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# MoodyPlayer : A Music Player Based on Facial Expression Recognition

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**Abstract -** *The most essential component of an individual's body is the human face and it acts as the main indicator for the behavioral and the emotional state of the individual. Information can be extracted from the human face in the form of facial features which can then be processed and trained to identify the mood of the individual. For recognition of an individual's mood, the system uses Facial Expression Recognition (FER) concept and depending on the recognized mood, song is played. This system eliminates the time-consuming and the tedious work of manually playing the songs from any playlist available on the Web or in any other Application. For face detection, the system utilizes the Viola-Jones (VJ) Algorithm along with Bounding Box technique while for the purpose of feature extraction Principal Component Analysis (PCA) is used along with the concept of finding the minimum Euclidean distance which classifies the mood of the individual.*

***Key Words***: **Facial Expression Recognition (FER), Feature Extraction, Viola-Jones Algorithm, Principal Component Analysis (PCA), Euclidean Distance, MATLAB, GUIDE (GUI Development Environment), Computer Vision System Toolbox.**

## 1. INTRODUCTION

Music has been proven to be an integral part of everyone's life. It acts as a source for entertainment and also used for various medical needs as it is proven to be a Stress Reliever. With the increasing advancements in the field of Multimedia in recent times, there are numerous high-end music players available with the latest features of handling the volume, modulation, pitch, sound, genre, etc [1]. Though these features are very useful for the users but sometimes it becomes quite irritating and time-consuming to manually browse through the playlist for the intended song which user wants to play based on his/her mood and emotional state. For the purpose of providing the users with the best possible and effortless pleasure of music, Facial Expression Recognition (FER) based systems have been adopted as they provide more fast, accurate and efficient results with less effort. With the world moving towards fields like Artificial Intelligence(AI) and Machine Learning(ML), our aim is to provide the users a platform through which on their current mood, music is played using Facial Expression Recognition.

### 1.1 Facial Expression Recognition (FER) System

Facial Expression Recognition uses the concept of Dimensionality Reduction where higher-dimensional features are converted into lower-dimensional ones. It firstly detects the face from the input image provided by the user following which facial features like Eye Pair, Nose and Mouth are extracted which are helpful in classifying the facial expression of the individual as Happy, Sad, Neutral, Disgust or Anger [2].

## 2. LITERATURE SURVEY

Emotion based music players are the need of the hour and will provide a boon to the fields of Emotion Intelligence, Medical Science and Psychology. In recent times, techniques such as Neural Networks (NN), Support Vector Machines (SVM), Local Binary Patterns (LBP) have also been used. We analyze these techniques which are in association with our application.

Using Image processing, an input like capture image or frame can be applied the result of which is the set of objects [3]. Human beings have an ability to express their emotions in different ways as Surprise, Sadness, Anger, Happiness and Disgust. The system follows three steps:

i. Image capture.

ii. Face detection along with Facial feature extraction–receiving the cropped essential facial components like Eyes, Lips and Eyebrow.

iii. Submitting to ANN(Artificial Neural Networks) to perform separately.

A system using a supervised learning approach can be implemented which receives images of various facial expressions during training phase along with the ground truth values as the inputs [4]. The face detection is performed using the Haar classifiers following which block LBP histogram features will be obtained from facial images. PCA is then used for reducing the data dimensions by finding Eigen directions. For detection, calculation of the block LBP histogram features and the feature vector classification using PCA for every class is performed. Class classification is done by calculating the minimum reconstruction error.

Support Vector Machines (SVM) considers the classification issue as a quadratic optimization problem. It standardizes classification risks like text classification and also medical diagnosis [5]. The vital points on face are considered as the input for SVM training following which the emotion is recognized efficiently.

The system has four vital components :

i. Image importing along with processing which acts as the input to SVM.

ii. Including SVM into the system application.

iii. Training the SVM.

iv. Presenting the output classified by SVM in understandable way.

## 3. SYSTEM OVERVIEW

The system requests for the user to provide it with his/her image for which the mood can be recognized. After receiving the image, the pre-processing of image is carried out where the image is enhanced because the face detection phase needs a clear image without any noise or blurriness for processing. Face detection is done with the help of the Viola-Jones algorithm alongside Bounding Box technique for detecting the essential facial features.

