MUSIC RECOMMENDATION SYSTEM BASED ON FACIAL EXPRESSIONS

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Abstract: Recent research and reports affirm that people react constantly to music and that music profoundly affects an individual's cerebrum action. This undertaking revolves around making an application to recommend music for users dependent on their mood by catching their facial expressions. Our Purposed System predominantly revolves around the strategy for identifying human emotions or their mood in a music player. In this system, computer vision algorithms (Open-CV) are utilized to decide the user's mood through their facial expressions. When the mood is recognized, the system recommends a playlist for that mood, saving a great deal of time for a user over searching and choosing a playlist and then playing melodies by themselves.

Index Terms - **Face Detection, Emotion detection, Haar cascade classifier, Open-CV, Machine Learning and fisher face Algorithm.**

I. INTRODUCTION

People tend to link the music they listen to, the emotion they are feeling. Research has shown evidence that music and music therapy have proved to increase socialization and cognitive and emotional functioning. The reports have found that an average person spends close to 12 to 18 hours a week listening to music. That means 2.6 hours daily. It would be helpful if the music player was "smart enough" to sort out the music based on the current state of emotion or mood of the person. Moreover, people have huge playlists or database of songs and hence most of the people just end up randomly selecting a song from their playlist which may not be appropriate for the current mood of the user, which ends up disappointing the user. Moreover, there is no commonly used application which is able to play songs based on the current mood of the user.

For the system that has been purposed, facial expressions play a significant role in determining the user's emotion. Depending upon the various facial expressions of users, the system determines the mood with the help of Machine learning Algorithms. Once the mood is recognized, the system suggests a playlist for that determined emotion, saving time for a user over selecting and playing songs physically.

The proposed system uses Haar cascade for face detection by capturing images of user's face as an input. The Emotion Recognition Module makes use of Fisher face classifier to identify their mood. The Music Recommendation Module suggests a playlist to the user depending upon the mood which is recognized.

II. LITERATURE SURVEY

Use of Haar Cascade Classifier for Face Tracking System in real time video, which is a paper [1], K. H. Wanjale, Amit Bhoomkar, Ajay Kulkarni and Somnath Gosavi purposed a system which detects faces in real time from a webcam or any video camera with help of Haar cascade classifier which is an Open-CV Algorithm.

Human face Recognition using LBPH [2] explains Haar Cascade classifier method of Open-CV library in detail and how the classifier is useful for face detection and Recognition.

In paper [3] Mahima Chandane, Ankita Chavan, Renuka Kamath, Dipali Madane and Madhuri Badole, in Intelligent Music Player Based on Emotions, purposed a Music System which can detect emotions of the user with the help of Fisher face Algorithm.

Paper [4] Emotion Recognition using facial Expression, explains different techniques and algorithms which can be used in face and emotion detection.

Paper [5] Emotion Based Music Player, elaborates about their purposed system with help of Haar Cascade Algorithm and how the system extracts facial features to recognize the mood.

Emotion based Music playing device [6], Purposed system is implemented with help of Raspberry Pi and software requirements of Open-cv, Tensor flow & numpy.

Paper [7] A Human Facial Expression Recognition Model based on Eigen Face Approach, tells how Eigen face classifier can be used to recognize the emotion by calculating the Euclidean distance between the input test dataset images and the mean of the eigen faces of the training images.

Paper [8] Emotion Based Music Player – X beats, explains the mobile application purposed with help of Image Processing. This application captures, analyze and presents music as per the emotion or mood of the user.

Paper [9] Yong-Hwan Lee, Woori Han and Youngseop Kim, proposed a system based totally on Bezier curve fitting. The system consists of two phases, for facial expression and emotion detection, first one is detection and analysis of facial features from the input image and the next phase is verification of facial emotions of characteristics feature within the region of interest.

III. PROBLEM STATEMENT

In this technology-based world, everyone needs their work to be done quickly without much of an effort as technology is so advanced. Various music players are developed with many features such as fast forward, reverse, variable playback speed, local playback, genre classification, etc. [6]. All these features may satisfy the user's basic requirements, but users ought to choose songs every time based on their mood or interest. This System overcomes the problem of searching and finding a song which matches the user's current mood, allowing them to play a mood based playlist and eliminating the time which is required for searching a playlist.

IV. IMPLEMENTATION

The purpose of the system with the help of machine learning algorithms is to provide an interactive way for the user to play songs according to their emotional state or current mood. It aims to provide an easy-to-use system for the users with simple and non-complex design and a way to build a bridge between emerging technologies and music.
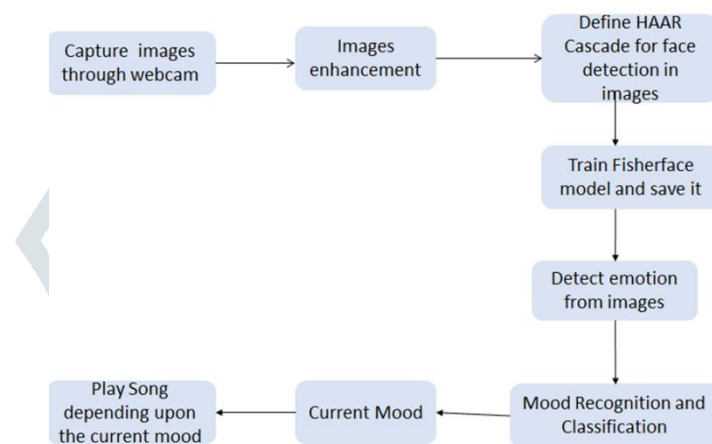

