ENDRSING MUSIC ON FACIAL EMOTION

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Abstract –

The expressiveness of music is well acknowledged, as is the ease with which different forms of human emotion may be mapped onto different musical genres. It is common practise to analyse a person's facial expressions to ascertain their emotional state, whether it be joy, anger, sorrow, fear, melancholy, or kindness. Humans' health isn't the only thing that music can affect; it can also alter how we feel and how we're feeling at any given moment. The use of music to heal emotional and mental disorders dates back centuries. When music therapy is combined with face expression recognition, the resulting smart system may classify a music library according to the moods evoked by different styles of music and then offer a therapeutic playlist to the psychiatrist. Patients' face detection and emotion recognition methods are applied to the picture. Based on this assessment, a playlist of songs designed to soothe and relax the patient might be suggested.

Key Words:

Fisher face is a machine learning algorithm used in image processing, facial expression recognition, music genre classification, and music therapy.

INTRODUCTION

Observing a person's facial expressions, we may infer their emotional state. Learning such intelligence by a computer, robot, or mobile device would be very useful in the actual world. The expression of feelings via music is often seen as effective. Expressing one's emotions is seen as a crucial component of any effective therapy plan. It has been linked to mental health in both artistic and scientific writing, whereas repressing emotions has been linked to the onset of a wide range of conditions. Traditional musical therapy did not use any kind of computer or artificially intelligent system; rather, the therapist physically observed the patient to determine the patient's mood. The therapist learns the patient's emotions and then chooses music that will help calm him or her down. This was a difficult job that required more time and effort, and it was frequently difficult to find a suitable selection of tunes. Even if they do take into account the user's mood, the songs chosen while making a playlist will just reflect the user's current mood; they won't make any effort to improve it. Consequently, if the user is down, he will be presented with a list of songs that have sad feelings, which may further worsen his mood and lead to depression. Therefore, the system envisioned in this research may infer the user's mood based on his expressions. As soon as it detects that the user is feeling euphoric, it will provide them with a customised playlist of tunes.

Exposé of the Issue

As an adaptable treatment that can be tailored to each individual patient, our proposed Facial

expression-based music therapy is an improvement over conventional music therapy in a number of ways. Therapeutic options exist for a wide range of conditions, including pain, depression, stroke recovery, stress, and more. Better care may be provided to patients when medical professionals have access to more data regarding their mental health while they undergo therapy.

Liter REVIEW

Real-time EEG-based emotion detection for music therapy was suggested by Olga Souring and co-authors [1], using two primary algorithms: the Information collection algorithm and the Music therapy algorithm. The writers here make a distinction between several forms of treatment; the first of these addresses problems with pain by using music designed to elicit feelings of joy in the listener to divert his or her focus away from the source of that discomfort. The second therapeutic approach involves dealing with depression by playing music designed to elicit a succession of sad, happy, and fulfilled feelings in the listener. Those who suffer from anxiety might benefit from a third kind of treatment. Emotions may be identified by analysis of electroencephalogram (EEG) data. FD values of EEG might show the geometric complexity of the signals. It was shown that EEG

signals may be processed in real-time using FD to detect and classify a variety of mental states. Ludwick Konieczny-Nowak explored the connection between musical features and subjective emotional experiences, and she explored the ramifications of these findings for music therapy. There are at least three different techniques to make music emotional. The first kind of musical connections is called episodic associations, and it connects certain pieces of music with specific moments or memories from the listener's past. Second, the musical similarity to non-musical occurrences is mirrored in the visual arts. The best option, structural expectancies, implies that feelings originate from the composition's structural choices. Gestalt Therapy and Emotional Expression Psychotherapists that use the gestalt approach [2] centre their work on the client's subjective emotional life. Gestalt therapy strategies are grounded on an existential conversation between therapist and client.

APPROACH TO DESIGN

The design for this project can be broken down into three main sections: (1) extracting facial expressions from images using key image processing techniques and a machine learning approach; (2) identifying musical genres; and (3) selecting and playing the most effective music for therapy for a given patient. The webcam takes many snapshots. It's possible that having more than one face picture will help us make more accurate emotion predictions. Since blurred photos might be a source of mistake (particularly in low light), we average many photographs to remove the blur. Histogram equalisation is a method of image processing used to increase contrast by making all of the picture's values the same. After this, the picture is cropped and turned to grayscale to remove everything from the background but the foreground, which significantly clarifies the situation. Emotional recognition in music requires a collection of musical recordings. A local collection of songs is utilised to generate a small dataset for initial testing and training, and then a subset of the thousands-strong Song Dataset may be used for further testing and training. Python MIR programmes like Libro SA and Paddio Analysis are useful for extracting musical features. These python programmes help in the analysis and retrieval of musical aspects like pace, rhythm, timbre, etc., and are then utilised in conjunction with the lyrics to facilitate grouping through unsupervised learning, using the k-means method. When using this method effectively, the centroids must be established by hand in order to determine where the clusters will be formed. Once that's done, it's time to tag each song with descriptive terms that will aid in the search process when facial expression detection has been performed. Then, the music database may be accessed with the right descriptors to have the required music playlist generated mechanically.

