FACIAL EMOTION RECOGNIZATION USING CONVOLUTION NEURAL NETWORK

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Abstract:

Facial Emotion is in general how the person feel in inner side either sad, happy, angry or any other emotion which is seen in the face. Through the facial emotion the person feeling will be evident in the face. The facial emotion recognition has got large importance with increase in the application of facial emotion detection in the various fields. The some of the applications of the facial emotion are medical, Law, Marketing, Security system, Entertainment, call center system, Monitoring, E-learning. In general human emotion can be detected with the facial expressions, voice, and body language. These methods are used by human in general to predict the emotion of the person. The human prediction of emotion will show the accurate results. So in order to use the facial emotion recognition in various fields, the automation of this emotion detection should be done. The some of the pervious works done in the facial emotion detection are the detection systems developed using the machine learning, Image processing, ECG. But some previous works like ECG is complex to use in the general applications. The other work involving the image processing, Machine learning has some limitations like the accuracy shown is not sufficient for the real time applications. In this paper the facial emotion reorganization is implemented using the deep Learning Techniques. The convolutional Neural Network is used to implement the proposed model. The Major issue in the facial emotion detection is recognizing the face in the live or in the image. In the proposed method the pre-trained cascade classifiers are used for the face reorganization. The Haarcascade front face classifier is used to detect face and the detected face is used for further prediction of emotion using the designed model. The fer2013 dataset is used for the training of the model which contain the 7 categories of emotions.

Keywords:

Convolutional Neural Network, cascade classifiers, Convolution Layer, Facial Emotion, Face Recognition.

1. Introduction:

Facial Expression is the expression of face that is obtained with the gesture of the facial muscles in the face. The Face Emotion is inner feeling of the person that is expressed with the facial expression. The facial emotions are sad, Happy, Angry, fear, surprise and other emotions.

The Facial emotion recognition has various applications in various fields. The some of the fields in which facial emotion detection can be used are Medical, Marketing, Law, Entertainment, E-learning, Security Monitoring. In Medicine the Facial emotions are used to identify the state of the person and it is used for rehabilitation that is help monitoring, identifying the enhance realism, client's emotion state during the counseling, patients feelings about treatment.

It is used to help patients deal with stress, anxiety and depression while giving the music therapy. In the E-learning the presentation style of an online tutor can be adjusted based on the facial expression during the lecture. Through this the more interactive and effective ways to teach students can be improved as the expression of students act as the feedback. Warning the other drivers based on the driver emotion so that accidents can be controlled.

The Facial emotion can be used in the ATMS so that the amount is not dispensing the money when scared. Recognizing the partner's true emotional state based on the facial emotion. In the Law it is used for the deeper discovery of depositions. In the marketing the impact of ads and the attention of visitors in engagement of ad, how is the buyers emotion in purchasing the decisions these can be used to improve the sales.

The deep learning is used instead of the machine learning when there is a large dataset. When the dataset is of big size, then the machine learning cannot perform accurately. Hence in the system the dataset is of large size and when working with the images the convolution neural network will work perfect to implement the system. The convolution layer consists of various filters to identify the edges, shape. The maxpooling layer is used to reduce the over fitting during the training. The dropout layer is used to remove the over fitting links created in training. The batch normalization is used for the normalization of the values.

2. Literature:

In this paper [1] the author proposed a facial expression recognition using the curve let transform and online sequential extreme learning machine initialized with spherical clustering. In this the author used the curve let transform to identify the facial expression and in this the proposed model is implemented and trained using the extreme machine learning.

In this paper [2] the author proposed a facial expression is recognized with the using the Gabor motion Energy filters. The author mentioned the applications of the facial expressions in the real world. The Gabor motion is explained in the paper which is used for the implementation of the system.

In this paper [3] the facial expression is detected using the image as the input to the system. In this author used the machine learning methods to implement the system. The various implementation of Automatic classification of facial images is explained in this paper.

In this paper [4] the driver distraction detection is proposed in the paper. In this the driver alteration system implementation techniques are proposed. The cascade classifier is used to detect the face of the driver. Then the implemented system is used and the input detected face is given as the input to the system and the driver distraction is detected.

In this paper [5] the author proposed the rapid object detection using a boosted cascade of simple features. In this the object detection methods are explained and the issues involved in the detection of the objects are explained. The cascade classifier used to detection of the object.

