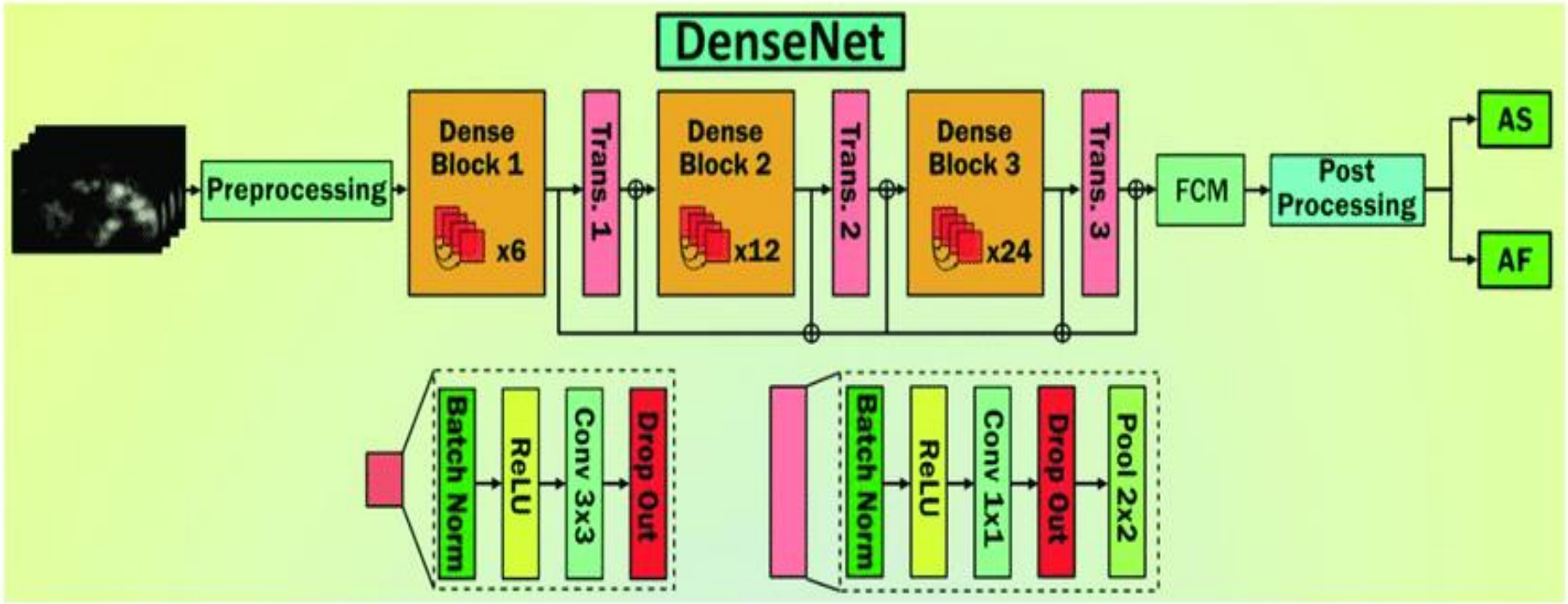
2] Dexpression Model:-



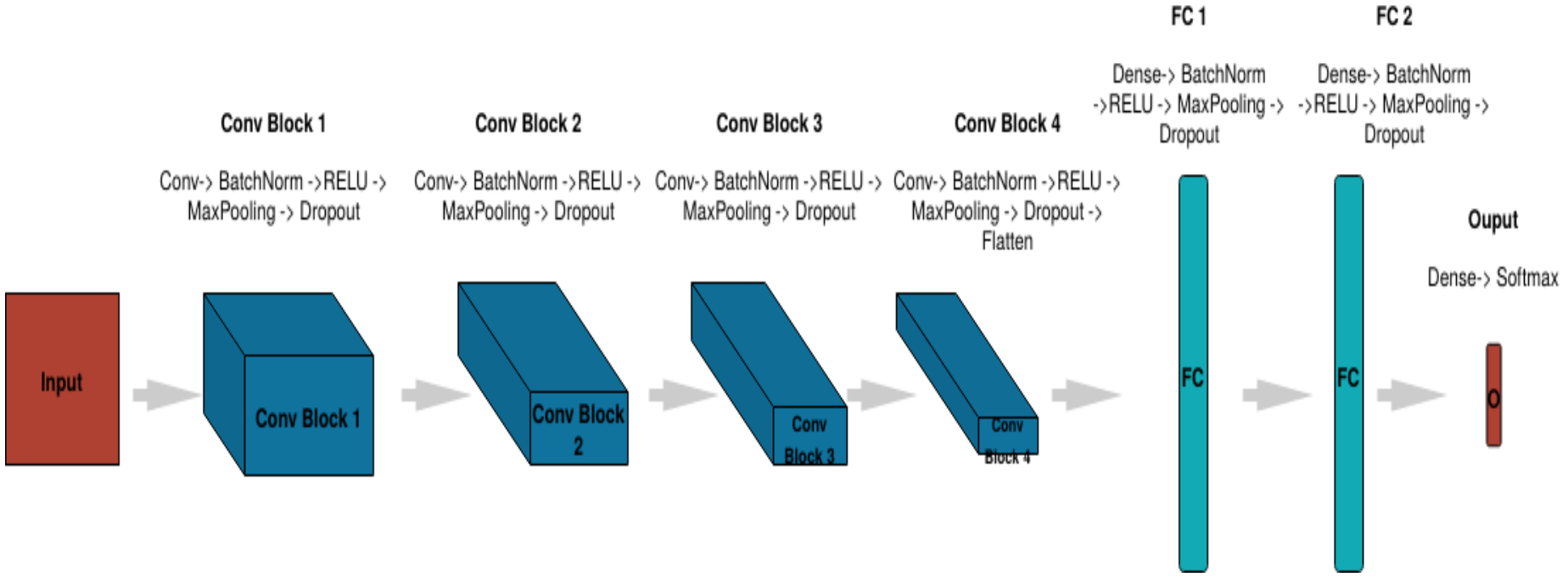
3] CNN Model:-


Convolution layer 1
Down-sampling layer 1
Convolution layer 2
Down-sampling layer 2
Convolution layer 3
Down-sampling layer 3
Happiness
Sadness
Anger
Surprise
. . .
Input image
Convolution and down-sampling layers
Fully connected classification

