The project is about emotion detection by measuring facial features using OpenCV (Python). This system can predict and recognize the expression of the person facing the camera.

this system has the ability to detect any face and based on training data it can recognize the expression and different facial features. It is very simple and easy way to detect the human emotion. And it is a very accurate system.

Facial expressions are a natural way to communicate emotional states and intentions. The **facial expression detection** method consists of three main steps: **face detection, feature extraction** and **modeling.**

Sample data : Here are some sample data from Kaggle for our model…...

Angry **Happy** **Neutral** **Sad** **Surprise**

Description of the project: In this project first, I start with the model building based on our collected dataset. this project goal can only be achieved by using two steps, first one is facial landmark detection for facial expression and later use that information to predict the emotion of that face.

I collect dataset from **Kaggle** and we imported the images into this project and built a training model of total 4 blocks of CNN (Convolutional Neural Network) layers and 2 blocks of Fully Connected layer and 1 block of Fully connected layer for the final prediction. In this project i used **ReLU** activation in the CNN and FC layers and **SoftMax** activation function for the prediction layer and **batch normalization** to categorize the dataset and **Dropout regularization** for preventing our model from being overfitting in the training section.

this model extracted 5 key points in the face and used it to recognize the expression to detect emotion and I print total 68 key points in the face for expression extraction.

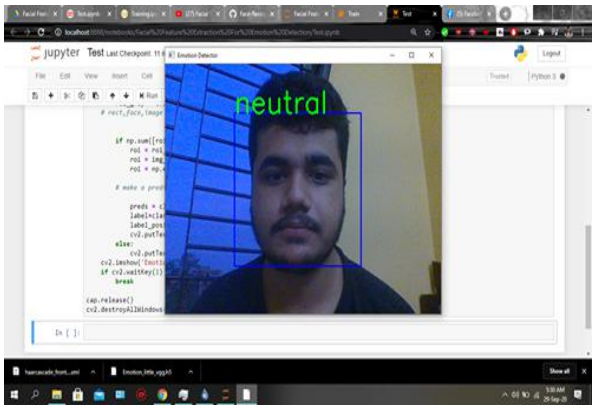
I use total 24282 images to train our model and 5937 images for validating our trained model.

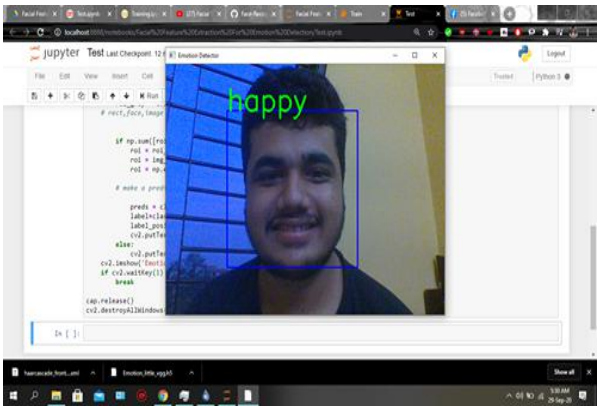
I train total 4 model, first 2 for seven types of emotion and later 2 for 5 emotion model.

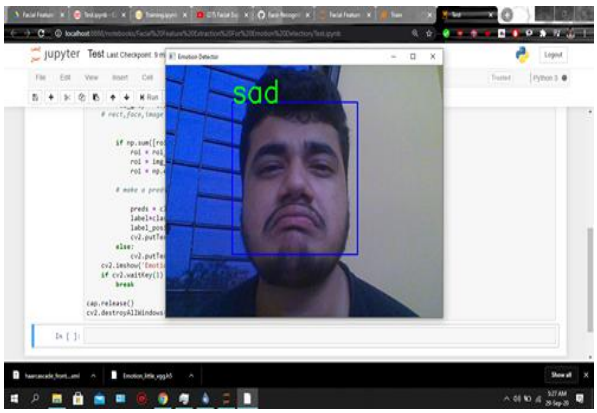
Results: The results for our four trained model is quite promising. I train 4 different models for comparing details and accuracy. And last 2 models with 5 classes of emotion are the better models than the first 2 models with 7 emotion or classes.

