Section A -Research paper

STRESS DETECTION USING FACIAL EXPRESSION

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ABSTRACT - This project will identify facial expressions that indicate a user's sentiment to specify if the user have any type of stress or enjoyment. Human Beings express their feelings through their emotions. Sometimes it is more convenient for humans to express their feelings through expression rather than words. This can be in the form of smiling or disgusting face and many more. This will help us in various fields, like in customer service applications to detect customer emotions and respond accordingly. It can also be used in hospitals to detect pain in patients who cannot communicate verbally. It can also be used in detection of user's stress in social media platform. It can be used in virtual reality where animated characters can mimic the actual facial expressions. In this project we used deep learning algorithm for distinguishing facial expression. The aim of this model is to evaluate previously stored image in memory or from the current feed given by the system's camera to anticipate a person's facial expression.

Keywords – Facial expression, Deep Learning, Convolutional Neural Network (CNN), OpenCV

1. INTRODUCTION

Facial Expressions have the major part in interpersonal communication. People understand each other sentiments more easily through facial expressions and voice tone. The picture which were pre-processed contributes in attaining greater image quality and so detecting sentiments more accurately.Facial Expression has gain lot of awareness over a past few decades as it helps us in various fields. It is used to refine Human Computer Interface so that computer that understand its surrounding like recognizing the human objective by detecting there facial expression. Computer Machines can understand their surrounding by capturing through cameras and sensors. It can also be used in customer service applications to identify and respond to user emotions for better understanding the needs of the consumer and deliver more personalized support [1][2][3]. It can be used in monitoring system in which assessing of person's attention can be measured. Our study focuses on improving previous models that were less effective. Data set is taken from kaggle to train our model. It uses grayscale images of human with different expressions that define a particular emotion. Grayscale image is used to simplify algorithm computation rather than colorful image.This

project involves models created using various machine learning and deep learning methods. It also makes use of some of Python's more efficient libraries to develop an application program that identifies human expressions in real time. Tensor Flow, Keras, OpenCV and pillow are some of the libraries. OpenCV is useful in the field of machine learning and image processing and this may be used to detect and analyze objects in photos, videos, and live feeds to recognize different kind of items,objects, people, animals, etc. Keras is best suited for rapid implementations and easy prototyping and provides support to CNN [4][5][6]. It provide simple and consistent APIs, designed to perform best practices to decrease cognitive load. It provide clear and responsive feedback in case of user mistake. The objective of this proposed system is to train a model for emotion recognition. This will include training the dataset and then validating the data using test dataset. We will try to build the project using CNN and will rely upon the most accurate algorithm for catering out our purpose [7][8][9].

2. LITERATURE SURVEY

[1]The authors utilized RAN, which stands for Region Attention Network. Attention network mechanisms are initially created using a reinforcement algorithm. The value of face area data can be recorded adaptively by RAN. Firstly they used the RAN without RB loss and added their attention module which performed well and create Region Biased Loss also known as RB-Loss function which helps in promoting a high attention weight for the most significant region [10] [11].

[2] In this paper DAN stands for deep alignment network is used for Facial Emotion detection challenge that makes use of face landmarks or patterns as part of the classification loss function. They propose to adopt a cutting-edge facial landmark recommendation system - Deep Alignment Network also known as DAN and enhance it that intended to reliably identify emotions. This minor tweak enables our approach, termed EmotionalDAN, to leverage the placement of face landmarks and include this information into the categorization process. We produce cutting-edge performance on two tough datasets for face emotion identification by training both keywords concurrently [12][13].

[3]Stationary images can be recognized by traditional methods but when it comes to changes in frame of an image or video it become more complicated task to identify facial expression.DNNs can extract more discriminative characteristics from visual input, as a consequence of which the features of the human figure is better represented. an approach that uses 3D CNN architecture and Long term Short Term Memory to extract temporal relationships between successive frames in a video series [14][15].

[4]In this research the authors described the patterns of frontal facial expressions.facial expression is recognized by extracting three face areas i.e eye region ,mouth region and auxiliary region. It is difficult to identify patterns related to facial expression so fuzzy classifiers is very helpful in emotion recognition step With the help of fuzzy classifiers emotion is recognized by linear matrix inequality (LMI) optimization method [15][16].

