Capstone Project

Face Emotion Recognition

By Nayana Pradeep

PROBLEM STATEMENT

- Due to the ever changing structure of Indian education landscape, also owing to the COVID lockdown protocols, large number of students are attending online classes. This change comes with its own drawbacks. Unlike the physical classroom, teachers are unable to understand the students' emotion during the class. This tampers the communicational aspect between the students and teacher.
- Applying deep learning algorithms to live video data to recognize the students emotion is a very good resolution for this problem. The solution to this problem is by recognizing facial emotions.
- The model should be able to real-time identify the emotions of students in a live class.

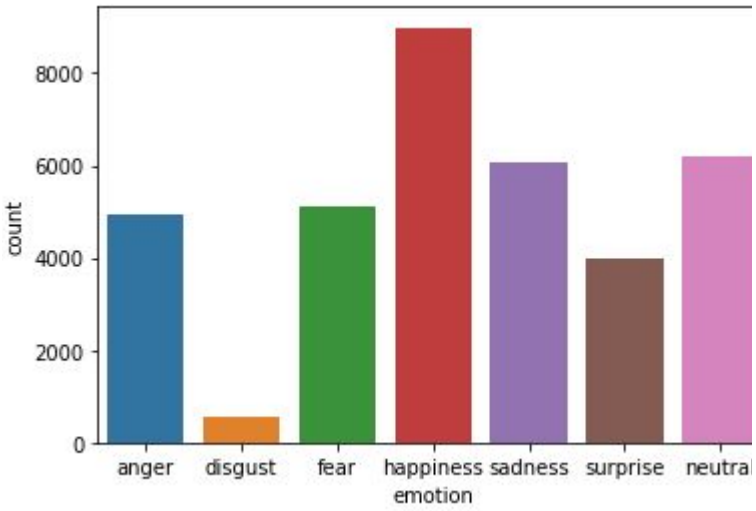
DATA SUMMARY

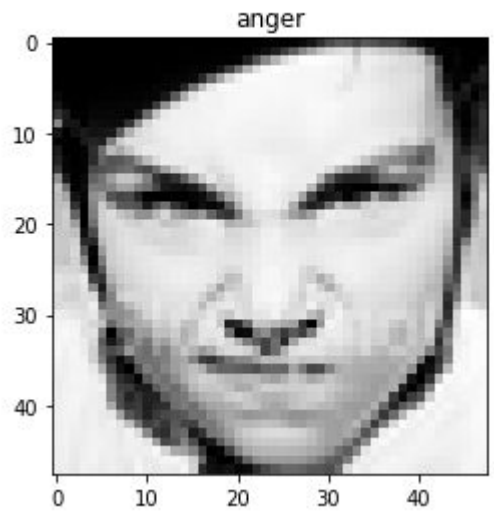
Kaggle Dataset Link:

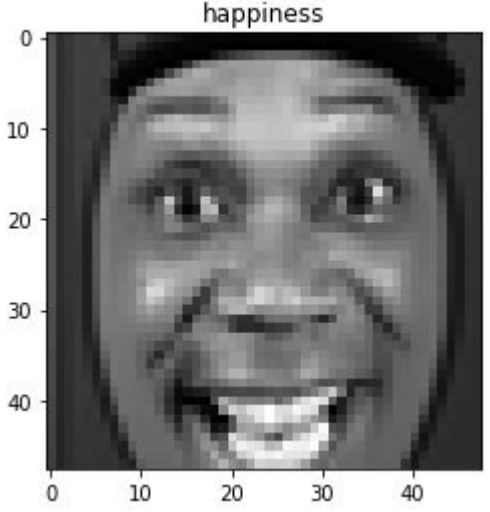
https://www.kaggle.com/c/challenges-in-representation-learning-facial-expression-recognition-challenge/data

- emotion : [0 – Angry, 1 – Disgust, 2 – Fear, 3 – Happy, 4 – Sad, 5 – Surprise, 6 – Neutral]
- pixels : Contains all the pixel values. There are a total 96 pixel values associated with each image because each image is grey-scaled and of resolution 48x48
- usage : Training, PublicTest and PrivateTest

