Capstone Project-5
Deep Learning

Face Emotion Recognition

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Contents

Introduction

- Face detection has been around for ages, taking a step forward, human emotion displayed by face and felt by brain captured in other video electric signal or image form can be approximated. Human emotion detection is the need of the hour so that modern artificial intelligence systems can emulate and gauge reactions from face. This can be helpful to make informed decisions be it regarding identification of intent, promotion of offers or security related threats.
- So our objective in this project is to train a deep learning model which can detect the emotion of face.

Problem Statement

The Indian education landscape has been undergoing rapid changes for the past 10 years owing to the advancement of webbased 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

- We 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

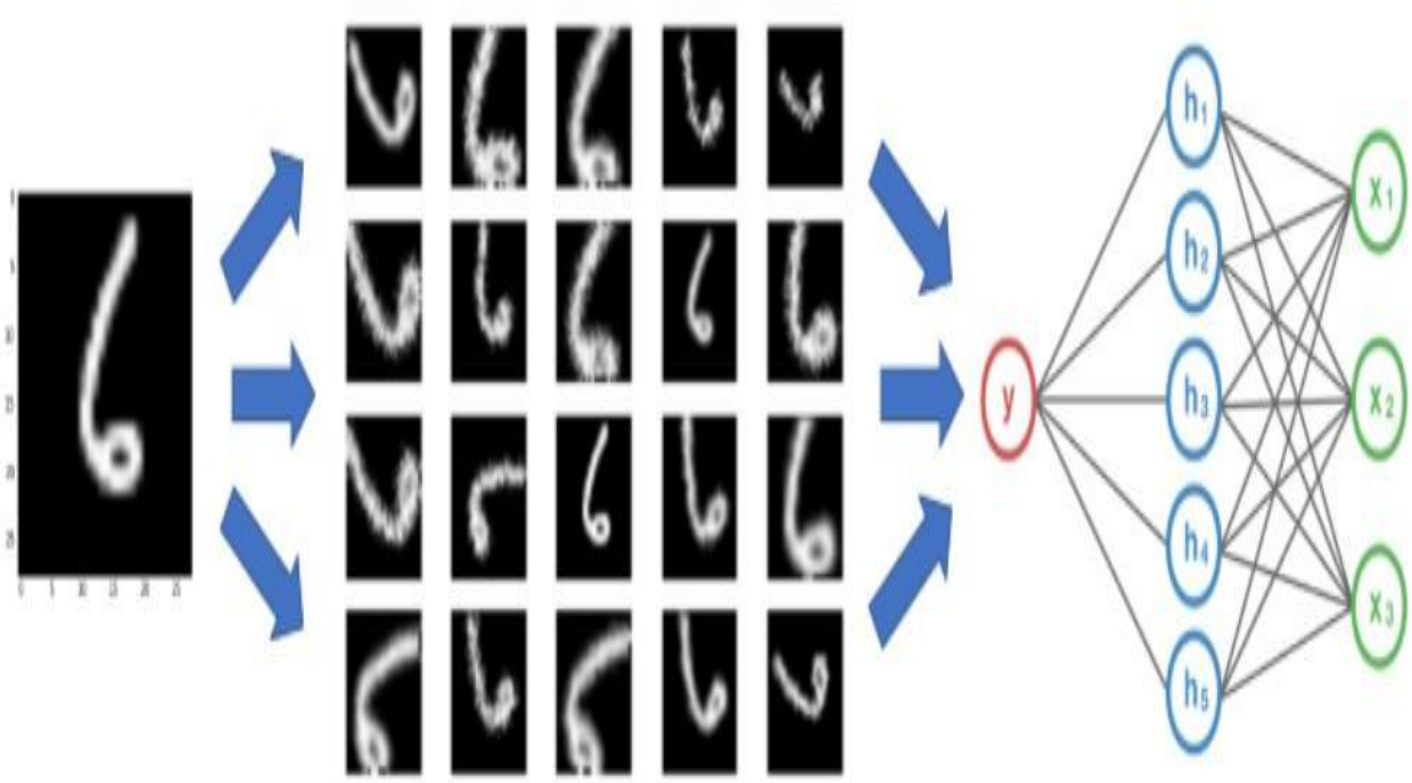
Label	Emotion	Number of images for Training	Number of images for Testing
0	angry	3995	958
1	disgust	436	111
2	fear	4097	1024
3	happy	7215	1774
4	sad	4830	1247
5	surprised	3171	831
6	neutral	4965	1233