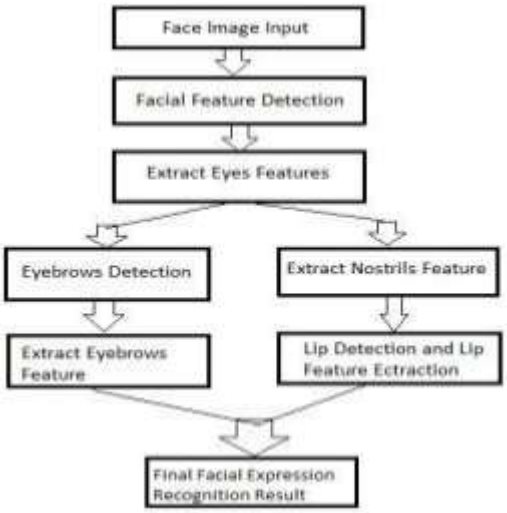
Extraction of Facial Characteristics:

Throughout the course of the appliance's operation, a photo will be captured that, after being pre-processed, will be expected to correspond to one of the emotion categories by the fisher face classifier. Additionally, the model is adaptable, letting the user change parameters to reduce categorical variation and leave just the variation due to subjective experience as a source of error. Method of Fisher Faces: When it comes to classification, Discriminant Analysis is the most effective method for reducing dimensionality. One of the most common kinds of Discriminant Analysis is the linear one. It's a technique for identifying a linear combination of attributes that may be used to categorise items into distinct groups. Therefore, it may function as a linear classifier in addition to a dimensionality reduction technique. When compared to principal component analysis (PCA), the between-class scatter is greater when using the Fisher faces method, which makes use of fisher's linear discriminant (FLD). A key goal is to improve the inter-class dispersion in comparison to the intra-class scatter. This is what causes the formation of dense clusters. Because the training dataset is labelled, this knowledge can be used to develop a more accurate model for reducing the dimensionality of the data. To begin, a picture matrix is made, with the possibility that each column contains a vector representing the pixel intensities. Many different things go into communicating a patient's feelings. Some examples include how you stand or sit, what you say, how your face and body move, and how you behave. Facial expressions are more significant than the aforementioned components since they are readily apparent to the observer.

Table 1: Emotion and Facial part

Parts of the Face	Emotion
lip corner pulled, open eyes, open mouth, cheeks raised	Happy
Eyebrow pulled down, open eyes, lip tightened	Anger
Outer eyebrow down, inner eyebrows raised, eyes closed, lip corner down	Sad
Outer eyebrow down, inner eyebrow up, mouth open	Fear
Eyebrow up, open eyes, jaw dropped	Surprise
Lip corner depressor, lower lip depressor, eyebrows down, nose wrinkled	Disgust

Above mentioned table is giving brief idea of different facial parts relation with different type of Emotion/Expression carried by Humans.



The aim is to employ machine learning algorithms to categorise feelings. We want to expand the emotion API so that we can learn the classifications the system makes based on the information we provide. Specifically, in the field of music information retrieval, the challenge of classifying music files in accordance with their genre might be difficult (MIR). A method to classify and organise songs is based on the genre, which is identified by some characteristics of the music like rhythmic structure, harmonic content, and instrumentation. This is especially helpful for therapists, who are increasingly overwhelmed by the proliferation of online music databases and the ease with which they can access music content. One of the most widely-used datasets in music signal processing is GTZAN, which was first suggested by G. Stamatakis in. Each track is 30 seconds long and has a frequency of 22050 Hz and a bit rate of 16 bits. The GTZAN has a total of 2,000 songs over ten different musical genres, including blues, classical, country, disco, hip-hop, jazz, metal, pop, reggae, and rock. Some machine learning techniques are mentioned here for classifying songs according to their genre. Specifically, this section makes use of Naive Bayes, Random Forest, K Nearest Neighbours, Decision Tree, and Support Vector Machine classification techniques.

