JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

FACIAL EXPRESSION DETECTION AND ANALYSIS USING ARTIFICIAL INTELLIGENCE TECHNIQUES

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ABSTRACT:

The rapid development of human-computer interaction and pattern recognition, coupled with the rapid update of computer hardware, people can deliver complex work to computers to meet certain life and market needs. It brings great convenience to humanity. Facial expression recognition is an intelligent human-computer interaction method that has emerged in recent years. It has a wide range of applications, such as VR games, medical car e, online education, driving, security, and so on. People's facial expression is one of the important ways to express their own emotions. Sometimes it is easy to find one's inner thoughts by his expressions. The main function of facial expression is to capture the emotional changes of the human through facial emotions. This system is developed using deep learning algorithm such as convolution neural network (VGG 19). Based on this system to detect the emotion like happy, angry, sad, surprise, fear, disgust neutral. , etc of human emotions.

KEYWORDS:
Artificial Intelligence, Facial Expression, Deep Learning, Neural Network, Image Processing

I.INTRODUCTION

The rapid growth of artificial intelligence has contributed a lot to the technology world as the traditional algorithms failed to meet the human needs in real time, Machine learning and deep learning algorithms have gained great success in different applications such as classification systems, recommendation systems, pattern recognition etc. An emotion recognition system can be built by utilizing the benefits of deep learning and different applications such as feedback analysis, face unlocking etc. can be implemented with good accuracy.

Facial expression recognition is the process of identifying human emotion based on facial expressions. Humans are naturally capable of recognizing emotion. Automated facial expression recognition has numerous practical applications such as psychological analysis, medical diagnosis, forensics (lie-detection), studying effectiveness of advertisement and so on. The ability to read facial expressions and then recognize human emotions provides a new dimension to human-machine interactions, for instance, smile detector in commercial digital cameras or interactive advertisements. Robots can also Benet from automated facial expression recognition. If robots can predict human emotions, they can react upon this and have appropriate behaviors.\

II.PROBLEM IDENTIFICATION:

Emotion plays a vital role in determining the thoughts, behavior and feeling of a human. In our day-to-day life we are facing different situations and our thoughts and emotions keep on changing based on that situations .To classify the different facial expressions of the human our system is developed.
In existing system, uses a lightweight Convolution Neural Network (CNN) for detecting facial emotions in real-time and in bulk to achieve a better classification effect. This system employs Multi-task Cascaded Convolution Networks (MTCNN)

to complete face detection and transmit the obtained face coordinates to the facial emotions classification model designed initially then it accomplishes the task of emotion classification**.**

III.PROPOSED SYSTEM

The facial expression recognition plays an important role in the research of emotional quantification. Under the trend of artificial intelligence, the communication between human and computer becomes easier and easier. The main idea of our project is to design an accurate face expression recognition system and to overcome the problems of arising due to several factors such as lighting variation, background noise and to avoid inability to recognize the face expressions but a different result is obtained. The Convolution Neural Networks is a specialized type of neural networks designed for working with two-dimensional image data. Conventional neural networks based on methods have been extensively used in classification task due to their excellence performance in facial analysis. Here we are trained CNN model with different depth using gray scale images. The proposed system model shown in fig.1.

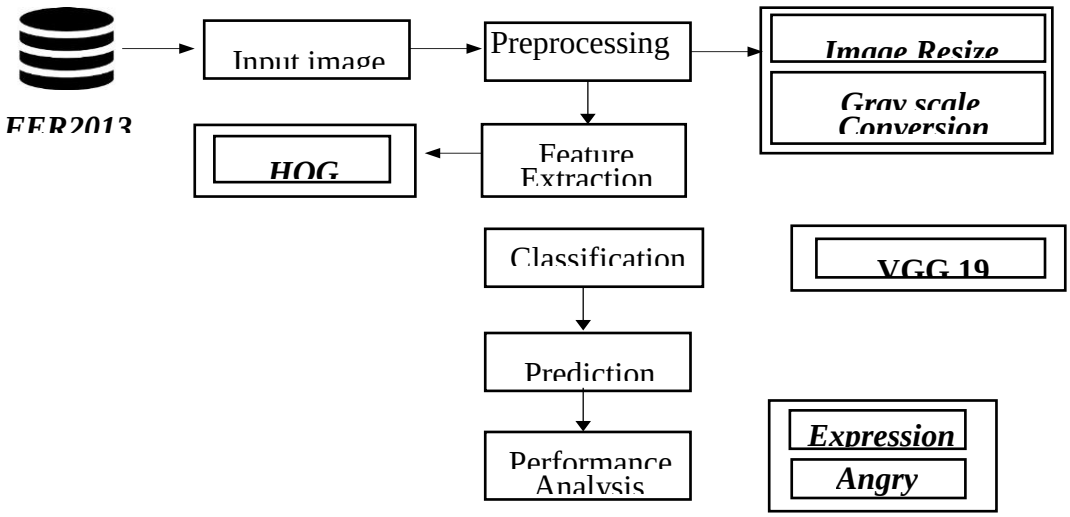


Fig 1.1Architecture:

3.1 INPUT IMAGE:

With the help of Convolution Neural Networks (CNN) we reduce the size of the original image to 50x50 image . A Convolution Neural Network (CNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other. The CNN is a feed forward neural network, which can extract features from a two-dimensional image and optimize network parameters by using back propagation algorithm. Common CNNs usually consist of three basic layers: a convolution layer, a pooling layer and a connective layer. Each layer is composed of several two-dimensional planes, that is, feature maps, and each feature map has many neurons. In convolution neural network, the input layer is a two-dimensional matrix composed of image pixels. The alternation of convolution layer C and pooling layer S is the core module to realize feature extraction of convolution neural network. This paper designs a CNN structure for facial expression recognition**.**

3.2 PADDING:

The objective of the Convolution Operation is to extract the high-level features such as edges, from the input image. Similar to the Convolution Layer, the Pooling layer is responsible for reducing the spatial size of the Convolved Feature. This is to decrease the computational power required to process the data through dimensionality reduction. Furthermore, it is useful for extracting dominant features which are rotational and positional invariant, thus maintaining the process of effectively training of the model. There are two types of Pooling: Max Pooling and Average Pooling. Max Pooling returns the maximum value from the portion of the image covered by the Kernel. On the other hand, Average Pooling returns the average of all the values from the portion of the image covered by the Kernel.

3.3STRIDING:

"Striding" means "jumping". It is optional. For example, if we give the stride=3, then for every time it jumps 3 pixels on the input image pixel. For example, if we give the stride=5, then for every time it jumps 5 pixels on the input image pixel.

IV.MODULES DESCRIPTION:

4.1 INPUT IMAGE:

The dataset contains the images in the form of '.jpg' or '.png'. In this step, we have to read or load the input image by using the read() function. In This input image we have to recognize the face expression**.**

4.2 IMAGE PREPROCESSING:

In our process, we have to resize the image and convert the image into gray scale. To resize an image, you call the resize() method on it, passing in a two- integer tuple argument representing the width and height of resized image .The function doesn't modify the used image; it instead returns another Image with the new dimensions. Convert an Image to Grayscale in Python Using the Conversion Formula and the matplotlib Library. We can also convert an image to grayscale using the standard RGB to grayscale conversion formula that is img Gray = 0.2989 * R + 0.5870 * G + 0.1140 * B.

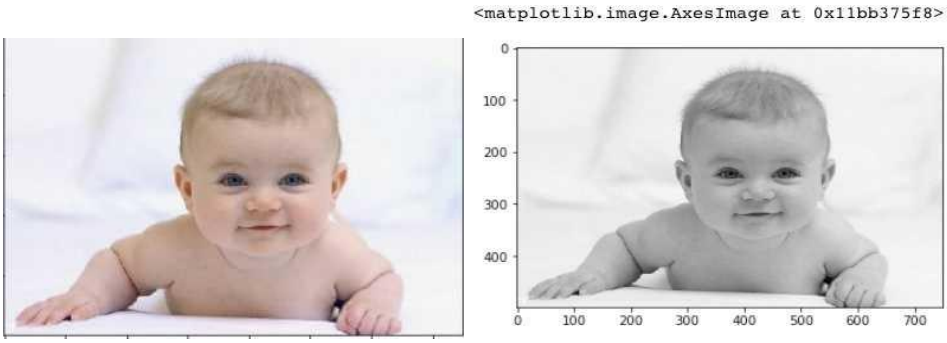


fig 1.2 color image to gray-scale image conversion

V. FEATURE EXTRACTION:

HOG, or Histogram of Oriented Gradients, is a feature descriptor that is often used to extract features from image data. It is widely used in computer vision tasks for object detection.

VI. IMAGE SPLITTING:

During the machine learning process, data are needed so that learning can take place. In addition to the data required for training, test data are needed to evaluate the performance of the algorithm in order to see how well it works. In our process, we considered 70% of the input dataset to be the training data and the remaining 30% to be the testing data. Data splitting is the act of partitioning available data into two portions, usually for cross-valuator purposes

VII. CLASSIFICATION:

In our process, we have to implement transfer learning such as VGG19.In this step, we can extract the features from the pre-processed image. VGG19 is a convolution neural network that is 19 layers deep. You can load an petrained version of the network trained on more than a million images from the Image Net database. The pretrained network can classify images into 1000 object categories. After by using transfer learning algorithm the 1000 classes are reduced to seven classes which is our expected output.