[5]The author of article [8] created a method of automated facial emotion or sentiments Recognition to recognize and discover facial landmarks in between a complex scene, A face expression recognition or identification system is built with the help of Convolution Neural Network also known as CNN. The

CNN model in the project is built on the LeNet Architecture and extracts a collection of facial motions and classify facial emotions. and the Kaggle facial expression (FER2013) dataset, which has seven different human facial expression class namely: happy, disgust, surprise, sad, afraid, rage, and neutral. Convolution Neural Network is used to create a human facial expression recognition system . The project's CNN model is based on the LeNet Architecture [17][18].

3. METHODOLOGY AND ALGORITHM

In this project firstly we designed our own convocation neural network and after that dataset is used to train our neural network model.Machine learning allows computers to function without being explicitly programmed. Computers are taught skills such as computer vision, language processing, pattern recognition, and so on. We leverage face emotion detection skills in this project by programming it to identify particular user emotions through picture or live video processing. After execution of code for training purpose , input data is then divided into a couple of directories. The first directory will have all of the photos, while the second will hold all of the information on the various sorts of emotions [19][20][21].

The Image Processing methodology used to acquire an improved image and extract useful information. It is a very effective way for turning a photograph into digital form and then performing various operations on it. This is a signal processing method in which the input is a 2D image with values ranging from 0 to 255 signifying the corresponding pixel value Preprocessing is a key phase that includes numerous strategies such as scaled and cropped pictures to save training time, and pixel variations to boost image diversity and eliminate over-fitting. Training of model comprises of many CNN filter layers and also Max Pooling layers, as well as pre-processing stages. The images undergoes pre-processing here, and after being filtered and pooled via multiple rounds, the model become trained. The model is trained to identify different expressions in frontal face .Face is a non rigid object and it is difficult to extract its features. Model is trained in such a way which calculate different features of nose, lips, eyes of different persons. From the live feed or previously stored data pictures were captured in OpenCV. The photos are then transformed to grayscale 48x48 images. The grayscale image is then compared to the trained model . To detect the user's faces, this module use the HaarCascade classifier.Many EMOTIONS THAT MAY BE DETECTED FROM a Picture [22][23].

Angry , Disgusted , Fearful ,neutral , Happy ,Sad, Surprised.

