

Capstone Project

Face Emotion Recognition

Individual Project
Uthaman A

Contents

- **Introduction**
- **Problem Statement**
- **Data Summary**
- **Dependencies**
- **Model Creation**
 - 1) **Using Deepface**
 - 2) **Using Transfer Learning**
 - 3) **Using CNN Layers**
- **Loss & Accuracy Plot**
- **Real-Time Local Video Face Detection**
- **Deployment of streamlit Webapp in Heroku and Streamlit**
- **Various Prediction images from the webapp**
- **Challenges**
- **Conclusions**

Introduction

- **What is Face Emotion Recognition?**
- **What it is so important?**
- **What is the Scope of Face Emotion Recognition**

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.

Global E-learning is estimated to witness an 8X over the next 5 years to reach USD 2B in 2021. India is expected to grow with a CAGR of 44% crossing the 10M users mark in 2021. Although the market is growing on a rapid scale, there are major challenges associated with digital learning when compared with brick and mortar classrooms. One of many challenges is how to ensure quality learning for students. Digital platforms might overpower physical classrooms in terms of content quality but when it comes to understanding whether students are able to grasp the content in a live class scenario is yet an open-end challenge. 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 video telephony software program (ex-Zoom) where it's not possible for medium scale class (25-50) to see all students and access the mood. Because of this drawback, students are not focusing on content due to 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 provides data in the form of video, audio, and texts which can be analyzed using deep learning algorithms.

Deep learning backed system not only solves the surveillance issue, but it also removes the human bias from the system, and all information is no longer in the teacher's brain rather translated in numbers that can be analyzed and tracked.

I will solve the above-mentioned challenge by applying deep learning algorithms to live video data. The solution to this problem is by recognizing facial emotions.

Data summary

I have built a deep learning model which detects the real time emotions of students through a webcam so that teachers can understand if students are able to grasp the topic according to students' expressions or emotions and then deploy the model. The model is trained on the FER-2013 dataset. This dataset consists of 35887 grayscale, 48x48 sized face images with seven emotions - angry, disgusted, fearful, happy, neutral, sad and surprised.

Here is the dataset link:- <https://www.kaggle.com/msambare/fer2013>

Label	Emotions	Number of images for Training	Number 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

Dependencies

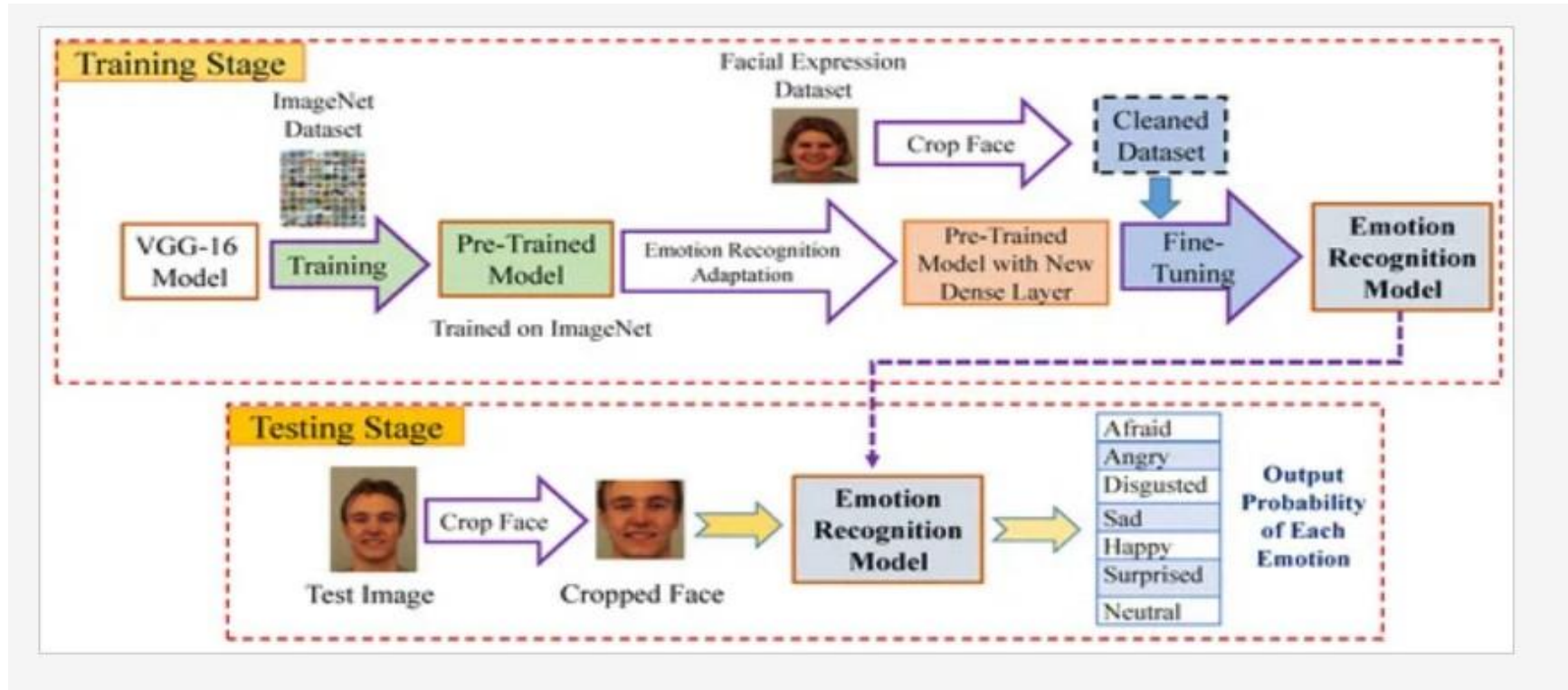
- 1) Python 3
- 2) Tensorflow 2.0
- 3) Streamlit
- 4) Streamlit-Webrtc
- 5) OpenCV

