

Capstone Project

Live Class Monitoring System (Face Emotion Recognition)

Team

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Introduction

Face Emotion Recognition

Importance

Applications

- Product Development
- Video game



Problem Statement

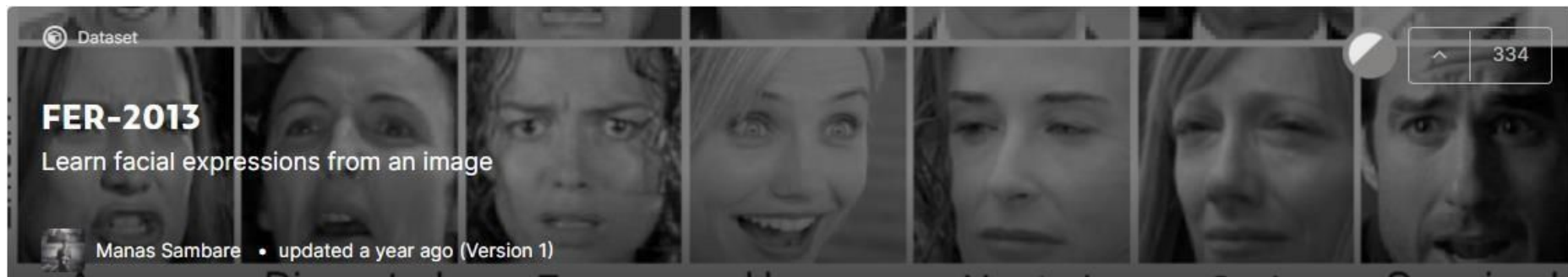
The Indian education landscape has been undergoing rapid changes for the past 10 years owing to the advancement of web-based learning services, specifically, eLearning platforms.

In a physical classroom during a lecturing teacher can see the faces and assess the emotion of the class and tune their lecture accordingly, whether he is going fast or slow. He can identify students who need special attention. Digital classrooms are conducted via a video telephony software program (ex- Zoom) where it's not possible for medium-scale class (25-50) teacher to see all students and access the mood. Because of this drawback, students are not focusing on content due to a lack of surveillance. While digital platforms have limitations in terms of physical surveillance but it comes with the power of data and machines which can work for you. It data can be analyzed using deep learning algorithms which not only solves the surveillance issue, but it also removes the human bias from the system.

Data Summary

Data Set link

<https://www.kaggle.com/msambare/fer2013>



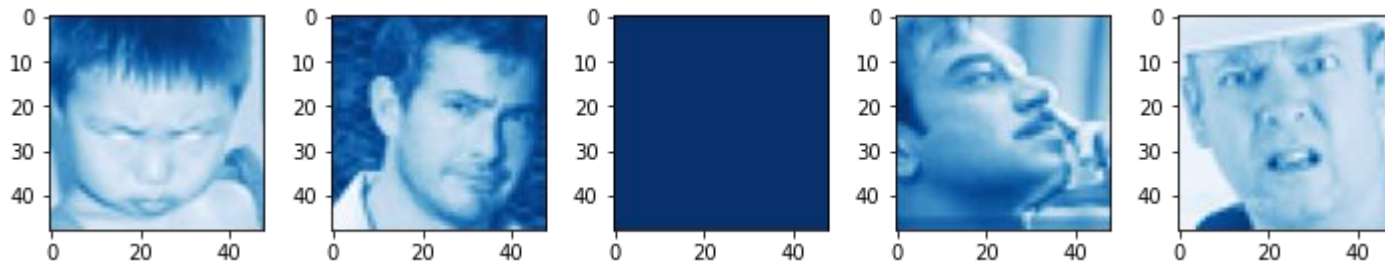
This dataset contains 35887 grayscale 48x48 pixel face images with seven emotions.

