# 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

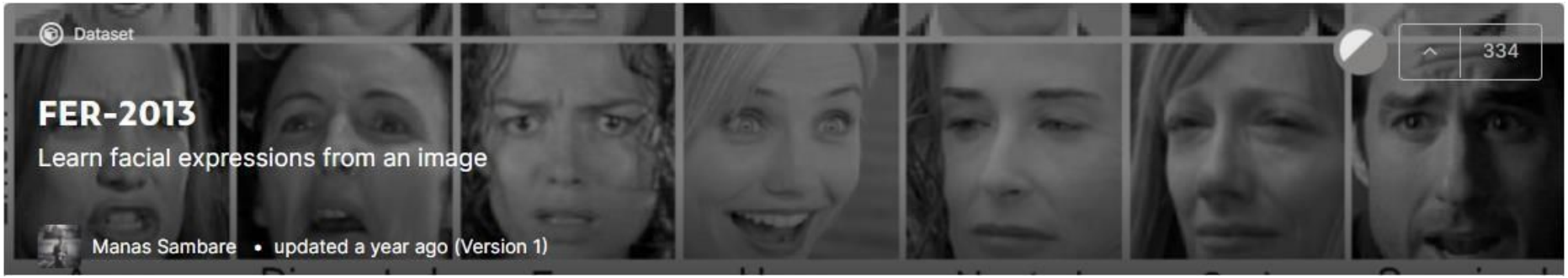
The Indian education landscape has been undergoing rapid changes for the past 10 years owing to the advancement of web-based learning services, specifically, eLearning platforms.

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.This 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

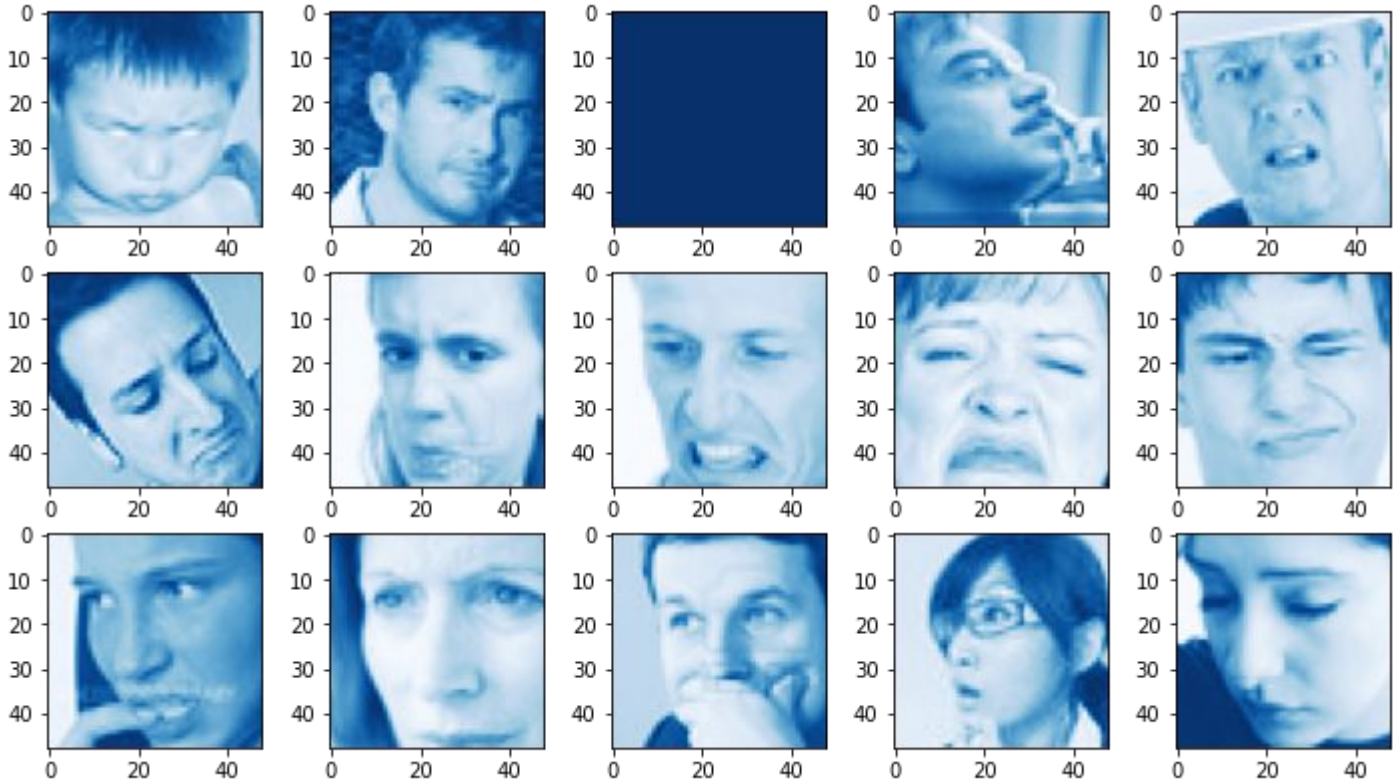
| Label | Emotion | No. of images for Training | No. of images for Testing |
|---|---|---|---|
| 0 | Angry | 3995 | 958 |
| 1 | Disgust | 436 | 111 |
| 2 | Fear | 4097 | 1024 |
| 3 | Happy | 7215 | 1774 |
| 4 | Sad | 4830 | 1247 |
| 5 | Surprised | 3171 | 831 |
| 6 | Neutral | 4965 | 1233 |

