International Journal of Scientific Research & Engineering Trends
Volume 7, Issue 4, July-Aug-2021, ISSN (Online): 2395-566X

Fine-Grained Facial Expression Recognition using Machine Learning

Prof. Pallavi Patil, Kalyani Limkar, Samruddhi Waghmare, Siddhi Bokil, Bhakti Vispute
Department of Computer Engineering,
Genba Sopanrao Moze Collge of Engineering,
Balewadi, Pune
pallapatilgsm@gmail.com, Kalyanilimkar4@gmail.com, Samruddhiwaghmare08@gmail.com, siddhibokil318@gmail.com, bhaktivispute56@gmail.com

***Abstract*- A face emotion detection system that cans analyses basic human facial expressions is being developed in this project. The proposed method analyses a person's face to determine his or her mood, and then plays an audio file that is related to that person's emotion based on the information obtained from the face. The system will first recognize a human face and then proceed to the next step in the process, and so on. The process of face detection is carried out. Following that, the technique of feature extraction is used to recognize the human face.. This method aids in the recognition of the human's emotion by utilizing features of the face image. Those feature points are discovered through the feature extraction of the lip, mouth, and eyes, as well as the brow. If the input face matches exactly to the face in the emotions base dataset, we can determine the exact emotion of the human and play the audio file that corresponds to the exact emotion of the human. In addition, we recommend music based on the mood that has been detected. Recognition under a variety of environmental conditions can be achieved through training on a small number of distinguishing characteristics of different faces. A straightforward, efficient, and accurate approach is proposed here. In the field of recognition and detection, systems play a critical role in achieving success.**

Keywords- Face Detection, Feature Extraction, Face Emotion, Recommendation.

I. INTRODUCTION

Mood detection based on emotion is a current topic in a variety of fields, and it has the potential to provide solutions to a variety of problems. Additionally, traditional challenges in captured facial images under uncontrolled settings such as varying poses, different lighting and expressions for face recognition, and different sound frequencies for emotion recognition, as well as different sound frequencies for emotion recognition, must be overcome. The database of any face and mood detection system is the most important part of the system because it allows for the comparison of the face features and the sound Mel frequency components. For the purpose of database creation, the features of the face are calculated and stored in the database. The data in this database is then used to evaluate the expression and emotion on the face using a variety of algorithms.

Emotional aspects have a greater impact on social intelligence, such as communication comprehension and decision-making, and they also aid in the understanding of human behavioural attitudes. Emotions play a significant role in communication situations. Emotion recognition can be carried out in a variety of ways, including verbal and nonverbal communication. Voice (Audible) is a verbal mode of communication that can be heard. Nonverbal communication includes nonverbal expressions such as facial expressions, actions, body postures, and gestures. Humans are capable of recognising emotions without any significant delay or effort, but machine recognition of facial expressions is a significant challenge.

The detection and identification of faces is one of the most fascinating areas of human- computer interaction currently under investigation. The number of distinguishing facial characteristics is relatively low, making it a particularly interesting task to observe them. The detection and identification of face objects from a person's face is a difficult task.

Searching for and recreating a human emotion using a human's face can be one of the most difficult assignments you will encounter in your professional life. A person's face is the most reliable way to detect and recognize them. There will be no recognition algorithms that work if the face detection step is skipped. The recognition stage is influenced by the rate of detection. To detect and localize an unknown non-face from a still image in the midst of all of this noise is an extremely challenging task.

Face emotion detection applications are still a difficult task to complete because face images can be affected by changes in the environment, such as changes in pose, changes in facial expression, or changes in illumination. Main goal of this system is to determine the human mood

using a face image as input, and then use the emotion results to play an audio file as a result of the system. a face recognition technique that is used to match the train face image to the original input face image is described in this section.

A straightforward, efficient, and accurate approach is proposed here. When compared to the existing approach, this system provides more accurate results. In the field of recognition and detection, systems play a critical role in achieving success. In other words, when compared to traditional methods, this produces significant results in a short period of time.

II. RELATED WORK

The extraction and classification of emotions from a face image is the subject of the work presented. There is a comparison of various algorithms for facial expressions research in terms of performance parameters such as recognition accuracy, number of emotions discovered, Database for experimentation, classifier used (among others) [1].

For the final decision, the presented system automatically recognizes the facial expression from the face image and categorizes it according to the emotions displayed. When it comes to face localization, the system makes use of a simplified technique known as the "Viola Jones Face Detection" technique. A subset feature selection technique is used to group together the various feature vectors in order to improve the performance of the recognition and classification process. Finally, the combined features are trained and classified using the SVM, Random Forest, and KNN classifier techniques [2] to achieve the desired classification accuracy.

In the three-step technique presented here, faces are detected using the Haar cascade, features are extracted using the Active shape Model (ASM), and the Adaboost classifier technique is used for the classification of five emotions: annoyance, disgust, happiness, neutrality, and surprise.

In this work, you will implement an efficient technique for creating a face and emotion feature database, which will then be used for face and emotion recognition of an individual. The Viola-Jones face detection technique is used to detect faces in the input image, and the KNN classifier technique is used to evaluate the face and emotion detection techniques [4, 5, 6, 7, 8, 9, 10, 11, and 12].