A image dataset is used for the purpose of training phase which consists of various images labeled in an appropriate manner for every emotion making up for a large collection of images. The user provided test image is then trained with the dataset images and with the help of minimum Euclidean distance to classify the mood of the user in action.

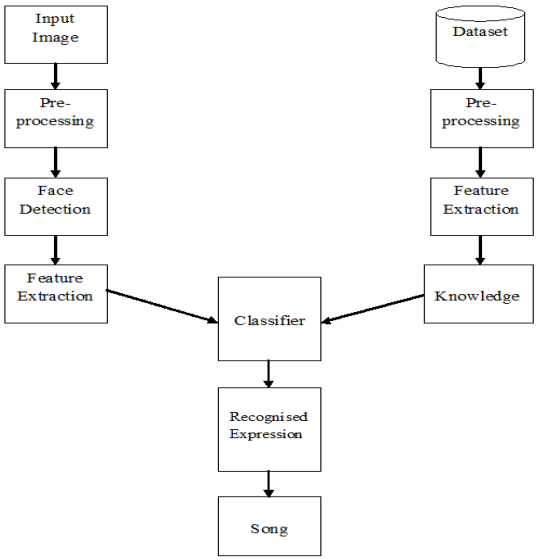


Fig. 1 System Overview

### 3.1 SYSTEM REQUIREMENTS

For the system, MATLAB is used as the platform for entire development purpose as it supports numerical computation, matrix based calculations, algorithm implementation and creating user interface.

GUIDE (GUI Development Environment) provides the system developer various tools for user interface designing. GUIDE Layout Editor helps in designing UI graphically without much effort.. GUIDE automatically generates the corresponding code for constructing the UI.

The Computer Vision System Toolbox provides algorithms and functions to design as well as simulate computer vision and video processing systems. Feature detection and extraction, matching along with object detection and tracking are also supported.

The users will need to have well functioning computer system ensuring approximate RAM, processor, Hard Drive and Operating System requirements.

## 4. SYSTEM METHODOLOGY

The system consists of various phases including processing, analyzing and recognizing the most essential entities which are mandatory for the mood recognition of the individual user.

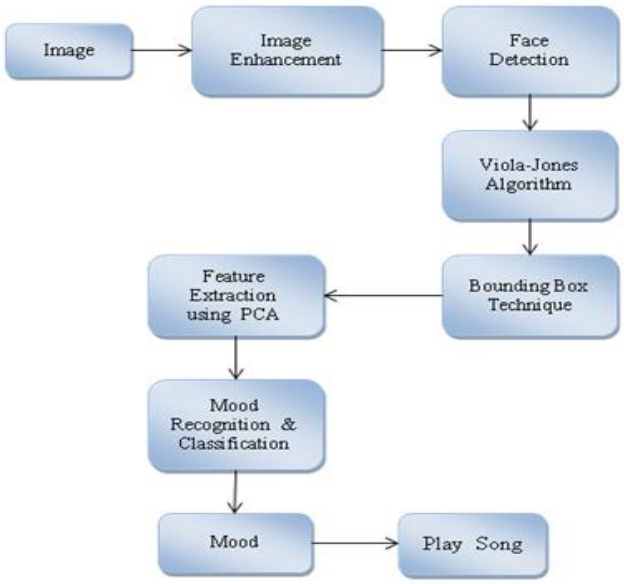


Fig .2 System Flowchart

### A. IMAGE ENHANCEMENT :

The primary task is to acquire the image from the user which is to be processed further for which the mood is to be recognized. The input image format will be in the .jpeg format. Here noise and blurriness is removed from the image following which the image is converted from RGB to Grayscale and then resized into 256*256 pixels.