# Data Summary

Angry

Disgust

Fear

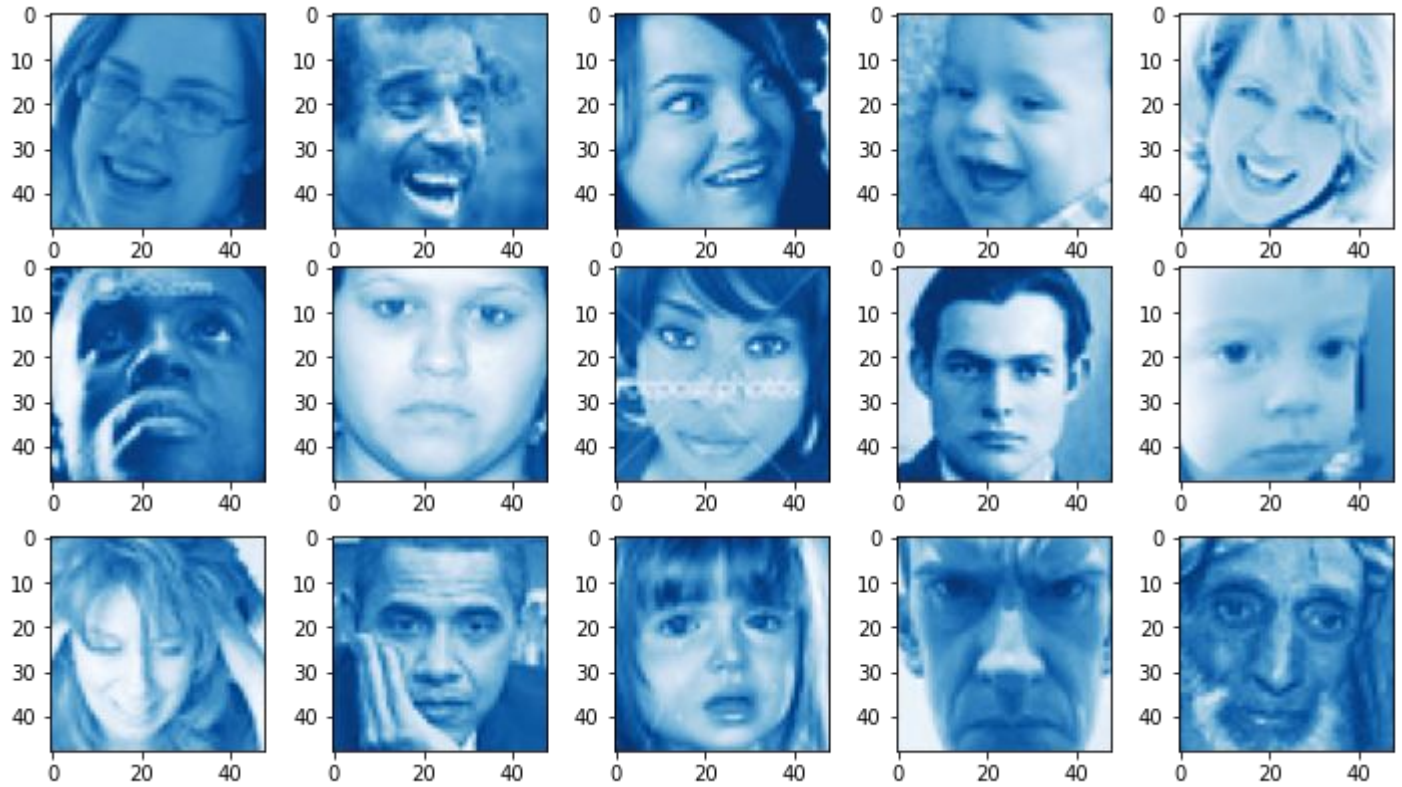


# Data Summary

Happy

Sad

Surprised



# Pipeline

**Data Exploration** → **Modeling** → **Model evaluation & deployment**

### Understanding the data

- Types of emotions
