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Facial Emotion Recognition

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Problem statement

Implementing an expert system which recognize's face emotion using Convolutional Neural Network(CNN)

Why Emotion Detection?

The motivation behind choosing this topic specifically lies in the huge investments large corporations do in feedbacks and surveys but fail to get equitable response on their investments Emotion Detection through facial gestures is a technology that aims to improve product and services performance by monitoring customer behavior to certain products or service staff by their evaluation

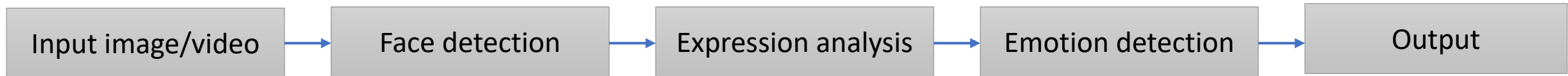


Introduction

- Facial expressions are the facial changes in response to person's:
 - Internal motional states,
 - Intentions,
 - Social communications.
- Facial emotion recognition system is one of main applications of machine vision that widely attended in recent years.
- It allows the machine to understand the emotions of human in turn enhancing its effectiveness in performing various tasks.
- It serves as a socially intelligent software tool.

Introduction cntd.

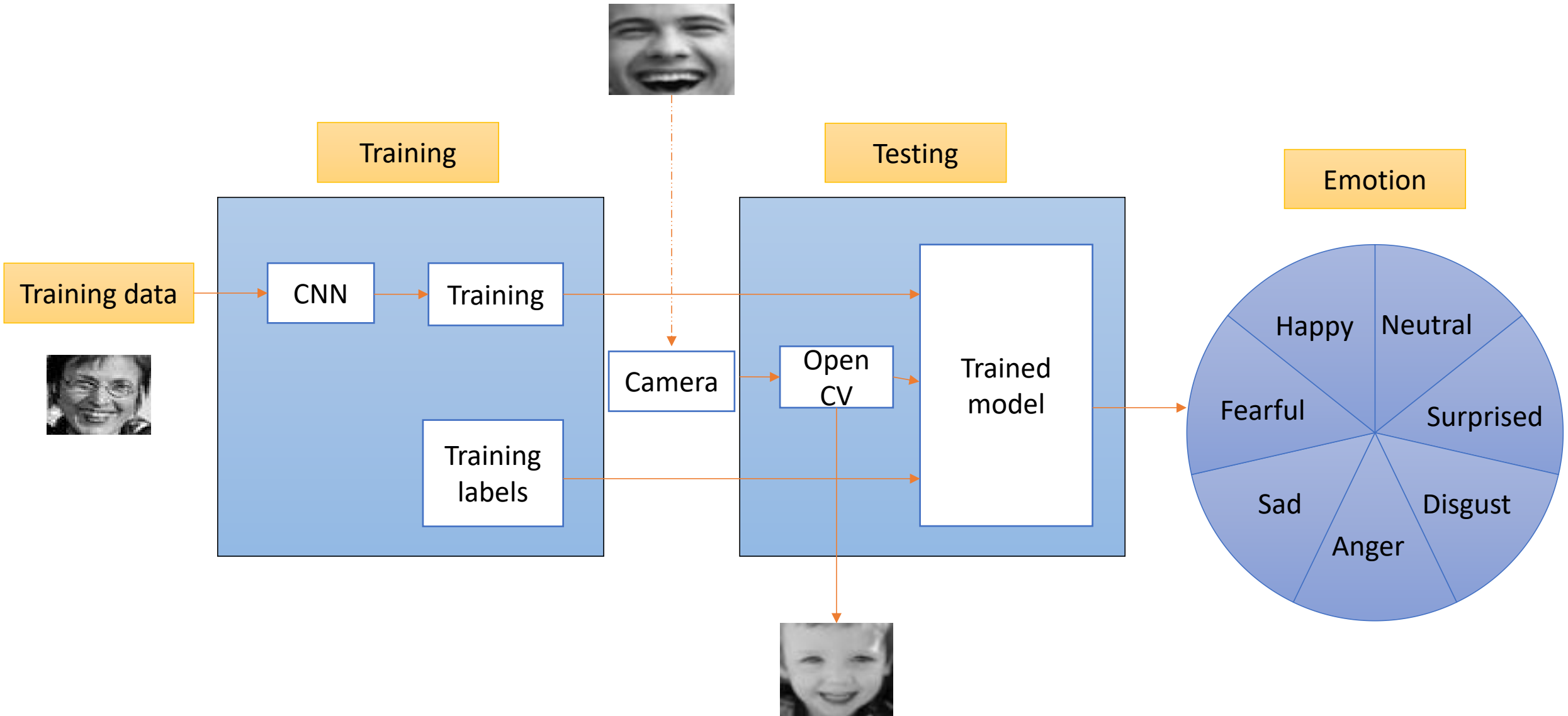
- Facial emotion recognition system is widely used in:
 - Security.
 - Entertainment.
 - Human machine interface.
- Various stages involved in facial emotion recognition system are:



Literature survey

Sr No.	Author	Title	Review	Conference paper	Year
1.	Eshan Saeedizade, Ahmad Kalhor	Real time Facial expression recognition using facial landmark and Neural Networks	Used Sigmoid activation function which had 65% accuracy	IEEE	2022
2.	Ninad Mehendale	Facial emotion recognition using convolutional neural network(CNN)	FERC couldn't start the step, for many emotion-based applications such as lie detector, mood-based learning for students, etc.	Springer	2020
3.	Pranshu Diwan, Rajeshwar Nadar, Aniruddha Bhatia	Analysis of Facial Emotion Recognition	Used Softmax activation function which had 68% accuracy	IEEE	2019
4.	Asad Khattak, Ulfat Batool	An efficient deep learning technique for facial emotion Recognition	Use deep learning technique CNN for emotion detection.	Springer	2021

Block Diagram



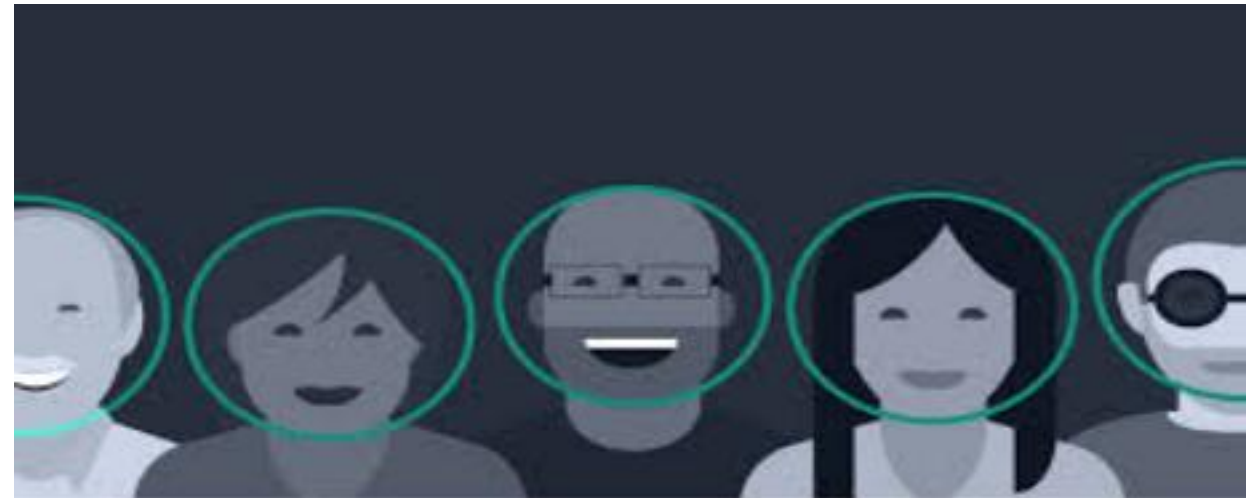
Algorithm

Haar Cascades

Haar cascade is an object detection algorithm which is used to identify faces in an image or real-time video.

The algorithm can be explained in four stages:

- Step 1- Calculating Haar Features
- Step 2- Creating Integral Images
- Step 3- Using Adaboost
- Step 4- Implementing Cascading Classifiers



Convolutional Neural Networks

- **Step 1- Convolution Operation-**

1. 1st building block
2. convolution operation
3. Touch feature detector
which serve as neural network features

- **Step 2- ReLu Layer-**

Relu layer helps to prevent the exponential growth in the computation required to operate neural network.