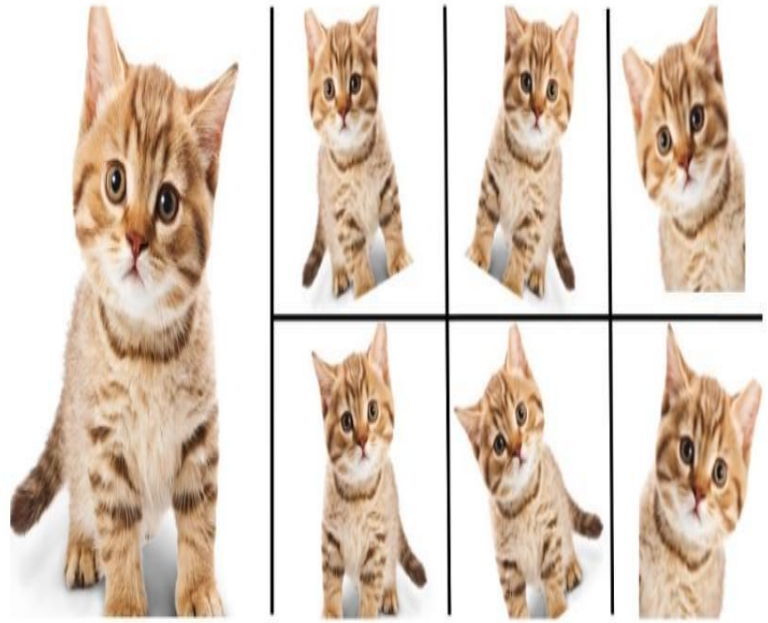
Dependencies

1. Python 3
2. Tensorflow 2.0
3. Streamlit
4. OpenCV

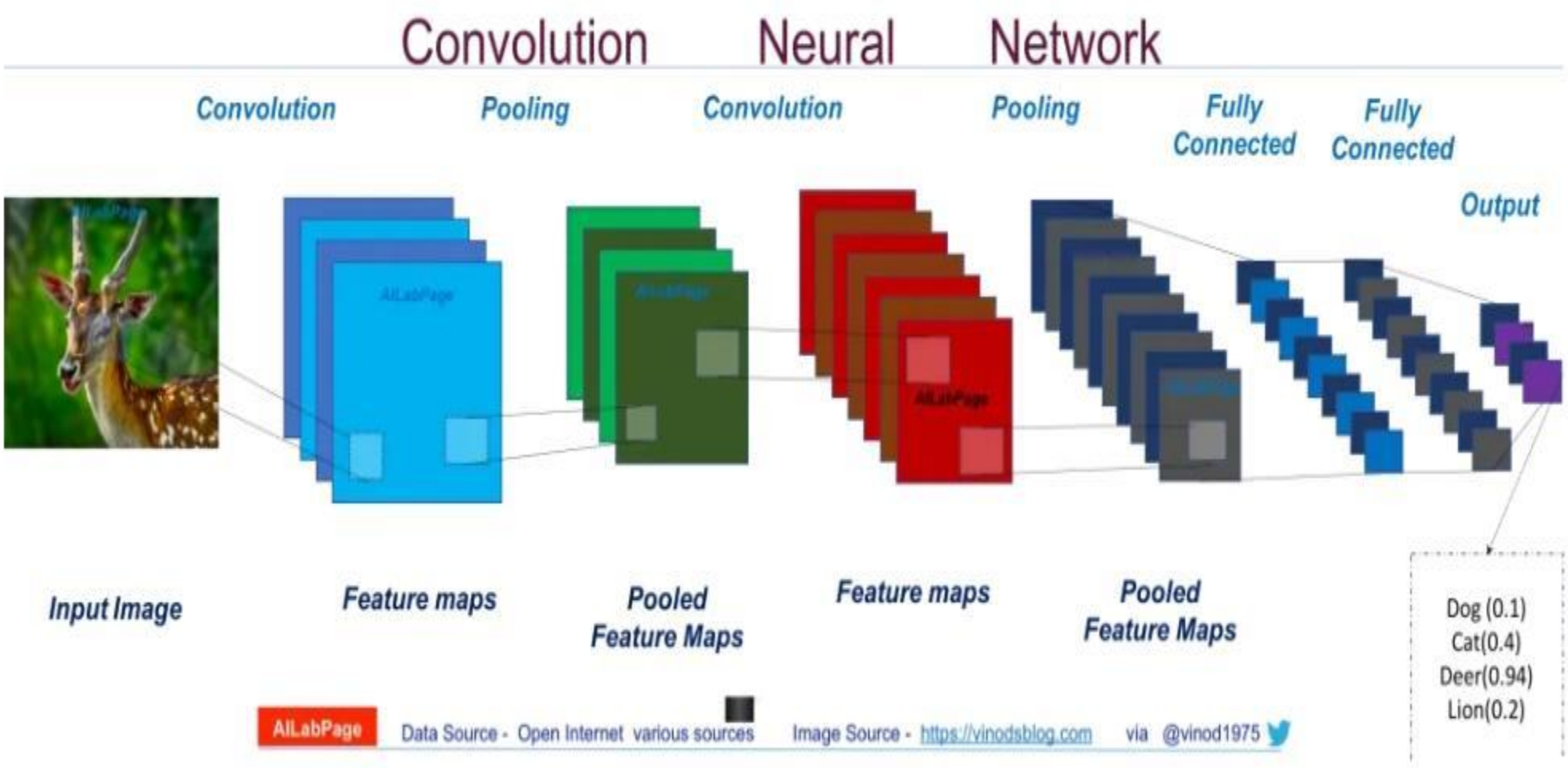
Data Augmentation

Data augmentation is a technique to artificially create new training data from existing training data. This is done by applying domain-specific techniques to examples from the training data that create new and different training examples