- Images in each category
- Their properties

### Modeling structures

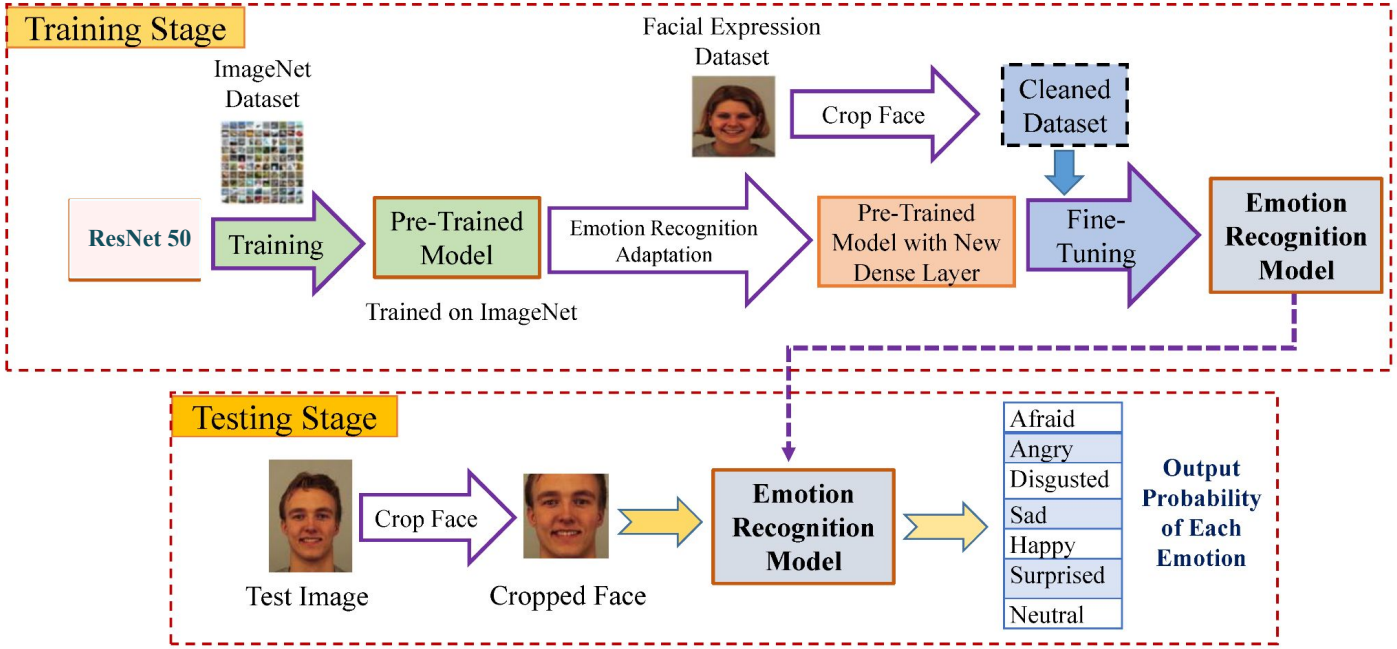
- Transfer learning
- CNN

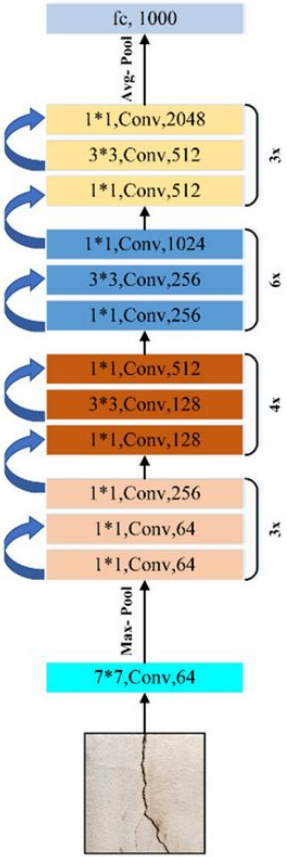
### Graphs and applications

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

