Capstone Project - 5
Face Emotion Recognition

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Content:

Problem Statement:

One of the many challenges in web based learning 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.

Introduction:

What is FER:

Facial Emotion Recognition (FER) is the technology that analyses facial expressions from both static images and videos in order to reveal information on one's emotional state.

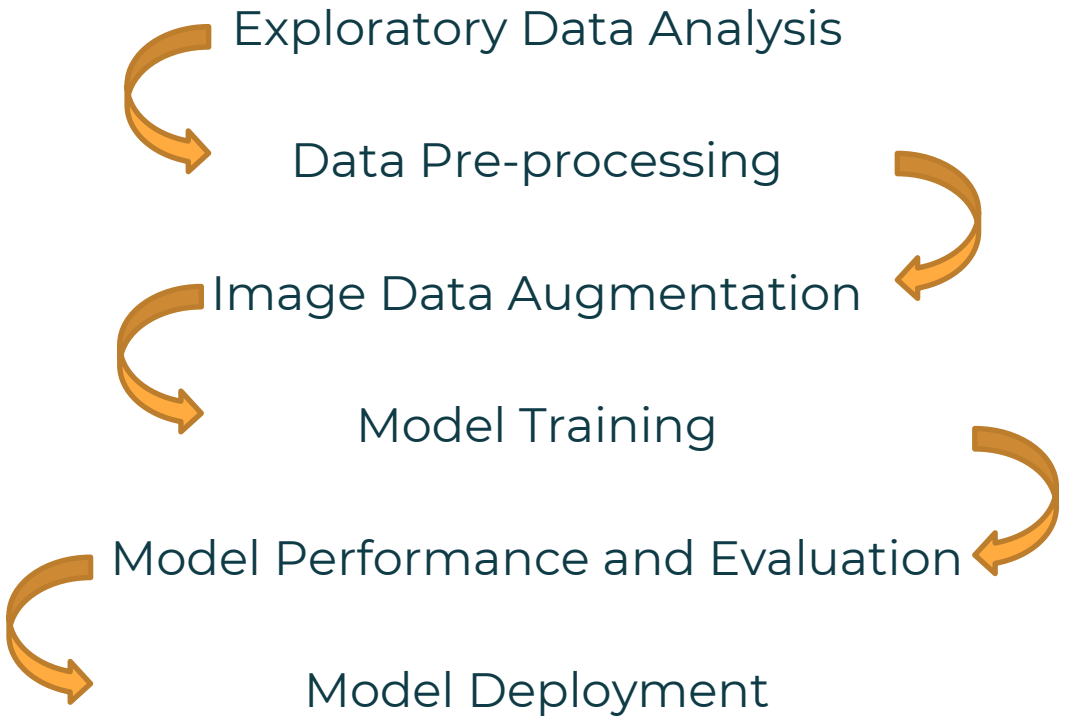
Data summary:

FER2013(Facial Expression Recognition 2013) Dataset:

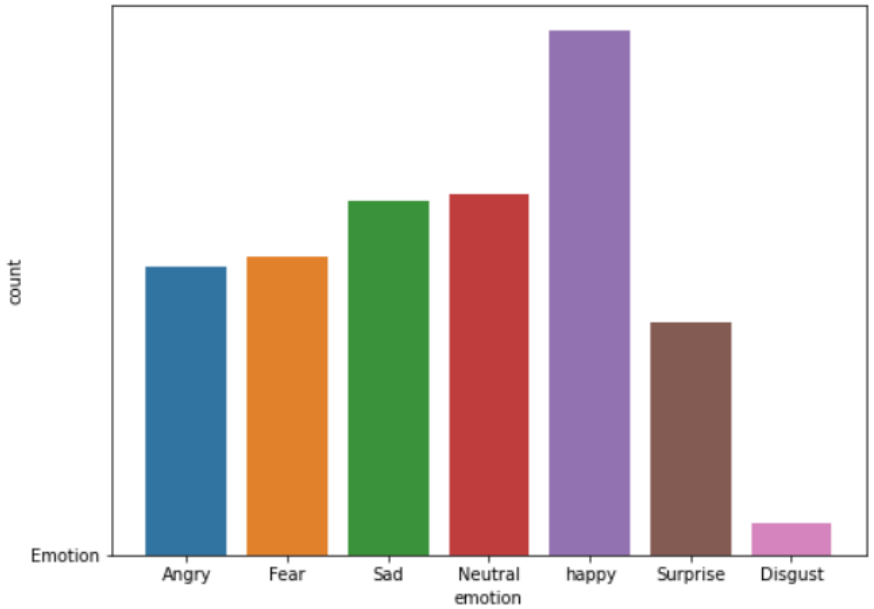
The data consists of 35887 grayscale images of faces at a resolution of 48x48 pixels. The faces have been automatically registered such that they are more or less centered in each image and take up around the same amount of area.