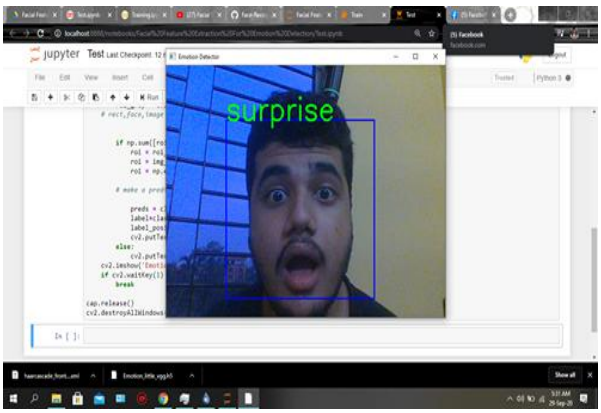
Here, sample Images after successful prediction of our model.....

Without the key points.....



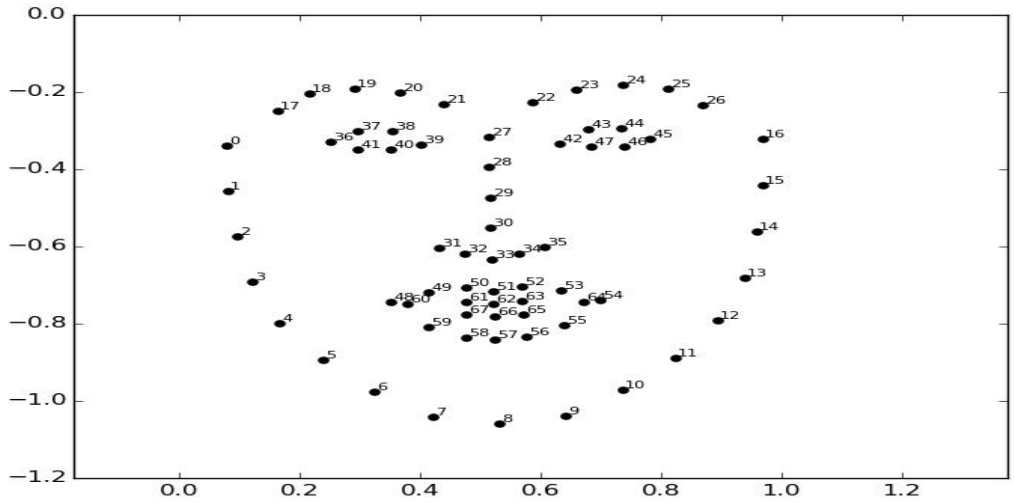




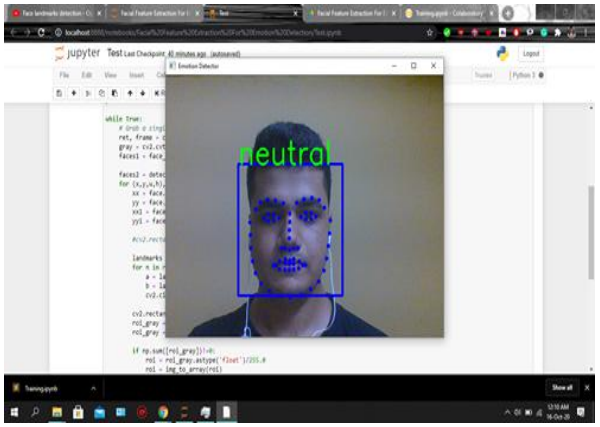


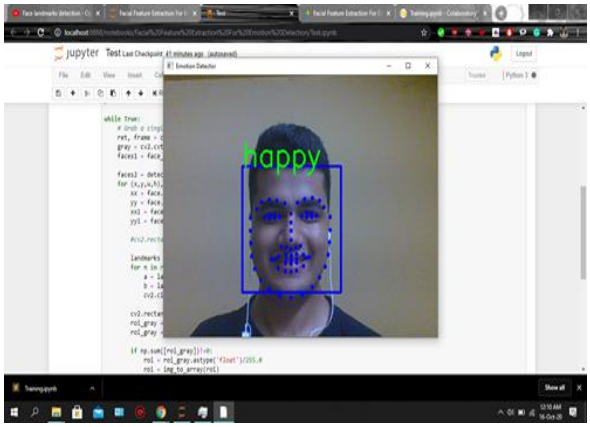
Facial landmark:(68 key points) The pre-trained facial landmark detector inside the dlib