# Model Creation

## 1) Transfer Learning (ResNet50)



# Modeling Steps


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

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

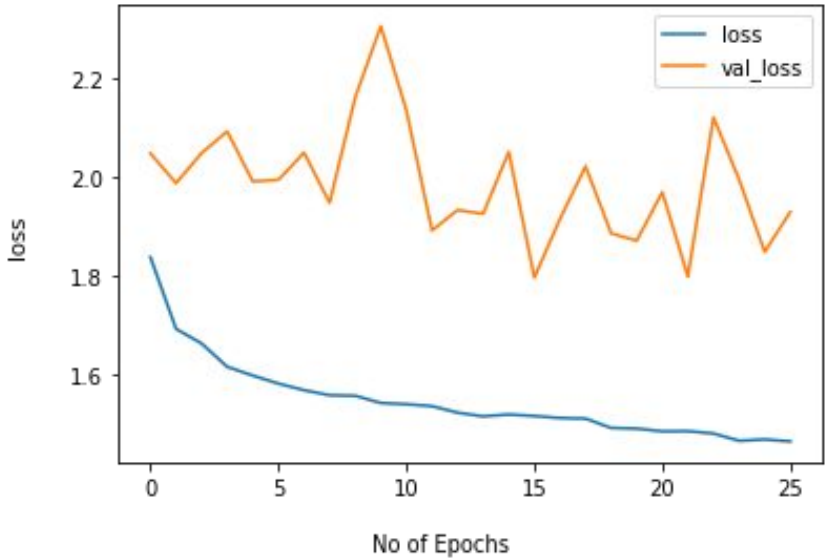
- Loss and accuracy plots
- Heatmap of confusion matrix

