Capstone Project Submission

Team Member's Name, Email and Contribution:

Name – Kanika Singh
Email id -
kanikasingh5433@gmail.com

Contribution
- **Introduction**
- **Problem statement**
- **Data Summary**
- **Build Deep-Face model and Resnet_50 (Residual Neural Network) model.**
- **Accuracy and loss plots (DeepFace and Resnet50)**
- **Confusion matrix**
- **Models Analysis**
- **Ran the local webcam for emotion detection on single as well as multiple face.**
- **Challenges**
- **Conclusion**

Name – Tanjul Gohar
Email Id –
tanjulgohar5@gmail.com

Contribution
- **Introduction**
- **Problem statement**
- **Data Summary**
- **Build Xception model and CNN (Convolutional Neural Network) model**
- **Accuracy and loss plots (Xception and CNN)**
- **Confusion matrix**
- **Models Analysis**
- **Created Streamlit webapp and deployed on Heroku.**
- **Challenges**
- **Conclusion**

Please write a short summary of your Capstone project and its components. Describe the problem statement, your approaches and your conclusions. (200-400 words)

Introduction:
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. Although the market is growing on a rapid scale, there are major challenges associated with digital learning when compared with brick-and-mortar classrooms. 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. We will solve the above-mentioned challenge by applying deep learning algorithms to live video data.

Problem Statement: Digital E-learning platforms have limitation in terms of physical surveillance to learn how much their students understanding through videos to tackle this challenge we have to deep learning algorithm. To detect emotions of student while learning we have to use face emotion reorganization system.

Dataset: 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.

Model Creation:
1) DeepFace model- Deepface is a deep learning facial recognition system created by a research group at Facebook. It identifies human faces in digital images. The program employs a nine-layer neural network with over 120 million connection weights. We imported above image which looks angry but our model gives us "27 years old white fear Man" this result. To get better results we decided to train our own model.

2) Resnet50 model - Deep residual networks like the popular ResNet-50 model is a convolutional neural network (CNN) that is 50 layers deep. A Residual Neural Network (ResNet) is an Artificial Neural Network (ANN) . We used Adam as our optimizer after training for 50 epochs using Adam and a batch size of 785, we achieved 63.11% accuracy on the test set and 67% on train set there is much less over fitting.

3) Xception model - **Xception** is a deep convolutional neural network architecture that involves Depth wise Separable Convolutions. This network was introduced Francois Chollet who works at Google. We used Adam as our optimizer after training for 50 epochs using Adam and a batch size of 785, we achieved 64 % accuracy on the test set.

4) CNN model - A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other. We used RMSprop as our optimizer after training for 50 epochs using RMSprop with learning rate 0.001 and a batch size of 785, we achieved 65 % accuracy on the test set.

Results: - The below table shows results obtained after training the model.

Model	Train Score	Test Score
Deep Face	NA	NA
Resnet50	68%	62%
CNN	74%	69%
Xception	72%	64%

Real time local video face emotion detection: - We created patterns for detecting and predicting single faces as well as multiple faces using OpenCV video capture in local webcam. This gave pretty much accurate prediction on sample images of different emotions.

Web APP: -. We deployed the app in Heroku if you saw in the starting section of GitHub repo you see the all the requirement files are there for creating an app on Heroku of name "**face-emotion-recognition4**". but due to high slug size the buffering takes time so we have run our app working on local and it ran properly and app is also fine also we've included video on GitHub repo.

Heroku Link: - https://face-emotion-recognition2110.herokuapp.com/

CONCLUSION: - To alleviate FER2013's inherent class imbalance, we employed class weights, data augmentation, and auxiliary datasets. By ensemble seven models we achieved 77% training accuracy and 69% accuracy for CNN model. We also found through network interpretability that our models learned to focus on relevant facial features for emotion detection.
Additionally, we demonstrated that FER models could be applied in the real world by developing a web application with real-time recognition speeds. It was interesting project and we learn lot from this project.

Drive link:
https://drive.google.com/drive/folders/1dkEPeLd7rZuwv416Iuvw577w3u1rWtQf?usp=sharing