Facial Emotion Recognition

DIP Project

Group Id : FER-1

Team Members

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Problem Statement

- We were assigned to solve a challenge in the field of facial emotion recognition.
- In the field of facial emotion detection, the major challenges arise due to poor lighting conditions, variable facing directions, ethnic differences and cultural differences. And a pile of unlabelled data !!
- We took on the challenge of improving the emotion recognition accuracy by applying curated preprocessing techniques on the train images based on the problems, employing one solution for each issue.

Introduction

- We searched for the challenges researchers are looking forward to solve in facial emotion recognition and selected some of them to solve as part of this project.
- Notably, lighting issues, face occlusion, racial differences and cultural differences are the main challenges being faced. [1].
- Our idea is to employ traditional image processing techniques and improve upon these edge cases present in the current facial emotion recognition methods.
- We aim to merge these techniques with the existing deep learning approach and increase their performance and accuracy.

Algorithm we used

- We have chosen a deep learning implementation of facial emotion recognition model. [2].
- It employs a mini Xception architecture as the backbone network.
- It uses the FER2013 faces dataset. [3].
- The model has an accuracy of 66% on validation dataset and also provides a pretrained model using usual preprocessing techniques.
- The upcoming slides will describe the problems we are solving and their possible solutions using the preprocessing techniques in detailed manner.

Lighting Issues

01

➢ Handled by Shikhar Arya

- Incorrect lighting on the faces while capturing images has always been a problem.
- To tackle this we need to make the complete face to be in the same lighting condition.
- One can achieve this by using histogram equalization.
- This generates a normalized lighting image which will have almost same lighting all over the face.

Different Skin Tones

02

➢ Handled by Rithika Nenavath

- People from different countries have different skin colors. A model trained on specific ethnic faces faces difficulties in detecting others.
- To overcome this, as the images are grayscale images, multiple images can be generated with variable intensities levels.
- These will depict the same as different skin colors in color images.
- All these different intensity generated images can be used for training, which could make the model forbid the skin color specific details.

Cultural Differences

03

➢ Handled by Kalyan Inguva

- People from different cultures express their emotions differently.
- Inorder to make our model universal for multicultural people, datasets of people faces from different cultures are considered for training
- This makes model learn cross cultural features and make it culture independent.
- For this data we scraped images from google and extract faces from the images.

Face Occlusion & Facial Features

04

➢ Handled by Shaik Masihullah

- Detecting face and emotion upon wearing masks, glasses and other face covering materials is a difficult task.
- In some cases, where at least half of the face is visible, we can extract numerical face encodings.
- Train the model on that encodings data.
- Moreover, face segmentation can also be used to extract only the face leaving out hair, background, etc.

