Capstone Project - 5

Deep Learning & ML Engineering

Face Emotion Recognition

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Introduction

- Facial Emotion recognition is a way of identifying the current emotional state of an individual to observer.

- Facial expressions can display personal emotions and indicate an individual's intentions within a social situation.

- Facial expressions and other gestures convey nonverbal communication cues that play an important role in interpersonal relations.

- Product Development : Observing users interaction while interacting with a brand or a product helps the company to assess the effectiveness of any business product.

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 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. If 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/c/challenges-in-representation-learning-facial-expression-recognition-challenge

- **This dataset contains 35887 grayscale face images with seven emotions.**
1. Happy
2. Angry
3. Neutral
4. Fear
5. Sad
6. Disgust
7. Surprise

Pipeline

Data Exploration

Modeling

Model Evaluation & Deployment

Understanding the data

- Types of emotions
- Images in each category

Modeling Structures
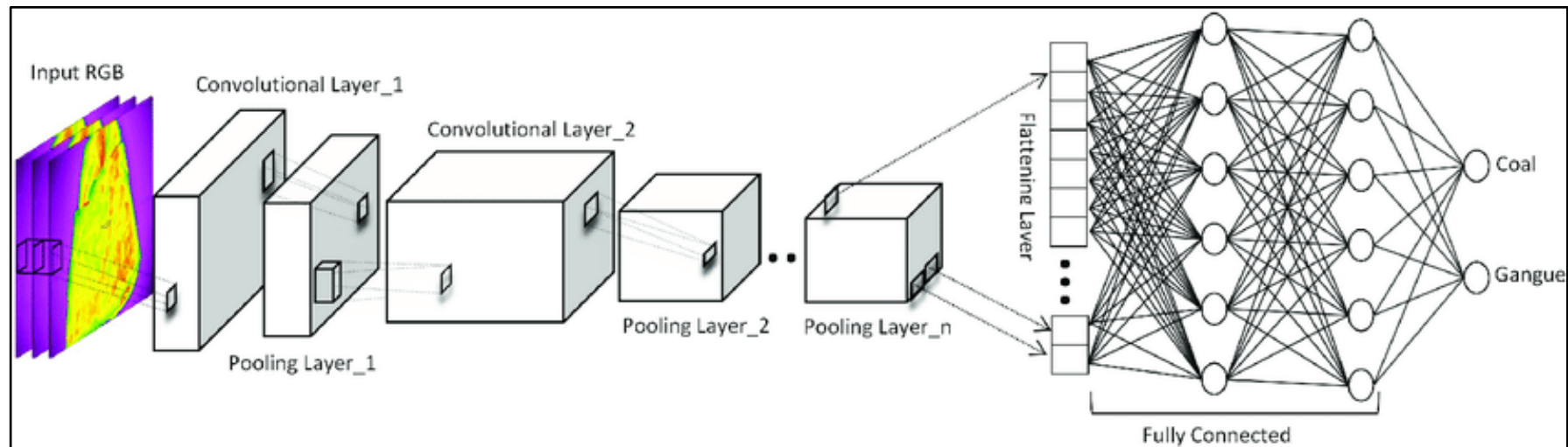
- CNN

Graphs and Aapplications

- Loss & accuracy plots
- Streamlit
- Heroku

CNN Model

CNN Model

- <u>CNN model build with the following architecture:</u>

➤ 17 convolutional layers

➤ 2 fully connected layers

- <u>Basic CNN architecture details:</u>

➤ **Input layer** - Input layer in CNN should contain image data

➤ **Convo layer** - Convo layer is sometimes called feature extractor layer because features of the image are get extracted within this layer.

➤ **Pooling layer** - Pooling is used to reduce the dimensionality of each features while retaining the most important information. It is used between two convolution layer.

CNN Model

➢ **Fully CL** - Fully connected layer involves weights, biases, and neurons. It connects neurons in one layer to neurons in another layer. It is used to classify images between different category by training and placed before the output layer.

