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A Survey on Emotion Detection through Facial Expressions Based Music Player

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ABSTRACT: Music has the power of healing an individual as quoted by Ray Charles. Music plays a very important role in recognizing an individual's emotions and state of mind; it is a great way for people to express themselves as well as it is an important medium of entertainment for music lovers and listeners. Listening to music helps us relax and calm down. Music is also considered to be the most effective medium as it can induce deep feelings with some kind of message in it. With the advancement in technology, the number of artists, their music, and music listeners all are increasing, and here comes the problem of manually browsing and choosing the music according to their mood or choice. This is where our project comes into the role, as we all know to face an organ of the human body which plays a vital role in extracting human behaviours and their state of mind. Our project detects the mood of the user and plays a song or playlist according to his mood. The project uses a web camera to capture the image of the user, it then classifies the facial expression as happy, sad, neutral, or angry and then plays the song according to the input image. The major advantage of this project is that the user doesn't need to implement and choose songs manually.

KEYWORDS: Face detection, Face identification, Face verification, Facial expression, Music classification, Music Recommendation

I. INTRODUCTION

Facial expression is an important form of emotional state and mental state. Psychologist Mehrabian's research shows that only 7% of the total information is passed by language, and 38% is transported by language auxiliary, such as the rhythm of speech, tone, etc. But the Ratio of information which passed by facial expression has reached 55% of the total. Therefore, a lot of valuable information can get by facial expression recognition that gives an effective way to the perceive person's consciousness and mental activity. Because of this, facial expression recognition, showing important theoretical research value, practical value and the life application value, has become an important research topic.

Roughly thirty years ago, music listeners have to listen to the radio, go to musical events, or buying cassettes to listen to their favourite music. At that time, music listeners did not have direct ability to decide which piece of music is going to be played next or music composition in a playlist (in a cassette or other media). In the 2000s, music listeners can listen to music digitally using devices such as computers or mp3 players and finally have a direct ability to create playlist and decide which music is going to be played.

Music listeners have a tough time creating and segregating the playlist manually when they have hundreds of songs. It is also difficult to keep track of all the songs: sometimes songs that are added and never used, wasting a lot of device memory, and forcing the user to find and delete songs manually. Users have to manually select songs every time based on interest and mood. User's also have difficulty to reorganize and playing music when playstyle varies. So, we have used Machine Learning concept which involves facial scanning and feature tracking to determine the user's mood and based on it gives a personalized playlist.

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BASIC TERMINOLOGIES

- **Face Detection**: Face detection is to determine that a certain picture contains a face we need to be able to define the general structure of face. Luckily human faces do not greatly differ from each other; we all have noses, eyes, foreheads, chins and mouths. all of these compose the general structure of a face. It is a concept of two-class classification: face versus nonface. Face detection can be regarded as a specific case of object-class detection. In object-class detection, the task is to find the locations and sizes of all objects in an image that belong to a given class. It can be understood as shown below:

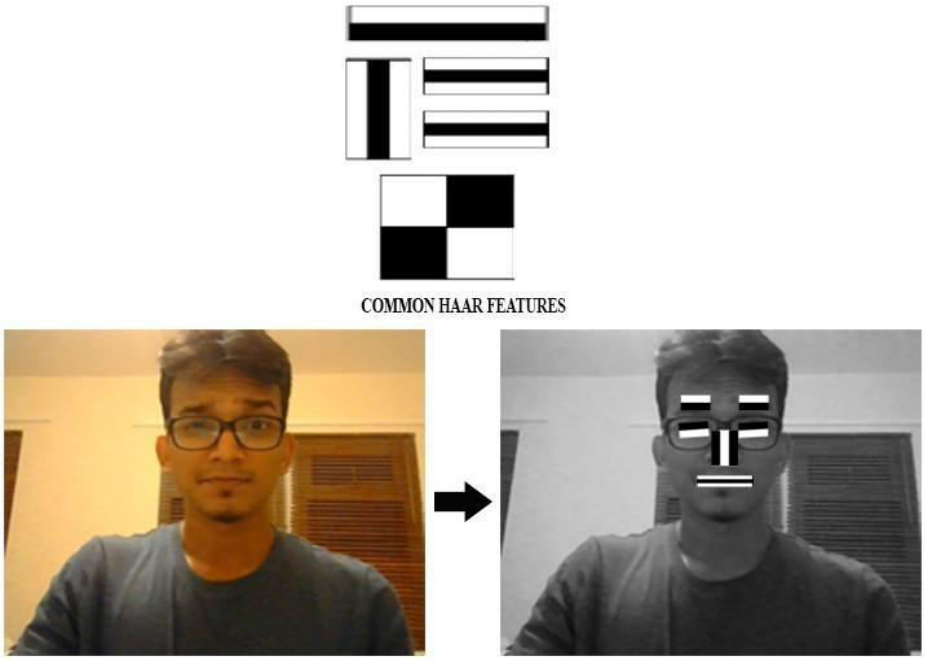

Fig-1: Object Detection

- **Face Identification:** In this the system compares the given individual to all the other individuals in the database and gives a ranked list of matches.
- **Face Verification:** In this the system compares the given individual with who that individual says they are and gives a yes or no decision.
- **Facial Expressions:** Facial expression is one or more motions or positions of the muscles beneath the skin of the face. These movements express the emotional state of the person to observers. It is a form of non-verbal communication. It plays a communicative role in interpersonal relations. The common ones are:

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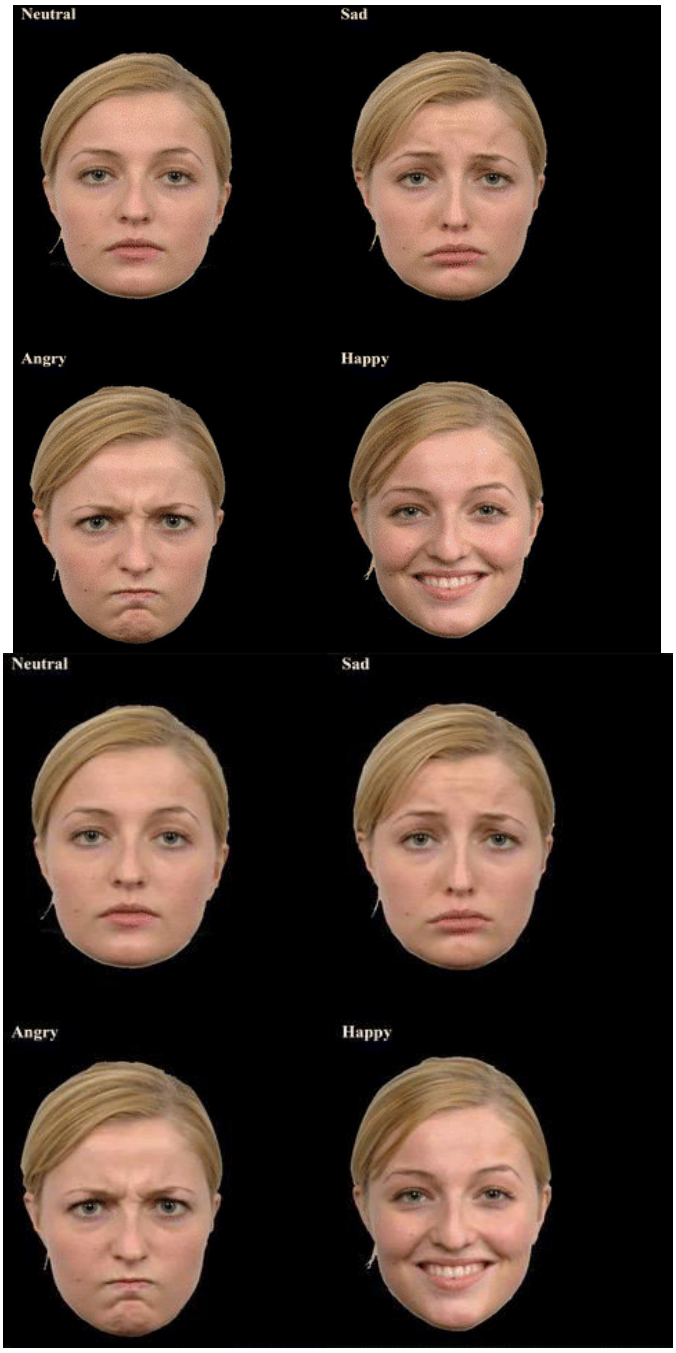

Fig-2: Facial Expressions

- **Music Classification:** Music emotion classification (MEC) is the multidisciplinary research area that is related to perceive the emotions from the songs and label the songs with particular emotion classes. MEC systems (MECS) extract the features from the songs and then the songs are categorized on the basis of emotions by comparing their features.

