

Emotion Analysis using Deep Learning

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Emotion Analysis using Deep Learning

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Abstract— Facial emotion recognition is the process of detecting human emotions from facial expressions. Facial expression is an important feature of human emotion recognition. It is the process of detecting the facial emotions and facial expression of a human. Facial expression detection is where we are giving some images or videos [8], then it will detect emotions or expressions of the person it will detect the facial expression or facial emotions. Recognizing or detecting emotions from faces has never been an easy task. The use of facial expression is easy to recognize customer satisfaction for marketing analysis to see whether customers are satisfied with the product or not. So facial expression is many kinds of reactions that the human face can perform. Some of the human emotions are fear, sad, happy, neutral, angry, surprise, disgust recognition of human emotion is not an easy task for machine learning [7]. So here we are using Convolutional Neural Network for the classification of images and recognition.

I. INTRODUCTION

Emotion analysis plays an important role in our digital world. We are using FER 2013 dataset and Each image is resized into a 48*48 pixels grayscale image. Our project focus is to classify the different types of emotions on a human face into one of seven categories using a Convolutional neural network. Any human emotion can be identified by observing the movements of eyes, mouth, nose, etc. So here we are implementing three stages to know the emotion of the person. A video or image is given as input to the system. Then the first stage is to detect the face in the image and extract some features like size, background, brightness then face is identified. The second stage is to detect the expression from the image then detected features are given to the classifier to identify the expression of the person.

II. KEYWORDS

Convolutional Neural Network, FER 2013, Facial Expressions, Haar Cascade Algorithm, Pooling.

III. LITERATURE SURVEY

There are many existing systems related to this field like face detection, age prediction, gender prediction etc. Some of the models are mentioned below.

1) Face Detection System:

- This system detects the face of a person from different objects in the input the face detection perform three steps like face identification, feature extraction, classification. This system only specifies if a face is detected or not. It is implemented by using LBP(Local Binary Patterns) algorithm. This algorithm is less accurate by comparing to HAAR cascade. So, still accuracy is a problem and it can't tell difference between two identical twins.

Person detection by recognizing the face. In this project it detect the name of the person, gender of the person by using person facial features.

2) Face recognition based on biometric:

Biometric identification is the automatic verification of any person based on some features of the person. In this face recognition they have used SVM classification, so by using this classification it is not suitable to perform large datasets. CNN classification is better than SVM classification. By using this CNN classification it automatically detects the important features without any human action

3) Age Detection by detecting the face:

In this the age of the person will be detected after the face detection. The age will depend on the facial points like forehead, cheeks, wrinkles, eyes etc features.

IV. PROPOSED SYSTEM

The proposed model determines the emotion of the face of human in front of camera. We chose Deep Learning to implement the model as it is better for classification and image processing problems. The model uses Convolutional Neural Network (CNN) to determine the emotion.

We have implemented two models for the emotion detection analysis, which gives the same emotion output but in a unique way of its own.

A. First Model:

This is our main model which determines the emotion, for many number of faces in one frame and gives the emotion on the face with the bounding box. It also produces curves for

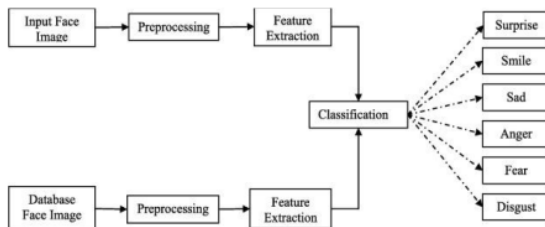
B. Second Model [7]

This model gives the output mainly focusing on one face, along with another frame having the prediction accuracies for every emotion.

We have constructed two models for the purpose of obtaining emotion percentage of every emotion for many faces. But if we consider for multiple faces we face overlapping problem.

Our model uses Keras, Tensor flow for the data processing. Model can be developed in different ways by machine learning, using just computer vision but we choose Keras as it is powerful in processing when compares to others in Deep Learning Implementation.

C. System Architecture

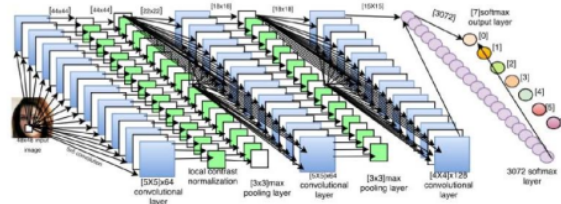


D. PROCESS

The above architecture is generalized architecture of the input processing. Where as the model has different steps as it applies convolutional network for the input in the classification steps.

1. Import all the required packages like Tensorflow, Keras, numpy, pandas, os and Haarcascade classifier.
2. Convert the image input into images, resizing images, converting images to grayscale.
3. Creating a model of convolutional layers [1] along with the pooling layers and flattening the final layer.
4. Training the model with the existing data set and producing ,saving the output.[4]
5. Face, eyes, mouth detection using HaarClassifier algorithm and passing them to the model [2].
6. Testing model with the input data and comparing the results and determining the emotion.
7. Producing the curves for the trained and input data.

The above steps are to be done for obtaining the final output. After the steps the graphs, determined emotion will be the final output. The output curves give the information about the accuracy of the model. And neural networks i.e convolutional networks are created as in the following image while processing the image.



E. ALGORITHMS

1) HAAR CASCADE ALGORITHM:

In our model we used this algorithm for face, eye, mouth detections. [2] Haar Cascade is machine learning Object Detection algorithm. It was proposed by Paul Viola & Michael Jones in 2001 in their paper "Rapid Object Detection using a Boosted Cascade of Simple Features".

