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Emotion Based Music Recommendation system using AI and Deep Learning

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ABSTRACT: This work is to build a face emotion detection system which can analyze basic facial expression of human. The proposed method used the humans face to identify the mood of that human and finally using this result play the audio file which related to human's emotion. Firstly system takes the human face as input then the further process will going on. Face detection is carried out. After that using feature extraction technique to recognize the human face. This method helps to recognize the human's emotion using feature of face image. Through the feature extraction of lip, mouth, and eyes, eyebrow, those feature points are found. If the input face wills matches exactly to the emotions base dataset face then we can identify the humans exact emotion to play the emotion related audio file. Also we recommend the music based on detected mood. Recognition under different environmental conditions can be achieved by training on limited number of characteristics faces. The proposed approach is simple, efficient, and accurate. System play's very important role in recognition and detection related field.

KEYWORDS: Face Detection, Feature Extraction, Face Emotion, Recommendation, ML, AI

I. INTRODUCTION

Mood detection based on emotion is the one of the current topic in the various fields which provides solution to various challenges. Beside 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. For the any face and mood detection system database is the most important part for the comparison of the face features and sound Mel frequency components. For database creation features of the face are calculated and these features are store in the database. This database is then use for the evaluation of the face and emotion by using different algorithms.

Emotional aspects have more impact on social intelligence like communication understanding, decision making and also helps in understanding behavioral attitude of human. Emotion play important role during communication. Emotion recognition is implemented out in diverse way; it may be verbal or non-verbal. Voice (Audible) is verbal way of communication & Facial expression, action, body postures and gesture is non-verbal form of communication. Human can recognize emotions without any meaningful delay and effort but recognition of facial expression by machine is a big challenge.

One of the most interesting areas of human computer interaction is face detection and identification. Distinguishing facial features are comparatively low and it is most interesting task to observe these. Detection and identification face objects from face is a challenging task.

Finding a human emotion using human's face which can be one of the most challenging assignments you will handle in your career. A face is the best way to detect and recognize a human. No recognition algorithms will work without face detection step. Rate of detection affects the recognition stage. With all these noise is a very intriguing task to detect and localize an unknown non-face from still image. Face emotion detection applications is still a challenging task since face images may be affected by changes in the scene, such as pose variation, face expression, or illumination. The main goal to propose this system is to find the human mood with the help face image as input and after that using

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these emotion results to play the audio file. A face recognition technique which is used here to matches the train face image to the original input face image.

The proposed approach is simple, efficient, and accurate. This system gives accurate result as compare to existing approach. System play's very important role in recognition and detection related field. That is this gives important result very quickly as compare to traditional methods. [1].

II. RELATED WORK

Presented work is the extraction and emotion classification of face image. Various algorithms of facial expressions research are compared over the performance parameters like recognition accuracy, number of emotions found, Database used for experimentation, classifier used etc [1].

Presented system automatically identifies the facial expression from the face image and classifies emotions for final decision. The system uses a simplified technique called `Viola Jones Face Detection' technique for face localization. The different feature vectors are club together using a subset feature selection technique to improve the performance of recognition and classification process. Finally the combined features are trained and classified using SVM, Random Forest and KNN classifier technique [2].

The presented technique use three steps face detection using Haar cascade, features extraction using Active shape Model (ASM) and Adaboost classifier technique for classification of five emotions anger, disgust, happiness, neutral and surprise [3].

In this work implement an efficient technique to create face and emotion feature database and then this will be used for face and emotion recognition of the person. For detecting face from the input image we are using Viola-Jones face detection technique and to evaluate the face and emotion detection KNN classifier technique is used [4].

This work objective is to display needs and applications of facial expression recognition. Between Verbal & Non-Verbal form of communication facial expression is form of non-verbal connection but it plays pivotal role. It expresses human related or filling & his or her mental situation [5].

In this presented system it is attention on the human face for recognizing expression. Many techniques are available to recognize the face image. This technique can be adapted to real time system very easily. The system briefly displays the schemes of capturing the image from web cam, detecting the face, processing the image to recognize few results [6].

In this work, adopt the recently introduced SIFT flow technique to register every frame with respect to an Avatar reference face model. Then, an iterative technique is used not only to super-resolve the EAI representation for each video and the Avatar reference, but also to improve the recognition performance. Also extract the features from EAIs using both Local Binary Pattern (LBP) technique and Local Phase Quantization (LPQ) technique [7].

In this study, a frame of emotion recognition system is developed, including face detection, feature extraction and facial expression classification. In part of face detection, a skin detection process is support first to pick up the facial region from a complicated background. Through the feature detection of lip, mouth, and eyes, eyebrow, those feature points are launch [8].