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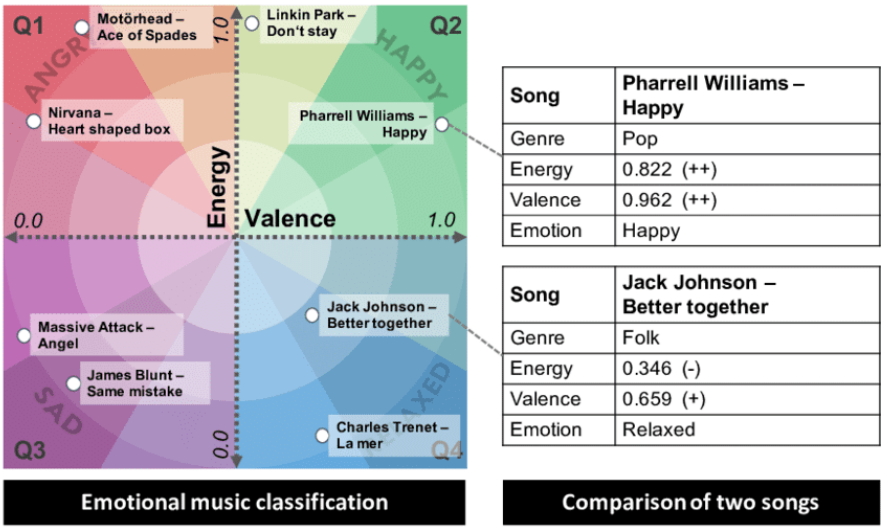