Data Summary

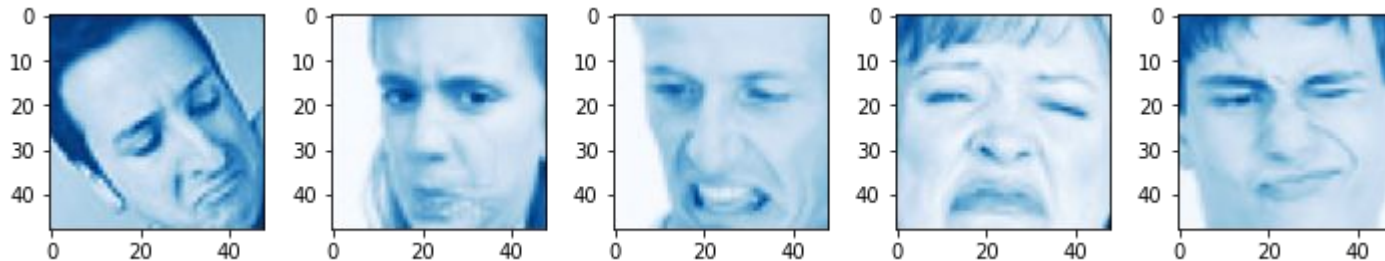
Label	Emotion	No. of images for Training	No. of images for Testing
0	Angry	3995	958
1	Disgust	436	111
2	Fear	4097	1024
3	Happy	7215	1774
4	Sad	4830	1247
5	Surprised	3171	831
6	Neutral	4965	1233