The purpose of this work is to demonstrate the requirements for and applications of facial expression recognition. When comparing verbal and non-verbal forms of communication, facial expression is a non- verbal connection that plays a crucial role in understanding the other person. It expresses human-related or filling-related information as well as his or her mental state [5].

The human face is the focus of this system's attention, which allows it to recognize different expressions. There are a variety of techniques available for recognizing a face image. This technique can be easily adapted to a real-time system due to its simplicity. Several schemes for capturing an image from a web cam, detecting a face, and processing an image to recognize a few results [6] are briefly demonstrated by the system.

In this work, we will use the recently introduced SIFT flow technique to register every frame in relation to an Avatar reference face model, which has been recently introduced. Then, using an iterative technique, not only is the EAI representation for each video and the Avatar reference super-resolved, but the recognition performance is improved as well. Also, the features from EAIs can be extracted using the Local Binary Pattern (LBP) technique as well as the Local Phase Quantization (LPQ) technique [7].

In this study, we develop a framework for an emotion recognition system, which includes face detection, feature extraction, and facial expression classification among other things. During a portion of the face detection process, a skin detection process is used to help identify the facial region in a complicated background environment. Those feature points are launched [8] as a result of the feature detection of the lip, mouth, and eyes, as well as the eyebrow.

In this work, a novel technique for recognizing facial emotions is discovered and described. Face identification is accomplished through the use of the Haar transform technique and the adaptive AdaBoost technique, while face recognition is accomplished through the use of the Principal Component Analysis (PCA) technique in conjunction with a minimum distance classifier. For the purpose of facial expression recognition, two techniques have been investigated. The former relies on the use of principal component analysis (PCA) and the K-nearest neighbour (KNN) classification technique, whereas the latter advocates the use of Negative Matrix Factorization (NMF) and the KNN classification technique [9]

III. PROPOSED SYSTEM

The proposed approach made use of the human face to detect emotion, and then used the result to play an audio file that was related to the human's emotion. First, the system receives a picture of a human face as input. During the image preprocessing step, we remove the noise from the image and convert it to grayscale format. After that, a face detection algorithm is applied. Then, using feature

extraction techniques, we can recognize the human face and use it to detect emotional expressions.

These techniques aid in the detection of a person's emotional state. Those feature points are discovered through the feature detection of the lip, mouth, and eyes, as well as the eyebrow. If the input face matches exactly to the face in the emotions-based dataset, we will be able to determine the exact emotion of the human and play the emotion-related audio in response to it.

In addition, we recommend music based on the mood that has been detected. Training on a small number of characteristic faces can be used to achieve detection under a variety of environmental conditions.

1. Advantages Proposed System:

- Face detection and cropping
- Detection the mood of human using human face image features.
- Play audio file using java based on human mood.

2. Proposed System Architecture:

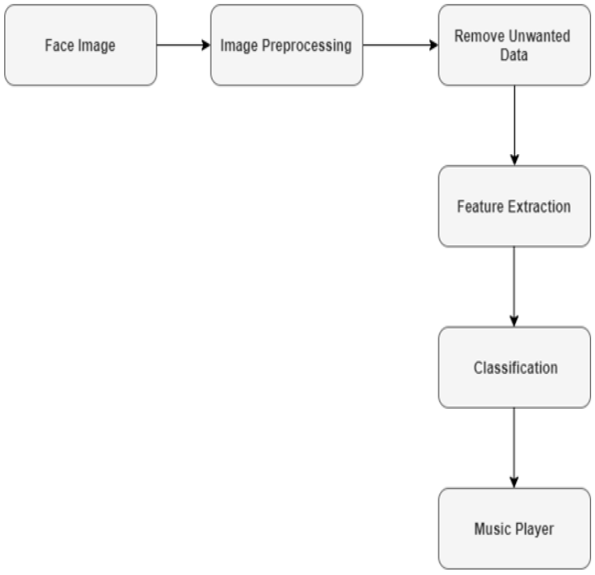

Fig 1. Proposed System Architecture.

IV. METHODOLOGY

Feature Extraction for Face Identification:

1. Color feature:

As most of the color distribution information can be captured by the low-order moments, using only the first three moments: mean, variance and skewness, it is found that these moments give a good approximation and have been proven to be efficient and effective in representing the color distribution of images (Stricker and Orengo 1995).

2. Edge Detection:

Most of the shape information of an image is enclosed in edges. So first we detect these edges in an image and by using these filters and then by enhancing those areas of image which contains edges, sharpness of the image will increase and image will become clearer.

3. Texture Feature:

Describes the structure arrangement of surfaces and their relationship to the environment, such as fruit skin, clouds, trees, and fabric. The texture feature in our method is described by hierarchical wavelet packet descriptor (HWVP). A 170- D HWVP descriptor is utilized by setting the decomposition level to be 3 and the wavelet packet basis to be DB2.