Fig-3: Emotion based classification

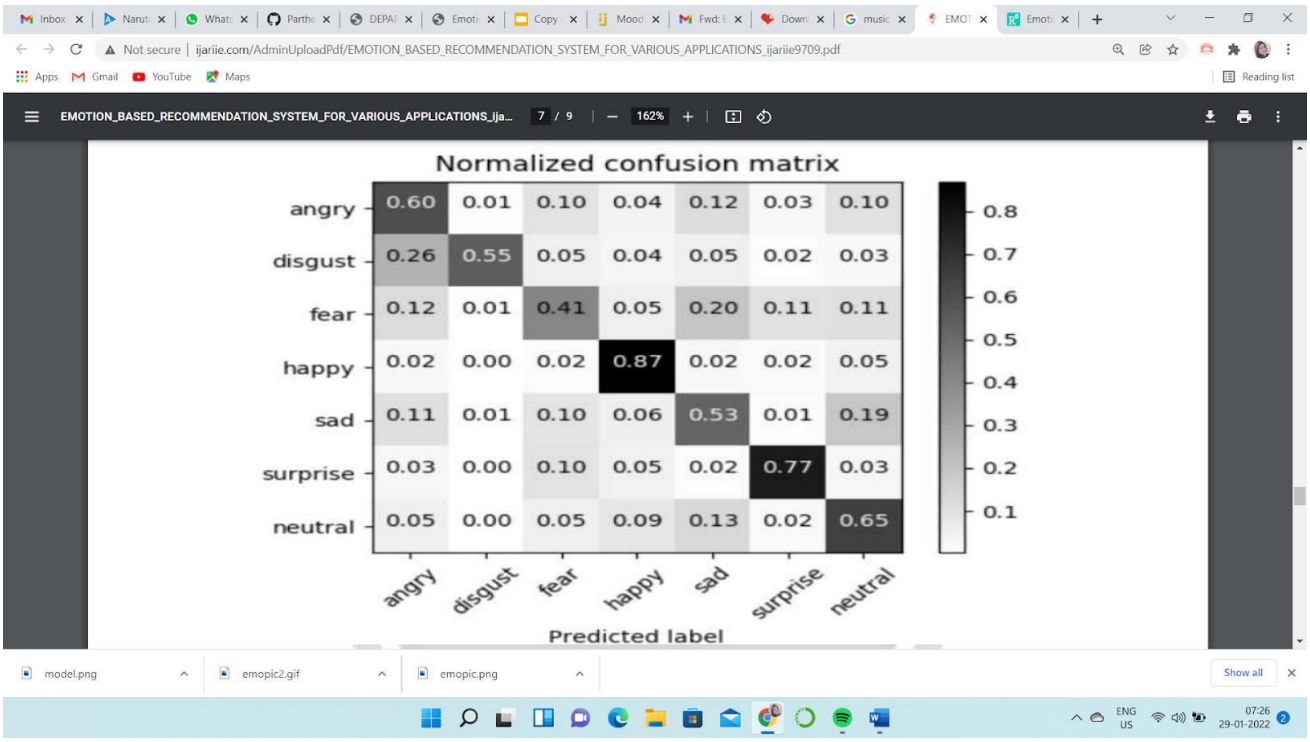

Fig-4: Confusion Matrix

- **Music Recommendation:** In this the system, according to the features extracted from the music we recommend the song matching with the emotion extracted from facial expression. Details of it will be mentioned in the following chapter, where we will also see how we plan on implementing the approach.

II. LITERATURE SURVEY

- **Sushmita G. Kamble and A. H. Kulkarni [1]**, they proposed a system in which they used PCA (Principal component approach) for feature extraction. To classify and recognize the expression Euclidean distance classifier was used. Then, the user's corresponding emotional state is recognized. When the user's expression is recognized,

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songs belonging to that category are then played. They used the database with 7 expressions of 4 individual's persons that results into 112 trained images.

- **Anuja Arora; Aastha Kaul; Vatsala Mittal [2]**, they submitted a program in which the DEAM data set was used to classify the emotions. It has more than 2800 songs with 4 emotions annotated: Happy, Sad, Angry and Relax, and with their values of valence and excitement. The idea behind this article is to pay attention to predicting emotions of an audio file as to how good audio elements are used in the music player.
- **H. Immanuel James, J. James Anto Arnold, J. Maria Masilla Ruban, M. Tamilarasan (2019) [3]** proposed "Emotion Based Music Recommendation" which aims at scanning and interpreting the facial emotions and creating a playlist accordingly. The tedious task of manually Segregating or grouping songs into different lists is reduced by generating an appropriate playlist based on an individual's emotional features. The proposed system focuses on detecting human emotions for developing emotion-based music players. Linear classifier is used for face detection. A facial landmark map of a given face image is created based on the pixel's intensity values indexed of each point using regression trees trained with a gradient boosting algorithm. A multiclass SVM Classifier is used to classify emotions Emotions are classified as Happy, Angry, Sad or Surprise. The limitations are that the proposed system is still not able to record all the emotions correctly due to the less availability of the images in the image dataset being used. Diverse emotions are not found. Handcrafted features often lack enough generalizability in the wild settings.
- **S. L. Happy and A. Routray [4]**, image from database is passed to the facial landmark detection stage to remove noise by applying Gaussian Filter or mask. Here itself they used Viola Jones technique of Haar-like features with Adaboost learning for face detection.The feature detection stage consists of Eyebrow corners detector, Eye detector, Noise detector, Lip corner detector. After this active facial patch are extracted, the classification of features is done by SVM (Support Vector Machine). While testing it will take the hundreds of images from the database and extract the features and classifies accordingly. They used CK+ (Cohn-Kanade) dataset and JAFEE dataset for training and testing the database. The training database consist of 329 images in total.
- **KrittrinChankuptarat,Raphatsak,Sriwatanaworachi, Supannada Chotipant [5]**,proposes a mobile music player application which is able to recommend songs based on the user emotion.When the application receives a user heart rate from a smart band or a face image from a mobile camera, it analyses what the user emotion is. Then, it suggests songs whose moods are relevant to that user emotion. The user and song emotions in this paper are divided into four types namely: neutral, happy, sad, and angry. The experimental results present that detecting the happy emotion is the most precise with around 98%, while the accuracy of the sad mood detection is the lowest with 40%.
- **Deepak Ghimire, Sung Wan Jeong, Joonwhoan Lee,Sang Hyun Park [6]**, the input images are selected from the training set. After this Landmark detection & Local representation will be done. By using LBP (Local Binary Pattern) algorithm, Local regions LBP features and Local Regions NCM (Normalized Centre Movement) features are extracted. Both the extracted features are added together, and all these are passed to the SVM (Support Vector Machine) classifier. CK+ dataset consisting of 593 sequences of different emotions from 123 subjects by using this dataset a human facial expression can be clearly identified. Only 327 out-off 593 sequences were given label for the human facial expression. They used at least two peak expression frames for anger, fear, sadness and one peak expression frame for disgust, happy, surprise. The system was trained with 6 types of facial expression
- **Cyril Laurier and PerfectoHerrera, MoodCloud [7]**, a real-time music mood visualization tool, Mood Cloud classifies music emotions into 5 types namely: aggressive, happy, party, relax and sad. It applies the SVM library to analyze the emotion dataset. The result is then presented by using a Flash player.
- **S Metilda Florence and M Uma (2020) [8]**, proposed a paper "Emotional Detection and Music Recommendation System based on User Facial Expression" where the proposed system can detect the facial expressions of the user and based on his/her facial expressions extract the facial landmarks, which would then be classified to get a particular emotion of the user. Once the emotion has been classified the songs matching the user's emotions would be shown to the user. It could assist a user to make a decision regarding which music one should listen to helping the user to reduce his/her stress levels. The user would not have to waste any time in searching or to look up for songs. The proposed architecture contained three modules, namely, Emotion extraction module, Audio extraction module and Emotion-Audio extraction module. Although it had some limitations like the proposed system was not able to record all the emotions correctly due to the less availability of the images in the image dataset being used. The image that is fed into the classifier should be taken in a well-lit atmosphere for the classifier to give accurate results. The quality of the image should be at least higher than 320p for the classifier to predict the emotion of the user accurately. Handcrafted features often lack enough generalizability in the wild settings.
- **Ali Mollahosseini, Behzad Hasani and Mohammad H. Mahoor (2017) [9]**, proposed "AffectNet: A Database for Facial Expression, Valence, and Arousal Computing in the Wild" where more than 1,000,000 facial images were obtained from the Internet by querying three major search engines using 1250 emotion related keywords in