Model Creation

1) Using Deepface

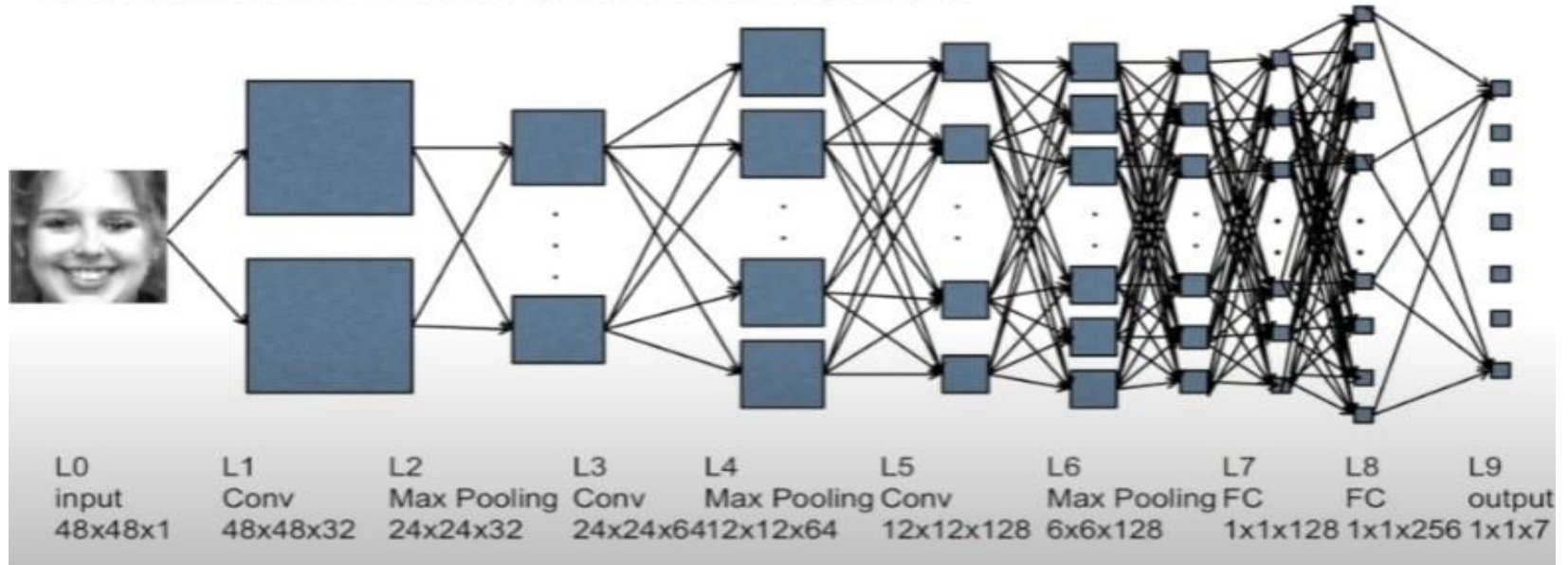


2) Using Transfer Learning

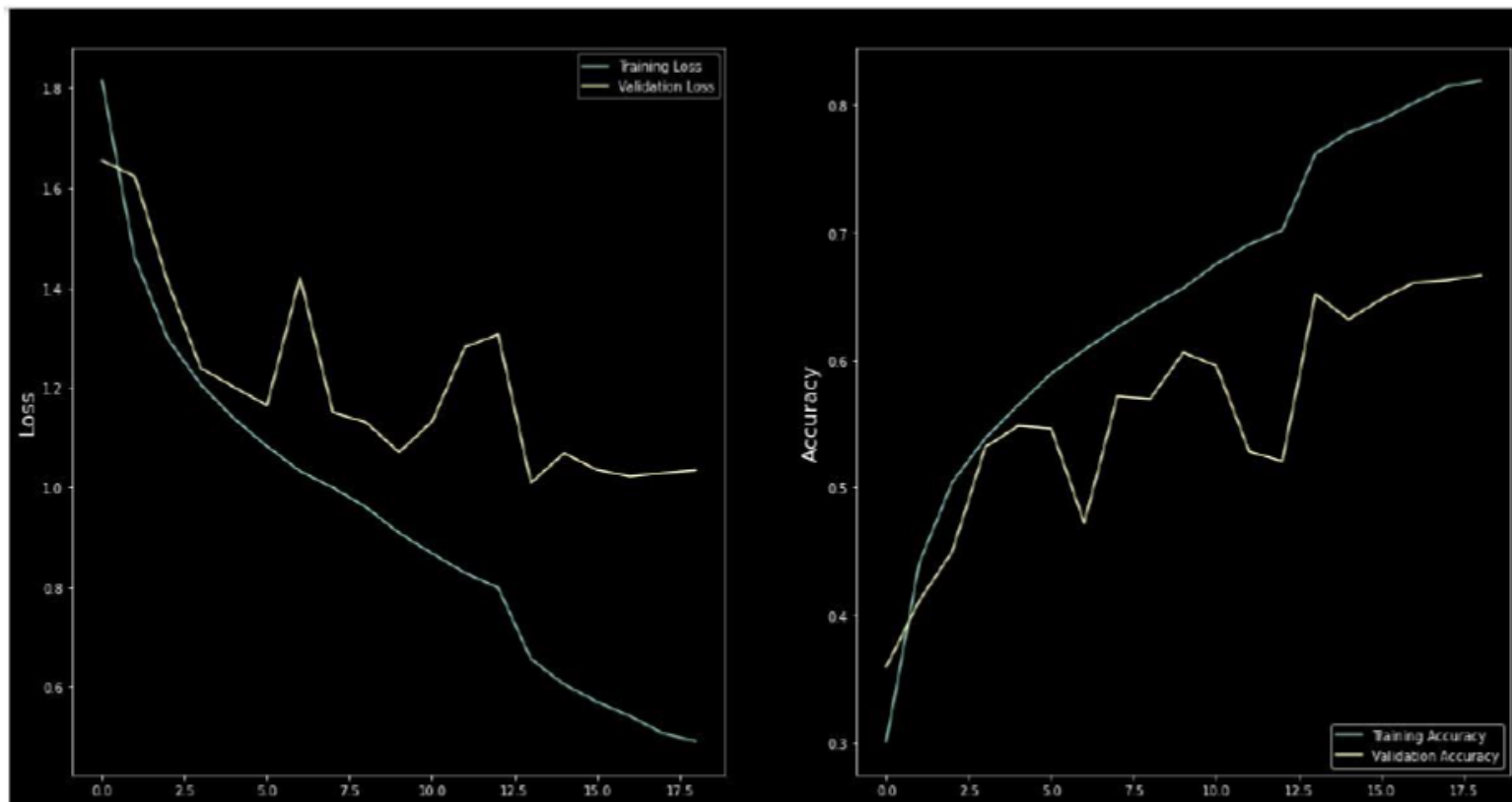


3) Using CNN Layer

Convolutional Neural Network Architecture:



Loss & Accuracy Plot



Real-Time Local Video Face Emotion Detection

I created two patterns for detecting and predicting single faces and as well as multiple faces using OpenCv videocapture in local.

For Webapp, OpenCv can't be used. Thus, using Streamlit-WebRTC for front-end application.

Deployment of Streamlit WebApp in Heroku and Streamlit

Different type of Deployment Platform.