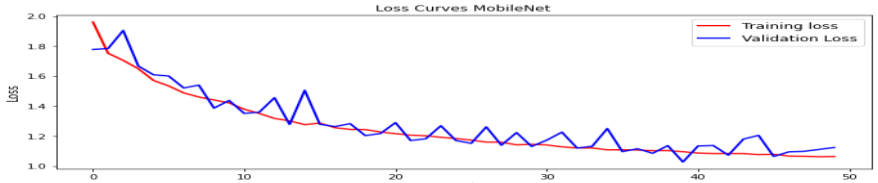
4] DenseNetModel:-

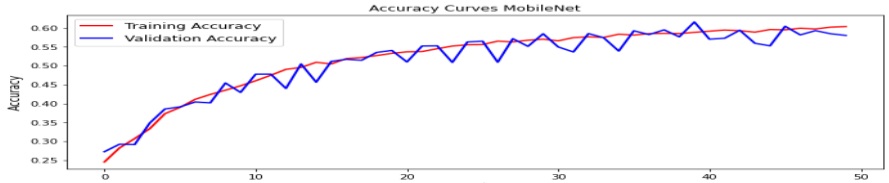


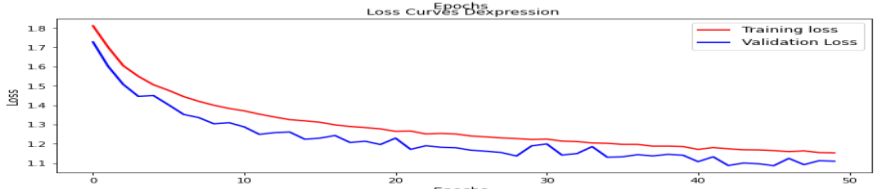
5] ResNet Model:-

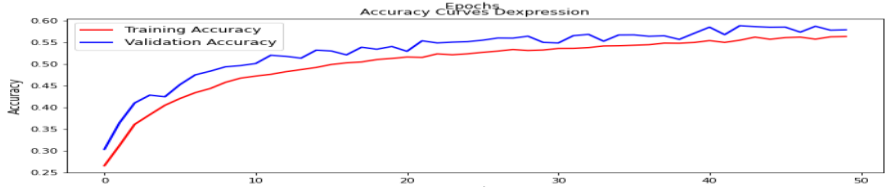


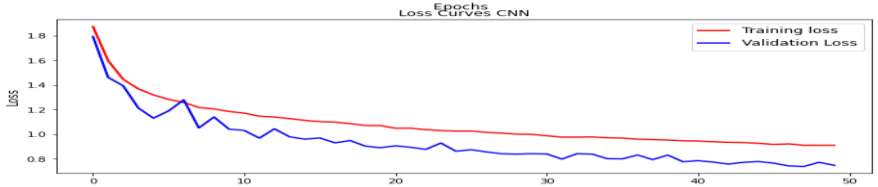
Accuracy and Loss Curves:-

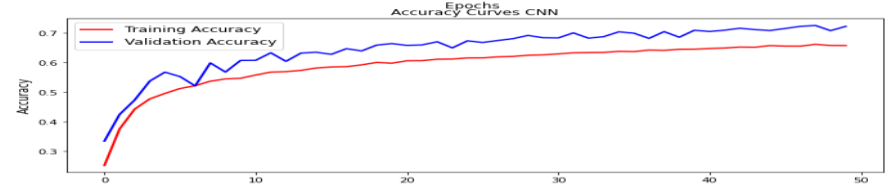


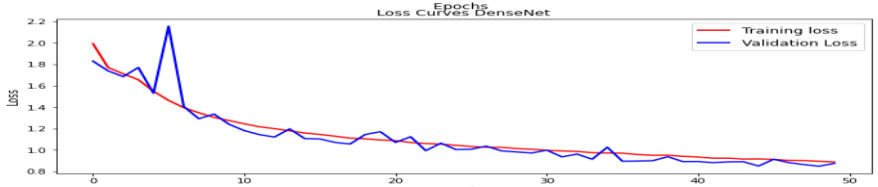


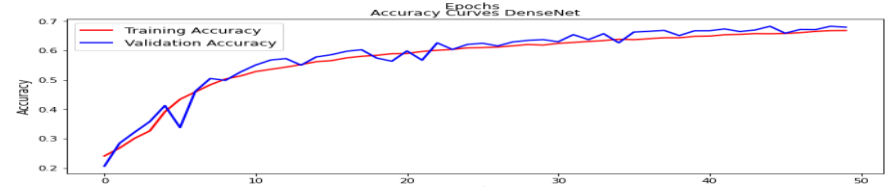


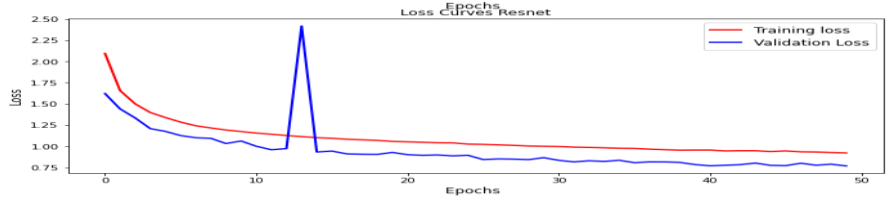