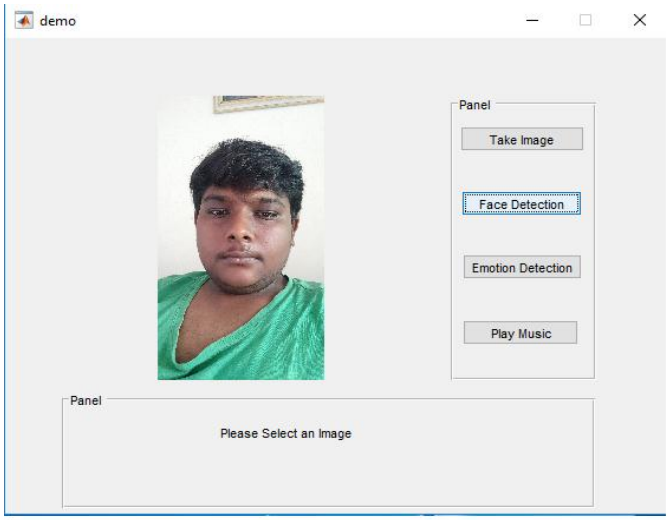


Fig .3 Image Acquisition

**B. FACE DETECTION :**

In this module, Viola-Jones(VJ) Algorithm creates a detector for detecting the facial images and the Bounding Box technique which is used to create a boundary around the essential detected objects like Mouth, Nose and Eye pair. These detected objects are considered by the feature extraction phase for further processing.

To detect the faces from the input image [6], a system object (facial) detector is created with the help of command used by the Viola-Jones algorithm is :

detector vision.CascadeObjectDetector('image1.jpg')

Once the object detector is created, step method is called with the help of following syntax:

BBOX=step(detector, I)

Which outputs BBOX which is M*4 matrix consisting of M bounding boxes having the detected objects [6].

To use the detector obtained, the steps are done:

i. Open desired image.

ii. Create detector object.

iii. Identify faces from the images.

iv. Annotate faces.

v. Display the images with annotated faces.

With Viola-Jones algorithm, the side-faced images or the images consisting of faces in any other direction except the frontal view will not be detected by the algorithm.

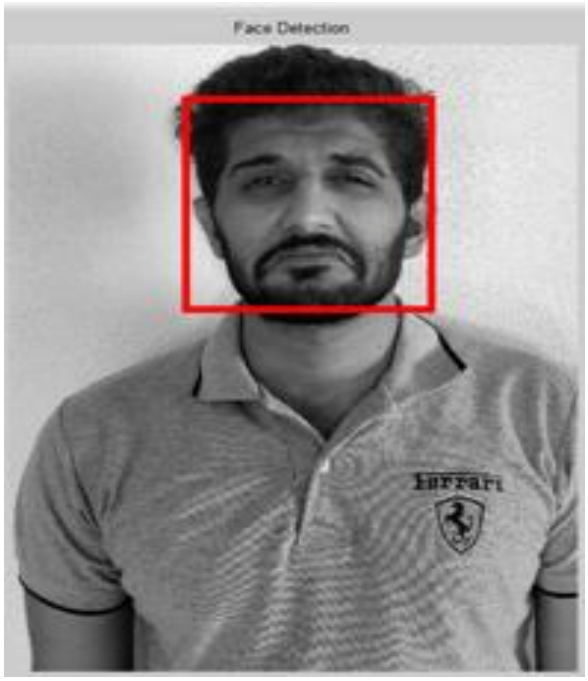


Fig.4 Face Detection using VJ algorithm

Fig.5 Bounding Box technique


Fig.6 Feature Detection using GUI

### C. FEATURE EXTRACTION AND EMOTION CLASSIFICATION :

This module consists of the PCA approach in which higher dimensional images are converted into lower dimensional ones, thus retaining the primary image information [7].

For using the PCA approach, following steps are performed:

i. The images are chosen from the training dataset.

ii. The average face i.e. mean is calculated and are then subtracted from training dataset images, output of which is matrix say X.

iii. By calculating XX', the Covariance matrix of X is found.

iv. From the covariance matrix, Eigen vectors are obtained by calculating Eigen values.

v. Reduced Eigen face is created.

vi. Eigen faces are calculated from the test image.

vii. From the input test image and the Eigen faces in the dataset, Euclidean Distance is calculated.

viii. The closest and the best-match is found after getting the minimum Euclidean distance.

ix. Classification of the current mood of the user is done from the image with minimum Euclidean distance.