EXPLORATORY DATA ANALYSIS



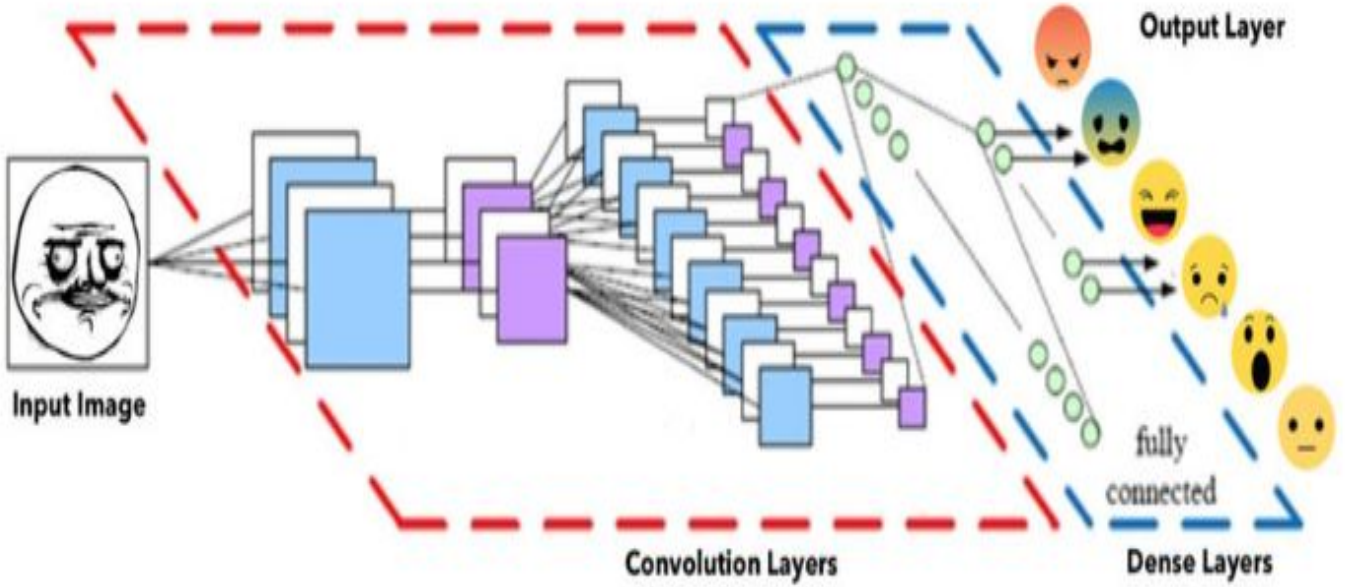




DATA TRANSFORMATION

- Flattened / pixelated images are converted into 3 dimensional image of size 48*48*1
- Images are stacked along the 4th dimension since the data has to be fed as batches rather than single images.
- Now that the images are ready, the emotions has to be label encoded for training models.
- Image arrays are normalized as the neural networks are highly sensitive towards non-normalized data