Also we use some common techniques for each layer

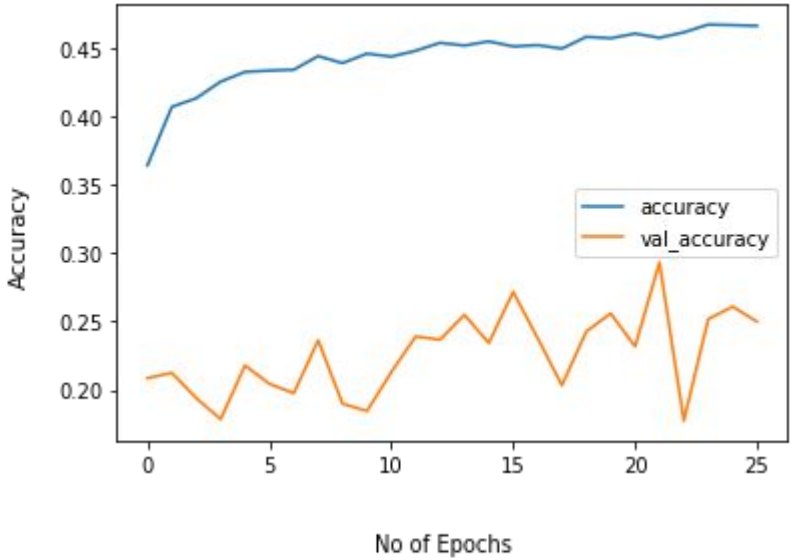
- Batch normalization
- Dropout

# Model Evaluation

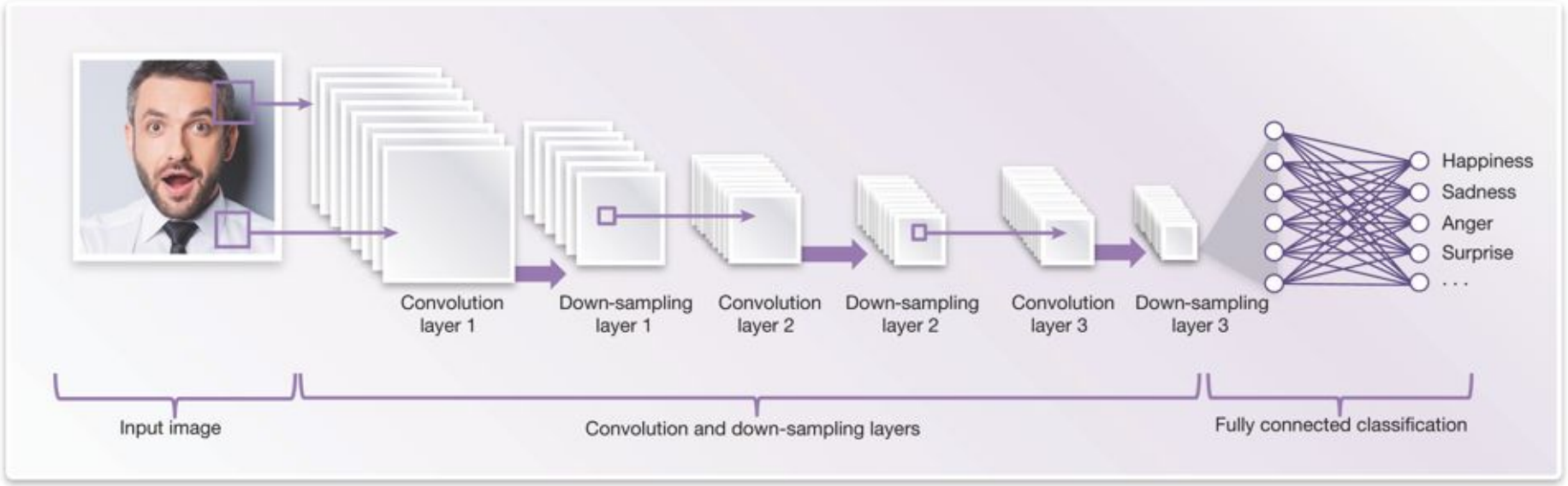
## Categorical Crossentropy




## Accuracy



# 2) CNN


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

# Modeling Steps

**Layers** → **Parameters** → **Evaluation**

- 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