Fig. 1 Flow of Purposed System

FACE DETECTION:

Open source is a library which is dedicated to easing the implementation of computer vision related program called Open Computer Vision Library (Open-CV) and is used in conjunction with applications that relate to the fields of HCI, robotics, image processing, and other such regions where visualization is significant and includes an implementation of Haar classifier detection and training [1]. This Library gives multiple numbers of functions for face recognition and facial detection. If anyone wants to train their own classifier for any object like mobile, Cars, etc. they can to create one with help of Open-CV [5]. This Library provides a pre-trained model called as Haar Cascade classifier, which is used for detecting the Face in an image. The aim of this classifier is to detect an object form the input image. The training can be performed by overlaying the positive images over a collection of negative images [2]. Positive images contains the images of the object that is supposed to be trained & negative images are the images of everything else, which do not contain the object we want to detect, like the surrounding of the object. This System makes use of haar cascade frontal face_default.xml file to detect the object which is face from the input images.

EMOTION DETECTION:

Fisher face Algorithm provided by CV2 library is used for detecting the mood of the user. This algorithm works on the concepts of LDA and PCA techniques. Linear discriminant analysis (also known as LDA) is a Learning method of machine learning. Principal Component Analysis (also known as PCA) can be said to be one kind of conversion from correlated variables to un-correlated mathematical values. Fisher face maximizes between-class variance and minimizes within-class variance. C class is the face with mean of class j denoted by $\bar{N}_j$ and the ith image in class j denoted as x_i^j . Scatter matrix are s_b and s_w respectively and they are calculated as shown below [4]:

$$s_b = \sum_{j=1}^{c} \left(\left(\bar{N}_J - N\right)\left(\bar{N}_J - N\right) \right)^T$$

$$s_w = \sum_{j=i}^{c} \sum_{i=1}^{N_J} (x_i^j - \bar{N}_j)(x_i^j - N)^T$$

$$W_{fisher-Descriminant} = argmax \left| \frac{W^T S_b W}{W^T S_w W} \right| [4]$$

Fisher face extracts principle components that help in separating one individual from another. An individual's features can't dominate another individual's features. Image recognition using this algorithm is primarily based on reduction of face area dimensions using PCA technique and then additionally applying LDA technique called as Fisher Linear Discriminant method to

attain characteristic attributes of an image. LDA is used to find a linear combination of features that splits two or more classes. It might be useful for dimension reduction, before further classification. It makes an effort to find the difference among classes of data [3]. The purposed system includes four emotions namely Angry, Happy, Neutral and Sad. Playlist of songs are made considering these four emotions.

MUSIC RECOMMENDATION:

Linking of python (back end) with java script is done with the help of EEL library which provides the privilege to access python methods from JavaScript. EEL library of python is like a connection between back end and front end of the purposed system. In the purposed system, each emotion has a set of songs assigned to it. When a particular emotion is recognized by the system, it plays that set of songs which are assigned to that respective emotion.

V. RESULTS

The main goal of this system was to successfully recognize the emotion by recognizing their facial expressions. The Fisher face algorithm which is tested on the dataset gave a very satisfying result. For the model that has been purposed with the help of Fisher face Algorithm, Happy was the most accurately identified emotion, followed by anger, Neutral and finally Sad with an accuracy rate of 95%, 92%, 86% & 80% respectively. The accuracy results are based on the confidence and prediction values during the testing phase. In this, the lowest the confidence value, the more the accuracy is considered.

Table 1 Testing & Confidence

Emotions	Testing Size	Confidence value
Angry	64	91.276
Happy	64	77.752
Neutral	64	94.074
Sad	64	211.021

Comparing to an existing model, of which the training is done by Eigen face classifier, the following graph shows the accuracy rate of each emotion with help of fisher face and eigen face algorithms. It is a bit surprising that both algorithms performed average at recognizing Sad emotion, as this emotion is often considered as a primary emotion.
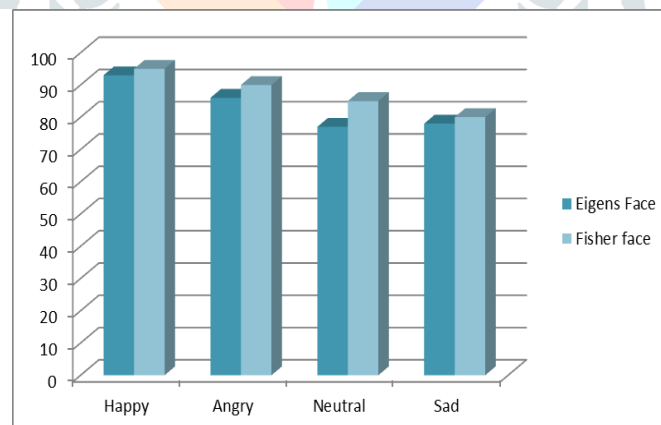

Fig. 2 Emotion Accuracy

VI. CONCLUSION

The mood based music player is utilized to give a superior music player experience to the end users. It simplifies the work of the user by capturing the image using a camera, recognizing their emotion, and suggesting an emotion based playlist through a more advanced and interactive system. It will help to reduce the searching time for music which will match their current feeling by decreasing the unnecessary processing time.

The future extension in the system would be to plan a component that would be beneficial for music therapy and may also assist the music therapist to cure a patient. It can also be used for facial recognition of people for authentication purpose.

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