Capstone Project

Face Emotion Recognition

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Introduction

- What is Face Emotion Recognition ?
- Why it is so important ?
- Facial Recognition is a technology which uses biometric markers to detect emotions in human faces
- The Architecture: we use of a convolutional neural network for the image recognition task instead of regular machine learning techniques such as Decision Tree or Gradient Boosting
- Applications of facial 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 eLearning is estimated to witness an 8 X over the next 5 years to reach USD 2 B in 2021 .India is expected to grow with a CAGR of 44 % crossing the 10 M 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 (exZoom) where it s not possible for medium scale class25 50) to see all students and access the mood. Because of this drawback, students are not focusing on content due to lack of surveillance. applying deep learning algorithms to live video data.

Problem Statement

- 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 abovementioned challenge by recognizing facial emotions.
- Final objective in this project is to train a deep learning model which can detect the emotion of face

Data Summary

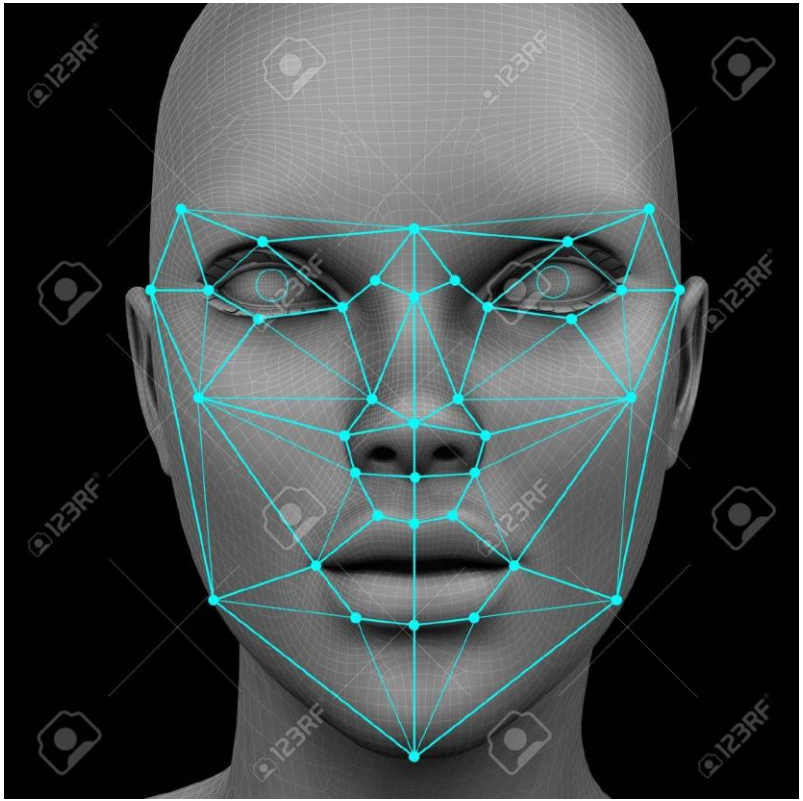
- I have built a deep learning model which detects the real time emotions of students through a webcam so that teachers can understand if students are able to grasp the topic according to students' expressions or emotions and then deploy the model. The model is trained on the FER 2013 dataset

- This dataset consists of 35887 grayscale, 48 x 48 sized face images with seven emotions angry, disgusted, fearful, happy, neutral, sad and surprised

Emotion	Number of images for Training	Number of images for Testing
angry	3995	958
disgust	436	111
fear	4097	1024
happy	7215	1774
sad	4830	1247
surprised	3171	831
neutral	4965	1233

