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Face Emotion Recognition

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***Abstract*—Facial expression recognition (FER) is a very challenging task for machines to understand the emotional changes in human beings. This paper presents the design of an artificial Intelligence (AI) system capable of emotion detection through Facial expressions. It discusses about the procedure of Emotion Detection. This paper proposed a convolutional neural networks (CNN) based deep learning architecture for emotion detection from images. The performance of the proposed method is evaluated using dataset Facial emotion recognition (FER-2013) Experiments show that the proposed algorithm obtains recognition accuracy of 74.143% and 95.253% on the FFE2013 database, respectively. Using convolutional neural networks, the proposed algorithm not only improves the accuracy, but also reduces the size of the model, which is competitive with existing methods in terms of size of the model parameters and recognition accuracy. Furthermore, this work also shows that only increasing the network layers hardly improves the recognition accuracy on the FFE2013 database.**

Key Words*: *Artificial Intelligence (AI); Facial Expression Recognition (FER); Convolutional Neural Network (CNN);

1.INTRODUCTION

Facial expression is one of the best ways to express emotional states. Emotion is a mental state associated with the nervous system associated with feeling, perceptions, behavioral reactions, and a degree of gratification or displeasure. One of the current application of artificial intelligence (AI) using neural networks is the recognition of faces in images for various applications. Most techniques process visual data and search for general pattern present in human faces in images. Face detection can be used for surveillance purposes by law enforcers as well as in crowd management. We present a method for identifying seven emotions such as anger, disgust, neutral fear, happy, sad, and surprise using facial images. Recently, with the advent of deep learning and the rapid improvement of processor performance, many methods based on deep learning have achieved the state-of-the-art recognition accuracy and exceeded previous results by a large margin. Among them, the deep neural network (DNN) and the convolutional neural network (CNN) have an ability to automatically extract useful representation from raw data. Convolutional neural network based on deep learning has been widely used in facial expression recognition. Because of the great success of the above neural network in image recognition, many FER algorithms use the above neural network for facial expression recognition and have achieved remarkable results. Facial recognition has a wide range of applications in humancomputer interaction, sociable robotics and medical treatment.

2. Literature Survey

"Facial Emotion Detection Using Deep Learning"(2020), Akriti Jaiswal, A. Krishnama Raju, Suman Deb, Department of Electronics Engineering, SVNIT Surat, India. In the given paper, Authors proposed a deep learning based Facial emotion detection method from image. Authors discuss there proposed model using two different datasets, and FERC-2013. The performance evaluation of the proposed facial emotion detection model is carried out in terms of validation accuracy, computational complexity, detection rate, learning rate, validation loss, computational time per step. We analyzed our proposed model using trained and test sample images, and evaluate their performance compare to previous existing model. Results of the experiment show that the model proposed is better in terms of the results of emotion detection to previous models reported in the literature. The experiments show that the proposed model is producing state-of-the-art effects on both two datasets.

"Facial Expression Recognition Based On Optimized ResNet"(2020), Yexiu Zhong, Senhui Qiu 1, 2, 3, *, Xiaoshu Luo1, Zhiming Meng4, Junxiu Liu11, School of Electronic Engineering, Guangxi Normal University, Guilin, 541004, China 2 State Key Laboratory for Chemistry and Molecular Engineering of Medicinal Resources, Guangxi Normal University, Guilin, China. In this paper, a simplified and efficient neural network SE-SResNet18 is proposed. By reducing the size of convolution kernel, removing the pooling layer of input layer, adding dropout layer and fusion SE module, the proposed method not only improves the recognition accuracy, but also reduces the size of the model. We evaluated the proposed method under the FER2013 and CK+ datasets, and experiments show that the proposed method has achieved 74.143% and 95.253% accuracies respectively. Comparing to other state-of-the-art algorithms, the proposed method outperforms in FER2013 and CK+ databases. In addition, this work investigated that a deep network hardly improves the recognition accuracy and provided the explanations.

3. PROPOSED METHOD

A. Emotion Detection Using Deep Learning:

In this paper we use the deep learning (DL) open library "Colab" by applying CNN to image recognition. We used dataset and trained with our proposed network and evaluate its validation accuracy and loss accuracy. Images extracted from given dataset which have facial expressions for seven emotions, and we detected expressions by means of an emotion model created by a CNN using deep learning. We have changed a few steps in CNN as compared to previous method using a Colab library and also modified CNN architectutre which give better accuracy . We implemented emotion detection using Colab with the proposed network.