Pseudo Labelling

05

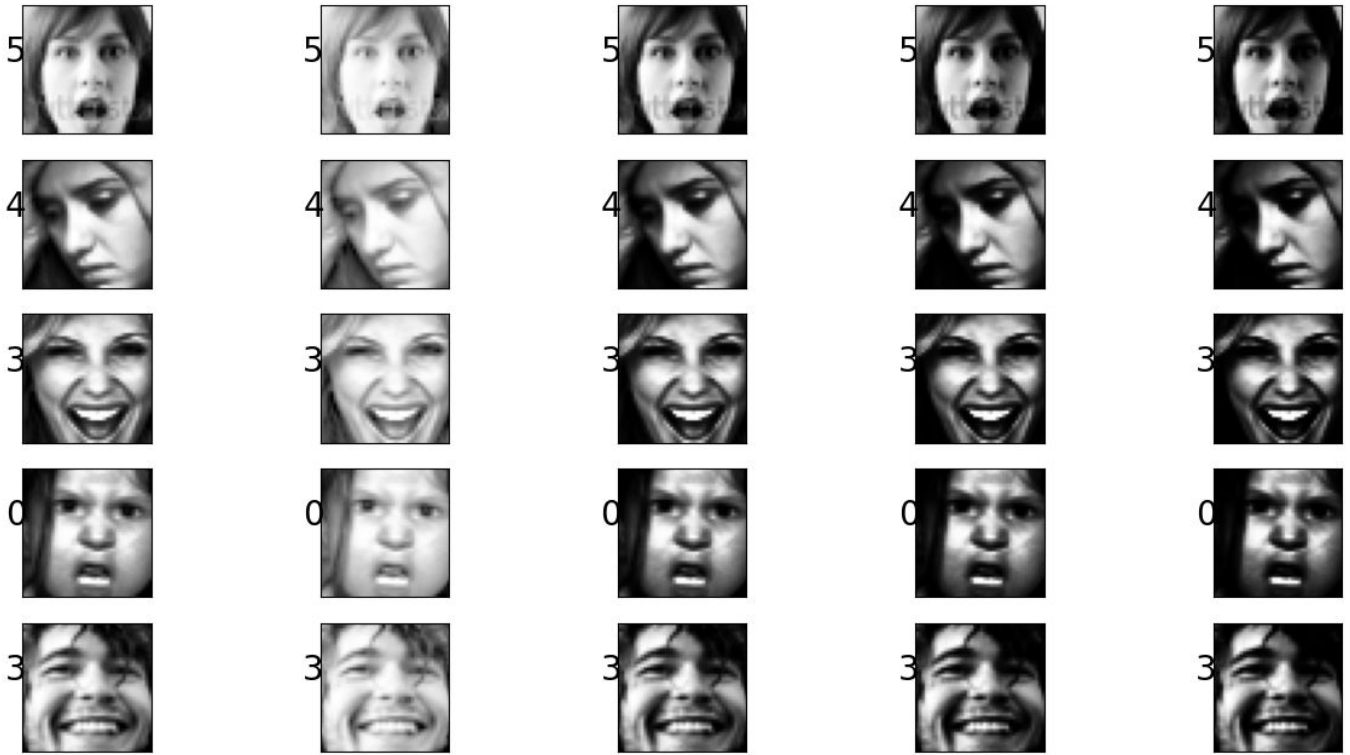
➢ Handled by Shaik Masihullah

- The multi cultural data we have scraped don't have emotion labels.
- So, to accompany that we employ pseudo labelling technique.
- The unlabelled data will first be predicted by the trained model of labelled data
- Then predicted labels of unlabelled data by the trained model will be used
- The model is re-trained with the newly labelled data.

Dataset

- The dataset we have used is also **FER2013**[3] which consists of 27000+ grayscale images of faces sized 48x48 pixels.
- There are seven emotions in the dataset, which are represented by their numeric labels.
- 0=Angry, 1=Disgust, 2=Fear, 3=Happy, 4=Sad, 5=Surprise, 6=Neutral
- Apart from this to add faces of different ethnicity and culture, the multi-cultural dataset was scraped from Google Images (American, African, Asian and Hispanic).
- These are labelled using pseudo labelling technique discussed further.