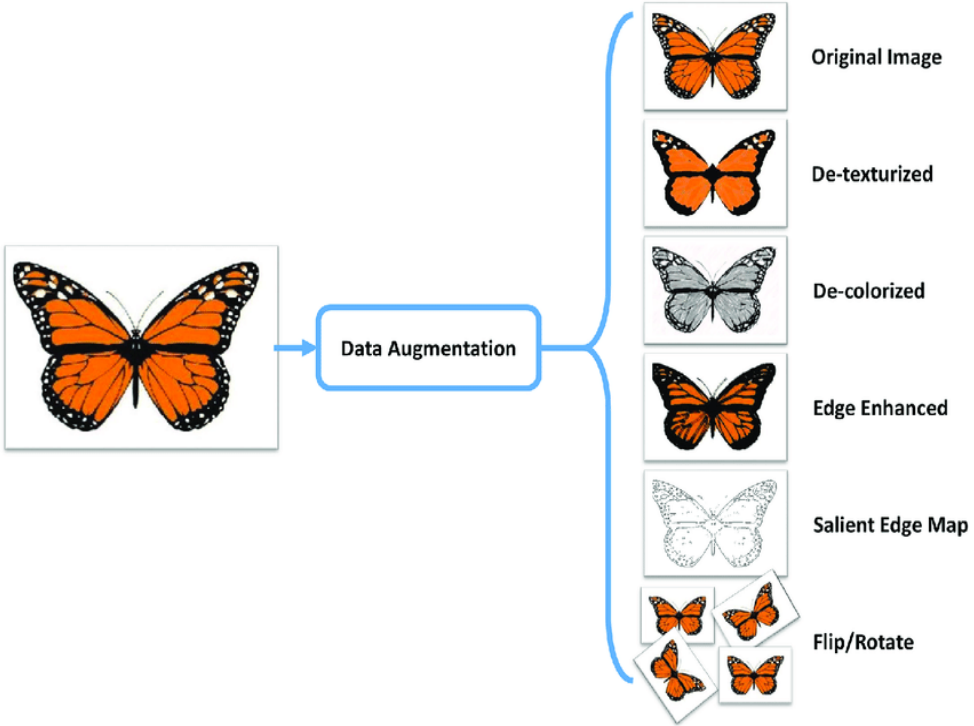
Face Embeddings

- By creating face embeddings you are converting a face image into numerical data.
- That data is then represented as a vector in a latent semantic space.
- The closer the embeddings are to each other in the latent space, the more likely they are of the same person.