Data Summary

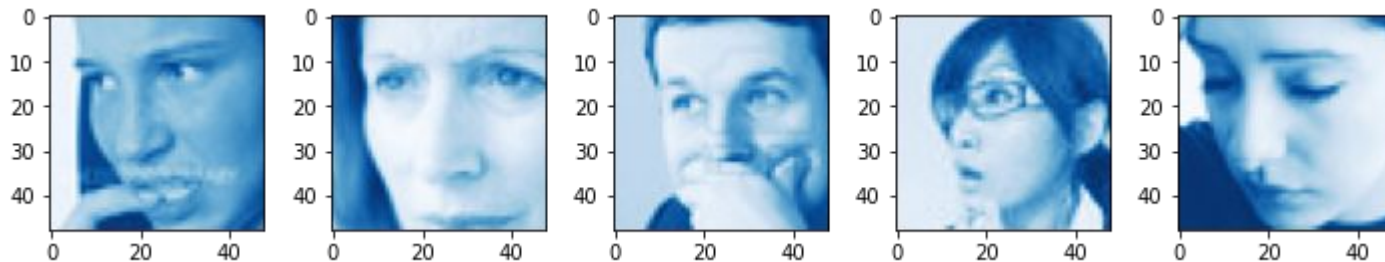
Angry



Disgust

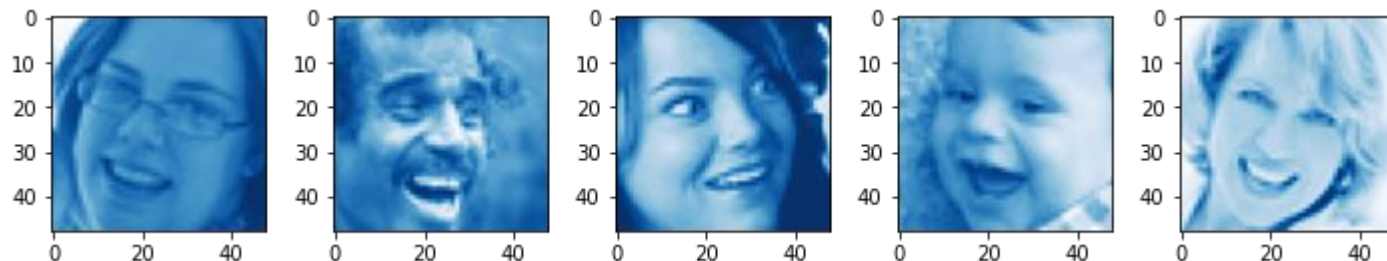


Fear

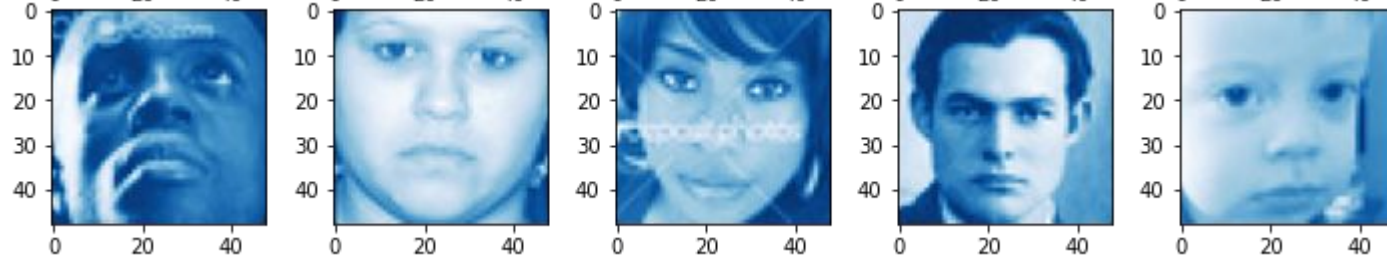


Data Summary

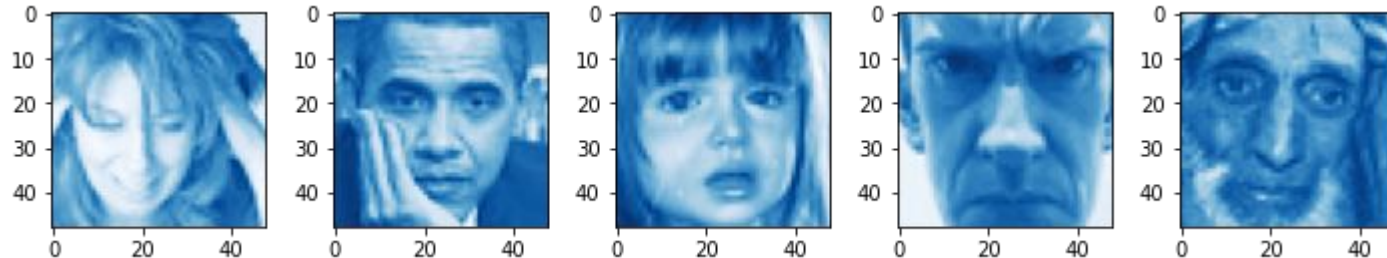
Happy



Sad



Surprised



Pipeline

Data Exploration

Understanding the data

- Types of emotions
- Images in each category

Modeling

Modeling structures

- Transfer learning
- CNN

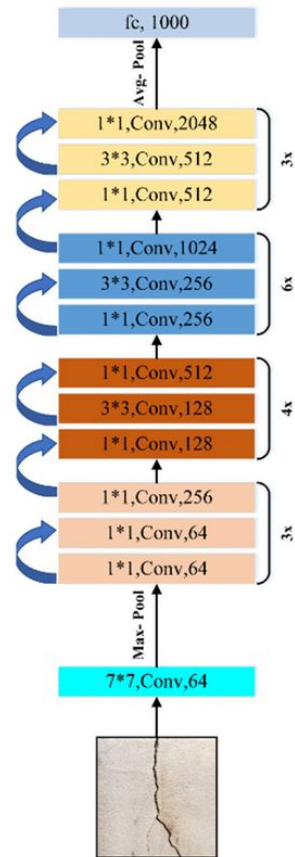
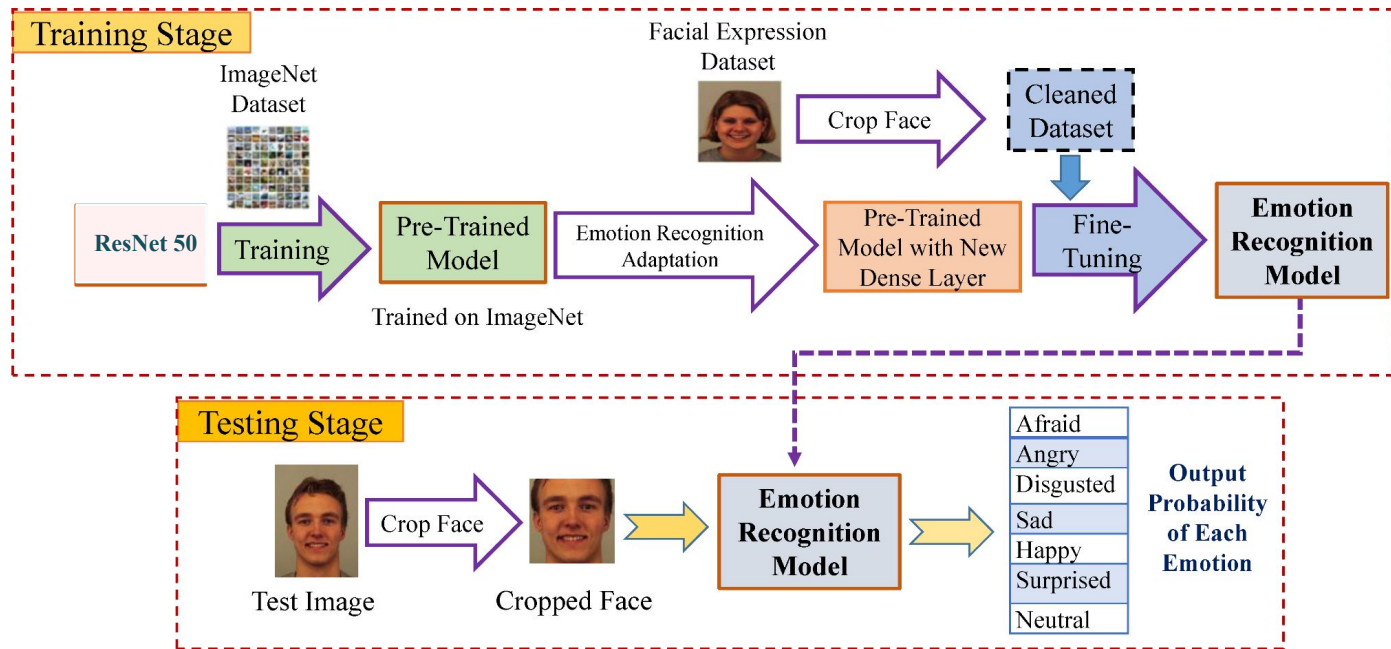
Model evaluation & deployment

Graphs and applications

- **Loss & accuracy plots**
- **Confusion matrix (Heatmap)**
- **Streamlit**
- **Heroku**

Model Creation

1) Transfer Learning (ResNet50)



Modeling Steps

Layers

- Pre trained 50 conv layers
- Flatten layer
- FCL - 512 units
- FCL - 256 units
- FCL - 7 units

Parameters

- Activation Function - ReLu, Softmax
- Epoch - 50
- Optimizer - Adam
- Batch size -32
- Callbacks- EarlyStopping, ReduceLROnPlateau

