Real Time Face Emotion Detection Using CNN

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ABSTRACT

Face emotion detection has evolved as a key field of study in pattern recognition as well as computer vision, and its applications have extended to encompass in AI,HCI, and security monitoring. Convolution neural network (CNN) is a deep learning architecture that can extract critical picture characteristics, and it has been demonstrated to outperform older approaches like Support Vector Machines (SVM) as well as Principle Component Analysis which is (PCA) in situations with considerable variations in shooting circumstances. In this paper, we provide an enhanced technique of facial expression detection using CNN, with the objective of categorising face pictures into seven distinct expressions. We built a novel CNN structure that employs convolution kernels to extract implicit features and max pooling to lower the dimensionality of the extracted features, customised to the unique properties of facial emotion identification. Along with face emotion detection, will provide the accuracy percentage of a particular emotion is also detected.

Key words:-*face emotion, computer vision, pattern recognition, CNN, Deep Learning.*

1. Introduction

Facial expressions are a significant instrument for communicating internal sentiments, and when coupled with language and music, they comprise the cornerstone of human emotional expression. Given their significance, it's no surprising that facial expression detection has been a key focus of research in recent years. Automatic recognition systems are crucial for artificial intelligence, with probable applications in of extensive study and in the domains of biomedical engineering [1], psychology[2], neurology [3] and health [4].

While humans can swiftly discern emotional indicators in face-to-face discussions, accurate emotional recognition remains a barrier for robots. Although enormous progress in face detection and feature extraction technology, issues including low accuracy and delayed identification exist. As such, continuous research in this field is crucial.

Convolution neutral network (CNN) is a cutting-edge neural network that integrates basic artificial neural networks with deep learning methods. By executing feature extraction and classification simultaneously, CNNs have demonstrated to be very effective in classification tasks. This result could be attributable to the ability of deep learning approaches to extract critical and unforeseen information through frequent weight updates and error reduction, hence circumventing the complex feature extraction and data reconstruction processes of traditional recognition algorithms.

2. Related Work and Methodology:-

Facial expression recognition using deep learning is among the techniques.This technology is utilized for the purpose of detecting and recognizing emotions exhibited by individuals, including but not limited to anger, fear,

happiness, disgust, sadness, and surprise. The primary objective of this approach is to detect face emotions and determine face expression states with great precision. The deep learning model used for this purpose receives indexed face pictures from a the dataset, and these images are used to train a CNN. The well trained CNN model is then used to accurately identify the specific face emotion being determined**.**

(Chang et al. employed Convolutional neural network trained model on the ResNet to get attributes of the dataset Fer2013. He put forward "complexity perception classification method" (CPC) was used with many other methods (LinearSVM, randomForest and softmax). CNN and Softmax using with CPC has obtained 71.35% and 98.78% detection accuracy for Fer2013 [5].)

2.1 Loading the datasets:-

Here we are using JONATHEN OHEIX dataset which contains the data comprises of 48x48 pixel photos of faces which are in the form of grey scale. The images have already been automatically recorded such that the face is approximately centred and occupies roughly the same quantity of area in each picture. Each picture correlates to a face emotion that falls into seven groups which are "(Angry, Disgust, Fear, Happy, Sad, Surprise, Neutral)". The collection comprises roughly 65000 pictures. Out of them,80% are used for training and 20% are used for testing and validation.