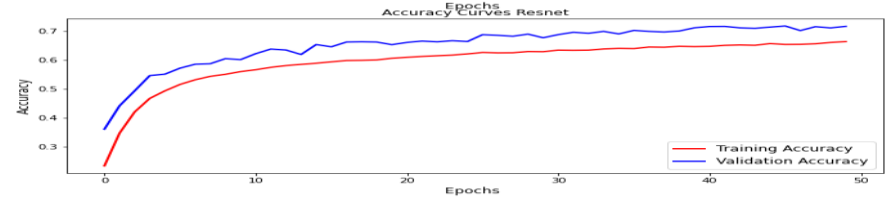




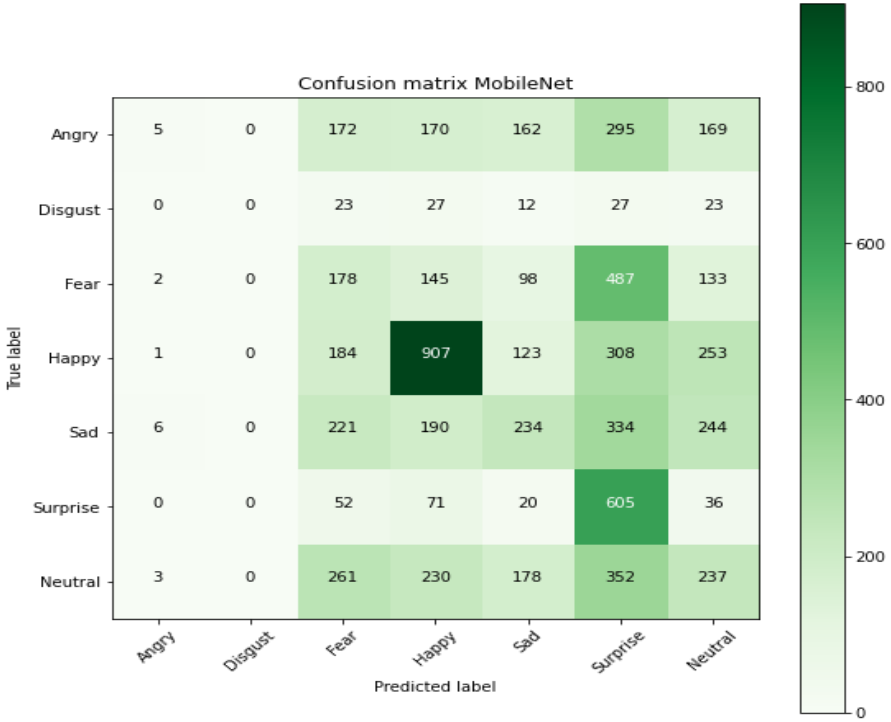








Confusion Matrix:-

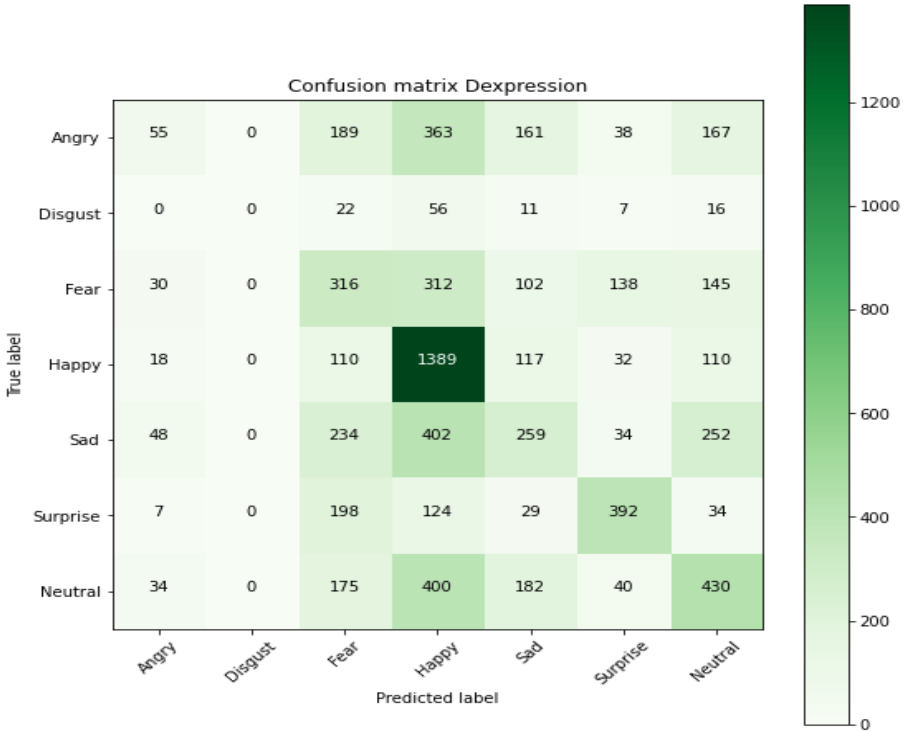


Confusion Matrix For MobileNet

	precision	recall	f1-score	support
0	0.294	0.005	0.010	973
1	0.000	0.000	0.000	112
2	0.163	0.171	0.167	1043
3	0.521	0.511	0.516	1776
4	0.283	0.190	0.228	1229
5	0.251	0.772	0.379	784
6	0.216	0.188	0.201	1261
accuracy			0.302	7178
macro avg	0.247	0.262	0.214	7178
weighted avg	0.306	0.302	0.269	7178