It has seven categories based on the emotion expressed in the facial expression (0=Angry, 1=Disgust, 2=Fear, 3=Happy, 4=Sad, 5=Surprise, 6=Neutral). There are 28,709 examples in the training set and 3,589 examples in the public and private test sets.

Approach:


Exploratory Data Analysis
Data Pre-processing
Image Data Augmentation
Model Training
Model Performance and Evaluation
Model Deployment

Exploratory Data Analysis:



As see in graph the number of data of Happy images is more and very less data of Disgust.

Data Augmentation:

Image augmentation is a method of altering original images by applying various transformations to them, resulting in many altered copies of the same image. Depending on the augmentation techniques used, such as shifting, rotating, flipping, and so on, each copy is unique in certain ways

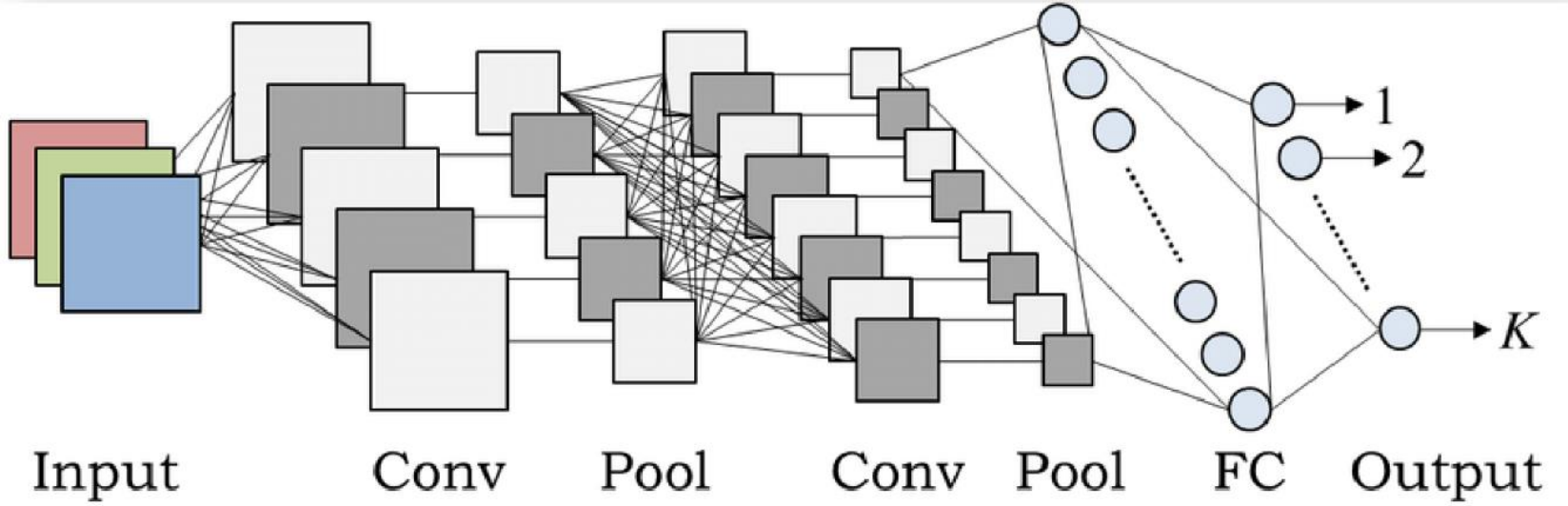
Convolution Neural Networks:

Convolutional neural networks use principles from linear algebra, notably matrix multiplication, to discover patterns inside an image, making them more scalable for image classification and object recognition tasks:

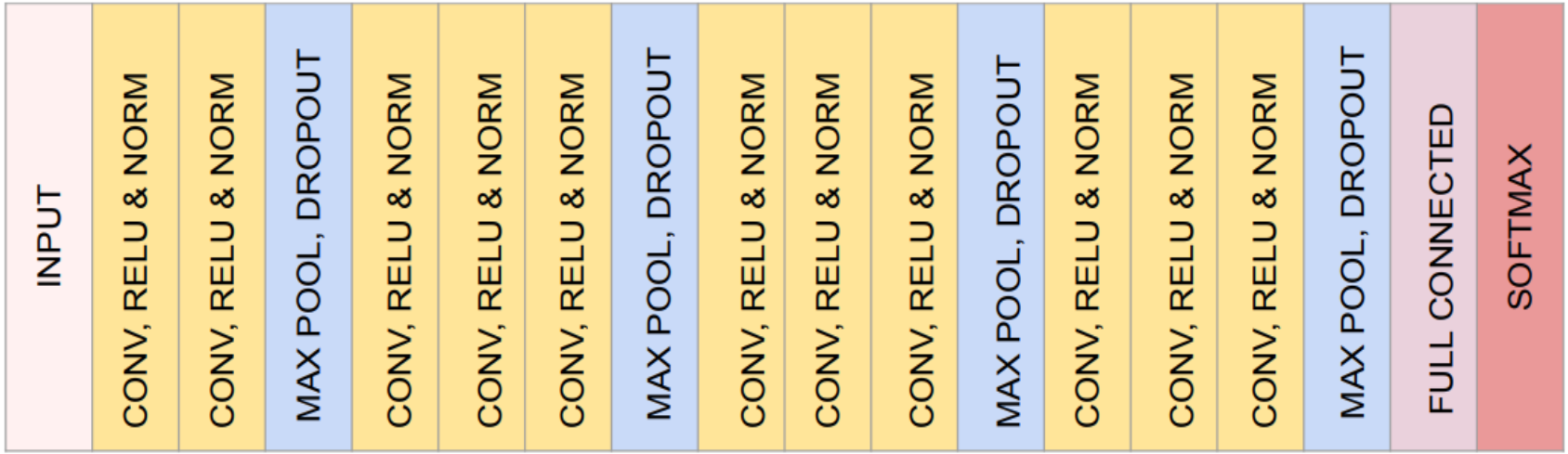
They have three main types of layers:

- Convolutional layer
- Pooling layer
- Fully-connected (FC) layer

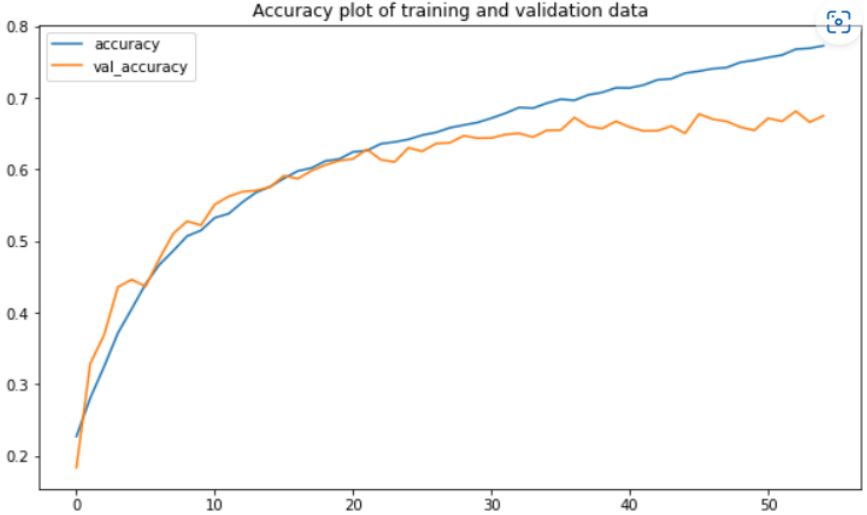
Using CNN Model:



Model Architecture:



Model Performance and Evaluation:



The best model weights were restored, which gave the following results for training and validation datasets:

loss: 0.6942 - accuracy: 0.7402 - val_loss: 0.9751 - val_accuracy: 0.6775

Model Performance and Evaluation:

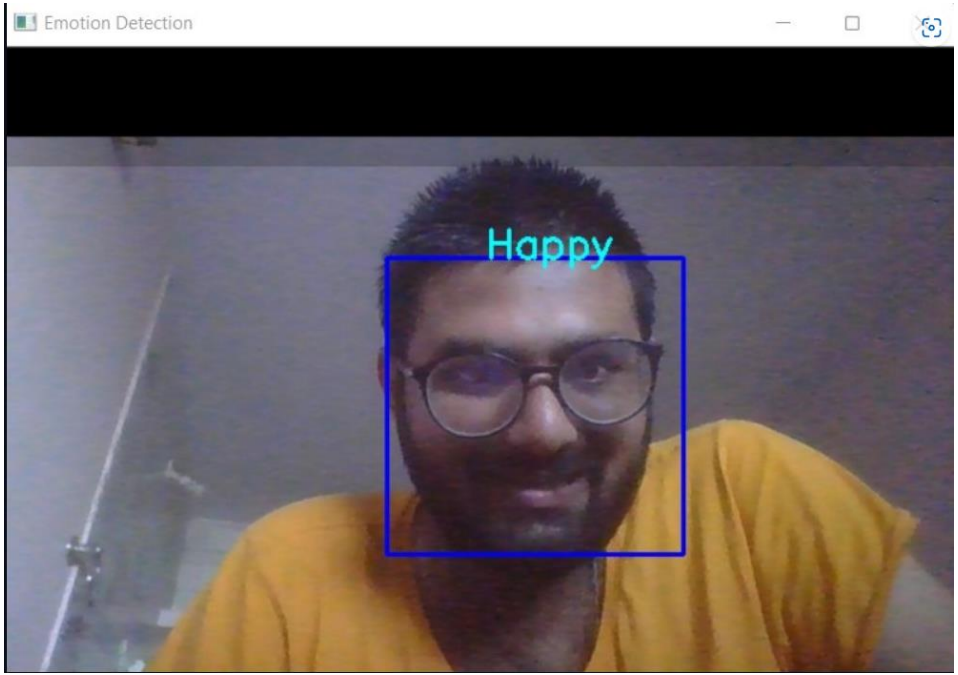
The results of the model on test dataset:

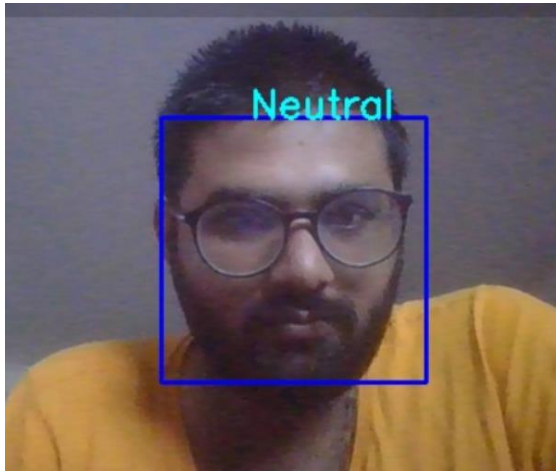
Gives the overall accuracy of 0.67 which is close to the results for validation sets, it means the model is working similarly for the unseen data as well.

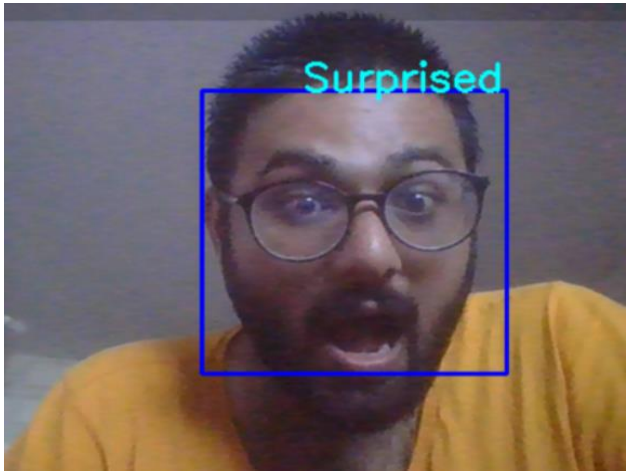
	precision	recall	f1-score	support
0	0.62	0.62	0.62	491
1	0.76	0.56	0.65	55
2	0.53	0.38	0.44	528
3	0.90	0.87	0.88	879
4	0.52	0.59	0.55	594
5	0.78	0.74	0.76	416
6	0.61	0.73	0.67	626
accuracy			0.67	3589
macro avg	0.67	0.64	0.65	3589
weighted avg	0.68	0.67	0.67	3589

Locally Real Time Emotion Detection:

- With the help of OpenCV-Python, a real time emotion detection was conducted locally.
- Next the web app was created using Streamlit framework for the same.
- Web App Deployment Is done on Streamlit.




Neutral


Surprised


Angry

Web App Deployment:

Streamlit Web App

Link: https://milanajudiya-face-emotion-recognition--app-ag8i7m.streamlitapp.com/

Streamlit is building web apps for Machine Learning and Data Science. We can instantly develop web apps and deploy them easily using Streamlit.

Conclusion:

- Face Emotion Recognition is a crucial application of deep learning algorithms which can be extended to every industry.
- Future work in relation to this project can include tracking and analyzing the emotions of the students. For example If a student is continuously predicted to be sad for a class of an hour, he/she could be flagged and a report of all the students could be generated at the end of the lecture for better analysis and further customized lesson plans.
- Another important point to conclude is CNN models could achieve extraordinary results if appropriate and good amount of training data is provided. For example for this particular case, the training data should include images of students while studying.

Conclusion:

- The model gave 67% accuracy for training data and 66% for validation data. And it gave 67% accuracy for the test.
- Model is identifying student emotion and successfully deployed the web app of real time emotion detection on Streamlit cloud.

Thank you