Visualizing a subset of training data



Procedure

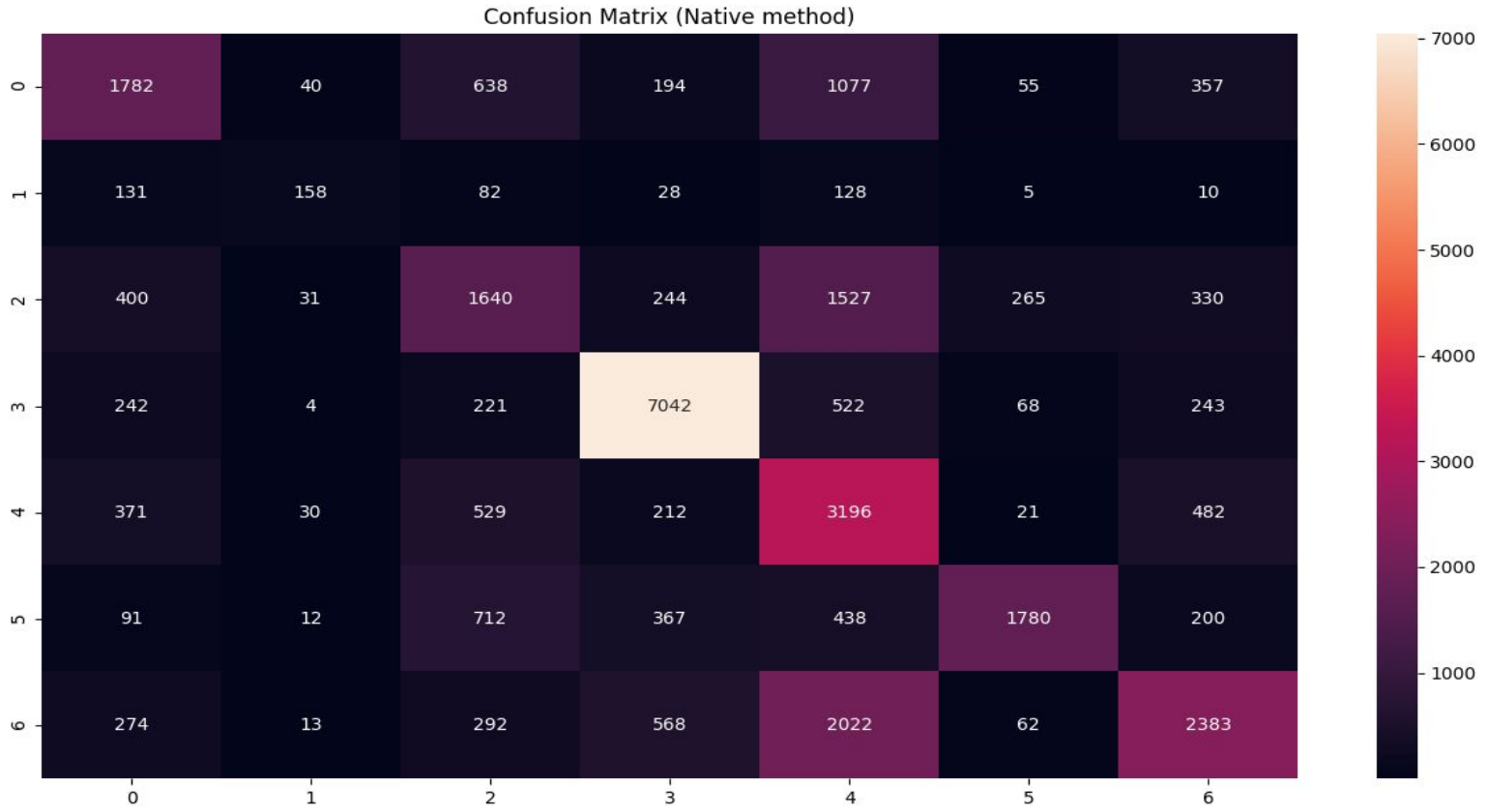
- Firstly, we train the model with the original dataset and observe the results.
- Then we apply the discussed preprocessing on each image in the dataset and produce variations in dataset.
- The model is then trained with the newly curated dataset and the results are noted.
- At last we compare the results of the model on both the datasets and report our observations and improvements achieved.