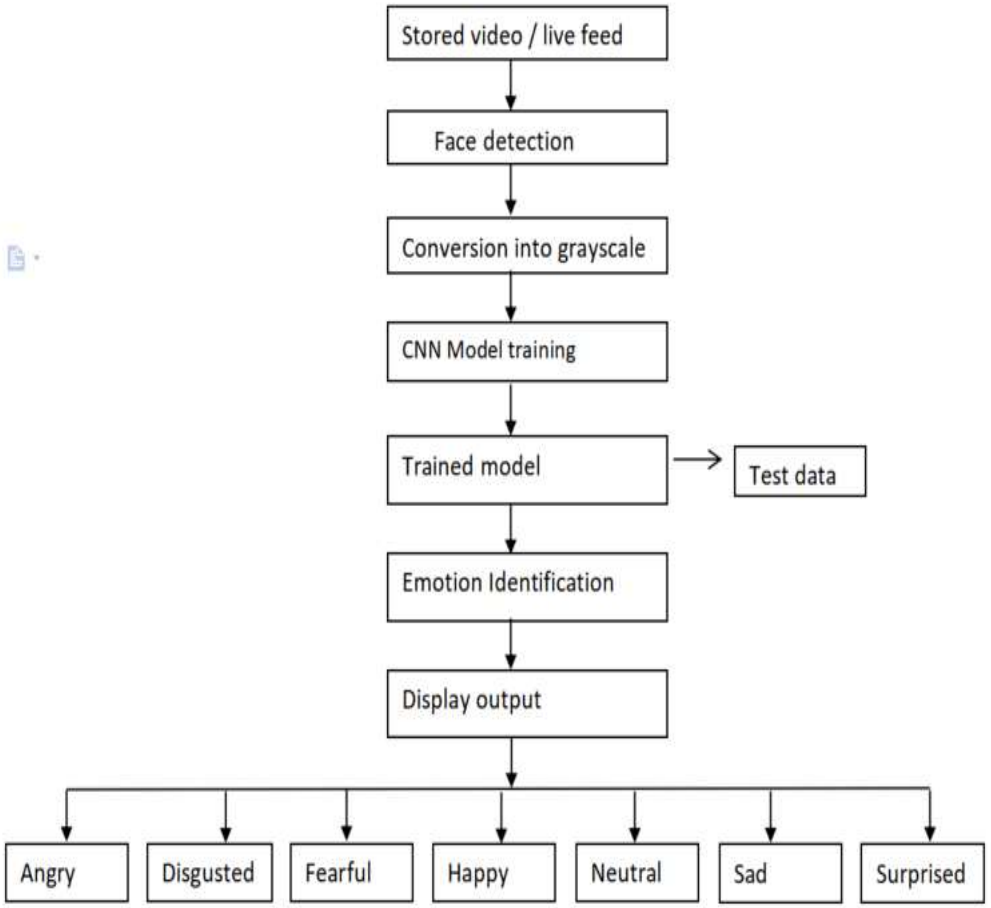


Fig. 1. FlowChart

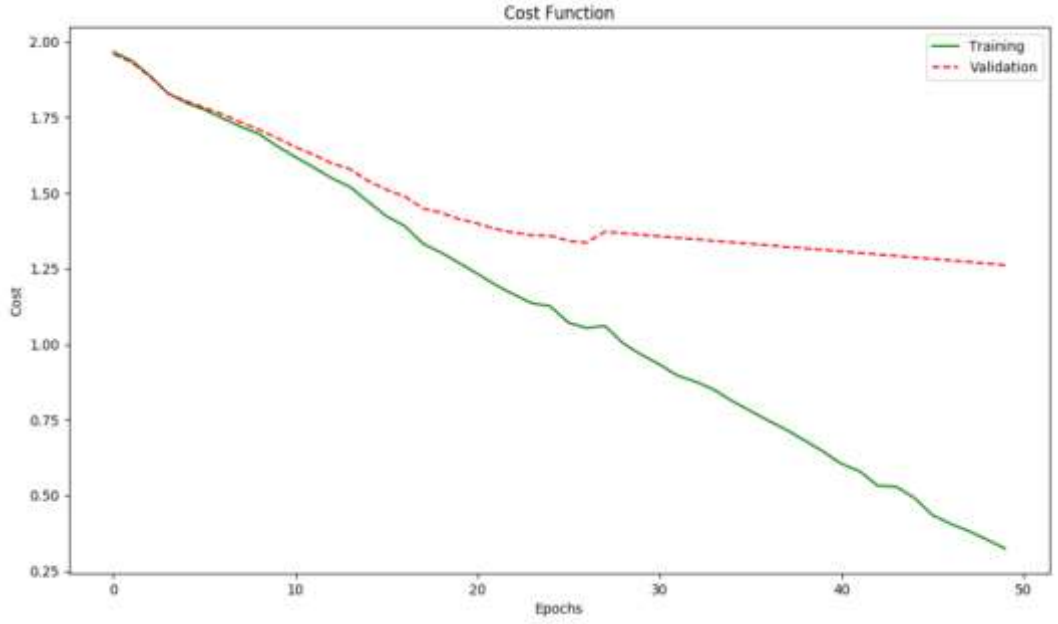


Fig 2. Cost function in training

1. CNN:

Convolutional neural networks are made up of a number of layers which include of an input layer, several number of hidden layers and output layer, of artificial neurons to learn complex and difficult patterns [24][25][26].
CNN is used for analysing visual imagery. It has a specialized method called convolution based on mathematical operation which involves the combination of two functions. Third function is produced by the two functions. A typical neural network has numerous layers. every layer consist neurons that are connected with neurons in the layer before it, and every neuron contains its own weight. The two layers namely convolutional and pooling layer are two types of layers present in CNN. However, similar with other neural networks, A ReLU stands for rectified linear unit layer, will also be present. as well as a completely linked layer.The ReLU layer functions as a function of activation. guaranteeing adequate nonlinearity as data goes across each tier in the network.. The Pooling layer is in charge of reducing the overall measurement of the Convolved Pattern. The computer power needed for processing the data is lowered when the size is reduced. Pooling is classified into two types: average pooling and maximal pooling. Convolutional neural networks operate differently because they deal with spatial data. Instead of being coupled to every neuron in the previous layer, Neurons present in this layer are exclusively coupled to nearby neurons and possesses same weight. The filtering mechanism that happens in this type of network is known as convolutional [27][28][29].

