

Facial Emotion Recognition in Python

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Abstract

It is general fact that humans are highlighted by other species in the world by the emotions which is expressed through facial expressions. As the Artificial intelligence are emerging and growing exponentially in many fields where it is important to recognize the human emotions when the auto reply system. The aim of this paper is to propose a system that can be used to recognize the facial expressions of human. An automated emotion recognition system which examines the expressions through various steps like segmentation, feature extraction and identification of human emotions from image or video. This application inspired by image processing and machine learning algorithms. Steps involved in this process are like Image Pre-processing, face detection, facial components, feature extraction and classification. This application uses the image captured from the webcam and the obtained image is compared with the trained dataset model available and then emotional state of the image will be displayed. Facial Emotion Recognition application is implemented using Convolution Neural Network (CNN). System has been tested with the dataset which contains the various emotions of the humans. The application has achieved 56.77 % accuracy and 0.57 precision on testing dataset. This application is capable of classifying human facial expressions into 6 essential emotions: happy, sad, fear, anger, disgust, and neutral.

Keywords: Artificial Intelligence, Image Processing, Machine Learning, Face Detection.

I. INTRODUCTION

The human face is an essential focal point of consideration in public activity assuming a significant job in passing on personality and feelings. This is very strong in spite of huge varieties in visual upgrade because of changing conditions, for example, condition, maturing and other regular variables (facial hair, mustache, haircuts and exhibitions). Face recognition gets comfortable component in different specialized fields, for example, video reconnaissance, military applications, personality check, film preparing, criminal distinguishing proof, security framework, labeling purposes and human-machine interaction.

The goals of this proposal is to produce a system enabled with image processing and machine learning

algorithms to identify and classify the some basic human emotion possessed by a personal. This can be used for many fields like daily analysis of emotions of employees, identifying a person in a video feed. The idea is to use neural networks for classification of emotions like CNN algorithm. CNN is one of the best machine learning algorithms for image classification and in these algorithms as the number of hidden layer increases and the dataset is increases the predictive power increases.

There are many challenges regarding the development of this facial emotion recognition system first one is to create the model and this would require a large dataset of images of human faces with emotions and needed that the images are properly labeled. In this system, we are going to use the CNN algorithm to create the model which is one of the best-known algorithms for image classification. For a good model, we needed to select the dataset based on different factors like human faces with all shades, for example, it should not be like for the same emotion category, a fair person's emotion is classified different from a dark shade person. And the dataset used included a sufficient amount of female face images in proportion to males. As there is the probability that if a system is trained on the dataset that includes the more male faces in proportion to female faces the system could predict the false values.

A. Overall Description:

For the most part, people can pass on goals and feelings through nonverbal ways, for example, gestures, outward appearances, and automatic dialects. This system can be significantly useful, for the machine to human interaction like think of a scenario where a personal assistant identifies your mood just by observing the face and based on mood provide suggestions. The significant thing is how smoothly the framework recognizes or separates the outward appearance from the picture.

B. Purpose:

The framework characterizes outward appearance of a similar individual into the essential feelings namely anger, disgust, fear, happiness, sadness, surprise and neutral. The main purpose of this system is that machine to human interaction is made efficient if the

machine can understand the mood of the user. Here, identification and order of outward appearances can be utilized as a characteristic route for the communication among man and machine. Furthermore, the framework power shift from individual to individual and furthermore changes alongside age, sexual orientation, size and state of face, and further, even the looks of a similar individual don't stay steady with time.

C. Motivations and Scope:

The analytical and computation power of machines are far beyond comparison to humans. These advanced machines like PCs are been in use for various problem solving, these machines when enabled with system to perceive human emotion have various advantages. These systems can be deployed in office to monitor emotions of employees, used by personal assistant to suggest the songs based on emotion identified using the system. For identifying a person in video surveillance with different emotions in mind.

II. LITERATURE SURVEY

In [1] a paper by Rituparna Halder et al., proposes for a facial emotion recognition system that uses image processing and machine learning as base for identification of emotions. They use neural network with image processing tools to classify the six basic human emotions.

In [2] paper by Hsi-Chieh Lee et al., proposes for facial expression recognition using image processing tools and neural networks. Tradition approach was used by them. They first extracted the face area from image file and after that extracted the key areas required for facial classification namely eyes, mouth, eye brows etc.

In [3] paper by James Pao uses a hybrid feature extraction method for emotion recognition. They used viola jones cascade object detector for face extraction from original image and then extracted the facial features from it. They made use of SVM (Support Vector Machine) for classification of expression into seven basic emotions.

III. PROPOSED SYSTEM

The outward appearance or emotion acknowledgment framework is executed utilizing the Convolutional Neural Network (CNN). The flow chart of the proposed approach is shown using blocks in the following two figures: (a) Training Phase (b) Testing Phase.

The first phase is training phase and this phase is used to create the model for emotion classification. This phase takes input as raw image, basic pre-processing is performed on these input images like converting it to grayscale, removing the noise etc. then later on intensity normalization is applied to the images. Then these processed images are provided as input to Convolutional neural network for training and creation

of model. The output of this is the CNN weights which later on will be utilised by testing phase for testing the model created. The next phase, testing phase makes use of CNN weights to correctly classify the emotions and test the model.

This application can take input from webcam as well, input is the raw image and based on model prepared using CNN weights classifies the emotion category. Approach used is fast and robust. And this application even shows the probability of classification of facial emotion in an image over seven facial expressions. For example, for a given webcam image it will classify the face emotion into probabilities or percentage of expression, like happy:75%, sad: 9%, disgust: 10%, angry: 30%, neutral :10%, scared :18%. This is easy to implement and gives even better result when trained over large dataset.