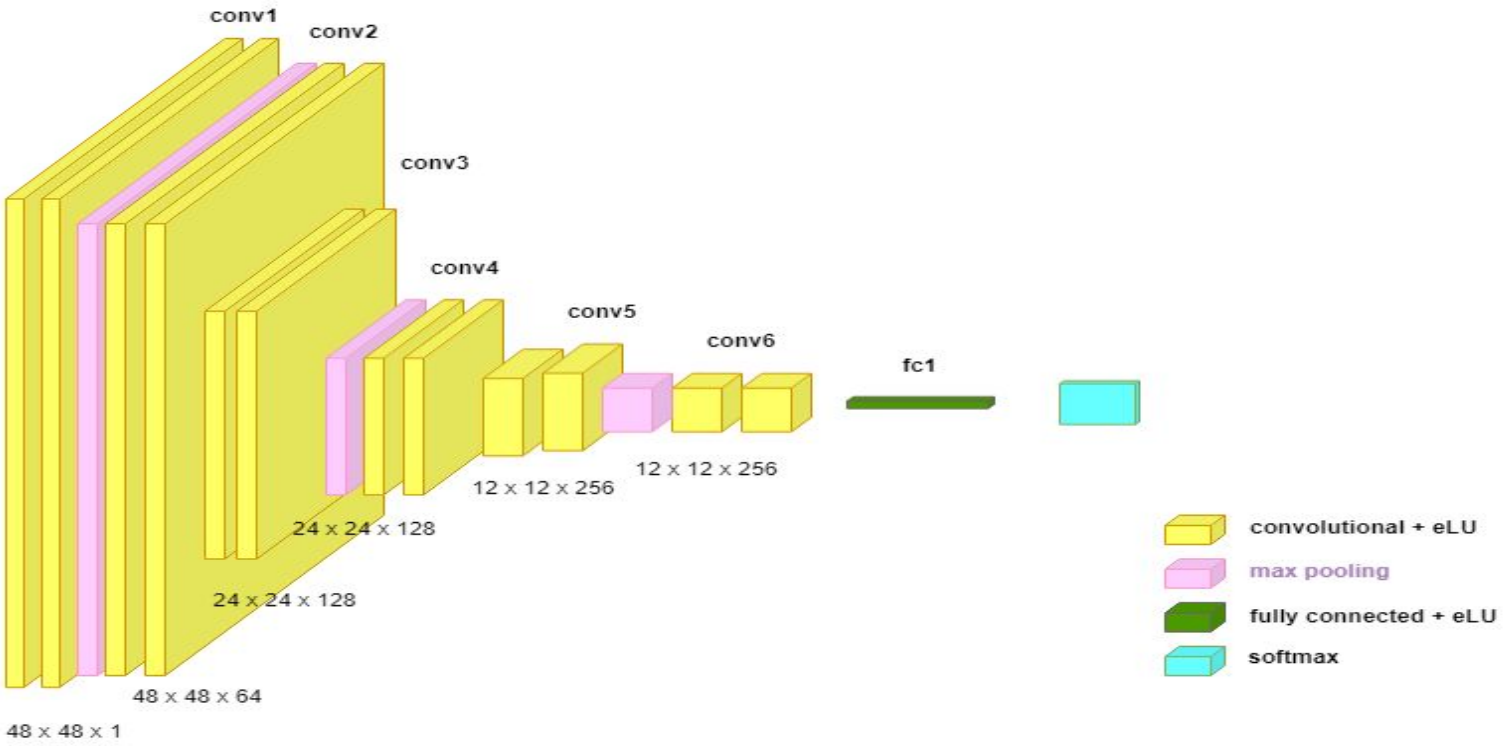
CNN ARCHITECTURE



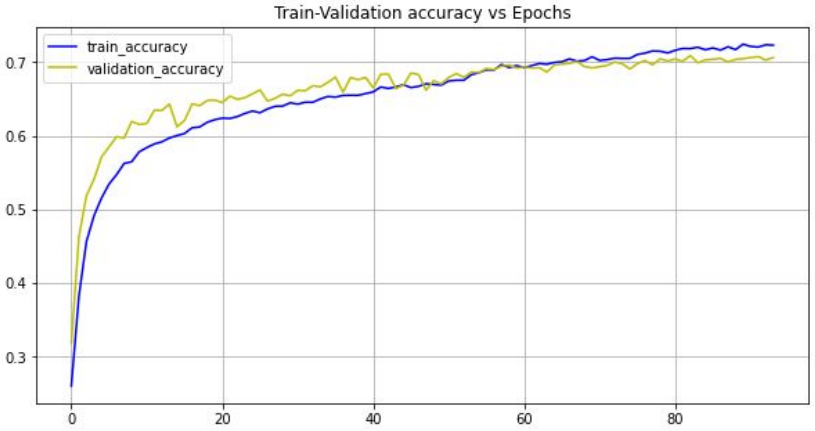
CUSTOM MODEL 1

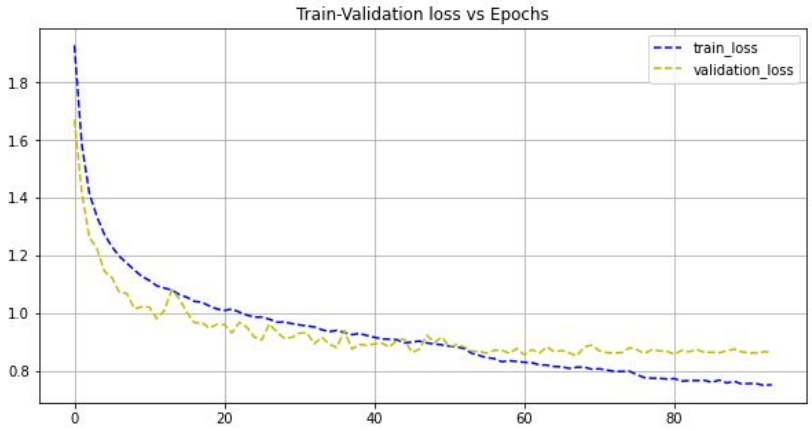
- ELU is used as the activation function in model 1.
- he_normal is used as kernel initializer as it suits ELU.
- Batch Normalization is also used for better results.
- Model1 has 6 convolutional layers with dropouts at regular intervals and one fully connected layer.
- Callback functions used : EarlyStopping and ReduceLRonPlateau