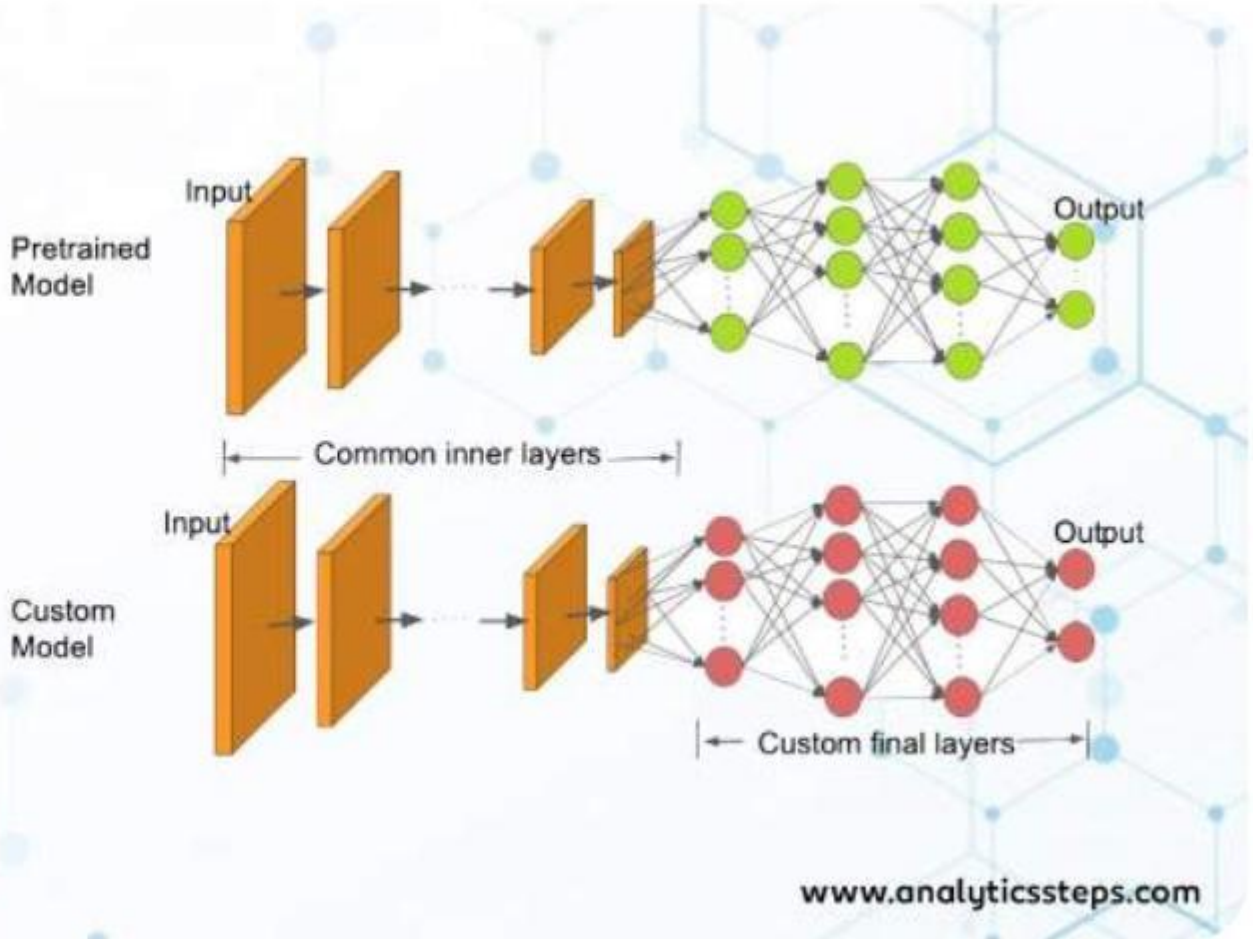
How CNN Works



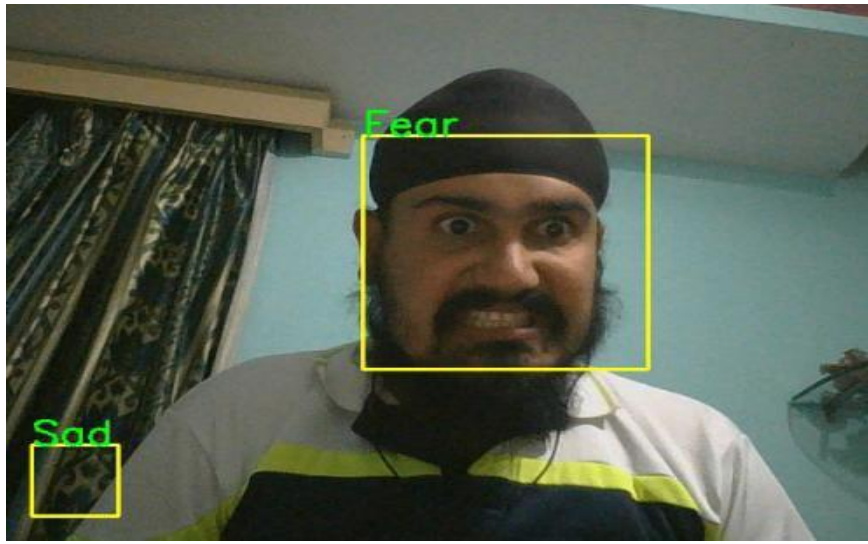
AI

analytic Steps

Transfer Learning



Test results of Open-CV in local machine




Emotion Detector
Happy

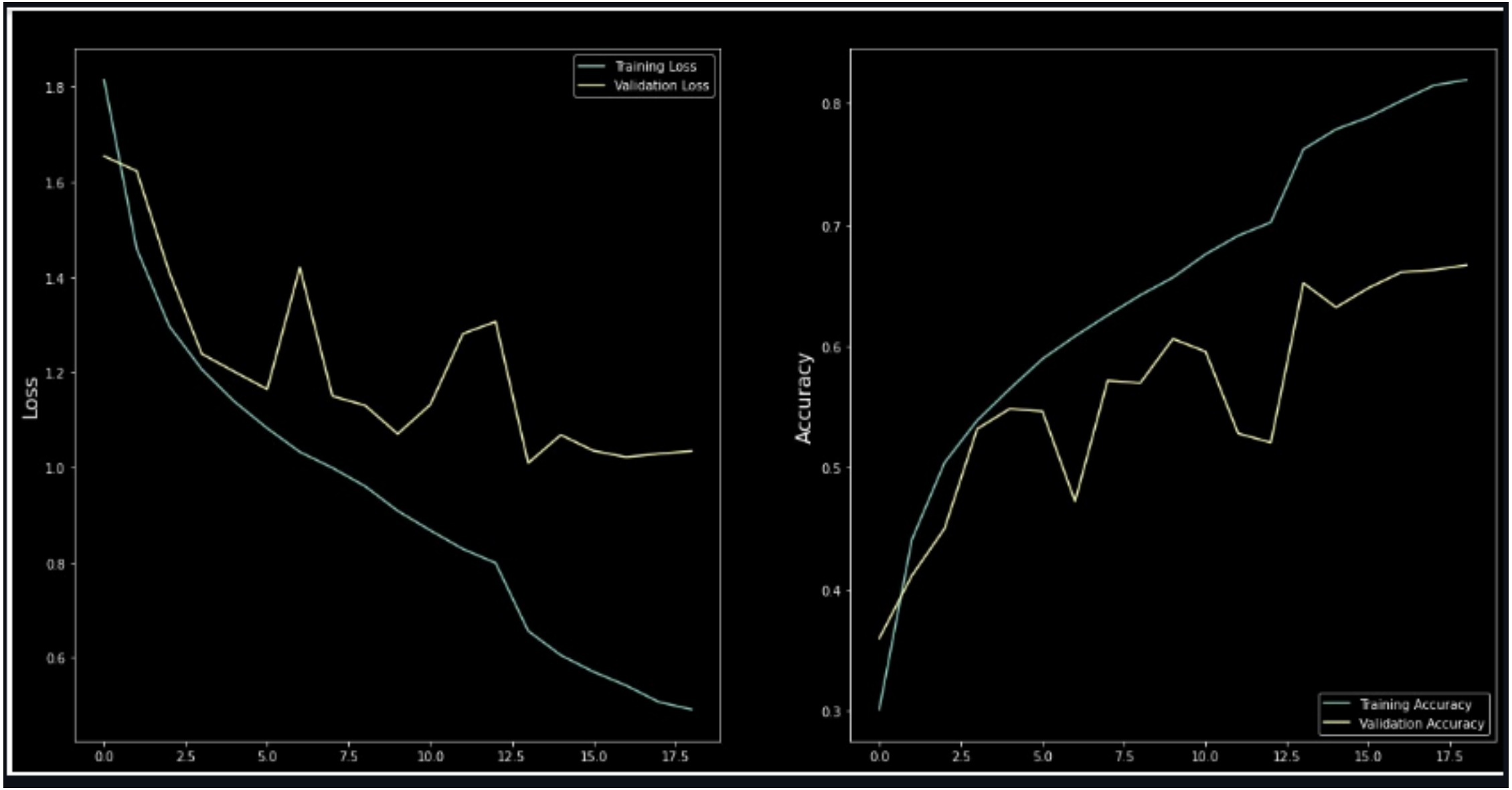

Happy


Happy

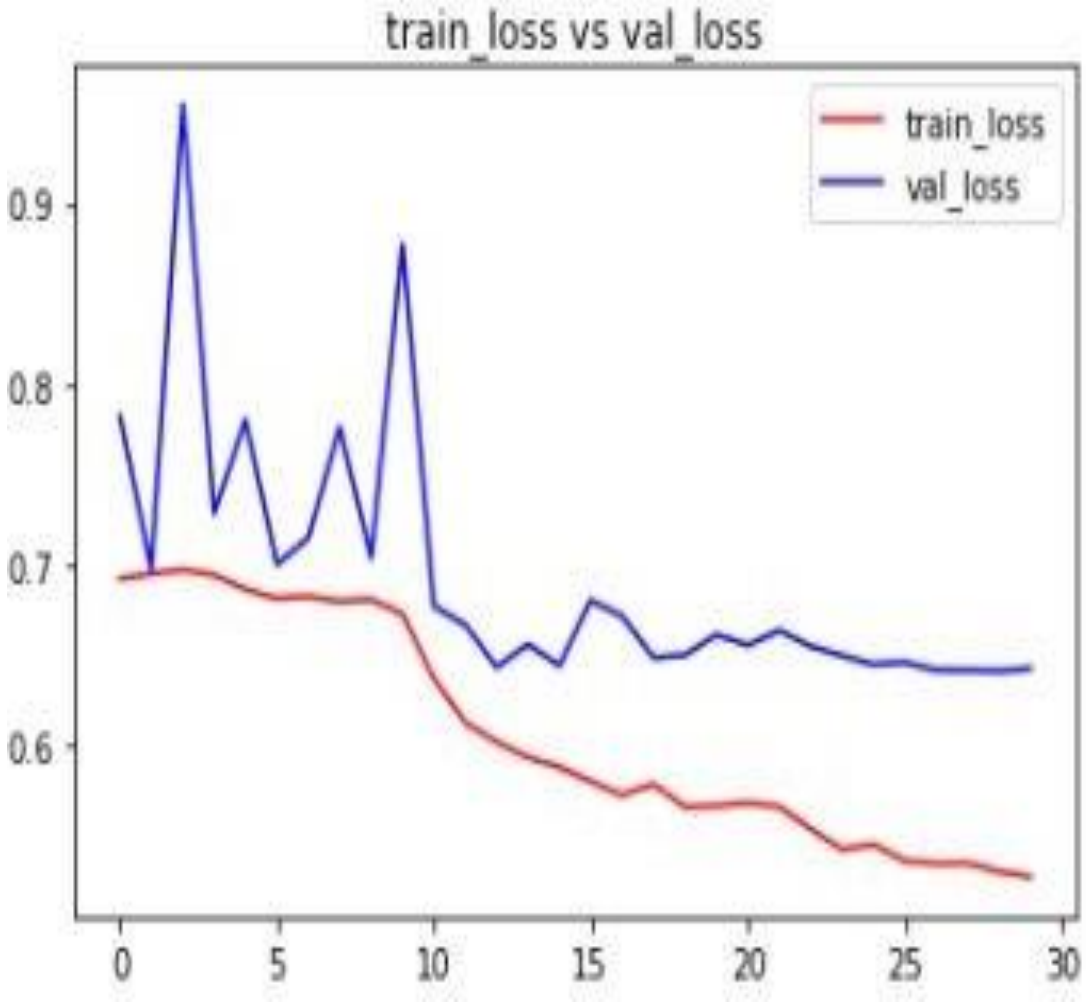

Sad
Neutral
Neutral
Neutra

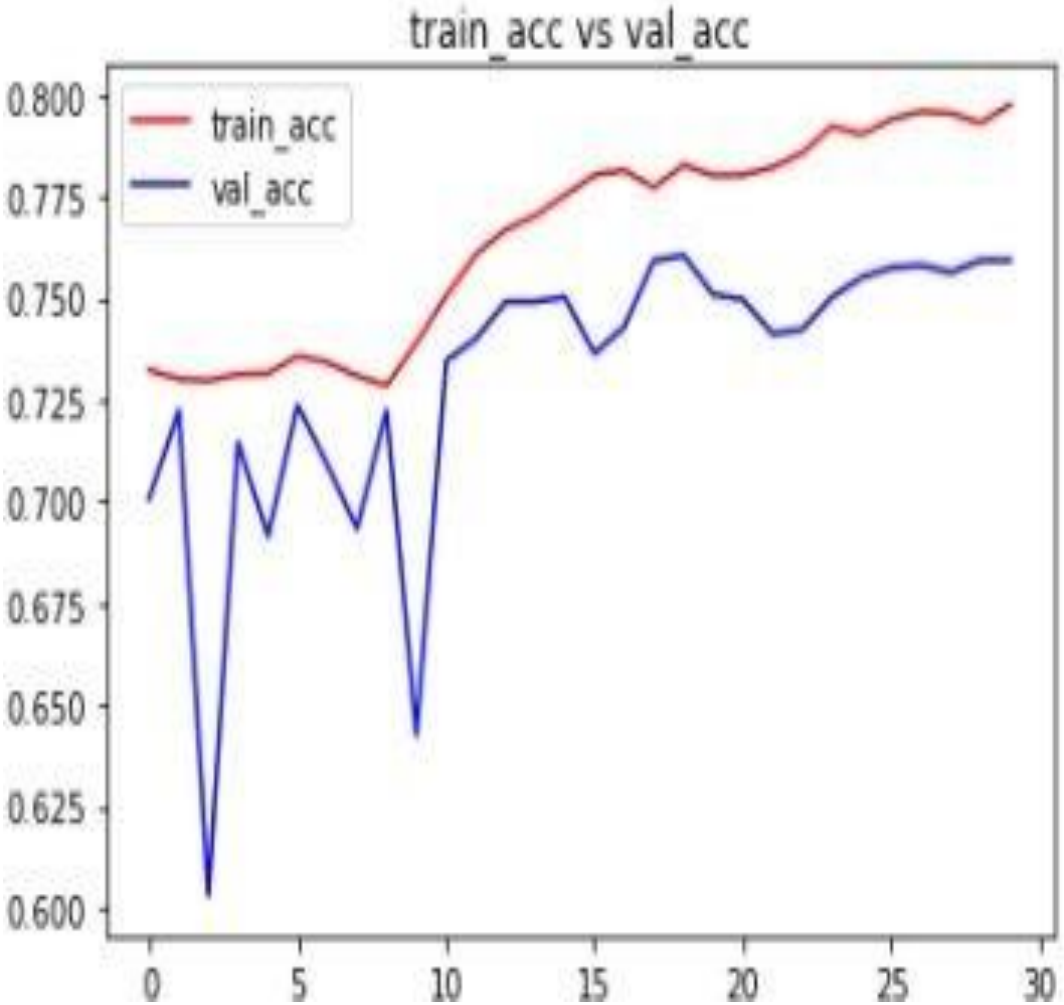

Emotion Detector
Sad
Sad

Loss and Accuracy plot



Transfer Learning Model





Deployment

- Amazon(AWS) EC2
- AWS Sage-maker(AWS) s3 Bucket
- Heroku
- Microsoft Azure

Streamlit link –