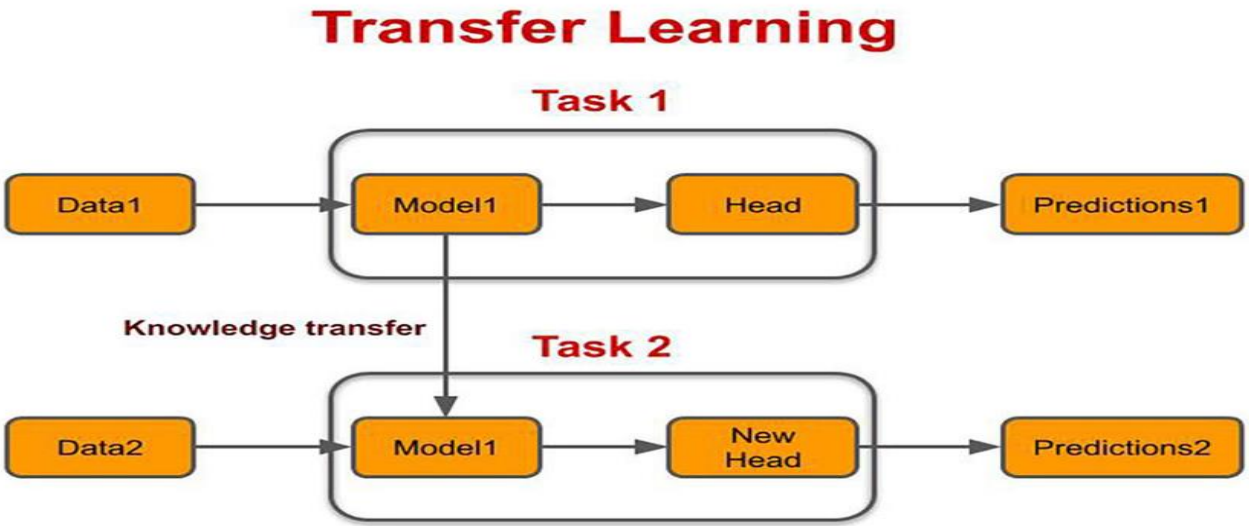


Data Augmentation

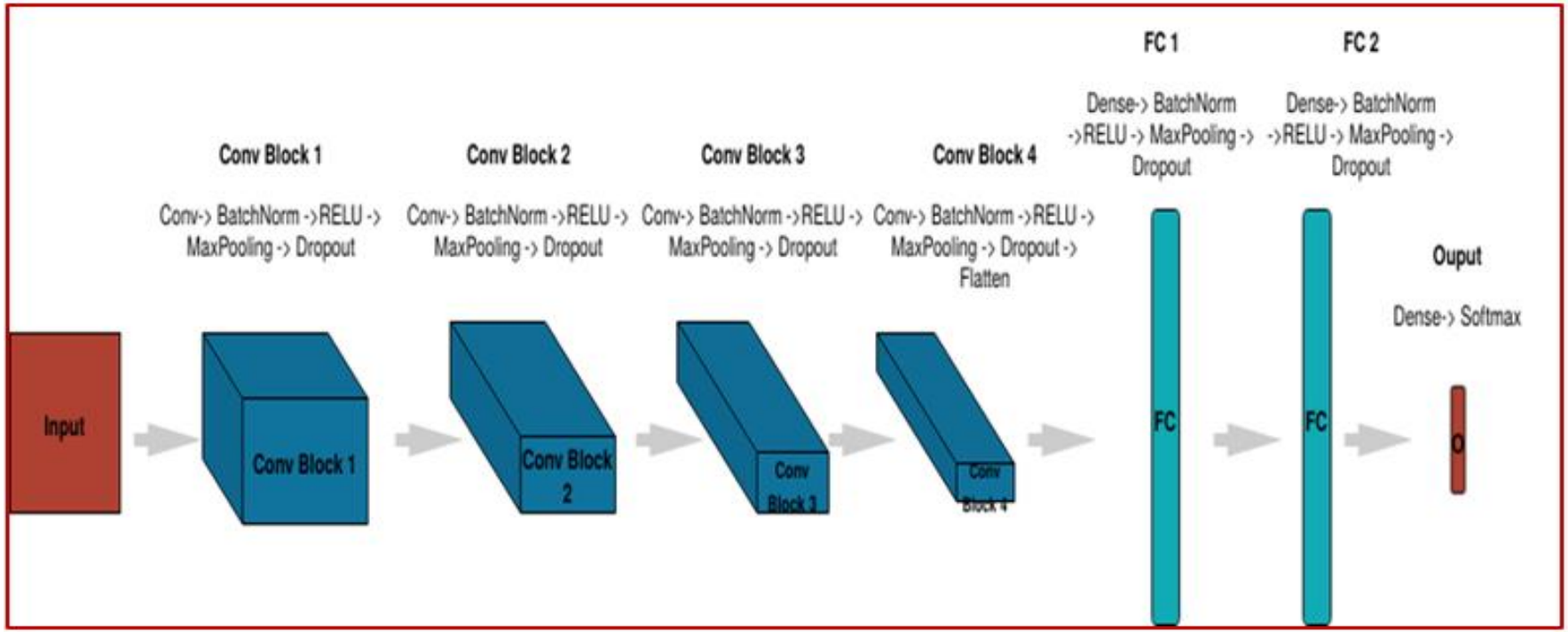
Data augmentation is a technique to artificially create new training data from existing training data. This is done by applying domain-specific techniques to examples from the training data that create new and different training examples



Transfer Learning



Model Building



Parameter:

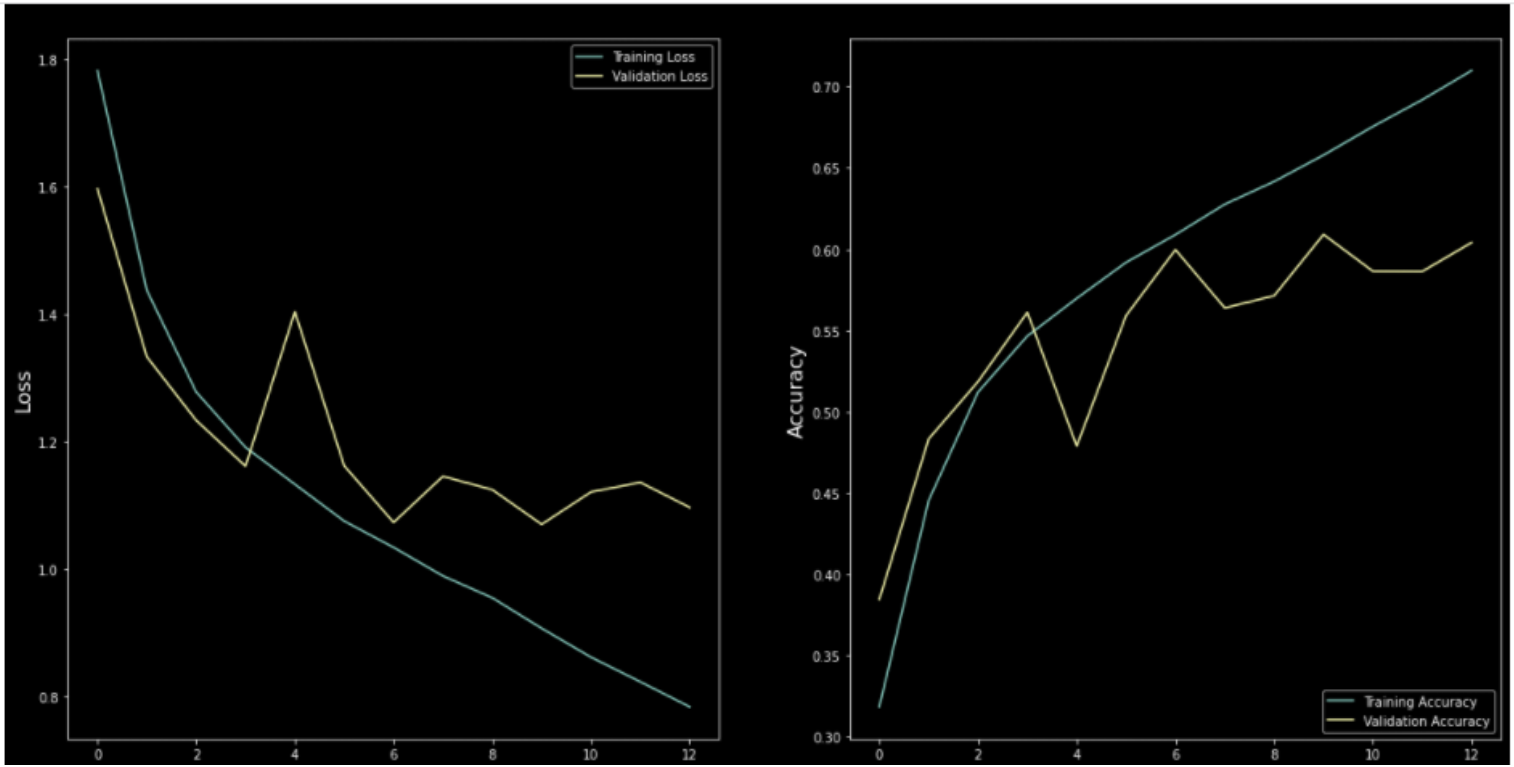
Learning rate in Adam : the learning rate is a tuning parameter in an optimization algorithm that determines the step size at each iteration while moving toward a minimum of a loss function.