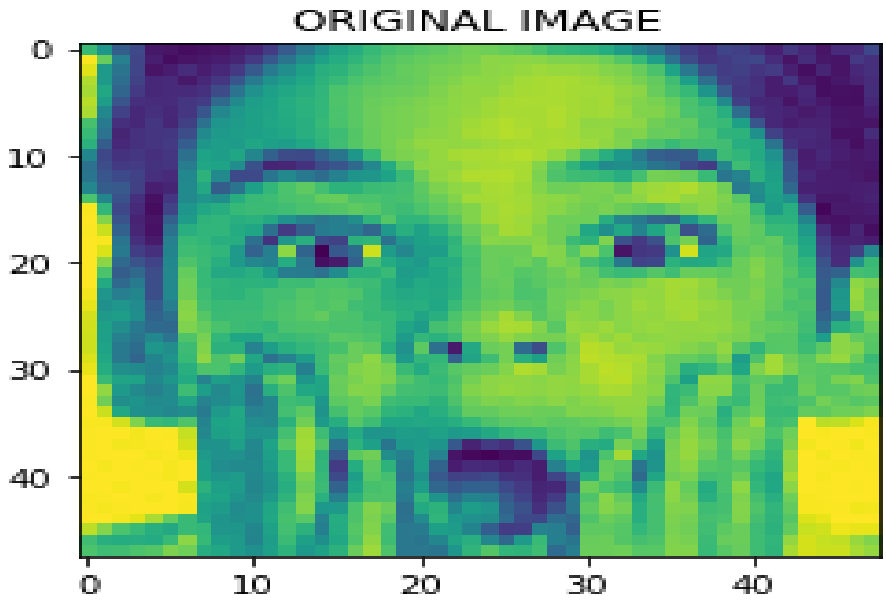
VIII. RESULT AND DISCUSSION

In our project we can detect expressions like happy, sad, neutral, fear, angry, disgust, surprise.

fig 1.3 sample image from fer-2013 dataset

Here we are taking surprise expression image as an input image

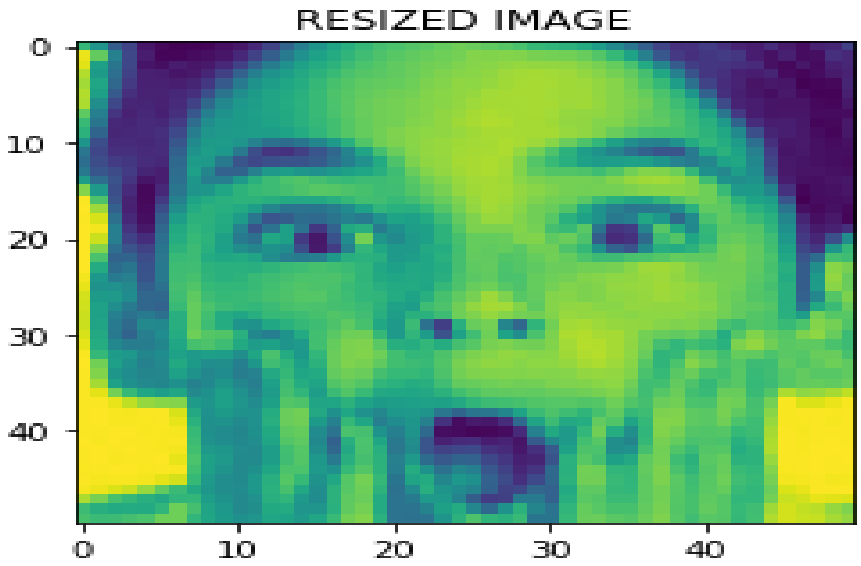
INPUTIMAGE:



Input Image

After selecting the input image from tkinter file we get an image as shown in Fig 9.3 on the output.

IMAGE PRPROCESSING



Preprocessed Image

Any images with different dimensions (i.e. Different height and width) is converted into standardized image size (50X50).The Figure shows a resized standard image**.**

FEATURE EXTRACTION

Different facial expressions have different features, based these features we will be able to classify the expression. This Figure shows feature extracted image after preprocessing.