CUSTOM MODEL1 ARCHITECTURE



CUSTOM MODEL1 PERFORMANCE

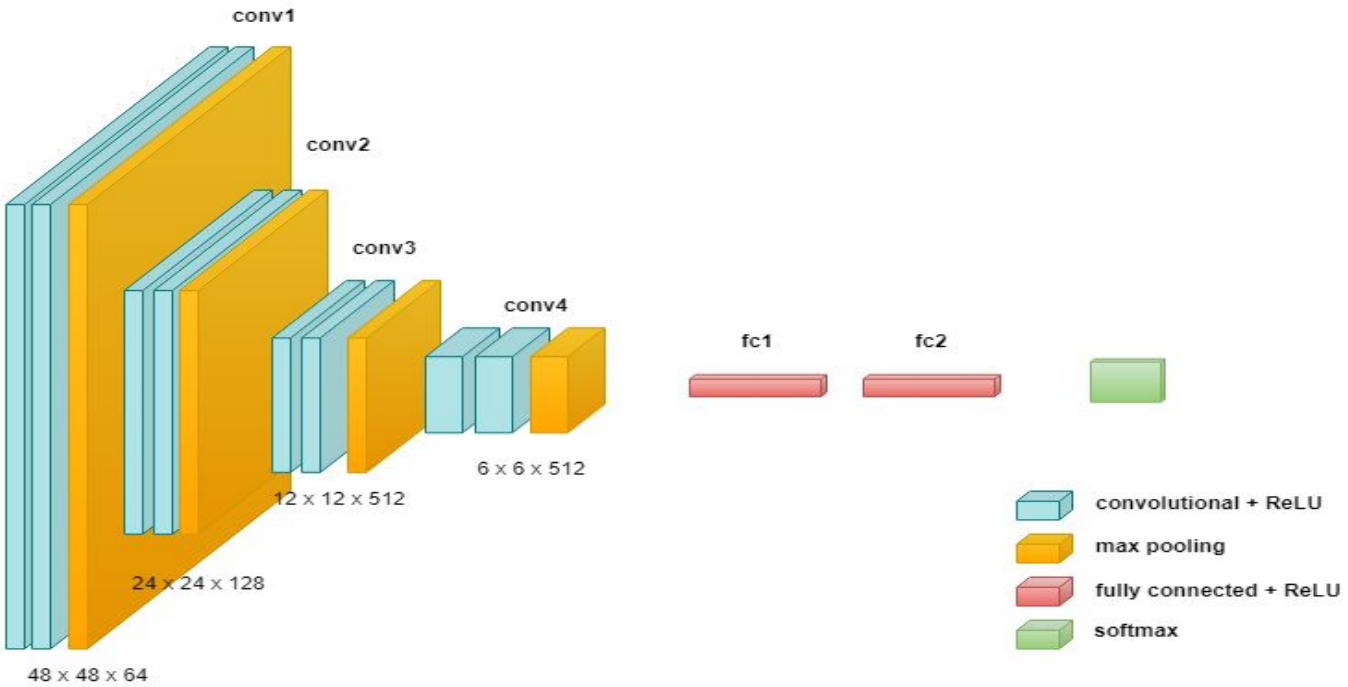




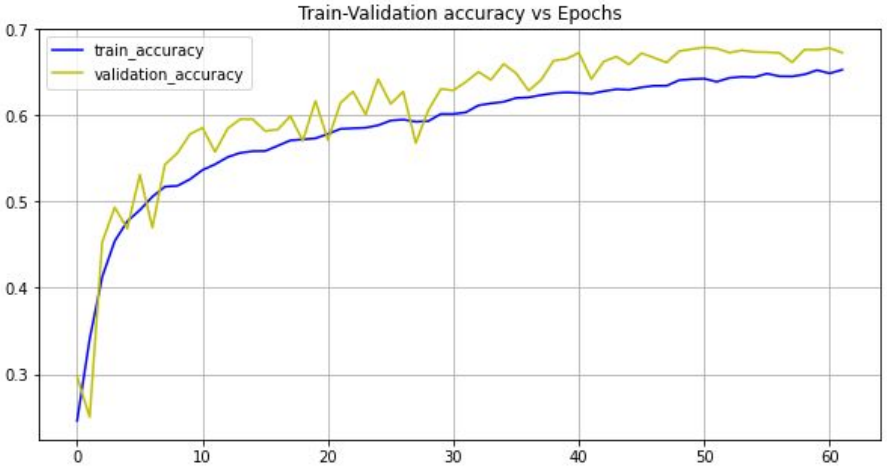
CUSTOM MODEL 2

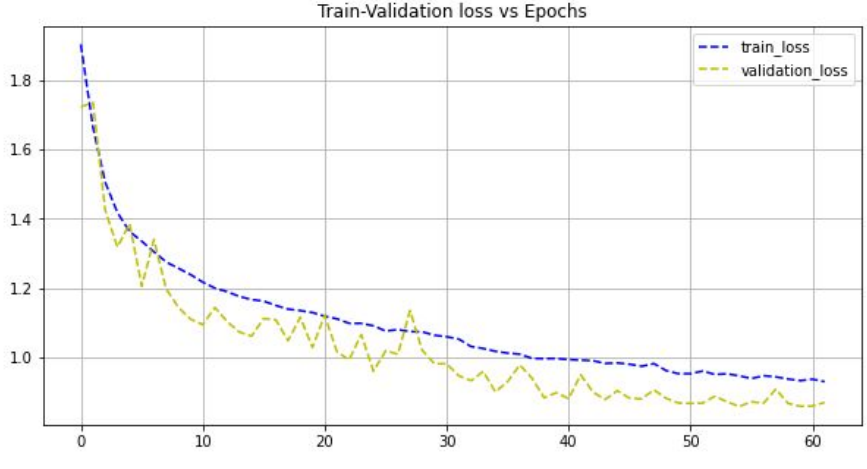
- Dropouts are used for the generalization purpose.
- RELU is used as the activation function
- 100 epochs were used
- Model2 has 4 convolution layers and 2 fully connected layers. BatchNormalization and dropouts are used in this model as well.
- Callback functions used : EarlyStopping and ReduceLROnPlateau