library is used to estimate the location of ***68 (x, y)-coordinates*** that map to facial structures on the face.

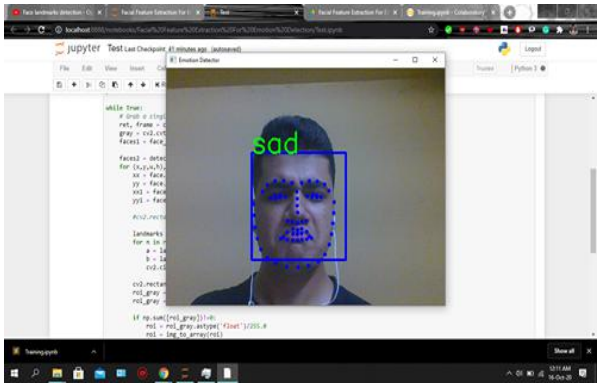
The indexes of the 68 coordinates can be visualized on the image below:

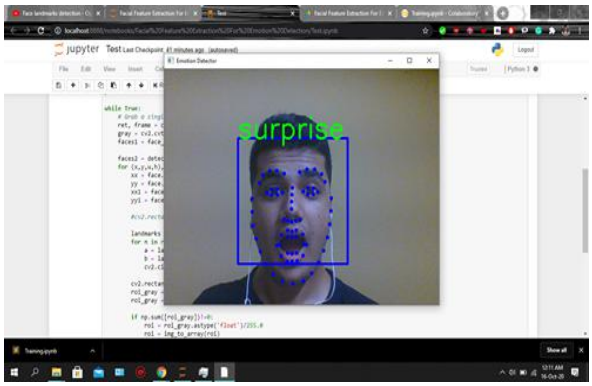


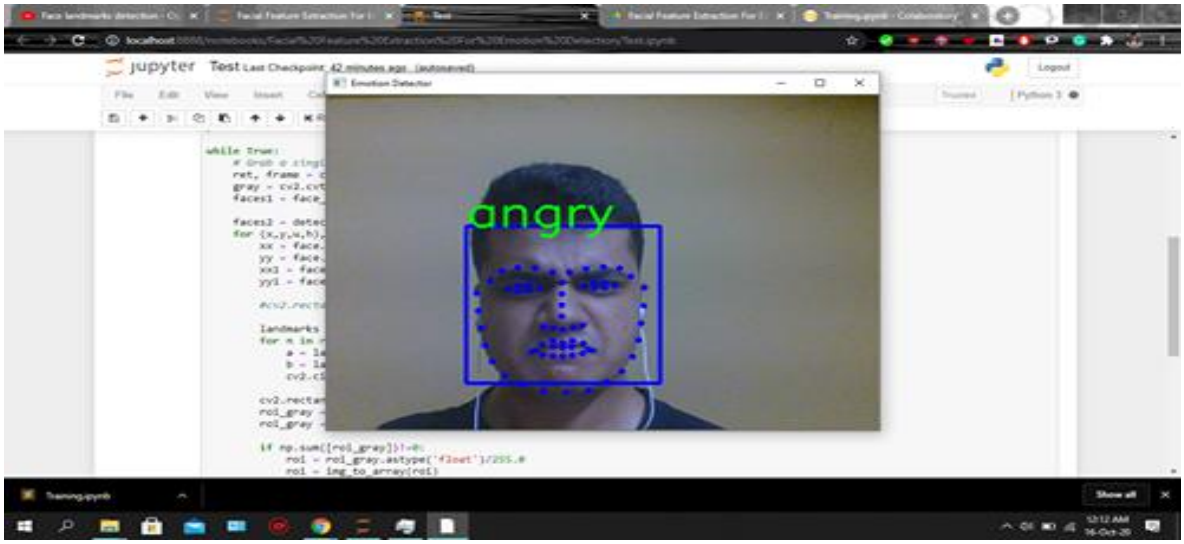
With the key points result.....