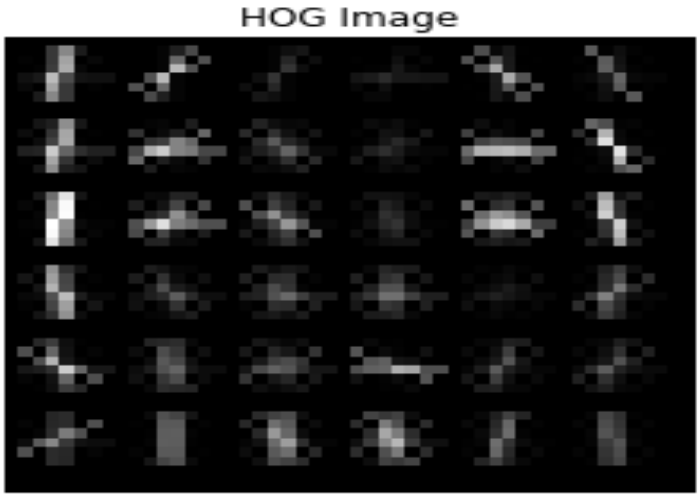


fig:image after feature extraction

CLASSIFICATION

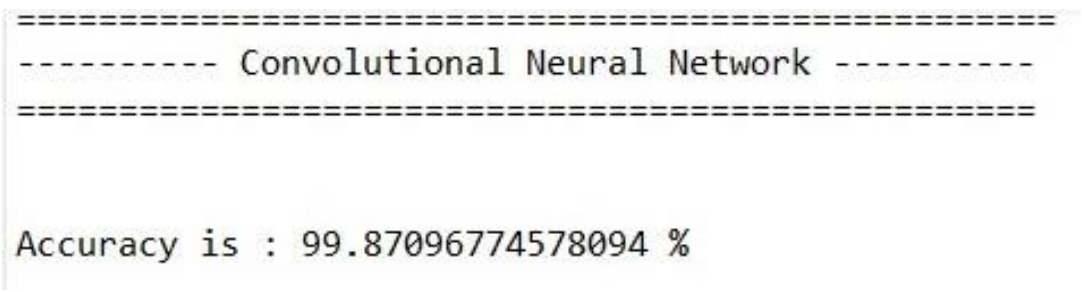


fig 1.4 accuracy in output

After implementing CNN algorithm for two times we will get an accuracy of more than 98% on the output.

PREDICTION

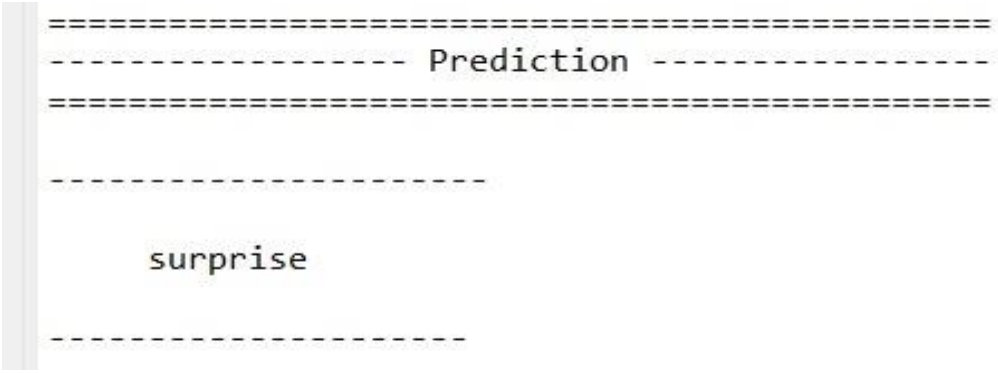


fig 1.5 predicted expression

Finally for our given input image the facial expression is predicted as "Surprise" which is shown in Fig 1.5.Accuracy of classifier refers to the ability of classifier. It predicts the class label correctly and the accuracy of the predictor refers to how well a given predictor can guess the value of predicted attribute for a new data.

$$AC= (TP+TN)/ (TP+TN+FP+FN)$$

PERFORMANCE ANALYSIS

The table 1.1 indicates the performance analysis of existing and proposed system. Here we are considering four parameters like Detecting time, Response time, Training accuracy and validation accuracy.

Parameter	Existing System	Proposed System
Detecting time	0.9 seconds	0.5 seconds
Response time	1.5 seconds	1 second
Training accuracy	78%	85%
Validation accuracy	67%	98% and above

CONCLUSION

In this paper, we proposed a facial expression recognition method using a CNN model which extracts facial features effectively. Compared to traditional methods, the proposed method can automatically learn pattern features and reduce the incompleteness caused by artificial design features. The proposed method directly inputs the image pixel value through training sample image data. Autonomous learning can implicitly acquire more abstract feature expression

of the image. The training process of the proposed method uses appropriate initialization of weights which has a great impact on the updating of weights. Our extensive experimental analysis shows that compared to the past literatures, the proposed algorithm can improve the recognition rate of facial expressions in complex background to a certain extent. Compared to FRR-CNN and R-CNN models, the convergence speed of proposed model is much faster in complex background environments. Also, the proposed method achieves a higher recognition rate. Facial expressions captured in reality may have various noises, such as face posture, occlusion, and blurring. To address this concern, as a future work, we will investigate more robust models which satisfy real conditions. We will also focus on how to reduce the complexity of network structure, and will try to recognize dynamic expressions with 3D convolution technology.

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