➢ **Output Layer** - Output layer contains the label which is in the form of one-hot encoded.

➢ **Batch normalization:** It improves the performance and stability of NNs by providing inputs with zero mean and unit variance.

➢ **Dropout:** It reduces overfitting by randomly not updating the weights of some nodes. This helps prevent the NN from relying on one node in the layer too much.

Modeling Steps

AI

Layers

- Input Layer - 48,48,1
- Layer 1&2 - 3*3,Conv,64
- Layer 3,4&5 - 3*3,Conv,128
- Layer 6 to 13 - 3*3,Conv,256
- Layer 14 to 17 - 3*3,Conv,512
- Flatten layer
- FC - 256units
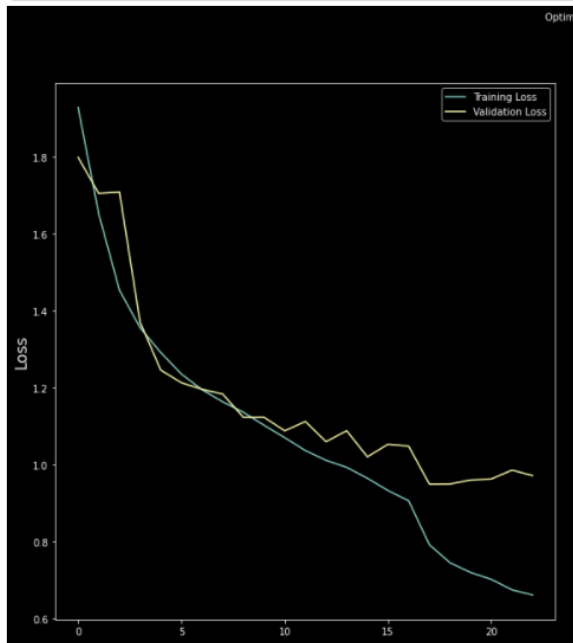- FC - 512units
- Output Layer - 7units

Parameters

- Activation Function - ReLu, Softmax
- Epoch - 100
- Optimizer - Adam
- Batch size - 32
- Callbacks- EarlyStopping, ReduceLROnPlateau, Checkpoint

Evaluation

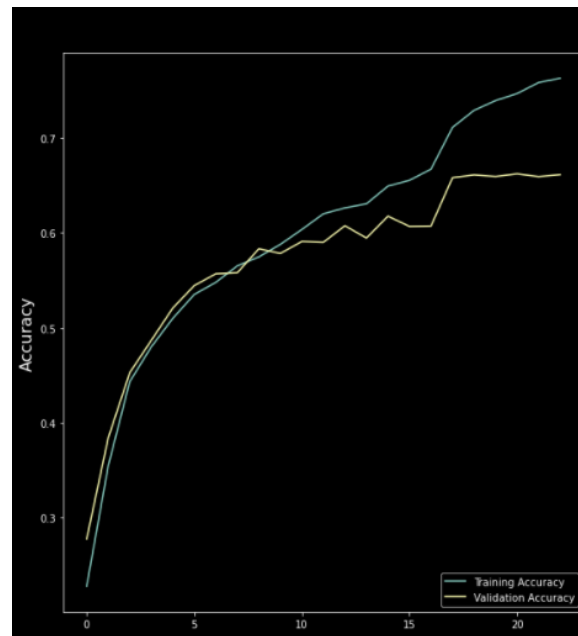- Loss and accuracy plots

Model Evaluation

Categorical Crossentropy

No of Epochs

Training Loss is nearby 0.5
Validation Loss is nearby 1

Accuracy

No of Epochs

Training Accuracy is nearby 76%
Test Accuracy is nearby 66%

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-emotion-detector-amol.herokuapp.com//

Conclusion

- The CNN model gave us training accuracy of 76 % and validation accuracy of 66 %.

- The application is able to detect face location and predict the right expression while checking it on a local webcam.

- A front-end model was successfully created using streamlit and run on a local webserver.

- Deployed streamlit web app on Heroku that runs on a web server.

- 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