In this work, a new technique for facial emotion recognition is found. The proposal involves the use of Haar transform technique and adaptive AdaBoost technique for face identification and Principal Component Analysis (PCA) technique in conjunction with minimum distance classifier for face recognition. Two techniques have been investigated for facial expression recognition. The former relies on the use of PCA and K-nearest neighbour (KNN) classification technique, while the latter advocates the use of Negative Matrix Factorization (NMF) and KNN technique [9].

III. PROPOSED SYSTEM

The proposed approach used humans face to detect the emotion and finally using this result to play the audio file which related to human's emotion. Firstly system takes the human face image as input. In image preprocessing step, we remove the noise of image and then convert it into grayscale. After that face detection is carried out. Then using feature extraction techniques to recognize the human face for emotion detection. These techniques help to detect the human's emotion. Through the feature detection of lip, mouth, and eyes, eyebrow, those feature points are found. If the input face wills matches exactly to the emotions based dataset's face then we can detect the human's exact emotion to play the emotion related audio. Also we recommend the music based on detected mood. Detection under different environmental conditions can be achieved by training on limited number of characteristics faces.

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ADVANTAGES PROPOSED SYSTEM:

1. Face detection and cropping
2. Detection the mood of human using human face image features.
3. Play audio file using ML based on human mood.

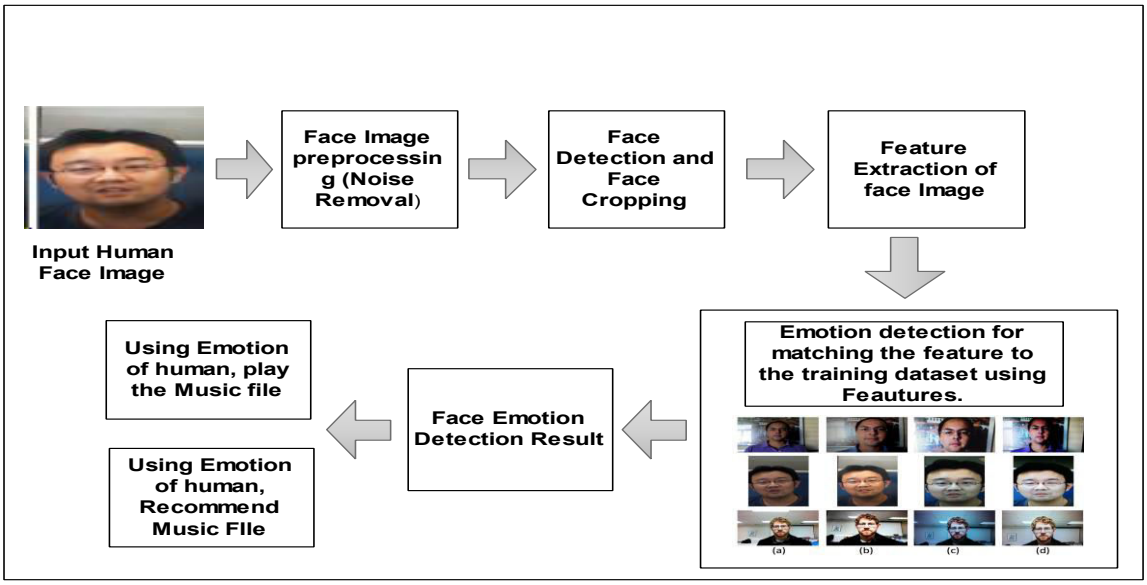

Fig1. Proposed System Architecture

IV. METHODOLOGY

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).
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.
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:

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

$$\sigma_i = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(P_{ij} - \mu_i)^2}$$

$$S_i = \left[\frac{1}{N}\sum_{j=1}^{N}\left(P_{ij} - \mu_i\right)^3\right]^{\frac{1}{3}}$$

Where, Pij is the value of the i^{th} color channel of the j^{th} 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.

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2. Mathematical Equations of Canny Edge Detector Method

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

$$g(m,n) = G_{\square}(m, n) * f(m, n)$$

Where

$$G_{\square} = \frac{1}{\sqrt{2\square\square^2}} \exp\left(\frac{m^2+n^2}{2\square^2}\right)$$

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

$$M(n, n) = \sqrt{g_m^2\ (m,n) + g_n^2\ (m,n)}$$

And

$$\boldsymbol{\theta}(m, n) = tan^{-1}\left[g_n(m, n) / g_m(m, n) /\right]$$

Step3: Threshold M:

$$M_T(m, n) = \begin{cases} M\ (m,n)\ if\ M\ (m,n) > T \\ 0 \qquad\qquad Otherwise \end{cases}$$

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.

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

VI .DATASET DESIGN

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

VII .RESULT

Let us consider the face image in figure 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.

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Fig. 1 Input Face Image

Fig. 2 Gray Image

Fig. 3 Noise Removed Image

Fig. 4 Face Detected 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.