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

- Loss and accuracy plots
- Heatmap of confusion matrix

**Also we use some common techniques for each layer**

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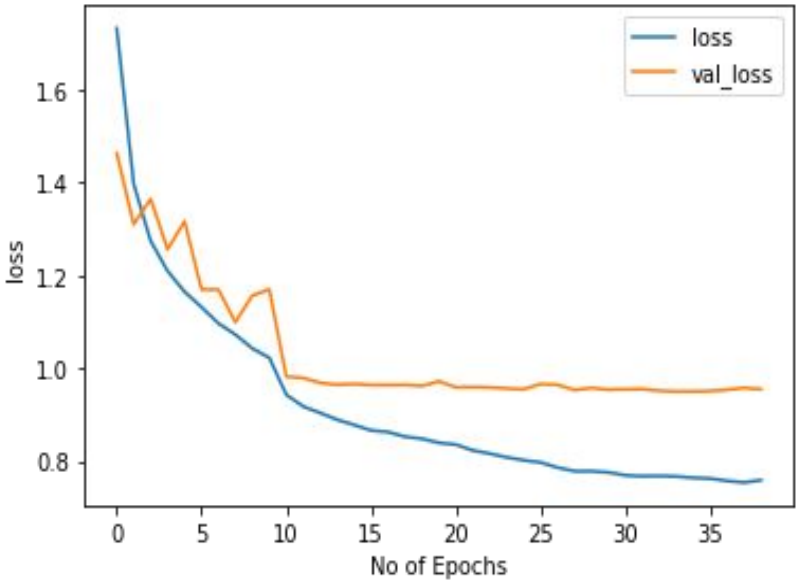
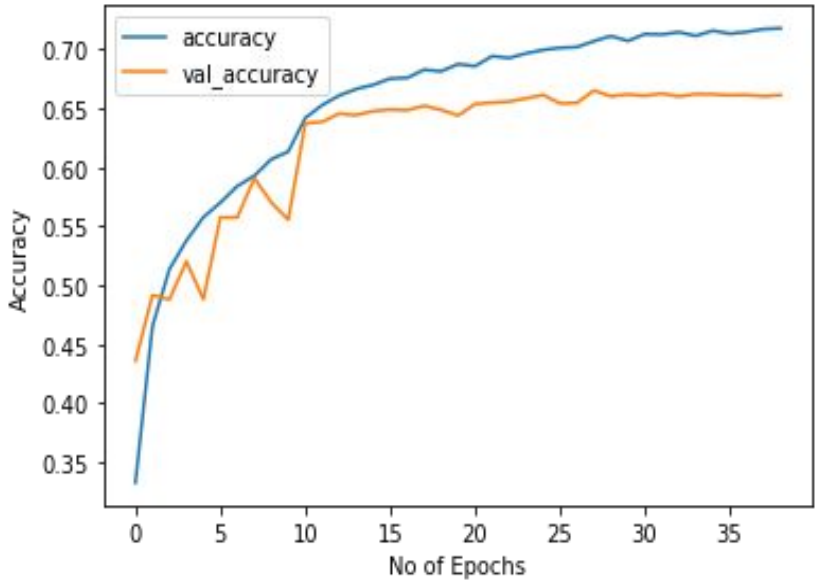
- **Dropout**