In this paper [6] the author proposed the histogram of oriented gradients for human detection. In this the author explained the various human detection in the images and the videos in the real time are the proposed. In this the limitations of the machine learning and image processing models in the detection of the face emotion is discussed. The various previous work involved in the detection of the human posters and the various cascade filters are discussed.

In this [7] the kaggle is a challenge giving website. In this the various things involved in the recognition of the emotion detection are mentioned. In this the dataset collection and the dataset preprocessing is explained which is used for the implementation of the face emotion detection system.

In this paper [8] author proposed the face detection and the facial expression detection using the various methods. The technical issues involved in the detection of the face in the human and the challenges in the dataset preprocessing for the training of the model is explained.

3. Proposed method:

In this paper the Facial Emotion detection is implemented using the deep learning, the Convolution Neural network. The some of the steps involved in the implementation of the project are dataset collection, data preprocessing, creating the model, training the model, evaluation of the model and saving the model, then saved model is used the future prediction.
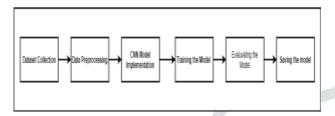

Figure 3.1:Steps to implement the proposed model

The dataset is collected for the training of the model. The fer2013 is the dataset consist of the 7 categories like sad, angry, fear, happy, surprise, neutral, disgust. This dataset is used for the training of the proposed model. The dataset is open source freely available in the internet. The dataset is collected and the dataset consists of the two columns. The first column consists of categories of emotions and the second column consists of the pixel information of the image. Through by using the python program the pixel values of the image is used to generate the gray pixel images. Finally after the processing of the dataset, the folder consists of the 7 categories with the images in each folder. The image is of size 48* 48 image. Then the dataset split into the training set and testing set. The training set is used for the training of the model and the testing set is used for the testing and evaluation of the model. The training set consists of 28,709 images in total. The rest of the images are used for the evaluation. The separate 100 images of each set is stored for the further testing of the model. Then the model is created using the convolution Neural Network.
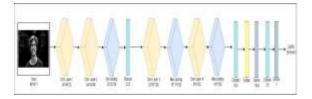

Figure 3.2: Architecture of the proposed model

The model is implemented using the sequential method. The various layers are arranged layer by layer. The first image is given as the input. The image size is 48*48*1 since it is a black and white image i.e grapy scale image. Then the two convolution layers are created and then the max pooling layer is created in order to reduce the over fitting of the model, the size of the pooling layer is 2*2,the relu activation function is used as the activation function. Then the dropout layer is created on the further to reduce the links created in the maxpooling layer. Then the output of the max pooling layer is normalized with the Batch normalization layer. In the Middle of the layers a Dropout is used in order to overcome the over fitting of the model. In this way another 2 layers of convolution, max pooling followed by batch normalization is done. Then the flatten layer is implemented. This layer flatten all the outputs of the Batch Normalization layer. Then the flatten output are given to the next created dense layer. The Dense Layer is created after the flatten , this will create a fully connected layer which is used for the classification. Then the drop out layer is created in order to reduce the number of output from layer to layer. Then a Batch Normalization is created. In this way another 2 layers of dense, dropout followed by Batch normalization is created. Then at last a last layer a dense layer is created with the 7 neurons, with the activation function 'Softmax'. The last layer give the output which specify the one of the 7 classes of emotion of the Human. Then the created model is compiled with the scg(sarcastic gradient descent optimizer) optimizer to find the weight and bias of the model created in the various layer. Categorical crossentropy is used to find the loss in the training the model. Then after the compilation the model is trained with the dataset collected.

The fit_ generator method will help us to train the model and to evaluation it. With the training data and the testing data for the validation of the model created. In this the epoch of 50 is used when training the model. After the training and evaluating the model is saved in the system, for this keras save method is used to save the trained convolutional model for the future prediction.

After the evaluation the model is saved for the further prediction of the new images. The haarcascade frontal face cascade classifier is used to detect the face in the image or video. Then the detected face is given to the trained model. Then the model will predict the emotion of the face. The model has working fine with the images as well as the live video detection of the face emotion.

4. Conclusion:

In this paper the facial emotion recognition system is proposed using the convolution neural network. The model is created using the convolution Neural Network then the fer2013 dataset available as the open source is used for the training and evaluation of the model created. Then the model is saved for the future prediction. The proposed method is works fine to predict the facial emotion in the image as well as in the live video. The proposed model is preforming well when compared to the machine learning model. In the future scope the more emotions can be added to the dataset and the further newly added emotions need to be classified. Further the mobile application or the desktop application with the easy handling interface can be implemented.

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