Hyperparameters

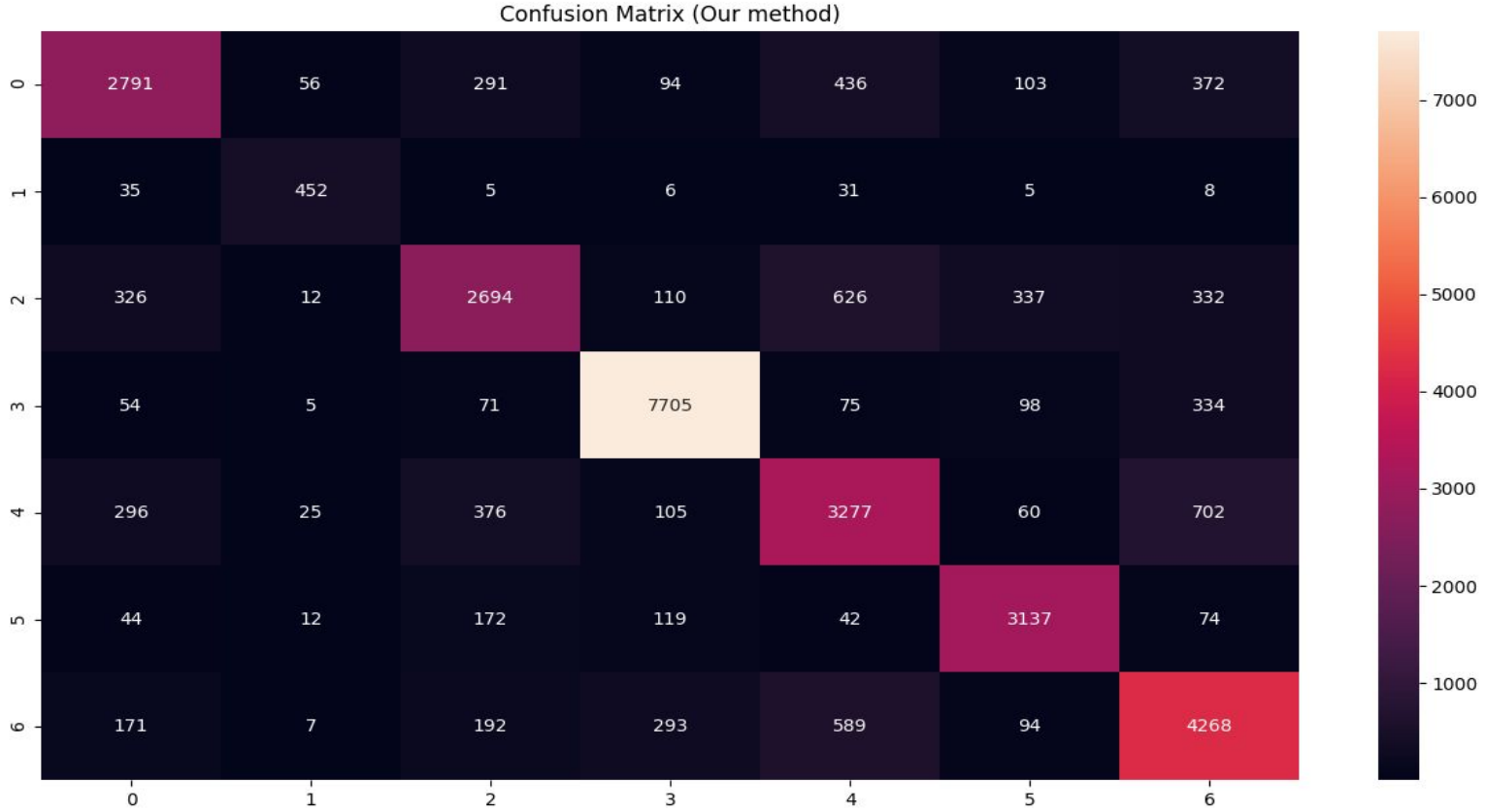
- Trained both the models for 100 epochs
- Batch size 32
- Patience of 5 for callback
- Validation split of 20%
- Adam optimizer
- Categorical cross entropy loss

Results

Model	Train Accuracy	Test Accuracy	F1 Score
Usual Preprocessing Model	70%	66%	0.5719
Our Custom Preprocessing Model	76%	75%	0.7703



0=Angry, 1=Disgust, 2=Fear, 3=Happy, 4=Sad, 5=Surprise, 6=Neutral



0=Angry, 1=Disgust, 2=Fear, 3=Happy, 4=Sad, 5=Surprise, 6=Neutral

Conclusion

- In conclusion we can say, after analysing the results of both the models with custom preprocessing techniques, that the accuracy has improved than the original preprocessing techniques.
- Our preprocessing techniques normalize the data irrespective of light shades, skin color and variability by changing their contrast, intensity levels and trying to accommodate the ethnic and cultural differences.
- We got an increase of 9% in accuracy and 20% hike in F1 score compared to the usage of usual preprocessing techniques.

Project Demo

Questions?

References

[1] Challenges of Emotion Recognition in Images and Video

[2] omar178/Emotion-recognition: Real time emotion recognition

[3] Challenges in Representation Learning: Facial Expression Recognition Challenge