Fig. 3. Training phase

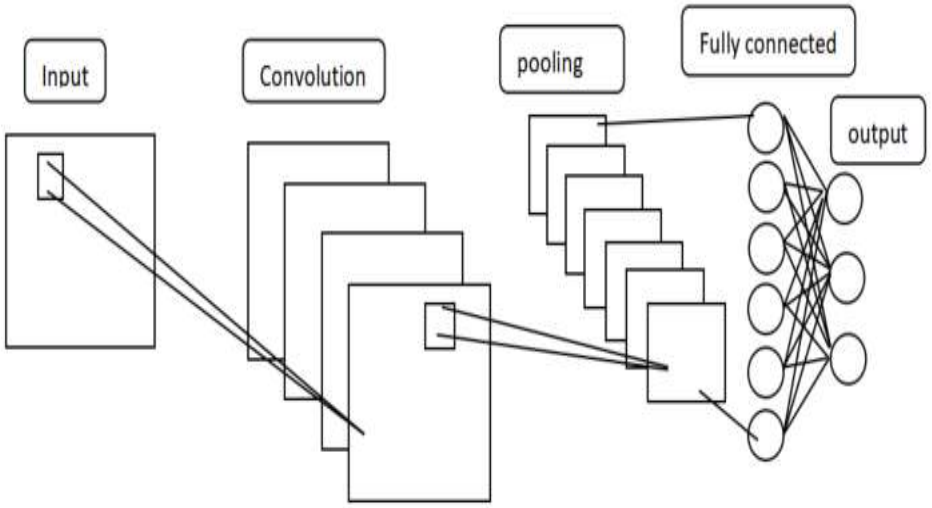


Fig. 4 Architecture of CNN

2. DATASET

The dataset used in this project is taken from kaggle named FER-2013. This data set having the 48 into 48 picture element grayscale frontal facial images of the human faces and it contains the different seven categories of emotions like angry or rage, disgust, afraid or fear, happy, surprise, sad, and neutral so in this data set we have around 28709 grayscale photos for the training phase and in the test phase we have around 3589 images [30][31][32].