In this algorithm the cascade classifier is trained with the positive images and negative images. Where positive images are the images containing object where as negative images are those which doesn't contain the object in these images. So, after this the algorithm gets trained and determines the object from the image.

We have the pre-trained algorithm in Computer Vision package, which was used in our model creation process.

In our model we use the Haar Cascade Classifier.xml file and get it into model using Cascade Classifier() function, which is present in OpenCV.[7]

2) CONVOLUTIONAL NETWORK:

The preprocessed image is inserted into the layer.

Convolutional Neural Network is algorithm present in Deep Learning for image processing, by using the weights in the image.

This network contains different layers where each layer has input and output. Convolutional layer has the input and output in the form of array vectors.

Convolutional Layers can be 1d, 2d, 3d varying by the input. For the voice and text input the layer will be 1d and for images it is 2d.

So, in the model we use 2d convolutional layer.

Each layer uses an activation function for processing that layer. Activation functions are like softmax, linear, sigmoid.

Here we use only softmax as sigmoid function returns the output values only between 0 & 1.

Softmax Activation function:

It is a mathematical function, which converts a vector of numbers into a vector of probabilities, where the probabilities of each value are proportional to the relative scale of each value in vector. It normalizes the output and converts the weights of into probabilities which sum to one value.

3) POOLING:

Pooling layer is applied after the convolutional layer, to remove the over fitting of model i.e; removal of

unnecessary values of the data. Pooling layer filters the input given.[4]

Here pool size should be chosen to pool the values of that layer. For every pool the pooling function is applied.

Pooling are of mainly two types:

1)Max Pooling:

In this pooling method the max value from the input values is given as output for every pool.

2)Average Pooling:

This method find the average value of every pool and gives it as output.

Example :

Input data is of size 5 X 5 then pool size can be 2X2, 3X3 etc. So, for every 2X2 (or) 3X3 of the current pool will be processed according to the type of function.

The inbuilt functions for these algorithms are available in "Keras" package.

V. EVALUATION

A. Data set:

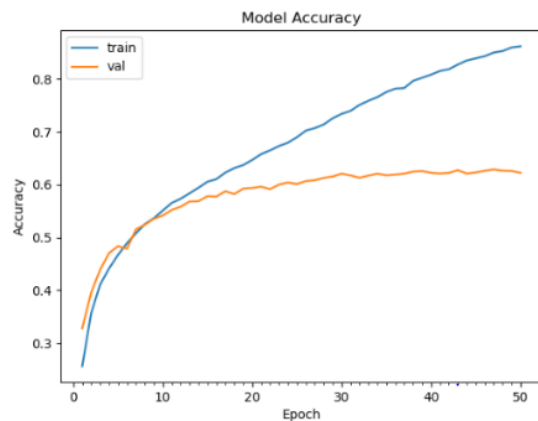
For this project we are using FEB-2013 dataset.

The FER-2013 dataset consists of 28,709 labeled images in the training set, 35,887 labeled images in the developmentset, and 7,178 images in the test set.in this dataset each image belong to any of these emotions: happy, sad, angry, afraid, surprise, disgust, and neutral, with happy being the most prevalent emotion, providing a baseline for random guessing of 24.4%. The images in FER-2013 consist of grayscale and 48x48 pixels. The FER-2013 dataset consist of the results of a Google image search of each emotion and related images of the emotions.

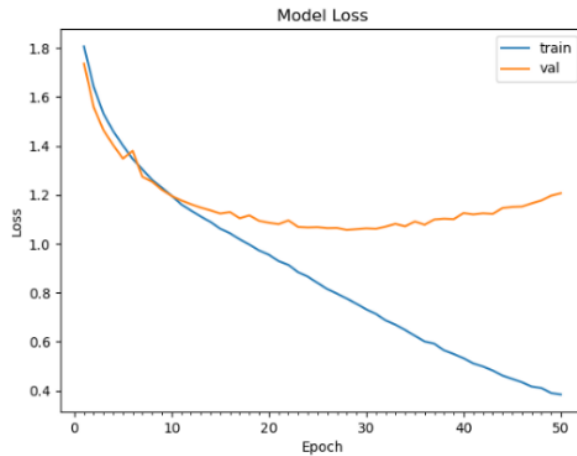
B. Result:

After training and testing the dataset it will generate two plots they are Model Accuracy by these plots we can estimate project.

Model Accuracy :

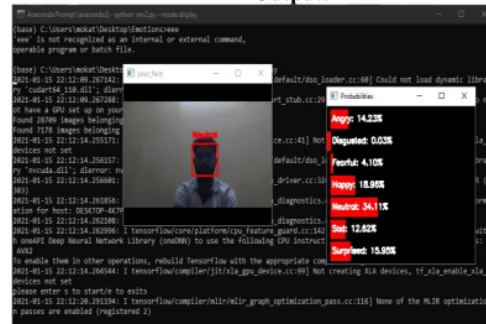


Model Loss:



After these we can detect emotion of the given input.

Output:



VI.CONCLUSION

Hence, our model detects the face of the person and based on the facial expressions or features, it determines the emotion of the person present in front of camera using Convolutional Neural Network. Our model mainly determines 6 emotions like sad, happy, neutral, angry, disgust. Emotion detection can be used in researches, education, entertainment [8], security etc.

VII. FUTURE WORK

- Model can be further improvised for extra emotions like crying, laughing, smiling, sleeping, shy etc.
- A website which detects the emotions and reactions of the person can be developed using the model.

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