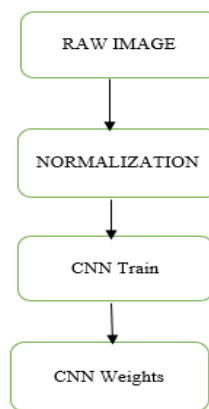


Figure: (a) Training Phase

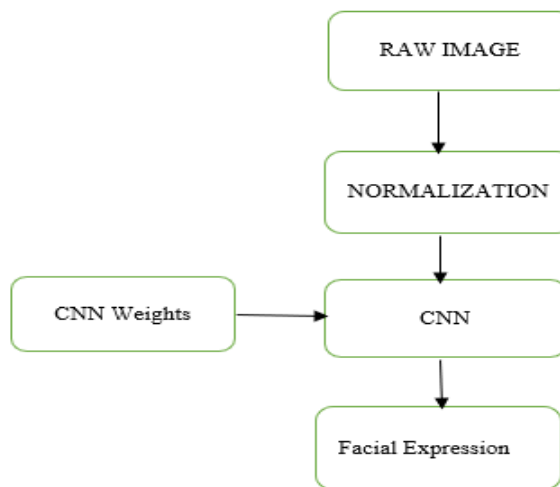


Figure: (b) Testing Phase

We are using CNN in this paper for classification of faces. Convolution Neural Network (CNN) is comprised of two types of layers:

- 1.The hidden layers
 - convolutions
 - pooling
- 2.The classifier part

Convolution is regularly spoken to scientifically with a reference mark * sign. In the event that we have an info picture spoke to as X and a channel spoke to with F, at that point the expression would be:

$$Z = X * F$$

For example, suppose we have an image size of 4 x 4 and filter size of 3 x 3, then we will have an output matrix of size 2 x 2. But what about output size when input matrix and filter is large. How do we find the output size? A simple formula expression would do so.
 Image Dimensions = (x, x)
 Filter Dimensions= (f, f)
 Output dimensions would be ((x-f+1), (x-f+1))

After Convolution layer, comes the pooling layer. The function of pooling layer is to perform continuous dimensionality reduction. One such pooling procedure used is called max-pooling, which takes the most extreme incentive in every window which diminishes the element map size while keeping the huge data.

IV. FUTURE WORKS

The face is recognized from the input original image and then facial characteristics which are essential for emotion classification like eyes, mouth, Eye brows are extracted from the face. And this is used by CNN classifier to classify the mood among six basic emotions possessed by humans.

Future work in this would include making this system more robust, secure, accurate and precise. Robustness involve dataset chosen must be well prepared with various factors keeping in mind like faces of all shades, males and female image proportion must be chosen well. Security is another important thing as this involve capturing image of the user and this information must not be misused. Advancement in this system would be integrating this classification facility with AI assistant and the assistant can use this information for more personalised suggestion at a particular moment.

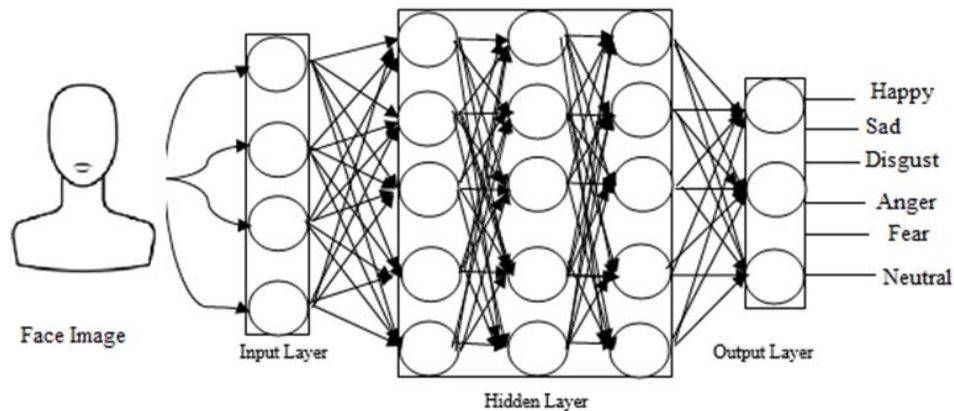
V. RESULT ANALYSIS

Anger, fear, happiness and sadness are " definitely not hard to-identify" feelings. These feelings can be identified unmistakably. As happiness involves sudden turning of the mouth to the edges up to the chin. Fear involves parallel turning of mouth edges. Whereas anger involves downwards furrowing of the eye brows.

Disgust then again, is emotion hard to identify, cause of this is mistakenly identifying opening of mouth in disgust with mouth opening in happiness. And furrowing of brows in anger with furrowing of brow in disgust.

Here, we are using CNN. Its efficiency increases if the number of hidden layers involved increases and the dataset on which the model is trained increases. We have included the accuracy percentage of some previous research done in below table. The accuracy obtained by the approach used here was 95% while testing.

S.No.	Literature Survey	Efficiency in %
1.	Paper 2	92
2.	Paper 3	81



A. Input layer

In the above picture took care of information then the picture given in input layer where it acknowledges the pixel of the picture as input in the form of array.

B. Hidden Layer

Hidden layers find out feature extraction by carrying out certain computation and manipulation.

C. Output Layer

Finally, there is fully connected layer that identifies the face in the image.

VI. CONCLUSION

In this we proposed the method to correctly classify the human emotions. The method uses image processing and convolutional neural network for creating the model and predict the six basic feelings possessed by humans. Six all inclusive feelings: Happy, Sad, Anger, Disgust, neutral and scared.

The system proposed classifies the emotion correctly most of the times. The fundamental goal is to build up a programmed feeling identification framework. Proposed framework worked as per expectations on webcam video feed.

VII. REFERENCES

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