Learning rate=0.0001

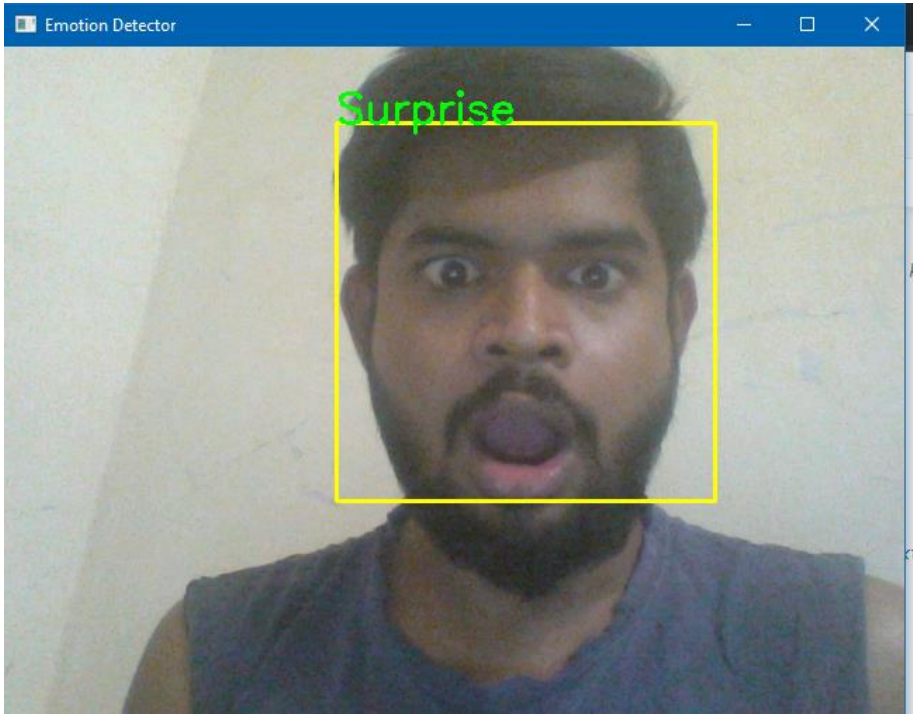
Epochs : In terms of artificial neural networks, an epoch refers to one cycle through the full training dataset