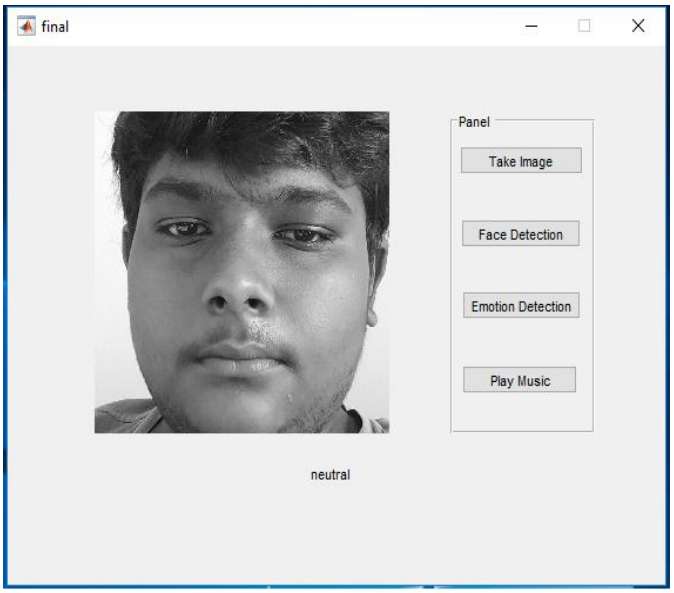


Fig.7 Feature Extraction and Mood Classification

### D. PLAY MUSIC :

After the mood of the individual is classified the song corresponding to the recognized mood is played by the system.

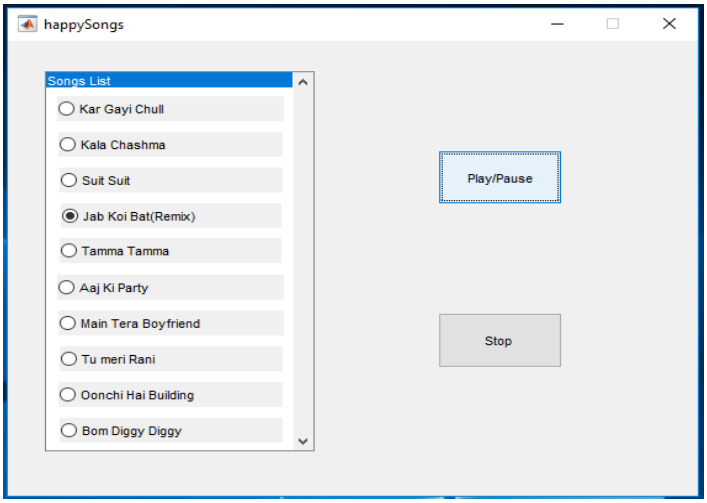


Fig.8 Play Music

## 5. RESULTS AND ANALYSIS

The system goes through various stages in order to get the required result. The test image which is provided by the user is considered for facial expression recognition which exactly matches with the images contained in the training dataset.

A survey regarding the emotions in the dataset images was conducted and the responses received from the users in the below table :

Table 5.1 Survey Analysis

| Facial Expression | No of Images | Predicted | Percentage |
|---|---|---|---|
| Happy | 13 | 12 | 92.3 |
| Sad | 09 | 09 | 100 |
| Disgust | 11 | 10 | 90.9 |
| Anger | 10 | 10 | 100 |
| Neutral | 07 | 06 | 85.7 |

Total = 94%

The system was also tested with Amazon Alexa by asking it regarding the mood and it played songs based on the mood i.e. it played sad song if a person is sad but our system plays motivational song for sad emotion.

The accuracy of system solely depends upon the extracted features during processing as those are the most necessary components in recognizing the mood of the individual. PCA approach makes use of the concept of

Euclidean distance with the help of which the final outcome attains an accuracy level of about 86.67%.

## 6. CONCLUSION AND FUTURE SCOPE

The system works using the principle of FER to play song based on recognized mood of the individual. It makes use of Viola-Jones (VJ) algorithm alongside PCA approach to extract essential facial features. The system eradicates the need of browsing through the Web or any other Mobile Application for desired song and ensures correct song is played for current mood of user.

The future scope for this system would be to implement it on Mobile platforms like Android or iOS, as there has been increase in the number of Mobile phone application users worldwide. Also in the work, at a time only one emotion is recognized so system design can be extended to a mixed mood recognition system which will further enhance the functionality and accuracy of the overall system. This system is applicable in various fields like Medical Science and Psychology as it will be helpful in Music Therapy treatment for music therapists to treat their patients suffering from depression, mental stress, fatigue and trauma. This can be also useful to identify the mood of a physically disabled person as we can understand their needs and help them accordingly.

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