Classification report

Confusion Matrix cont.

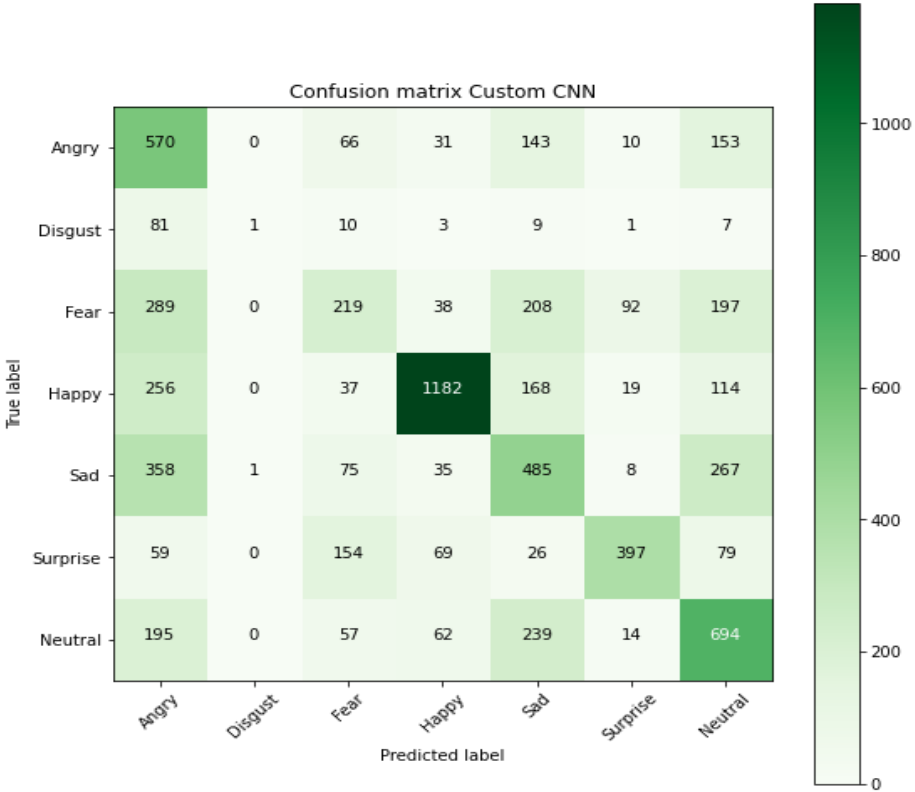


Confusion Matrix For Dexpression

	precision	recall	f1-score	support
0	0.286	0.057	0.094	973
1	0.000	0.000	0.000	112
2	0.254	0.303	0.276	1043
3	0.456	0.782	0.576	1776
4	0.301	0.211	0.248	1229
5	0.576	0.500	0.535	784
6	0.373	0.341	0.356	1261
accuracy			0.396	7178
macro avg	0.321	0.313	0.298	7178
weighted avg	0.368	0.396	0.359	7178

Classification report

Confusion Matrix cont.