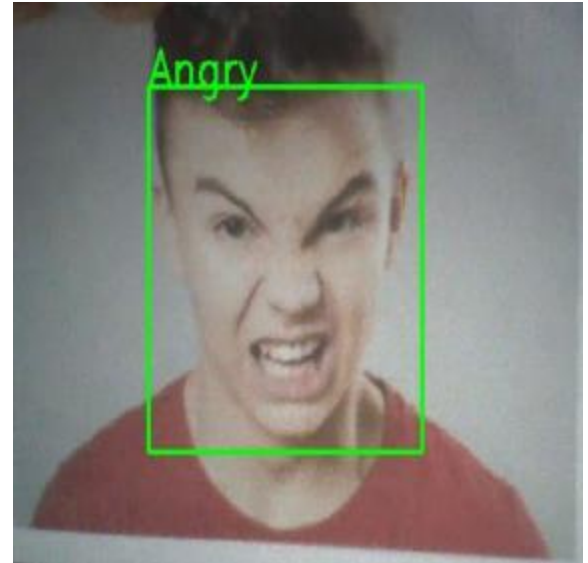
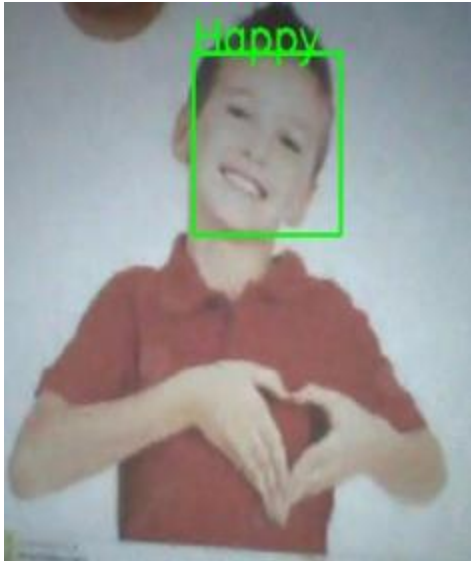
What is Heroku and Streamlit Sharing ?

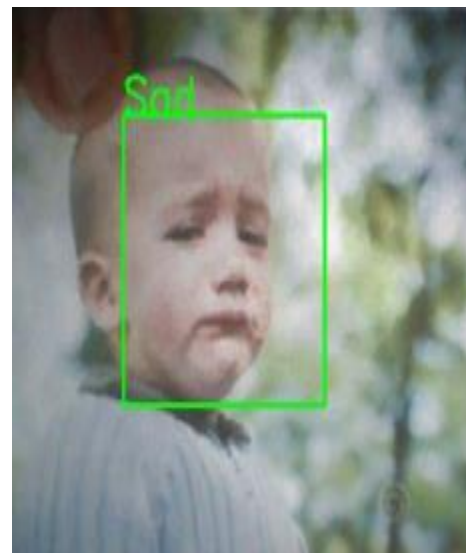
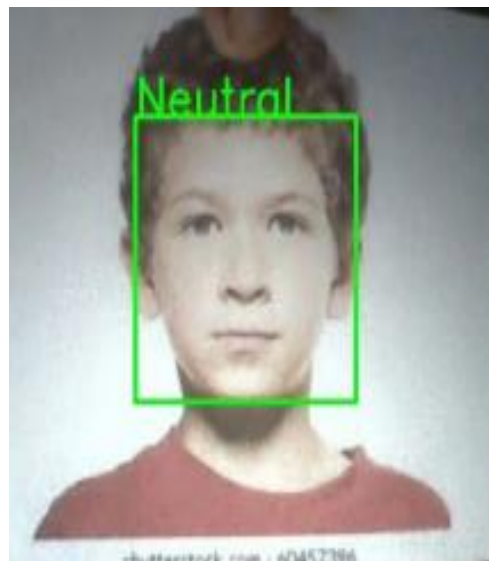
Heroku Link: <http://faceemoreg.herokuapp.com/>

Streamlit Link: <https://share.streamlit.io/uthamana/face-emotion-recognition/main/app.py>

[N.B :- If the website didn't open, then try refreshing the page 2 to 3 times.]

Various prediction Images from the WebApp







Challenges

- **Large Image Dataset to Handle.**
- **Couldn't able to connect GPU with Jupyter Notebook.**
- **Tried creating lot of models till find the best one.**
- **Continuous Runtime and RAM Crash due to large dataset.**
- **Carefully tuned Hyper parameters.**

Conclusion

- Finally I build the WebApp Using Streamlit and deployed in Heroku and Streamlit Sharing.
- The model wich was created by CNN layers gave training accuracy of 82% and test accuracy of 66%

Thank You