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six different languages. About half of the retrieved images were manually annotated for the presence of seven discrete facial expressions and the intensity of valence and arousal.

- **Aayush Bhardwaj et al. [10]** detect emotion using Electroencephalography (EEG) signals. EEG signals are that it detects real emotions arising straight from our mind and ignores external features like facial expressions or gesture. Hence EEG can act as a real indicator of the emotion depicted by the subject. Independent Component Analysis (ICA) and Machine Learning techniques such as Support Vector Machine (SVM) and Linear Discriminant Analysis (LDA) to classify EEG signals into seven different emotions.

III. CONCLUSION

The project presents a generic model to recommend applications based on the user emotions. The core of our proposed approach is to construct the recommendation model from music, for music plays an important role in conveying emotions of the users. The aim of this paper was to explore the area of automatic facial expression recognition for implementation of an emotion based music player. Beginning with the psychological motivation for facial behavior analysis, this field of science has been extensively studied in terms of application and automation.

The Emotion Based Music System will be of great advantage to users looking for music based on their mood and emotional behavior. It will help reduce the searching time for music thereby reducing the unnecessary computational time and thereby increasing the overall accuracy and efficiency of the system. The system will not only reduce physical stress but will also act as a boon for the music therapy systems and may also assist the music therapist to therapize a patient. Most of the media player provide list of songs in users music library and option to select or search the song but it becomes increasingly difficult task. System will provide better enjoyment to the music listeners by providing the most suitable or appropriate song to the user according to his current mood.

In this paper, we present a proposed system and an approach for the automatic creation of mood based playlist. The proposed system will reduce the efforts of user in creating and managing playlist it will not only help user but also the songs are systematically sorted. The fundamental purpose of the system was to change or maintain the emotional state of the user and boost up the mood of the user by exploring music tracks or providing motivational quotes with specific attributes.

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