B. CNN Architecture:

The networks are program on top of Colab, operating on Python, using the Colab library. This environment reduces the code's complexity, since only the neuron layers need to be formed, rather than any neuron. The software also provides real-time feedback on training progress and performance, and makes the model after training easy to save and reuse. In CNN architecture initially we have to extract input image of 48*48*1 from dataset FERC-2013. The network begins with an input layer of 48 by 48 which matches the input

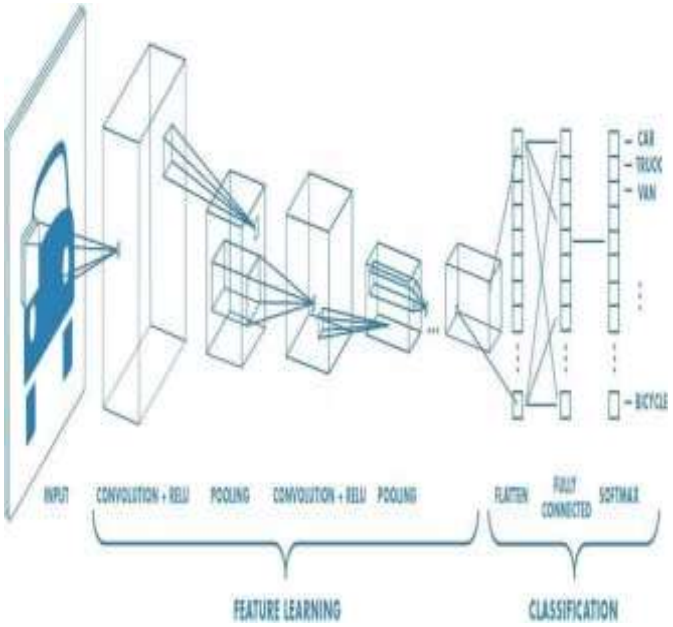

Fig-1: CNN Model

functionality in deep learning, and then concatenated for better accuracy and getting features of images perfectly as shown in Fig.1. There are two submodels for the extraction of CNN features which share this input and both have same kernel size. The outputs from these feature extraction sub-models are flattened into vectors and concatenated into one long vector matrix and transmitted to a fully connected layer for analysis before a final output layer allows for classification.

This model contains convolutional layer with 64 filters each with size of [3*3], followed by a local contrast normalization layer, maxpooling layer, followed by one more convolutional layer, max pooling, flatten respectively. After that we concatenate two similar models and linked to a softmax output layer which can classify seven emotions. We use dropout of 0.2 for reducing over-fitting. It has been applied to the fully connected layer and all layers contain units of rectified linear units (ReLu) activation function.

First, we are passing our input image to convolutional layer which consists of 64 filters each of size 3 by 3, followed by ReLu activation function. Maximum Pooling is used to reduce dimension reduction so processing speed will increase. We are using concatenation for getting features of images (eyes, eyebrows, lips, mouth etc) perfectly so that prediction accuracy improved as compared to previous model. Furthermore, it is followed by fully connected layer and softmax for classifying seven emotions. A second layer of maxpooling is added to reduce the number of dimensionality. Here, we use flatten layer, fully connected layer and softmax layer in ouput layer for seven emotion classification.

C. Dataset:

Neural networks, and particularly deep networks, needs large amounts of training data. In addition, the choice of images used for the training is responsible for a large part of the eventual model's performance. It means the need for a data set that is both high quality and quantitative. Several datasets Are available for research to recognize emotions, ranging from a few hundred high resolution photos to tens of thousands of smaller images. The two, we will be debating in this work, are the Japanese Female Face Expression (JAFFE) [15], Facial Expression Recognition Challenge (FERC-2013) [16] which contains seven emotions like anger, surprise, happy, sad, disgust, fear, neutral.

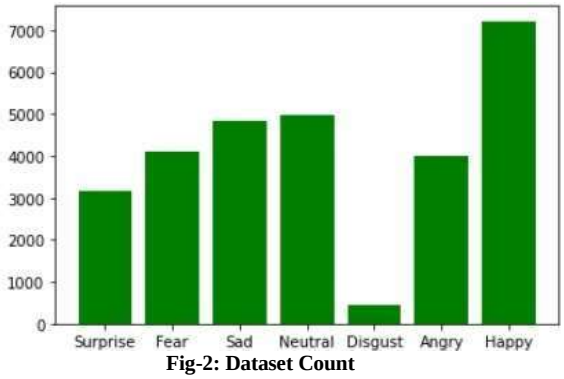

Fig-2: Dataset Count

D. Advantages:

- It allows us to understand others on emotional basis.
- It is useful & important for security & healthcare purposes.

E. Disadvantages:

- Huge storage requirements.
- Privacy issues.