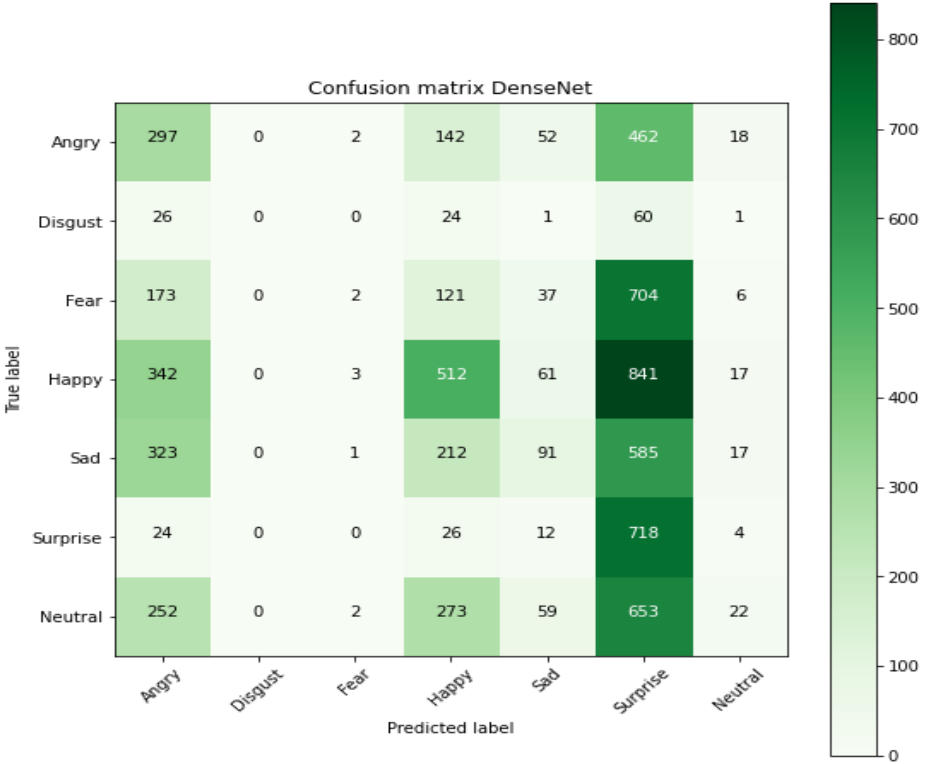


Confusion Matrix For CNN

	precision	recall	f1-score	support
0	0.315	0.586	0.410	973
1	0.500	0.009	0.018	112
2	0.354	0.210	0.264	1043
3	0.832	0.666	0.740	1776
4	0.379	0.395	0.387	1229
5	0.734	0.506	0.599	784
6	0.459	0.550	0.501	1261
accuracy			0.494	7178
macro avg	0.511	0.417	0.417	7178
weighted avg	0.534	0.494	0.497	7178

Classification report

Confusion Matrix cont.