CUSTOM MODEL 2 ARCHITECTURE



CUSTOM MODEL 2 PERFORMANCE





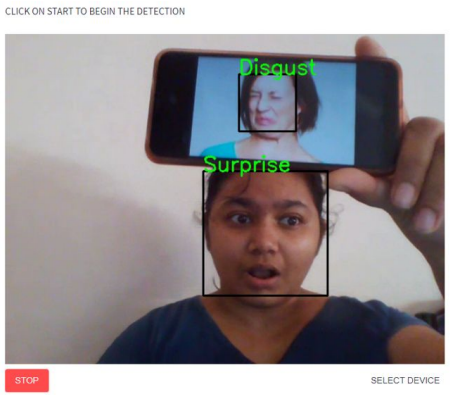
PERFORMANCE EVALUATION

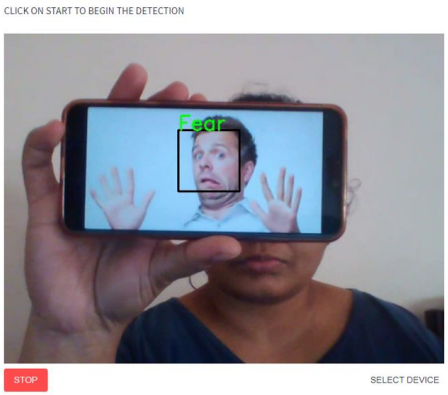
- Model1 gave 79 and 71 percentage accuracy for training and validation set respectively.
- Model2 gave 72 and 68 percentage accuracy for training and validation respectively.
- Callback functions are used for optimizing the training progress for both the models.
- Model 1 is used for emotion detection application.

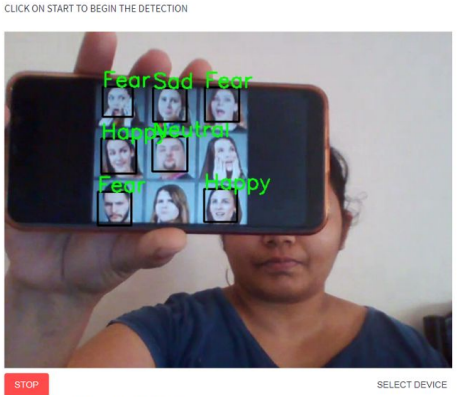
DEPLOYMENT ON STREAMLIT & HEROKU

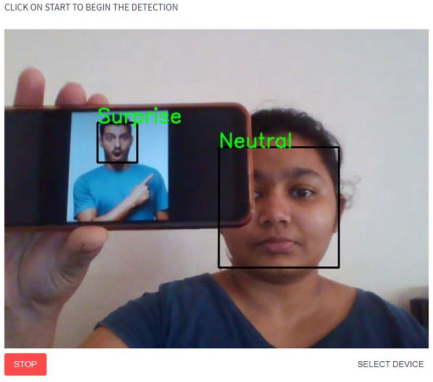
- https://share.streamlit.io/nayanapradeep/face-emotion-recognition/main/app.py
- https://emotion-recognition-2021.herokuapp.com/
- Python Version 3.7

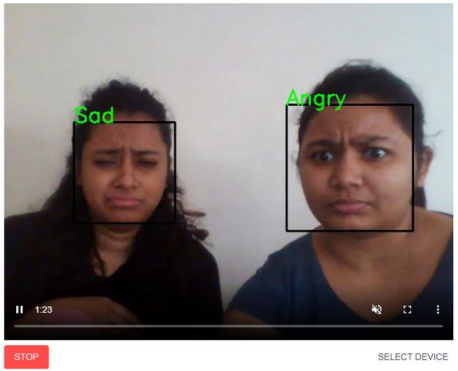
STREAMLIT LOCAL APP DEMO

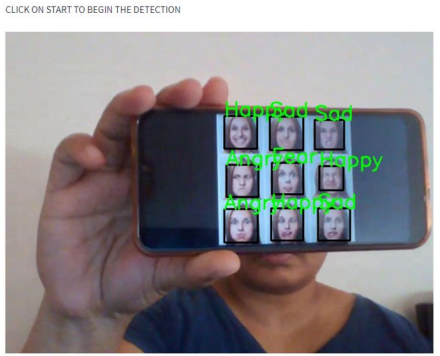












CONCLUSION

- Final model has an accuracy of 79 percentage.
- Emotion Recognition Application is promptly detecting the face using HaarCascade classifier and then detects the correct emotion using the trained model 1.
- Front end of the application is created using the streamlit and working well in local

.

- Demo Link : https://github.com/NayanaPradeep/Face-Emotion-Recognition/blob/main/Demo/Emotion_Recognition_Streamlit_Demo_Local.mp4

CHALLENGES

- Training model takes up lot of time and memory causing RAM crashes
- Takes a long time to experiment on various models to find the optimal one.
- Version issues were causing problems in the local leading to numerous attempts of installation and uninstallation.
- Deploying to streamlit was slighlty difficult owing to changes in the structure and introduction of new methods.

THANK YOU