# Model Evaluation

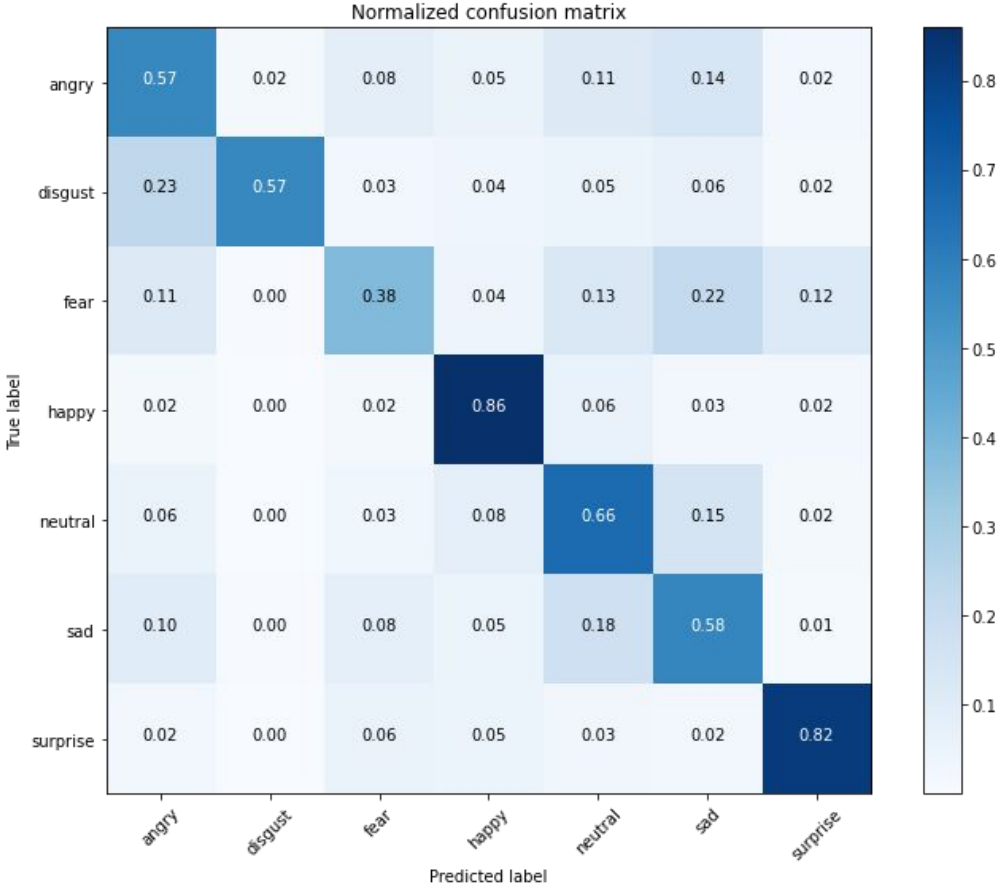
## Categorical Crossentropy




## Accuracy



# Confusion matrix (Heatmap)



# Real Time Face Emotion Detection

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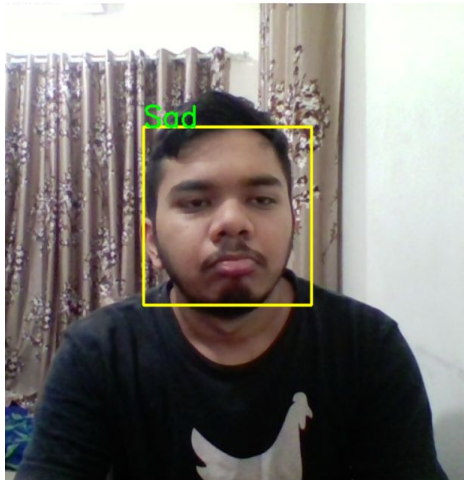


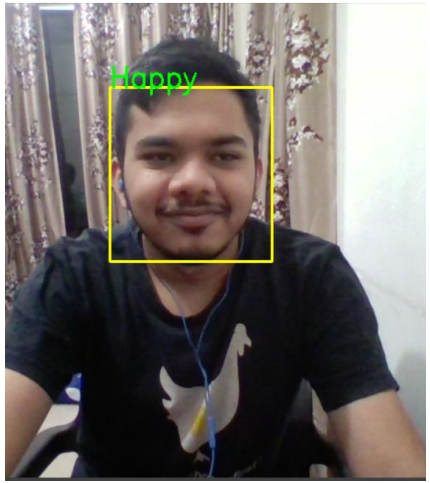



# Deployment

## 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