Evaluation

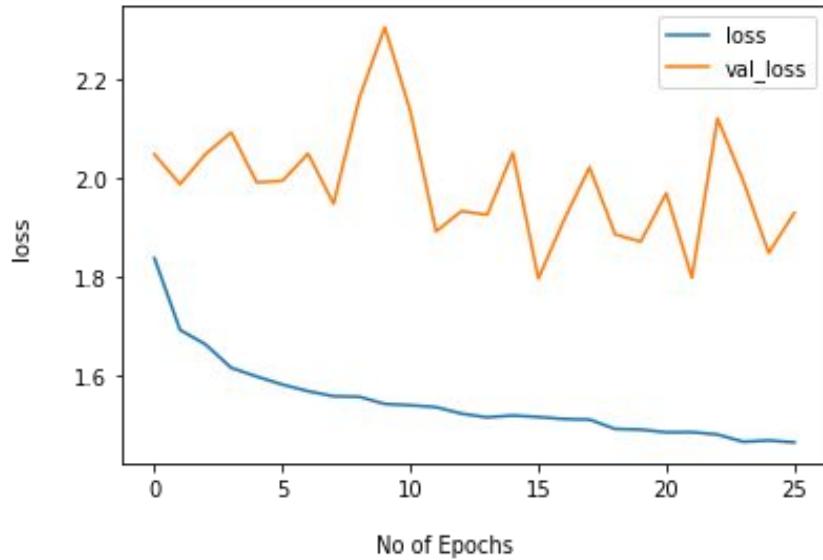
- Loss and accuracy plots
- Heatmap of confusion matrix