V. MATHEMATICAL MODEL

Face Image Feature Extraction using Global Features

1. Mathematical Equations of Color Feature Extraction Method:

The color distribution information can be captured by the low-order moments, using only the first three moments: mean, variance and skewness, it is found that these moments give a good approximation and have been proven to be efficient and effective in representing the color distribution of. These first three moments are defined as:

$$\mu_i = \frac{1}{N} \sum_{j}^{N} = 1 \; P_{ij}$$

Where, Pij is the value of the ith color channel of the jth image pixel. Only 3 x 3 (three moments for each color component) matrices to represent the color content of each image are needed which is a compact representation compared to other color features.

2. Mathematical Equations of Canny Edge Detector Method:

Step1: Smooth the image with a Gaussian filter to reduce noise and unwanted details and textures.

$$\mathbf{g\ (m,n) = G\sigma\ (m,\ n)\ *\ f\ (m,\ n)}$$

Where

$$G_\sigma = \frac{1}{\sqrt{2\pi\sigma^2}}\ Exp\ \frac{\left(m^{2+n^2}\right)}{2\sigma^2}$$

Step2: Compute gradient of g (m, n) using any of the gradient operations (Roberts, Sobel, Prewitt, etc) to get:

And

$$\boldsymbol{\theta}\ (\mathrm{m}, \mathrm{n}) = tan{-}1\ [\ gn\ \ (\mathrm{m}, \mathrm{n})\ /\ gm\ (\mathrm{m}, \mathrm{n})\ /]$$

Step3: Threshold M:

$$M\ (\mathrm{m}, \mathrm{n}) = \{M\ (m, n)\ if\ M\ (m, n) > T$$
$$T\ \ 0\ \ Oth\ erwise$$

3. Mathematical Equations of Texture Feature Extraction Method:

According to co-occurrence matrix, there are several textural features measured from the probability matrix to extract the characteristics of texture statistics of remote sensing images. Correlation measures the linear dependency of grey levels of neighboring pixels.

$$\text{Correlation} = \frac{\sum_{i=0}^{Ng-1} \sum_{j=0}^{Ng-1} (i,j)p\ \ (i,j) - \mu_x\ \ \mu_y}{\sigma_x\ \sigma_y}$$

4. Dataset Design:

- We will use the Japanese Female Face Expression dataset.
- This data set consists of several facial expression images of Japanese female models.
- The JAFFE database is available free of charge for use in non-commercial research.
- We will divide this data set as testing and training.

VI. RESULT

Let us consider the face image in fig.1. Gray scale conversion is completed which is shown in figure 2 and Median filtering is implemented on the acquired images to get rid of the unwanted noises. The outcomes are displayed in the figure 3 respectively.

Fig 2. Input Face Image.

Fig 3. Gray Image.

Fig 4. Noise Removed Image.

After noise remove, next step to detect the actual face. So using cascade classifier, the face detection is done. The outcomes are displayed in the figure 4.

Fig 5. Face Detected Image.

After face detection, next step is to crop the detected face from image for feature extraction process. The outcomes are displayed in the figure 5.

Fig 6. Face Crop Image.

Next, image feature extraction process, all features are extracted from image and using that feature and also training data features to recognized the mood of person.

Fig 7. Mood Detection.

The following graph and table shows the mean, variance and skewness values of each face image which is sad and happy.

VII. CONCLUSION

The proposed work, which is based on human emotion detection and implements a feature extraction algorithm, is described below. The extraction of feature information from a face image and the matching of the feature information to the training emotion- based human face dataset are required for the detection of human emotion using the face image. After that, the system played the audio file, which was the additional work, based on the results obtained. In addition, we recommend music based on the mood that has been detected.

The work can be further developed in order to improve the recognition accuracy as well as the processing time for large face databases. As a result, our system can play a critical role in the detection of human emotions based on facial expressions.

REFERENCES

[1] Bharati Dixit, Arun Gaikwad, "Facial Features Based Emotion Recognition". ISSN (e): 2250-3021, ISSN (p): 2278-8719 Vol. 08, Issue 8 (August. 2018).
[2] J Jayalekshmi, Tessy Mathew, "Facial expression recognition and emotion classification system for sentiment analysis". 2017 International Conference.
[3] Suchitra, Suja P. Shikha Tripathi, "Real- time emotion recognition from facial images using Raspberry Pi II". 2016 3rd International Conference.
[4] Dolly Reney, Neeta Tripathi, "An Efficient Method to Face and Emotion Detection". 2015 Fifth International Conference.
[5] Monika Dubey, Prof. Lokesh Singh, "Automatic Emotion Recognition Using Facial Expression: A Review". International Research Journal of Engineering and Technology (IRJET) Feb-2016.
[6] Anuradha Savadi Chandrakala V Patil, "Face Based Automatic Human Emotion Recognition". International Journal of Computer Science and Network Security, VOL.14 No.7, July 2014.
[7] Songfan Yang, Bir Bhanu, "Facial expression recognition using emotion avatar image". 2011 IEEE International Conference.
[8] Leh Luoh, Chih-Chang Huang, Hsueh-Yen Liu, "Image processing based emotion recognition". 2010 International Conference.
[9] Jiequan Li, M. Oussalah, "Automatic face emotion recognition system". 2010 IEEE 9th International Conference.