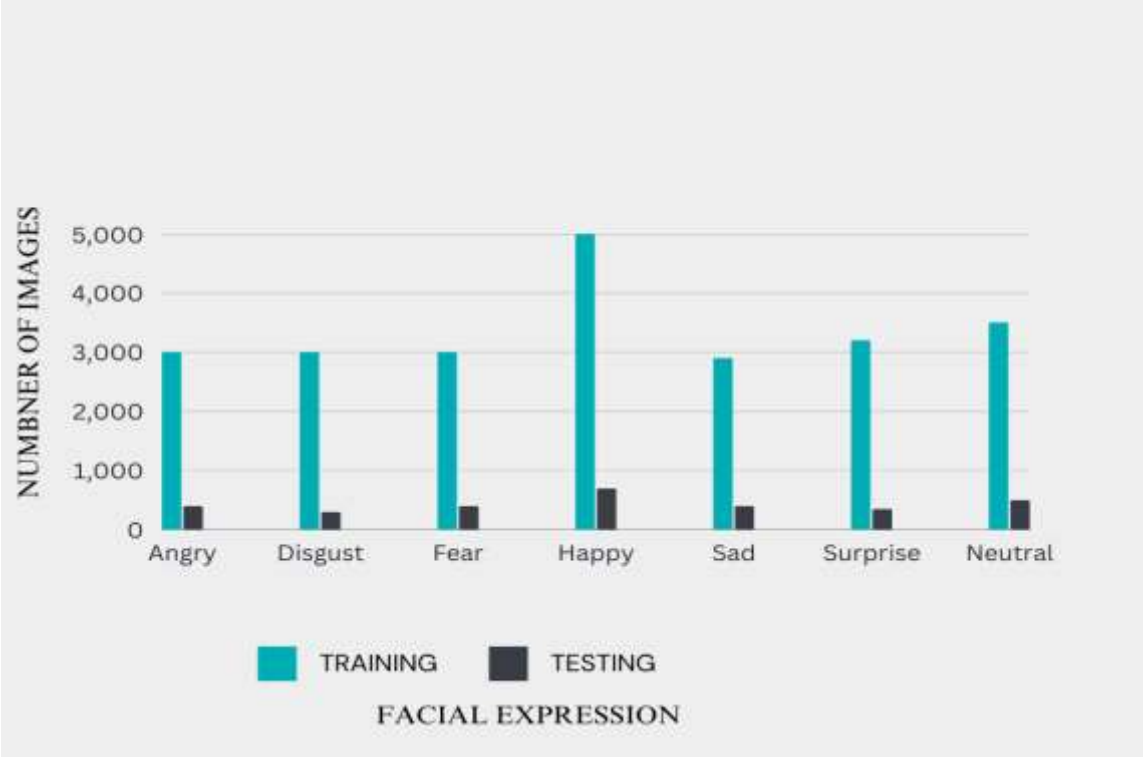


Fig. 5. Training and testing data validation

4. RESULTS

In this study, we effectively display a person's diverse emotions by his shifting facial expressions and can determine the tension on his face from his expressions. We can use our classifier to live videos or streams. First create a virtual environment and it possess its own dependencies. To recognise frontal faces in a video frame, a haar cascade classifier is utilised. This model may be utilised for existing videos or that have a live feed from a web camera. Below are some live feed results of our model [33].

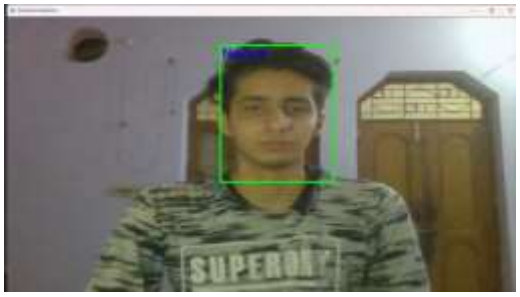
Prediction table	Anger	Disgust	Fear	Happy	Sad	Surprise	Neutral
Anger	0.41612	0.020769	0.108774	0.068099	0.108729	0.048339	0.13193
Disgust	0.04618	0.92238	0	0	0	0	0
Fear	0.16236	0.00924	0.393142	0.054571	0.122122	0.107844	0.173548
Happy	0.11865	0.006703	0.090508	0.678665	0.080498	0.043549	0.155164
Sad	0.17135	0.008063	0.150811	0.067099	0.378353	0.043739	0.194234
Surprise	0.04686	0.005042	0.095785	0.035938	0.026949	0.615265	0.048574
Neutral	0.14054	0.005042	0.11422	0.089062	0.137814	0.052364	0.496136

Fig. 6. Matrix for facial expression recognition

5. I/O Screenshots

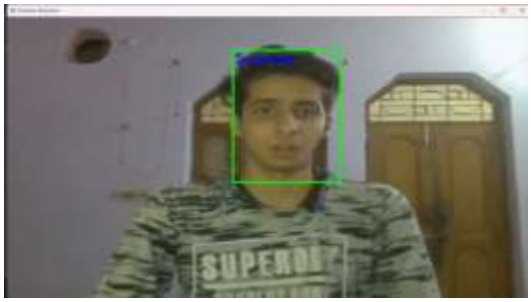
Normal image

grayscale image



Neutral

Happy



Surprised

Sad

Angry

6. CONCLUSION

We were successful in implementing the above mentioned concept and now have a working model of Face Emotion Detection using a Convolutional Neural Network architecture.computer vision is a subpart of AI in which PC is trained to interpret pictures and extract key elements from them.We tried to load the live video with the help of openCV through the video webcam and did the same processing that was used for the image or static image and predicted the positions and marked a frame or border.

Normal photos were transformed to grayscale images in order to train the model more readily. OpenCV handles haar cascades, which are used to identify face expressions in pictures. We attempted to distinguish seven unique types of facial emotions. Using the FER 2013, we trained with multiple training data sets, and the system achieves a 92% accuracy rate.

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