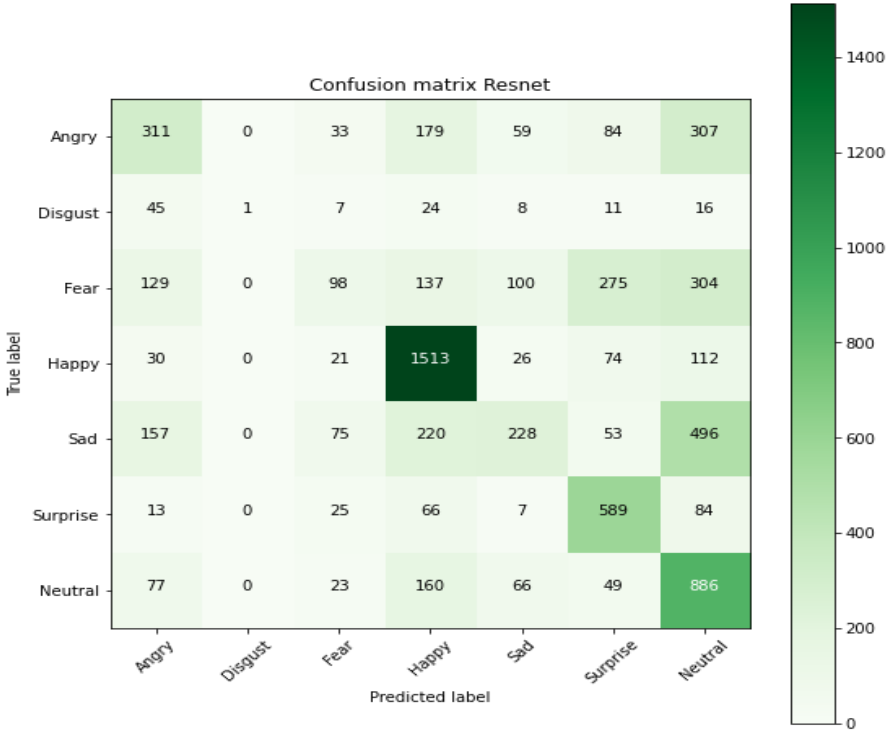


Confusion Matrix For DenseNet

	precision	recall	f1-score	support
0	0.207	0.305	0.246	973
1	0.000	0.000	0.000	112
2	0.200	0.002	0.004	1043
3	0.391	0.288	0.332	1776
4	0.291	0.074	0.118	1229
5	0.178	0.916	0.299	784
6	0.259	0.017	0.033	1261
accuracy			0.229	7178
macro avg	0.218	0.229	0.147	7178
weighted avg	0.269	0.229	0.175	7178

Classification report

Confusion Matrix cont.



Confusion Matrix For Resnet

	precision	recall	f1-score	support
0	0.408	0.320	0.359	973
1	1.000	0.009	0.018	112
2	0.348	0.094	0.148	1043
3	0.658	0.852	0.743	1776
4	0.462	0.186	0.265	1229
5	0.519	0.751	0.614	784
6	0.402	0.703	0.511	1261
accuracy			0.505	7178
macro avg	0.542	0.416	0.379	7178
weighted avg	0.491	0.505	0.456	7178

