FACIAL EMOTION RECOGNITION USING CONVOLUTION NEURAL NETWORK

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ABSTRACT

Facial expression plays a serious role in every aspect of human life for communication. It has been a boon for the research in facial emotion with the systems that produce to the terminology of human-computer interaction in real world . Humans socially interact with each other via emotions. In this research paper, we've proposed an approach of building a system that recognizes facial emotion employing a Convolutional Neural Network (CNN) which is one among the foremost popular Neural Network available. It is said to be a pattern recognition Neural Network. Convolutional Neural Network reduces the dimension for giant resolution images and not losing the standard and giving a prediction output what's expected and capturing of the facial expressions even in odd angles makes it stand different from other models also i.e. it works well for non-frontal images. But unfortunately, CNN based detector is computationally heavy and may be a challenge for using CNN for a video as an input. We will implement a facial emotion recognition system employing a Convolutional Neural Network employing a dataset. Our system will predict the output supported the input given thereto . This system can be useful for sentimental analysis, can be used for clinical practices, can be useful for getting a person's review on a certain product, and lots of more.

Keywords— Facial Emotion Recognition, Deep Learning, CNN, Image Processing.

I. INTRODUCTION

In this world when a person's being becomes speechless thanks to some reason at that moment his countenance communicates many things of his state of mind at that specific moment. Humans always had the innate ability to recognize and distinguish between faces (for ex the mother and a child)[3].

Humans interact socially with the help of emotions, which is considered a universal language. Facial emotions are one among the important aspects of human communication that help us understand the intentions of others [4]. Hence, it's natural that research of facial emotion has been acquiring tons of attention over the past decades with applications not only in perceptual and science but also in affective computing and computer animations [5].

Human-Computer Interaction Technology (HCIT) refers to a kind of technology that takes computer equipment as the medium, to realize the interaction between human life and computer systems [5]. In recent years with the rapid climb and progress in pattern recognition and AI , and lots of more new emerging technologies there are many libraries and modules available specifically for image processing in neural networks. Among which one among them is Convolution Neural Network (CNN) best fitted to facial emotion recognition and pattern finding.

In this paper, we are getting to undergo Face Emotion Recognition (FER) employing a Convolutional Neural network for a far better result outcome. It is also best fitted to any angle emotion recognition i.e. it can recognize the face emotion at any odd angle. Facial Expressions are liable for conveying information that's hard to perceive. It has been applied within the fields of distance education, peace , public review surely things, and many more. Hence, creating a system that's capable of face detection and emotion recognition has become an important area of research..

II. LITERATURE SURVEY

This section of the literature survey eventually reveals some facts based on thoughtful analysis of many authors work as follows.

[1] E. Pranav, Suraj Kamal, C. Satheesh Chandran, M.H. Supriya, Facial Emotion Recognition Using Deep Convolutional Neural Network, Advanced Computing and Communication Systems (ICACCS) 2020 6th International Conference on, pp. 317-320, 2020:- The rapid growth of artificial intelligence has contributed a lot to the technology world. As the traditional algorithms did not meet the human needs in real time, Machine learning and deep learning algorithms have gained great success in several applications like classification systems, recommendation systems, pattern recognition etc. The main focus of this work is to make a Deep Convolutional Neural Network (DCNN) model that classifies 5 different human facial emotions. The model is trained, tested and validated using the manually collected image dataset. The model has comparable training accuracy and validation accuracy which convey that the model has a best fit and is generalized to the info . The model uses an Adam optimizer to reduce the loss function and it is tested to have an accuracy of 78.04%. The work can be extended to find out the changes in emotion using a video sequence which in turn can be used for different real time applications such as feedback analysis, etc.

[2] G. Cao, Y. Ma, X. Meng, Y. Gao and M. Meng, Emotion Recognition Based On CNN, Access IEEE, 2019 Chinese Control Conference (CCC), pp. 8627-8630, 2019:- Neural network is a statistical learning model inspired by biological neural networks. This paper attempts to use the EEG signal from the DEAP data set to classify the emotion of the themes , this data set represents the emotional classification research. Then the principal component analysis is employed to scale back the dimension of the preprocessed EEG data, therefore the main emotional EEG features are obtained. Then the accuracy of the classification of the training samples and therefore the test samples is tested by the CNN algorithm, and therefore the other classification methods are compared to get the nerves. In this paper, the neural network model is used to induce the subjects' emotion through the short music film stimulation material, and the user's emotion is classified from the EEG signal. As an advanced machine learning technique for emotion classification, the neural network is considered as a machine used to simulate the way in which the brain performs a specific task. This study provides a considerable classification accuracy, which is better than the previous research. It is important to prove that the neural network can be used as an effective classifier for EEG signals.

[3] Lu Lingling liu, Human Face Expression Recognition Based on Deep Learning-Deep Convolutional Neural Network, Access IEEE, 2019 International Conference on Smart Grid and Electrical Automation (ICSGEA) :- In recent years, with the rapid and effective development of deep learning(DL) and deep convolution neural network(DCNN), the traditional facial expression recognition(FER) technology is difficult to satisfy the requirements of accurate human-computer interaction, automatic fatigue driving monitoring, intelligent and efficient classroom and other amusive tasks. The deep convolutional neural network with more optimized characteristics is needed in facial expression recognition, so the proportions above can be improved. In this paper, compared with the existing deep convolutional neural network optimization in facial expression recognition, these shortcomings are studied in this paper. The training dataset named fer2013 is used to train convolutional networks. The final results show that the method used in this paper can have a good effect on facial expression recognition.
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III. PROPOSED SYSTEM