F. Results

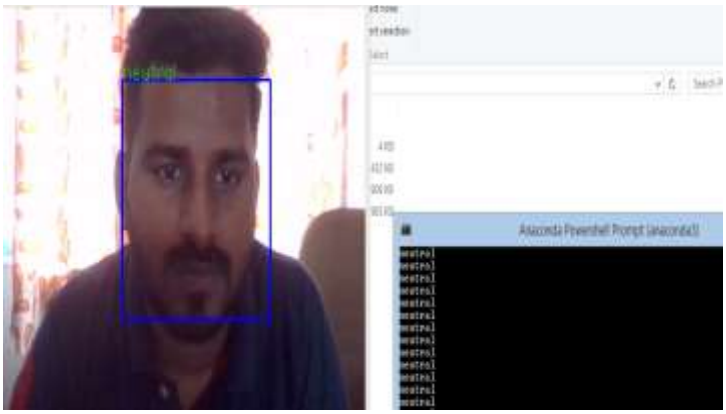

Fig-3: Neutral Emotion

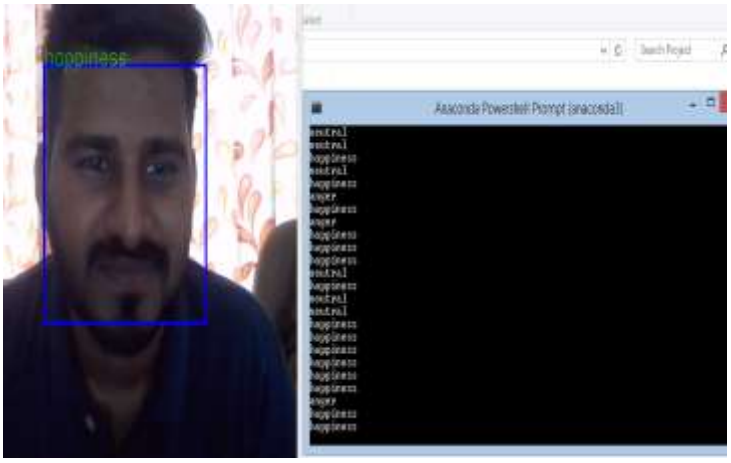

Fig-4: Happiness Emotion

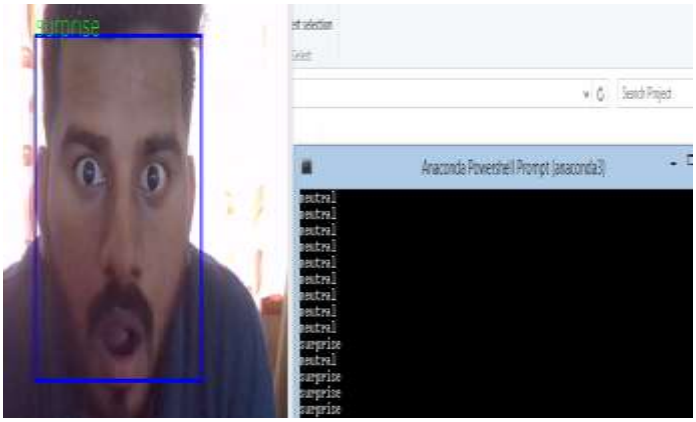

Fig-5: Surpise Emotion

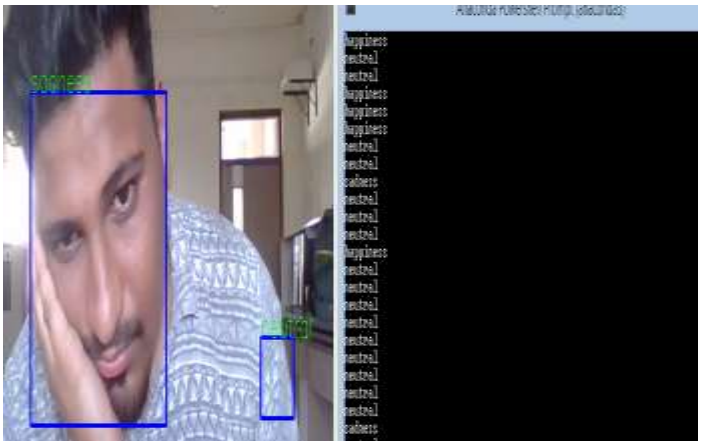

Fig-6: Sadness Emotion

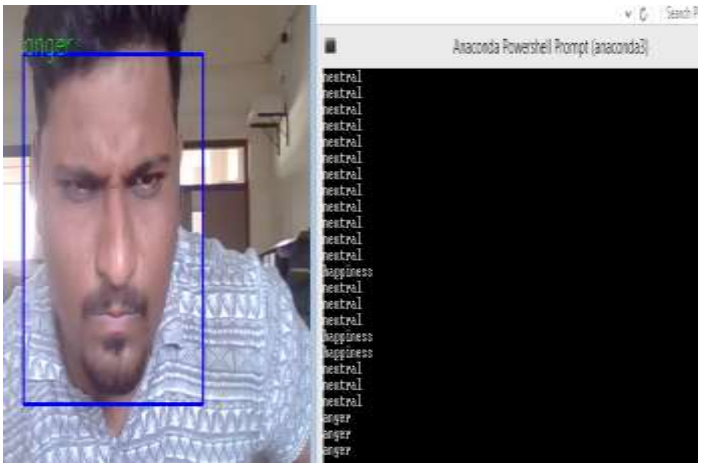

Fig-7: Anger Emotion

4. CONCLUSIONS

In this paper, we have presented a deep learning based Facial emotion detection method from image. We discuss our model using dataset, FERC-2013. The performance of the Facial emotion detection model is carried out in terms of validation accuracy, detection rate, and validation loss. We analyzed our model using trained and test sample images from dataset.

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