https://share.streamlit.io/vaibahvj50/face-emotion-recognition/main

Challenges faced during the project

- Biased dataset
- The whole process was computionally heavy and time consuming.
- Continuous Runtime and RAM Crash due to large dataset.
- Tried creating lot of models till find the best one.
- Couldn’t able to connect GPU with Jupyter Notebook.
- Working on pre trained models
- Training the model
- Writing a code to access webcam using opencv
- Deployment part

Summary

- Transfer learning has best accuracy over 78%
- We used CNN sequential model with 4 Convolution Layers with relu as activation function and 2 Fully connected layers passed through softmax function
- We initially got a validation accuracy around 64% with batch size 64, and epochs 50.
- By Hyper tunning the model to 128 batch size, Epochs =150 with Adaptive learning rate = 0.0001 reach validation accuracy of 69% at 138 Epoch
- We run the best model weights h5 file to OpenCV it worked with all 7 emotions.

Conclusion

- It is capable to predict almost every kind of faces whatever be the ethnicity or races of the individual it will tackle all.
- Our model is robust to variation in lightning i.e. works even in the dim environment accurately.
- There is no need to put special make-up or do any other kind of adjustments to detect faces or to detectemotions, we just only need to allign our faces beneath the camera.
- The model will detect faces automatically and will calculate facial expression based on the data of the faces whether their is a rigid motion in the data it's capable of adjusting all automatically.

Scope for improvement in our model

- The model has been trained with only 38k input images. In future ,gathering more input images could improve the performance of the model.

- Optimal Hyper parameters tuning could improve the accuracy of the model.

- Our model was not able to predict ‘disgust’ emotion , we can add more images for disgust emotion in training dataset.

Future Scope of Deep Learning

- Patient Monitoring in hospitals to judge the effectiveness of prescribed drugs is one application to the Health Sector.
- Diagnosis of diseases that alter facial features and psychoanalysis of patient mental state are further possibilities.
- Recognition of more facial expressions by adding more "expression units" of individual.

THANK YOU