Model summary.....

Layer (type)	Output Shape	Param #
conv2d_8 (Conv2D)	(None, 48, 48, 32)	320
activation_11 (Activation)	(None, 48, 48, 32)	0
batch_normalization_10 (Batc	(None, 48, 48, 32)	128
conv2d_9 (Conv2D)	(None, 48, 48, 32)	9248
activation_12 (Activation)	(None, 48, 48, 32)	0
batch_normalization_11 (Batc	(None, 48, 48, 32)	128
max_pooling2d_4 (MaxPooling2	(None, 24, 24, 32)	0
dropout_6 (Dropout)	(None, 24, 24, 32)	0
conv2d_10 (Conv2D)	(None, 24, 24, 64)	18496
activation_13 (Activation)	(None, 24, 24, 64)	0
batch_normalization_12 (Batc	(None, 24, 24, 64)	256
conv2d_11 (Conv2D)	(None, 24, 24, 64)	36928
activation_14 (Activation)	(None, 24, 24, 64)	0
batch_normalization_13 (Batc	(None, 24, 24, 64)	256
max_pooling2d_5 (MaxPooling2	(None, 12, 12, 64)	0
dropout_7 (Dropout)	(None, 12, 12, 64)	0
conv2d_12 (Conv2D)	(None, 12, 12, 128)	73856

activation_15 (Activation)	(None, 12, 12, 128)	0
batch_normalization_14 (Batc	(None, 12, 12, 128)	512
conv2d_13 (Conv2D)	(None, 12, 12, 128)	147584
activation_16 (Activation)	(None, 12, 12, 128)	0
batch_normalization_15 (Batc	(None, 12, 12, 128)	512
max_pooling2d_6 (MaxPooling2	(None, 6, 6, 128)	0
dropout_8 (Dropout)	(None, 6, 6, 128)	0
conv2d_14 (Conv2D)	(None, 6, 6, 256)	295168
activation_17 (Activation)	(None, 6, 6, 256)	0
batch_normalization_16 (Batc	(None, 6, 6, 256)	1024
conv2d_15 (Conv2D)	(None, 6, 6, 256)	590080
activation_18 (Activation)	(None, 6, 6, 256)	0
batch_normalization_17 (Batc	(None, 6, 6, 256)	1024
max_pooling2d_7 (MaxPooling2	(None, 3, 3, 256)	0
dropout_9 (Dropout)	(None, 3, 3, 256)	0
flatten_1 (Flatten)	(None, 2304)	0
dense_3 (Dense)	(None, 64)	147520
activation_19 (Activation)	(None, 64)	0
batch_normalization_18 (Batc	(None, 64)	256
dropout_10 (Dropout)	(None, 64)	0
dense_4 (Dense)	(None, 64)	4160
activation_20 (Activation)	(None, 64)	0
batch_normalization_19 (Batc	(None, 64)	256
dropout_11 (Dropout)	(None, 64)	0
dense_5 (Dense)	(None, 5)	325
activation_21 (Activation)	(None, 5)	0

Total params: 1,328,037
Trainable params: 1,325,861
Non-trainable params: 2,176

Challenges: This model is near accurate for 5 emotion prediction like sad, happy, angry, surprise and neutral but it cannot fully recognize the emotion for fear and disgust from the faces.