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. 5 Face Crop Image

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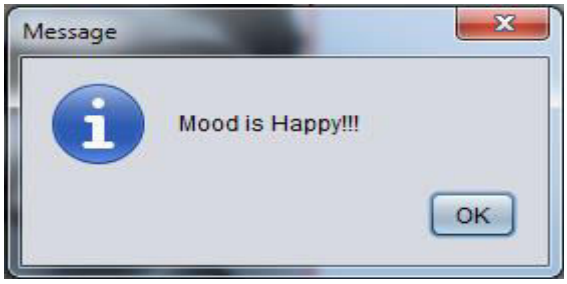

Fig. 6 Mood Detection

Play audio file using Python based on human mood.

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

Table: Mean Variance and Skewness Table

Mood	Features	Results			
		Input 1	Input 2	Input 3	Input 4
Happy	Mean	84.73	97.62	84.67	116.30
	Variance	4878.07	3704.32	5086.78	4364.88
	Skewness	-6.32	-6.62	-7.12	-5.25
Sad	Mean	69.24	98.15	92.53	141.76
	Variance	2928.70	3548.83	3354.24	6918.48
	Skewness	-10.24	-7.84	-8.36	-4.04

Result Graph:

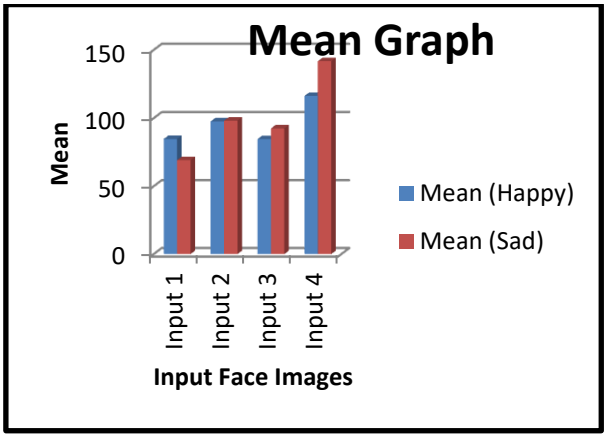

Fig. 7 Mean Graph

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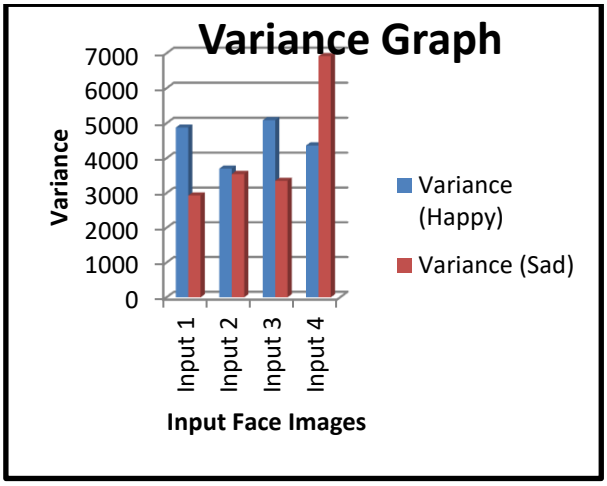

Fig. 8 Variance Graph

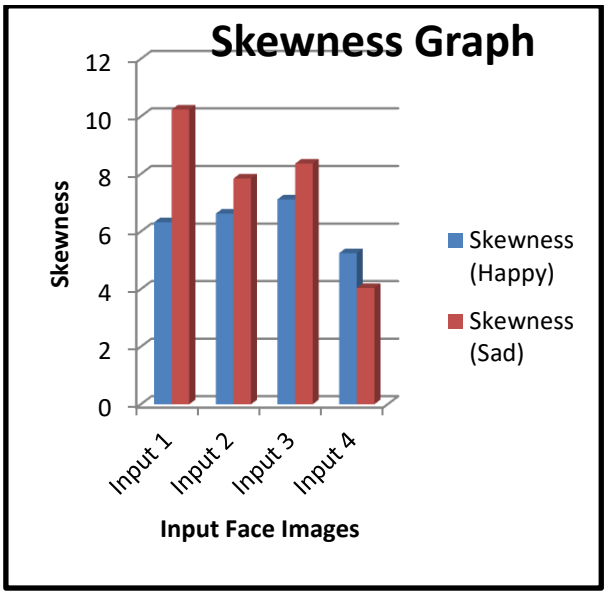

Fig. 9 Skewness Graph

VIII .CONCLUSION

Proposed work based on human emotion detection which implements a feature extraction algorithm. For the detection of human emotion using the face image, extraction of the feature information and matching the features to the training emotion's based human face dataset. After that using these results system played the audio which is the additional work. Also we recommend the music based on detected mood. The work can further be extended for improving the recognition accuracy as well as time for large face databases. So our system can perform the very important role in human emotions based emotion detection.

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