Real Time Facial Expression Recognition using CNN and OpenCV

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I. INTRODUCTION

The level of uncertainty at continuance is considerable, making human and machines to depend on these sensory machines. In this project, we are presenting the $ 64000-time facial features recognition of human expressions like Anger, Fear, Happy, Sad, Surprise, Neutral, Disgust. Facial recognition using convolutional neural network (CNN)may be a reasonably a neural network where the input is image contains less fully connectivity between neurons. The CNN contains many layers like input layer, pooling layer, convolutional layer, Fully connected layer, loss layer. Face recognition system is employed to spot the face of the person from the image or video using the features. The face recognition software works by initially scanning, analysis and data matching. The initial scanning scans whether the image may be a face or not. The analysis is completed by identifying the facial features. The data matching is completed by deep learning method where it checks where it checks with the database. The main goal of this project is to induce a fast baseline to compare if the CNN architecture performs better when it uses the raw materials of images for training, or if it's better to feed some extra information to the CNN (such as landmarks or HOG (Histogram of Oriented Gradients) features which may be a feature descriptor employed in computer vision and image processing for the aim of the thing detection. It counts the gradients orientation in localized portions of the image. The results shows that the additional information helps the CNN to perform better. To train the model we use Fer2013 dataset that contains 30000 images to facial expressions grouped into seven categories that's mentioned earlier like Anger, Fear, Happy, Sad, Surprise, Neutral, Disgust. Real time faces are detected using OpenCV, then we extract the face landmarks using dlib. We also extracted the HOG features and that we input the raw image data with the face landmarks using into a convolution neural networks (CNN).

II. LITERATURE SURVEY

By facial expressions a person's mental and emotional behaviour their attitude, age, sex can be detected. 1. Development of facial expressions classifier using neural networks (2019 conference IEEE) it

(1).jpg (1).jpg

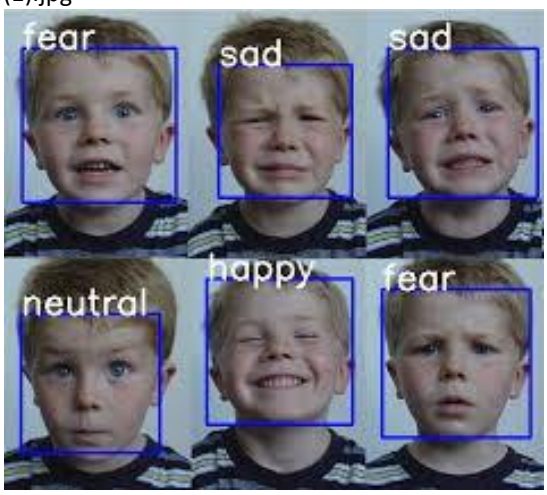

Fig. 1. Example images from the FER2013 Dataset illustrates the different facial expressions such as fear, neutral, sad, happy, angry, surprise, disgust.

classifies the facial expressions using convolution neural networks (CNN). CNNs are biologically inspired variants of multi-layered perceptron network (MLP). This CNN interrupt and classify the facial expression into seven different classes as we discussed in our project like

Anger, Happiness, Fear, Disgust, Happy, Sad, Surprise, Neutral. It also uses a deep CNNs to do the task.2. Facial expression recognition using weighted mixture Deep Neural Network based on double facial images (2018 journal article IEEE). In this paper they discussed that however we detect the facial expression using the technique which we implemented but the accurate hand crafted features are not detected because of the human individually. A weighted mixture deep neural network paves the way to detect the accurate features of facial expressions. It has pre-processing, Face detection, rotation rectification, data augmentation. Then by calculating the two channels of facial images of grayscale images and LBP (local binary pattern) along with weighted fusion it detects the facial expressions.3. Geometry Guided Pose Invariant Facial Expression Recognition (2020 journal

IEEE). This paper proposes the end to end deep learning mode. It can be automatically that can increase our training date set for our task. It also uses a shape geometry by facial landmarks. The facial landmarks are generated by a target pose and expressions. It is based on the Generative Adversial Network(GAN).It paves way of facial image synthesis and post invariant facial expression recognition.4.cGAN based facial expression recognition for human robot interaction(2019 approach).In this paper they approach a conditional generative adversial network based approach .It alleviate the intra-class variation .IT contains generator and three discriminator which transforms the query image into another protype facial expression.5.Real time facial expression recognition based on CNN (2019 conference IEEE).In this paper they discussed that a while capturing image in a camera there may be a change in image due to light and other factors .Such a change can cause incorrect recognition of a facial expression. To solve the problem that take a change in an image characteristic that improved the accuracy of the facial expression.6. Exploring priors of a Sparse face recognition on a smartphone (2017 journal IEEE). It uses Sparse representation classification (SRC) algorithm in OpenCV. It uses 21 optimization which make it robust to noise and occlusions. It first learns from optimized projection matrix from the given training data set. It is implemented on the android smartphones, where it faces a crisis of 85-90 percent of computation time .The method which is 50 times faster .7.Tensorflow-Based Automatic Personality Recognition used in Asynchronous Video Interviews.(2019 journal IEEE).In this paper they discussed an end to end AI interviewing System was developed using Asynchronous Video Interview(AVI) and a TensorFlow AI engine which performs automatic Personality recognition accuracy based on the features extracted from the AVI of 120 real job applicants. It can give a 90.9 to 97.4 percent .8.Occlusions Aware Facial Expressions Recognition using CNN with Attention Mechanisms(2019 journal IEEE).In this paper used a convolution neural network with attention mechanisms that grabs the occlusions regions of the face and most discriminative un occluded regions. It also contains patch based ACNN and local based ACNN. PACNN - local facial patches were GACNN integrates local and global facial patches. It can also include the accuracy.9. WGAN-based robust occluded facial expressions recognition (2019 journal IEEE). In this paper they concentrated more on occulated facial expressions recognition using Wasserstein Generative Adversial Network (WGAN) based method. It contains one generator and discriminator. The discriminator distinguishes between the real and fake images.10. Recognising facial expression using a shallow convolutional neural network(2010 journal IEEE).In this paper they discussed a shalloe CNN with three layers to classify static and micro expressions with small training dataset because the CNNs suffers from the problem that it overfits with the small training dataset. It should be best in FERPlus, CASME and CASME II AND competitive on FER2013 and SAMM training dataset.