Also we use some common techniques for each layer

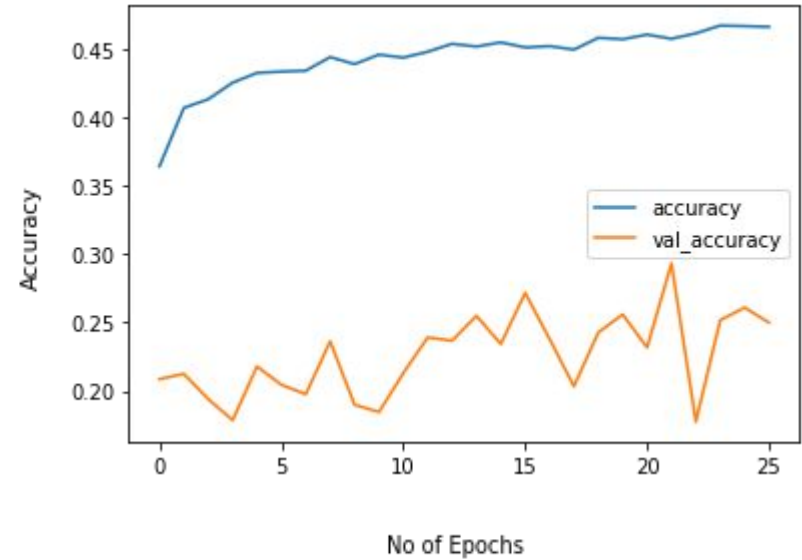
- Batch normalization
- Dropout

Model Evaluation

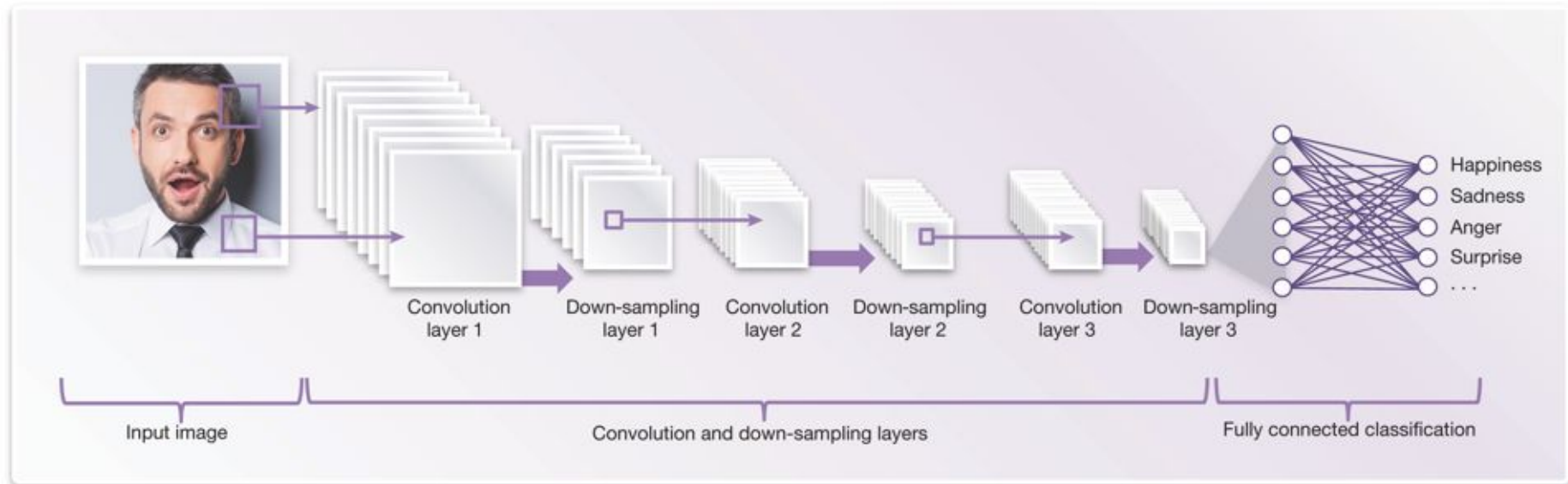
Categorical Crossentropy



Accuracy



2) CNN



Modeling Steps

Layers

- Layer 1- 3*3,Conv,64
- Layer 2- 3*3,Conv,128
- Layer 3- 3*3,Conv,254
- Layer 4- 3*3,Conv,512
- Flatten layer
- FC - 512 units