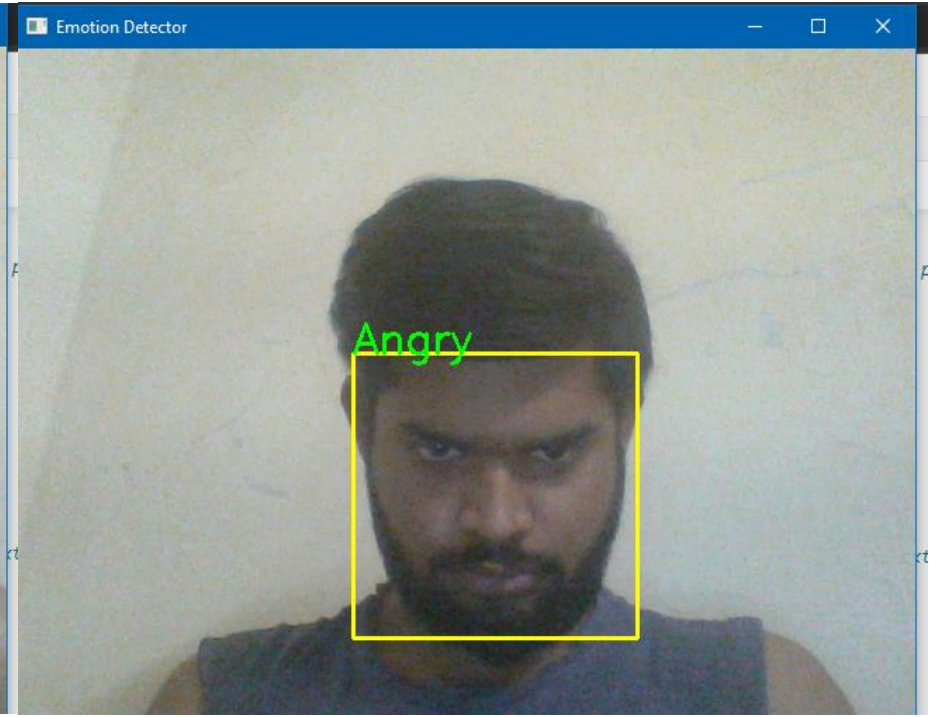
#Epochs = 48

Loss and Accuracy Plot

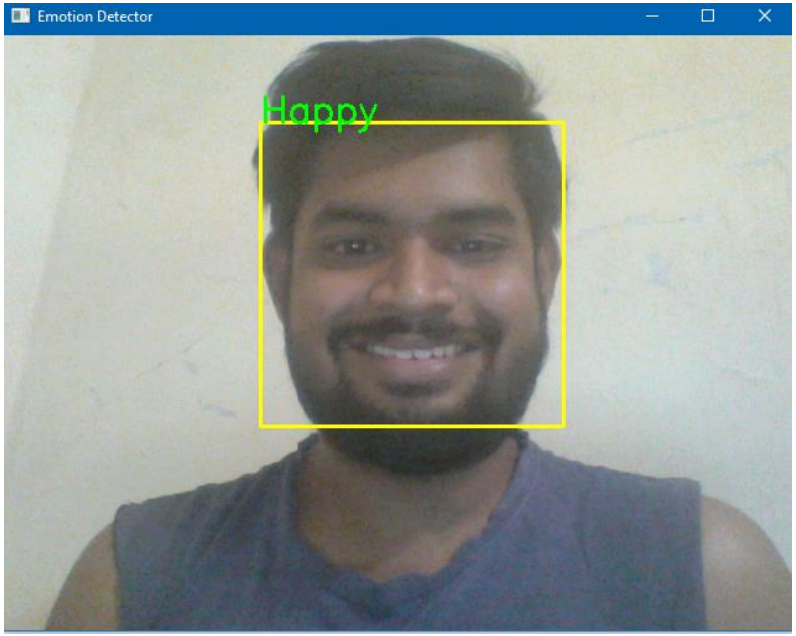


Test result of Model in Local Machine





Test result of Model in Local Machine



Deployment

Heroku is a cloud platform as a service supporting several programming languages. One of the first cloud platforms, Heroku has been in development since June 2007, when it supported only the Ruby programming language, but now supports Java, Node.js, Scala, Clojure, Python, PHP, and Go.
I tried Heroku for deployment but my model size was 53 mb and total slug size is exceeding 500 mb so I deployed it with streamlit share.

Link: https://share.streamlit.io/dharmesh-data/final--face-emotion-recognition-/main

Challenges face:

- Large Image Dataset to Handle
- Couldn’t able to connect GPU with Jupyter Notebook
- Finding model weight required lot of training
- In Deployment on Heroku slug size is major problem

Summary

- Our model is giving an accuracy of 70% and is robust in that it works well even in a dim light environment.
- The application is able to detect face location and predict the right expression while checking it on a local webcam.
- The front-end of the model was made using streamlit for webapp and running well on local webapp link.
- Finally, we successfully deployed the Streamlit WebApp on Streamlit share that runs on a web server.
- And we believe that through this model teachers can understand the students' perception during online classes and change the way of teaching if needed by understanding the students' motive.

Thank You