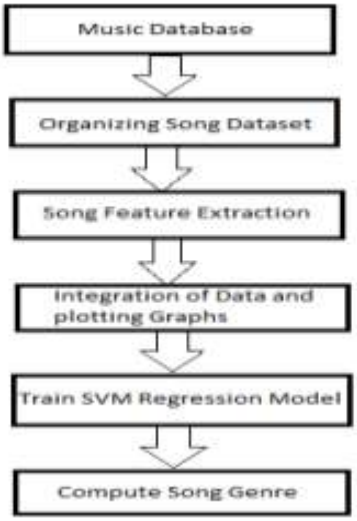


Fig 2: Music Genre Classification

The SVM (Support Vector Machine):

To examine data for classification and regression, machine learning experts employ support-vector machines, which are supervised learning models with accompanying learning algorithms. A support vector machine (SVM) is a non-probabilistic binary linear classifier that is trained using a collection of training samples labelled as belonging to one of two categories or the other (although methods like Platt scaling exist to use SVM during a probabilistic classification setting). A support vector machine (SVM) model may be thought of as a spatial representation of the examples, with each point being mapped such that the samples from the various classes are separated by a gap that is as clear as feasible. Then, the side of the divide that the new instances land on is used to make predictions about which group they belong to.

Applications

- SVMs may be used to classify photos.
- SVM can distinguish handwriting.
- The SVM method has found extensive use in a variety of scientific disciplines.
- Furthermore, SVMs may be used to classify texts and hypertexts.

Many different feelings are compiled and shown in the chart. Many songs are represented for each mood. The SVM algorithm classifies the user's phrase and returns a playlist of music that fit the user's specified mood. Therapeutic Suggestions Unit:

This part of the system is in charge of making a customised playlist for the patient. The playlist may be customised per therapist choice, and the songs can be recategorized as needed. Depending on the user's disposition, a certain set of categorised music will be played. When the mapping process is finished, an appropriate playlist is made. When creating the playlist, similar songs are categorised together. Comparing songs across 50 ms intervals, with each 10 ms window as the centre, allowed us to determine how similar they were to one another. Based on our findings, we can say that each of those gaps is about the same length as a musical note. The feature values of audio files were compared with the feature values (for similar characteristics) of audio files with the same class label. There are two separate mechanisms at work in the recommendation engine. Both the patient's and the therapist's musical tastes and preferences are taken into account when making song recommendations.

IMPLEMENTATION OUTCOME

Python 3.6 or later is used for the implementation. Here, testing was done on moving pictures with the goal of achieving real-time performance for face emotion identification. Pictures of several people were captured by the built-in camera. Training the face, which relies on minimising differences between classes, is subsequently done

using the recognised faces as input. Using the Fisher facial recognition approach with more characteristics increases its effectiveness. The picture is distorted and marred by noise here.

After the colour picture is transformed into grayscale, the size is reduced to 300 by 300. Find here the outcomes of the suggested application.

Recognizing Variations in the Face:

The major goal is to extract the patient's mood in a real-time setting by identifying the patient's face from a taken picture and then recognising various facial traits.

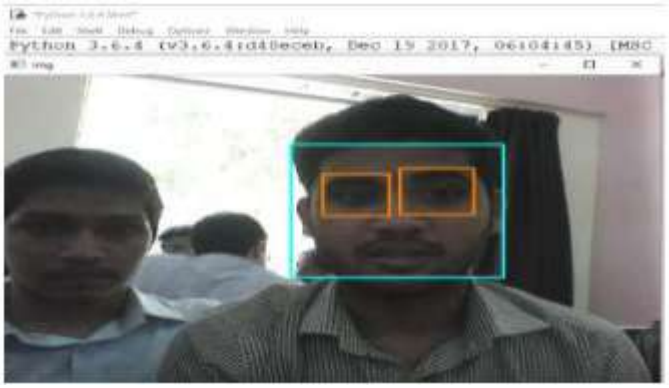


Fig 3: Real-time Detection of Face and Eyes

Fig 4: Real-time Detection of Mouth Facial Expression Extraction:

Different type of expression of patients can be extracted like Happy, Sad, Neutral, Disgust, Anger, Fear, and Surprise.

Fig 5: Happy and Disgust Emotions

The GUI for Music Therapy:

Fig 6:Graphical User Interface

CONCLUSION

The intelligent system is built bearing in mind the ease of usage by the therapist and to give them the power of machine learning for their day-to-day job. This musical treatment system was designed keeping in mind the convenience of use and intuitive interface of the music player for listening songs of the necessary mood. Once the user launches the application and begins the programme, the software automatically recognises the emotions of the person in front of camera and plays the music appropriately. The online music player is constructed by combining HTML, CSS and java script, making it incredibly powerful and durable. The major attraction of the music therapy application is it automatically plays music and includes an opportunity for further upgrading the learned model by picking the training of model again.

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