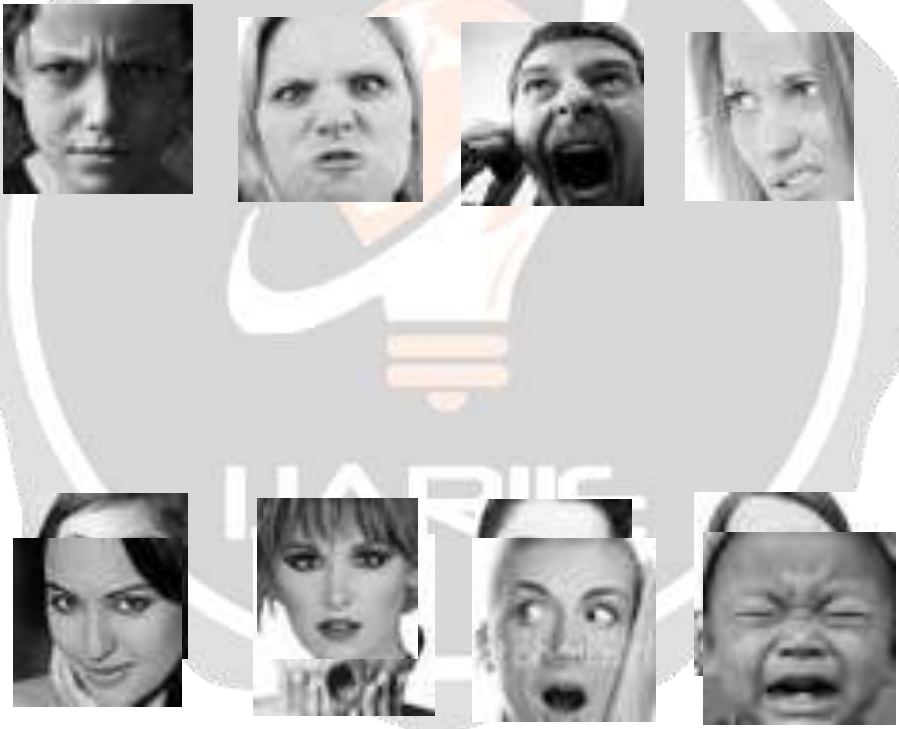


Fig 1. Showing some images of different emotions from dataset.

2.2. Architecture:-

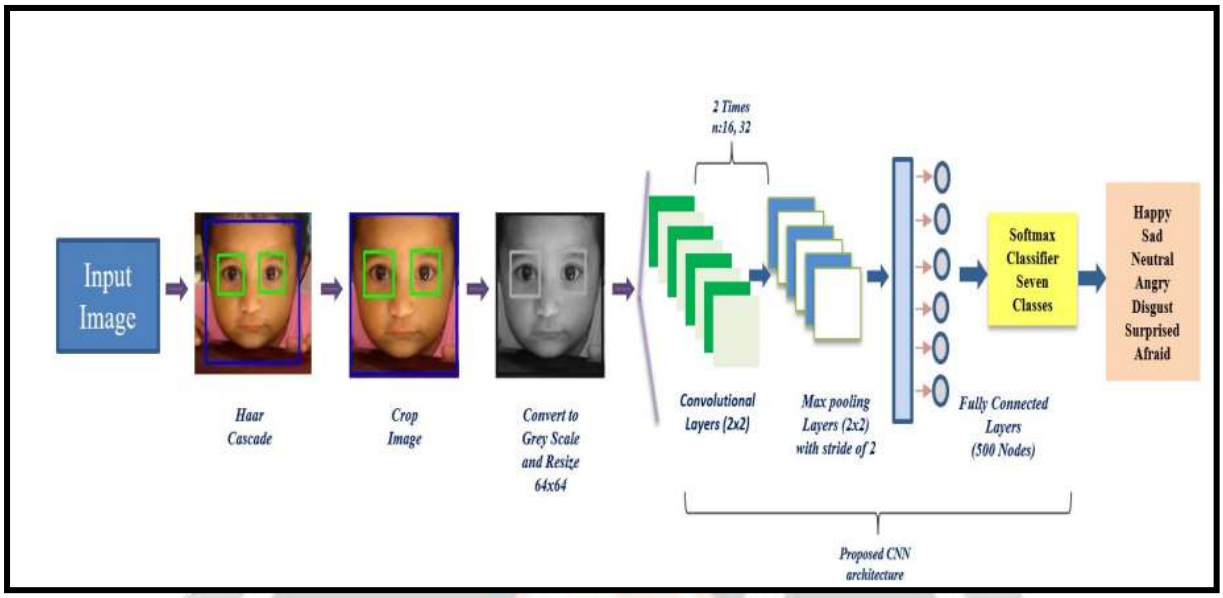


Fig 2. Architecture of CNN

In this approach, we utilize a Sequential model that contains the layers depicted in the diagram above. The first layer is a Convolution2D layer that consists of 32 filters and an input shape of 48 x 48 x 1. This input shape is derived from the jonathen oheix dataset, and we transform it into a grayscale image resulting in the shape of 48 x 48 x 1. The output of the Convolution2D layer is then fed into a MaxPooling2D layer with a pool size of (3,3), which decreases the output of the Convolution2D layer. A Dropout layer is employed to drop one-quarter of the nodes in the subsequent layer. The flattened output is then passed to a Dense layer consisting of 256 nodes. Finally, a Dense layer with 12 nodes and a SOFTMAX activation function is added to provide the probability of each node being the predicted output. The digit with the highest probability is the predicted output for the given input. All three layers, i.e., the Convolution2D layer and the two dense layers, use the RELU activation function since it effectively models nonlinear data.

2.3 Modules:-

Importing the modules:-

Here we are importing the required modules which are required for training the model.