- FC - 256 units
- FC - 7 units

Parameters

- **Activation Function - ReLu, Softmax**
- **Epoch - 50**
- **Optimizer - Adam**
- **Batch size -32**
- **Callbacks- EarlyStopping, ReduceLROnPlateau**

Evaluation

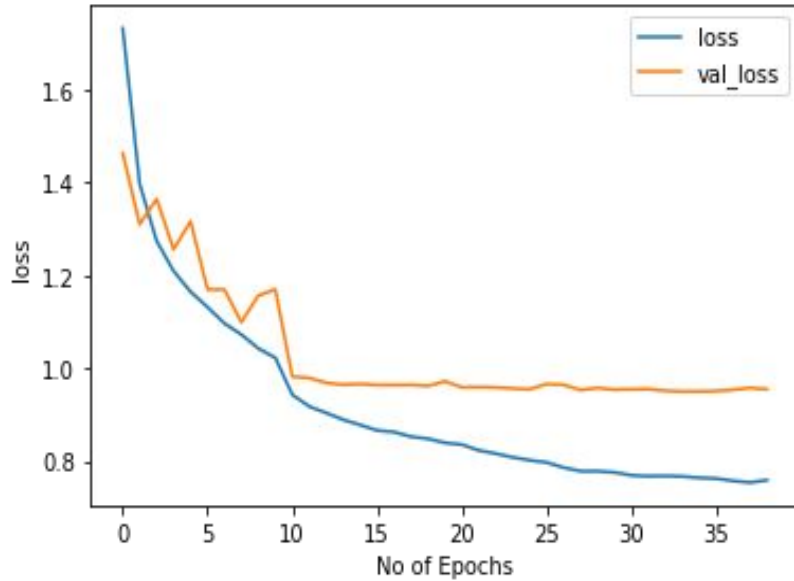
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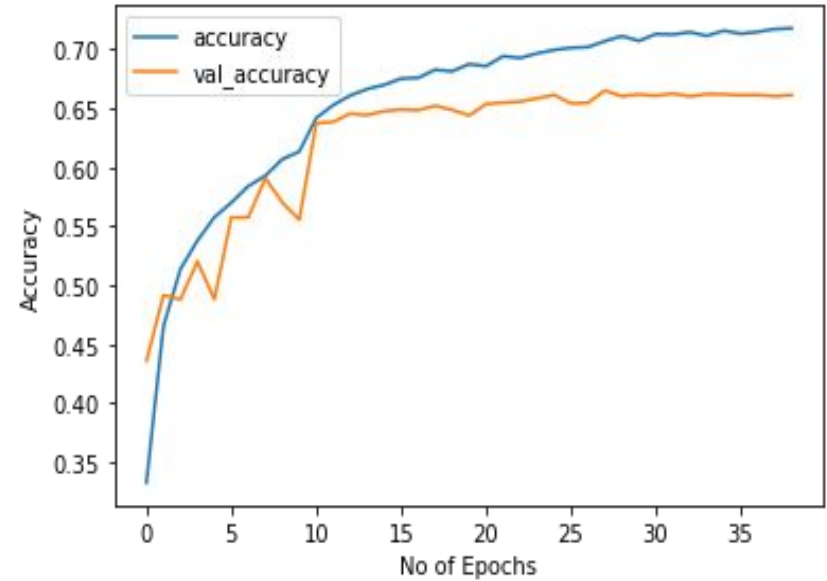
- **Batch normalization**
- **Dropout**