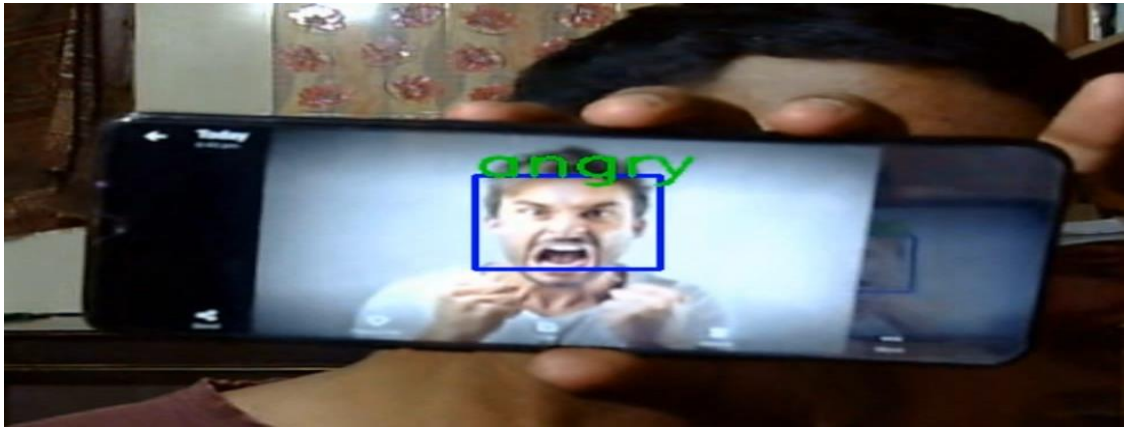
Classification report

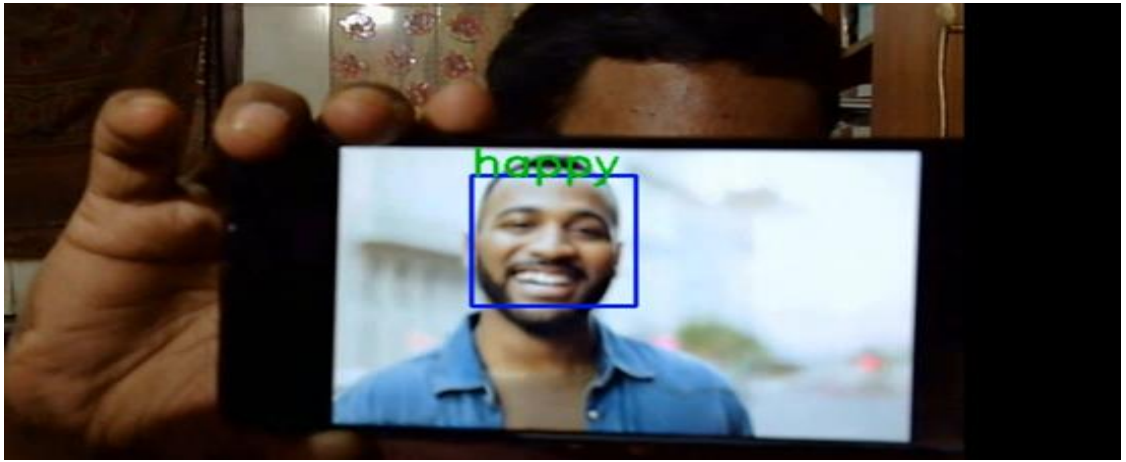
Confusion Matrix cont.

- The ResNet model was chosen because it had the highest training accuracy of all the models, and its validation accuracy was nearly 72 percent, which is comparable to CNN models.

Real-Time Face Emotion Detection:-

Real-Time Face Emotion Detection cont.





Deployment:-

Creating Web App Using Streamlit:-

- Streamlit is a Python framework for developing machine learning and data science web apps that is open-source. Using Streamlit, we can quickly create web apps and deploy them. You can use Streamlit to make an app the same way you'd make a Python programme. It's possible with Streamlit. Working on the interactive loop of coding and viewing results is a pleasure.In the web application.

Deployment in cloud platform:-

- AWS (Amazon Web Services) is a comprehensive, evolving cloud computing platform provided by Amazon that includes a mixture of infrastructure as a service (IaaS), platform as a service (PaaS), and packaged software as a service (SaaS) offerings.

Link of Deployment in AWS- http://15.206.194.193:8501/

Challenges:-

- To handle a large image dataset.
- Selecting the number of filters and neurons.
- Select a batch size to avoid the system crashing.
- GPU connection to our notebook.
- Deployment.

Conclusion:-

- We started this project with two objectives: to achieve the highest level of accuracy and to implement our model into practice in the real world.
- Among the models tested were MobileNet, Dexpression, CNN, DenseNet and Resnet
- The ResNet model was chosen because it had the highest training accuracy of all the models, and its validation accuracy was nearly 72 percent, which is comparable to CNN models.
- As a result, we save the Resnet model and use it for facial expression prediction.
- A front-end model was successfully created and run on a local web server using Streamlit.
- On Amazon's AWS cloud platform, the Streamlit web application has been successfully deployed.

Thank You