Those modules which are:

```
import keras
from keras.preprocessing.image import ImageDataGenerator
from keras.models import Sequential
from keras.layers importDense,Dropout,Activation,Flatten,BatchNormalization
from keras.layers import Conv2D,MaxPooling2D
import os
```

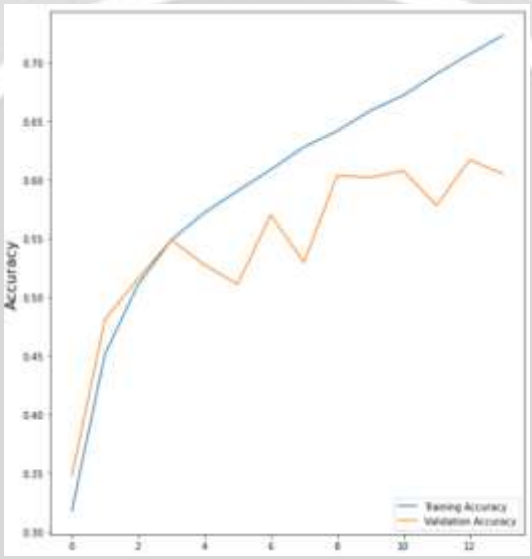
Here mainly Keras, which is used in CNNs to simplify the process of building and training neural networks by providing an easy-to-use API for designing complex architectures and pre-built layers for tasks such as image classification and object detection. Along with keras we are using lots of libraries and model like ImageDataGenerator and Sequential model for making the model to perform efficiently.

Making training and validation data:-

In this Module, we are giving training to the model using ImageDataGenerator() and using batch size as 128 and after that giving "target size" as same as "picture size" and "colour mode" as "gray scale" which is standard colour of images in black and white in colours.This gray scale gives algorithm the simplified images.

Model building:-

In this Module, the Main thing happens the model is building, here we are using the sequential model for building the CNN model which involves in the four CNN layers which contains the Convo2D,BatchNormalization,Maxpooling,Dropout and Activation as the functions. These all the functions undergo 4 times with the increased amount of the pool size to build the Model. After that, with the help of adam optimizer making the model more optimized.After building the Model, making the model to fit with the training and the validation data.



Model Evaluation:-

Fig 3.Showing the result of Training accuracy and validation accuracy.

3. Results:-

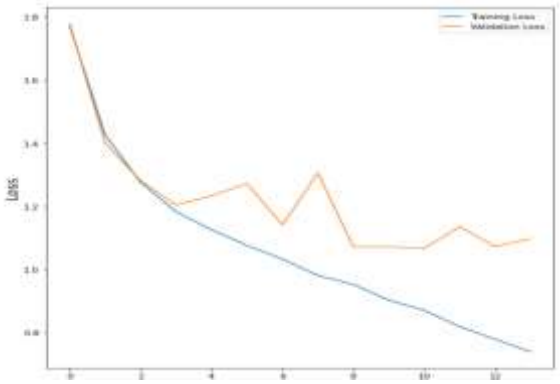


Fig 4. Showing the result of Training Loss and validation Loss.

Fig 5. Showing the result of emotion neutral of 60% accuracy.

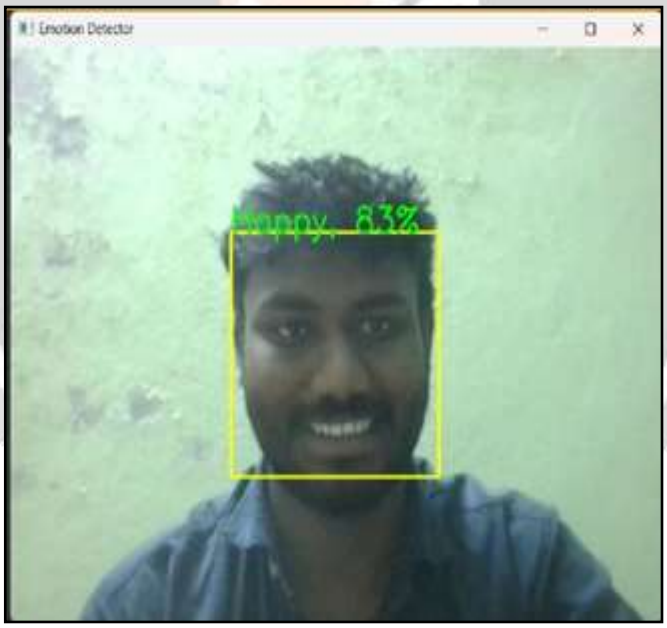


Fig 6. Showing the result of emotion happy of 83% accuracy.

4. Conclusion:-

This paper offers a face emotion detection system that leverages a convolutional neural network and contains an image pre-processing phase. The inclusion of the pre-processing phase and the use of CNN layers to the network have resulted to better experimental outcomes in terms of both responsiveness and efficiency. Going ahead, we plan to broaden our study to incorporate a bigger database, with the objective of strengthening the resilience of the facial expression detection system in new scenarios, such as those with fluctuating light conditions and occlusion. Additionally, we want to integrate new functionality to the recognition system, such

as gender identification and other attributes, with a particular emphasis on further boosting recognition performance**.**

5. REFERENCES:-

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