Model Evaluation

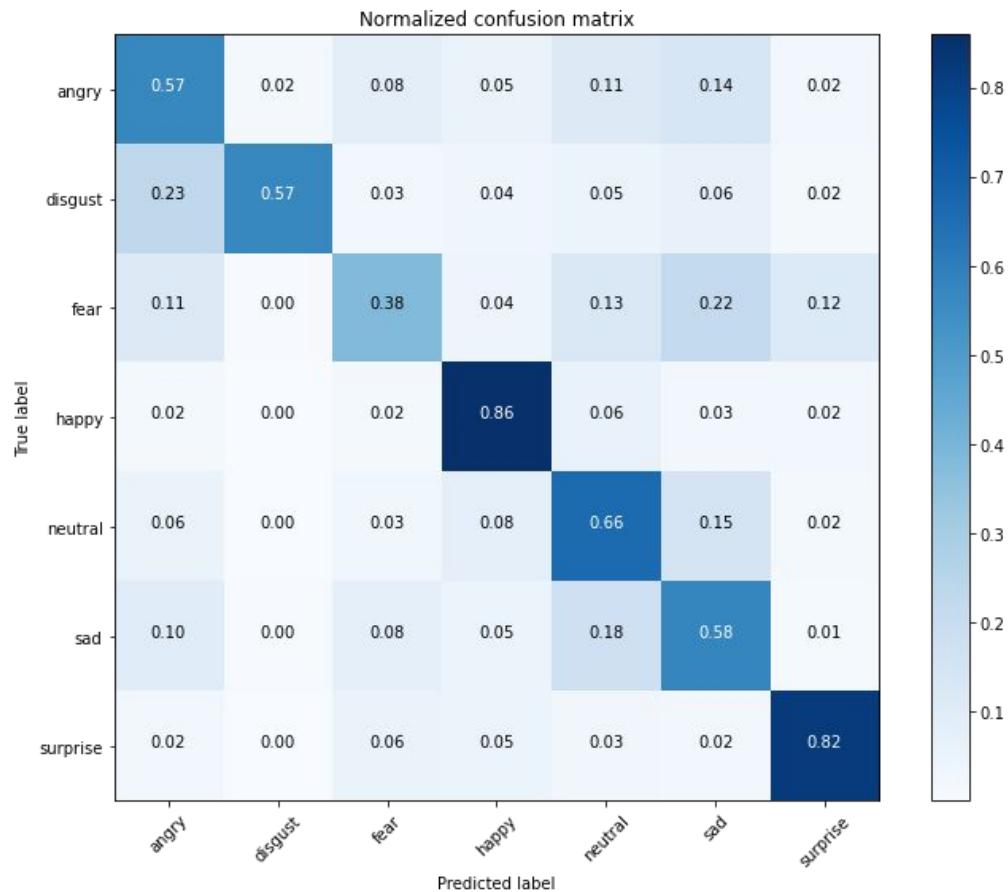
Categorical Crossentropy



Accuracy



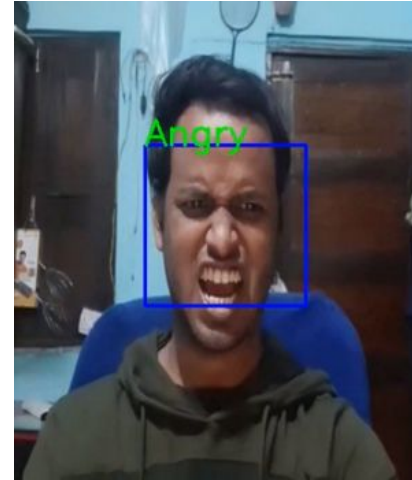
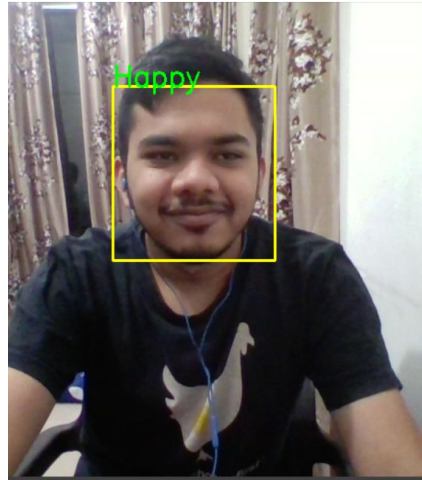
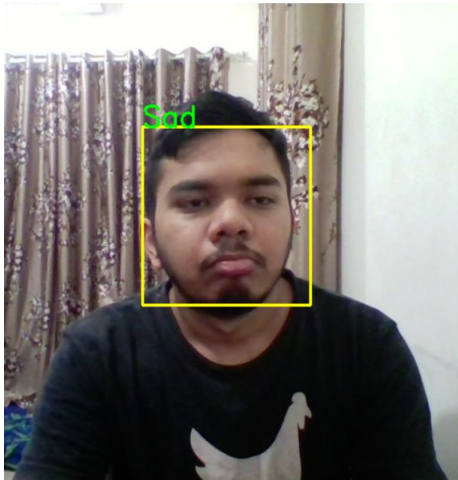
Confusion matrix (Heatmap)



Real Time Face Emotion Detection



Real Time Face Emotion Detection



Deployment

Creating Web App Using Streamlit

Streamlit is an open-source python framework for building web apps for Machine Learning and Data Science. We can instantly develop web apps and deploy them easily using Streamlit. Streamlit allows you to write an app the same way you write a python code. Streamlit makes it seamless to work on the interactive loop of coding and viewing results in the web app.



https://share.streamlit.io/aaryant31/face_emotion_recognition/main/app.py

Deployment

Deployment in cloud platform

Heroku is a container-based cloud Platform as a Service (PaaS) supporting several programming languages as Java, Node.js, Scala, Python, PHP, and Go.



<https://face-recognition-emotion.herokuapp.com/>

Challenges

- Large image dataset to handle
- Connecting Gpu to jupyter
- Selecting No. of filters and neurons
- Selecting batch size to avoid crashing of the system
- Deployment



Conclusion

- The CNN model gave us training accuracy of 71 % and validation accuracy of 66 %.
- A front-end model was successfully created using Streamlit and run on a local webserver.
- Successfully deployed Streamlit web app on Heroku and streamlit share that runs on a web server.



Thank You