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III. PROPOSED MODEL

The ultimate aim is to get a reference a CNN whether it works better with raw pixels or to provide some extra information. The result shows us that extra information provided by us makes the CNN to perform better. The model works by detecting the real time faces using OPENCV(Open Computer Vision Library)which has more than 2500 optimized algorithms which includes both classic and the state of art of computer vision and machine learning algorithms. These algorithms can be used to detect the real time faces, objects, human actions. Then the dlib which is a cross platforms in c++ language, extracts the facial landmarks and HOG (Histogram of oriented gradients) features which is used in object detection and it also counts the occurrences of the gradient orientation in localized portions of the image. These HOG feature and facial landmark is given input to the convolutional neural network (CNN). This in turn recognise the facial expressions deep from the images or camera stream. Here we used Convolution neural network model uses a little pre-processing compared to other classification algorithms. This is independent of the prior knowledge is the main advantage. CNN network which is prone to the overfitting data.

IV. IMPLEMENTATION

Required Packages:

- TensorFlow
- Keras

- numpy
- OpenCV3
- scikit-learn
- dlib
- scipy, pandas, skimage

Prerequisites:

You need to have installed following software and libraries in your machine before running your project.

- python3
- OpenCV
- Keras

After downloading data from the aforementioned source, you have to structure the data into separate folders corresponding to the seven class labels. Then you can use the code in the file (source code)'FacialExpressionCNN.ipynb' to train the model. You can add or delete layers in MLP part of the model based on your data and results. Don't forget to save your model after each epoch.

A. Algorithm

Conventional Neural Networks algorithm

1.Initialize all weights and biases of the CNN to a small value.
2.Batch-size = 256, Epochs = 10, Input-size = (48,48,1)
3.ImageDataGenerator() for converting pixel values into a vector of values.
4.model = sequential() , created a neural network.
5.model.add(Conv2d) , created a conv2d layer.
6.model.add(MaxPooling2d) , created a pooling layer.
7.model.add(Conv2d)
8.model.add(Conv2d)
9.model.add(AveragePooling2d)
10.model.add(Conv2d)
11.model.add(Conv2d)
12.model.add(AveragePooling2d)
13.model.add(Flatten) , Flattens the dimensions to a single dimension.
14.model.add(Dense) , To create a fully connected layer.
15.model.add(Dropout) , added a dropout layer to prevent overfitting by setting 0 for some nodes during activation.
16.model.add(Dense)
17.model.add(Dropout)
18.model.add(Dense)
19.model.add(Dropout)
20.model.add(Dropout)
21.model.add(Compile)
22.update weights and biases
23.w(new)=w(old)+del(w)
24.Find Error and Accuracy

V. OUTPUT

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Fig. 2. Example images from the FER2013 Dataset illustrates the different facial expressions such as fear, neutral, sad, happy, fear

VI. RESULT

For Facial expression recognition, Using the LBP feature often the facial areas like eyebrows, eyes, cheeks are taken but here we take an image or camera view and identifying the facial expressions as mentioned above. We used FER2013 dataset which contain 3000 images. It doesn't take the videos as input features as it done by active appearance model, but it simply takes the images or pictures as a input feature, and analysing the CNN network. Although the facial features contain many as well as, we are simply analysing the basic feature whether it is a face or not using CNN, if it is face it shows the expressions as discussed above. It also gives high accuracy as compared to other model by simply showing that seven expressions. Our proposed model is the real time facial expression recognition using deep CNNs architecture of current FER methods, lead to improvement in accuracy on FER2013. The CNN architecture is used current state-of-architecture. This paper mainly focuses on the FER performance by means of FER2013 datasets in CNN-based FER and it is largest available dataset in the field. The results obtained by this dataset can detect the facial expressions such as anger, surprise, happy, disgust which is discussed earlier. We have identified the existing bottlenecks by employing the deep CNNs lead to the significant improvements in FER2013 performance.

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