When an image is provided as an input to the system for Image Processing using our model i.e the python library without caring what the image is and consist of, it directly converts that image into an array. An array of pixel values that are the numbers, where the dimension of the array depends on the resolution of the image.
But according to the dimension the color of the image whether you have given the grey image or a colored image the dimension's value varies. This is how the system manipulates an image based on the pixel values which again is dependent on the color of the image and this is how the image input works on the computer.
Neural Networks have an equivalent functionality same as the human brain neurons have. Neural Networks undergo many layers for their processing. Neural Networks has three layers input, hidden, and output layers. There are some

new terminologies added like channel, weight, activation function, threshold function.
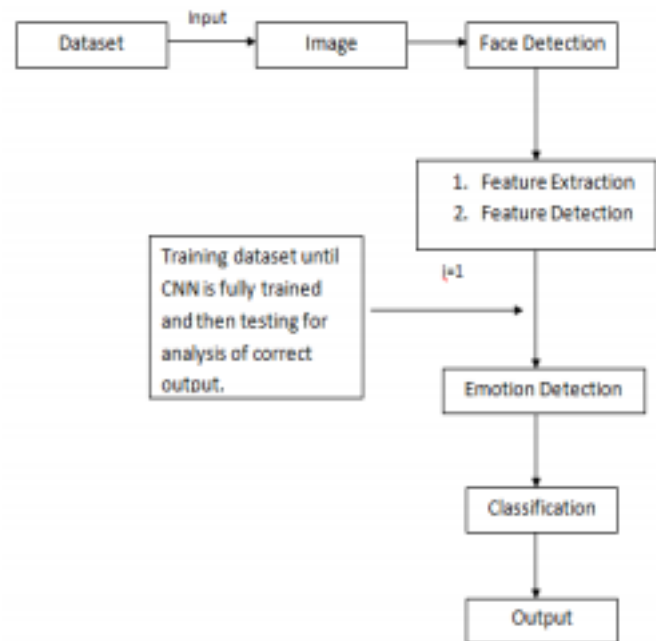

Fig. 1 System Architecture Diagram

A. Image Processing

In our paper, we are handling the concept of Image Processing rigorously for emotion detection from a picture . Image Processing is usually referred to as a strategy of performing some important quite operation on a picture for a particular output. In our paper, during this processing, we've input as a picture and output as a characteristic/ features related to that image within the sort of various emotions like anger, happiness, sadness, neutral, etc. that are expressed by people.

B. Neural Network

Neural Networks are are almost like neurons within the human brain and works with concepts of weights, input, activation function, channel, etc. as follows:
The set of elements represented by the set of input(x) in the form of x1,x2,x3…..xn are connected but the connection between the input activation function is drawn by the set of weights()which are represented by 1,2,3…..n. Besides this, we have Bayer's letter 'b'.
After applying the output of the activation function represented by (z) which is: $y=(i\ wi*xi+b)$
where xi is input, i is the weight of xi, a is that the bias added in this neuron, and is the activation function.
This is where we collect the summation of input as a one unit. The another concept that is to be done is convolution operation convolution in images. We have a single input in an picture and then we apply filters to it.

C. Activation Function

Generally, the Activation Function is employed for determination purposes i.e. the output of a neural network. There are a lot of commonly used Activation Functions, whereas in our case depending upon the sum of weighted input either it is larger than zero or not it acts as a filter

deciding whether the information will be further passed on and how strong the signals will be. On the other hand, if the value is equal to or less than zero then the signal will vanish.

D. Stride

Stride denotes the number of steps to be taken during the traversal of an array during the Pooling. The default value of stride is generally 1 [16].

The algorithm that can be used

CNN

Among the several deep learning models available, Convolutional Neural Network (CNN), especially, deep learning is one among the foremost popular neural networks [4]. Convolutional Neural Network is a FeedForward Network to process and recognize image data with the grid version. Being one of the Neural Network it also consists of an Input layer where the image is input, Hidden layers like Convolution Layer, ReLu Layer, Pooling Layer, and Fully Connected Network.

Convolutional Layer - Converts images into an array
The size of the feature map is controlled by three variables:
Depth-Number of filters used for the convolution operation [3].
Stride-Number of Pixels by which the filter matrix traverses over the input matrix [3].
Padding-It's good to input matrices with zeros around the bordering matrix [3].

IV. FUTURE SCOPE

As human emotional recognition is one among the main aspects of human life from a communication point of view, it is
very useful for evaluating and manipulating the Face Emotion. Facial Emotion has many effective impacts in many
scenarios, they can be stated as follows:

➢It can be used in the Medical field for a patient diagnosis for a drug's effect .

➢It can be used for the treatment of the people who lack in communication and don't understand how to express their feelings to others.

➢ It can be used as an alternative for detecting and lying during the investigation of a criminal suspect.

➢Driver's drowsiness while driving can also be detected for awareness and create safety precautions from any kind of accidents or incidents i.e it can be used for Safety purpose also and comes under Security and Surveillance .

➢Product Review of a customer while testing or checking out that product, while purchasing and knowing the state of mind of the customer whether he likes that product or not can be reviewed by his facial expression. This can lead to profit in the production or improvement of the quality of the product. It is used for Business Analysis purpose in real world.

V. CONCLUSION:

Thus, from the proposed system we have successfully studied facial expressions recognition Using Convolution Neural Network for various fields of Applications like Security and Surveillance, Medical Diagnosis, Business Analysis, Sentiment Analysis and many more.

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