- **Step 3- Pooling-**

In the pooling layer we shrink the image stack into a smaller size(48x48). Pooling is passing through the activation layer(ReLU layer)

- **Step 4- Dropout-**

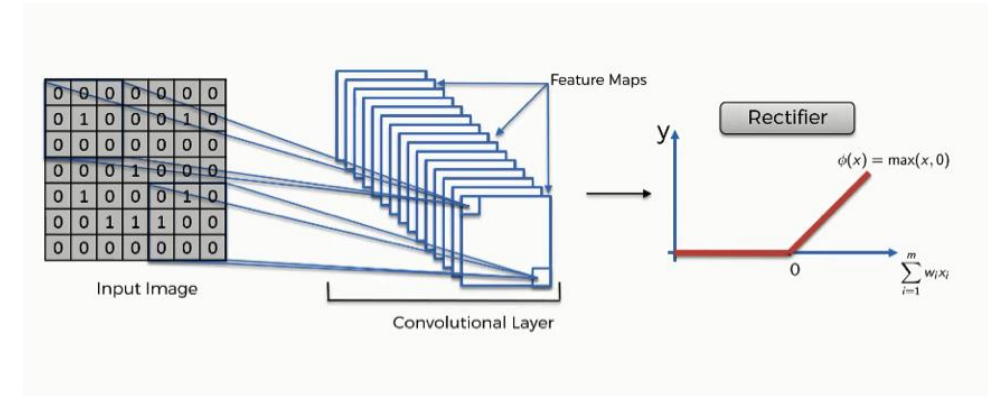
Another typical characteristics of CNN is Dropout layer. The dropout layer is the mask that nullifies the contribution of some neurons towards the next layer and leaves unmodified all others.

- **Step 5- Flattening-**

Flattening is used to convert all the resultant 2D array from pooled feature mapped into a single long continuous linear vector. Flatten layer is used to flat all the values.

- **Step 6- Dense layer-**

Dense layer is used to classify image based on output from convolutional layers. It is also used to feed all outputs from the previous layer to all its neurons.



Hardware/Software requirements:

Hardware: Windows/linux/Mac system with minimum 8gb of Ram and 4gb GPU

Software: VS code/ jupyter Notebook/ Google Colab

Dataset

FER2013 Dataset

Total images in dataset: 35887

Trained images: 28709

Tested images: 7178

Applications:

The scope of this system is to tackle with the problems that can arise in day to day life, Some of the scopes are:

- The system can be used to detect and track a user's state of mind.
- The system can be used in mini-marts, shopping center to get the feedback of the customers to enhance the business, The system can be installed at busy places like airport, railway station or bus station for detecting human faces and facial expressions of each person. If there are any faces that appear suspicious like angry or fearful, the system might set an internal alarm.
- This system can help people in emotion related research to improve the processing of emotion data.
- Clever marketing is feasible using emotional knowledge of a person which can be identified by this system.

Limitations:

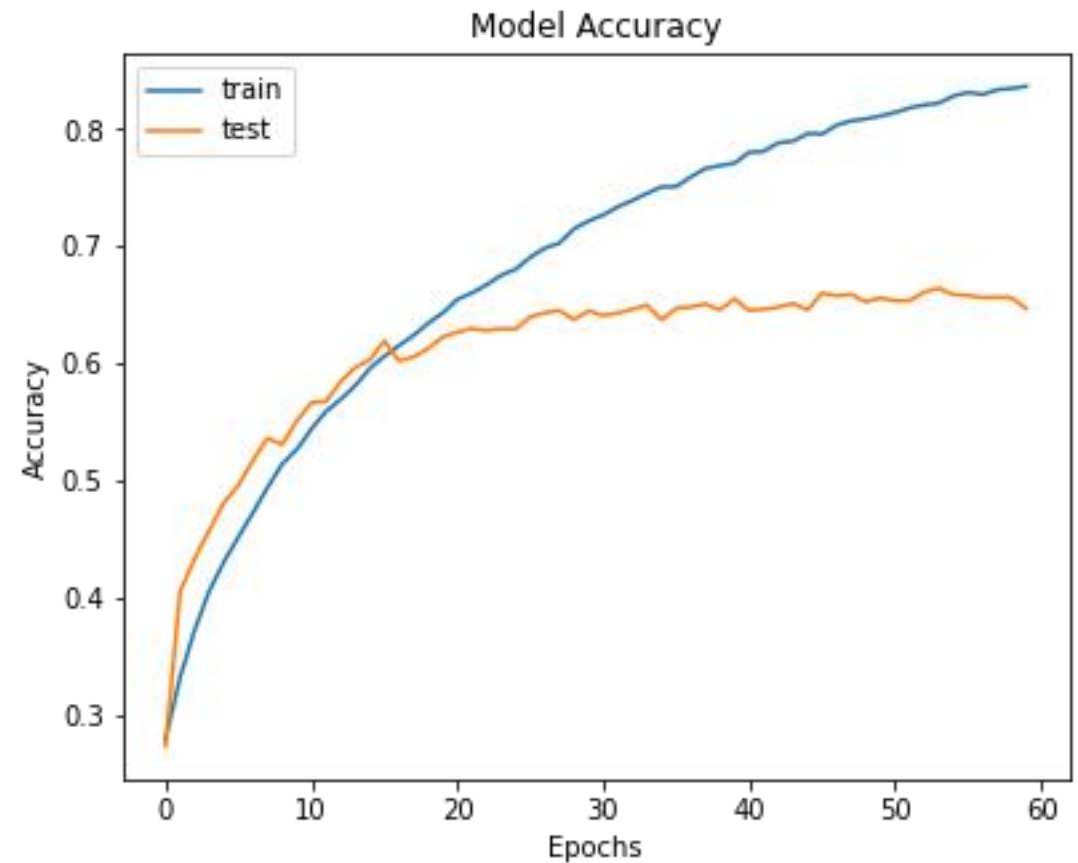
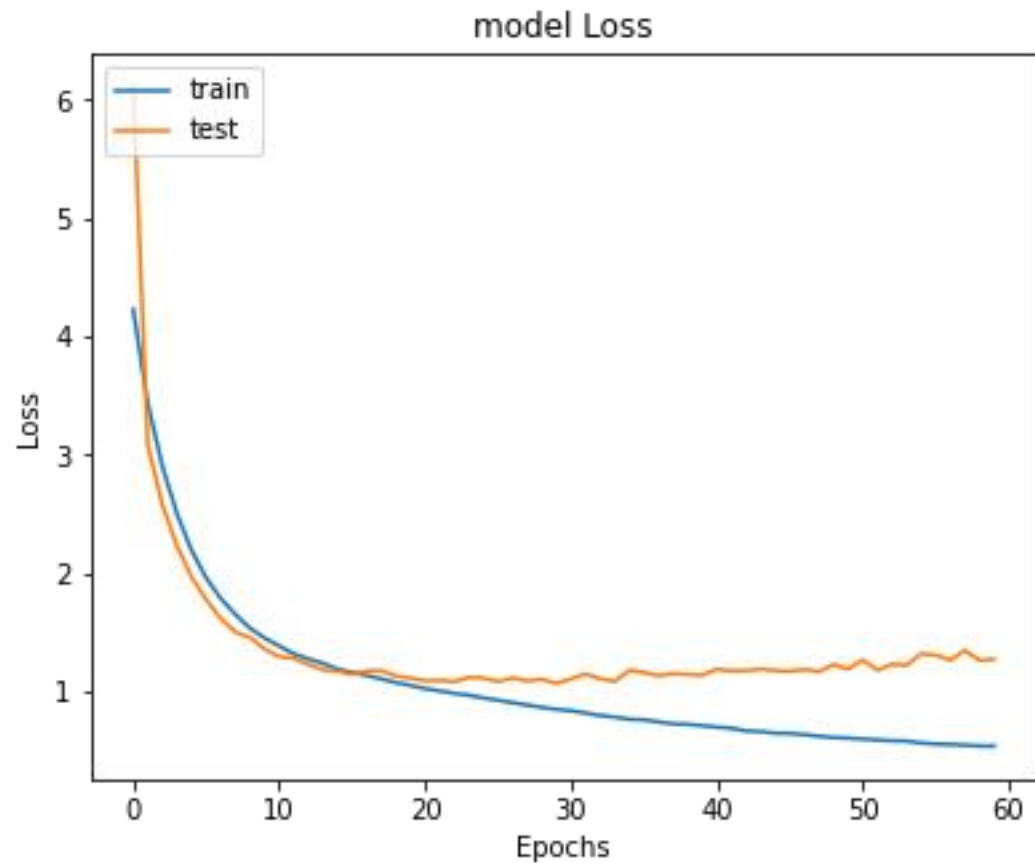
- Small Image Sizes make Facial Recognition More Difficult
- Different Face Angles Can Throw Off Facial Recognition's Reliability

Future Scope

- Further in future using some various algorithms and activation functions we can try to check the accuracy of the model and accordingly conclude the best practice for face recognition.
- In upcoming time we can also build the model, switching from grayscale format I.e. black and white images to rgb format I.e. colored images.
- Our system can be used in Digital Cameras wherein the image can be captured only when the person smiles.
- In near future, enhancing the existing face emotion recognition model, it will also be possible to switch on/off smart appliances using facial expression.

Results

Accuracy of our face emotion detection model is 92%



Conclusion

We proposed a Convolutional Neural Network (CNN) architecture for facial emotion detection. There are seven classes of facial emotions, we test data in real-time using Haar-Cascade Classifier to give the in the round of face.

We accessed the FER2013 dataset and trained the model to create visualizations, the greater the number of epochs passed, the higher is the accuracy obtained.

References

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THANK YOU!!!