

# ML APPROACH FOR MUSICAL THERAPY USING FACIAL EXPRESSIONS

**Bhargavi<sup>[1]</sup>, Chinmayi<sup>[2]</sup>, K. Kanchana<sup>[3]</sup>, M. S. Sudhir Srinivas<sup>[4]</sup>, Mrs. Kavyashree G. M<sup>[5]</sup>**

<sup>[1][2][3][4]</sup> UG Student, Dept. of CS Engg Sir M. Visvesvaraya Institute of Technology, Bangalore, Karnataka, India

<sup>[5]</sup> Asst Professor, Dept of CS Engg Sir M. Visvesvaraya Institute of Technology, Bangalore, Karnataka, India

Corresponding author email: <sup>[1]</sup>bhargavikharvi@gmail.com <sup>[2]</sup>chinmayibhat01@gmail.com  
<sup>[3]</sup>kanchanak2022@gmail.com <sup>[4]</sup>sudhirsrinivas254@gmail.com <sup>[5]</sup>kavyashree\_cs@sirmvit.edu

## ABSTRACT

Music significantly contributes to development and improves one's mood because it is a major source of amusement and motivation to continue. It can help us and give us confidence when we're down. We frequently experience a fall in mood when we listen to depressing music. We experience happiness when we listen to upbeat music. Our paper proposes an Android app, which suggests music to the user depending on his present emotions and thus uplift the user's mood. This system uses the device camera to take a picture of the user and recognizes his face & facial expressions. We aim to use CNN and Viola Jones algorithms for face detection and compare them both. The FER2013 dataset would be used to test the system.

**Keywords** - Facial expression, Emotion Recognition, Musical therapy, Feature extraction, Music Recommendation, CNN

## 1. INTRODUCTION

Music is one of the most powerful forms of media, which can evoke strong emotions and overwhelm listeners with subliminal messages. It effectively manipulates our feelings, which in turn affects how we feel. Other forms of media include books, movies, and television dramas; however, music conveys its message far more quickly than these other forms of media. It can help us and give us confidence when we're down. We frequently experience a fall in mood when we listen to depressing music. We experience happiness when we listen to upbeat music.

The enormous advancements in machine learning and artificial intelligence have accelerated the automation of numerous tiresome operations very challenging to accomplish manually. Another area that has recently gained importance is emotion recognition. In many situations, machine interpretation is superior to human interpretation. A person's emotional state can be read and identified by automated decision-making systems for a variety of purposes, including suggestions.

Humans typically indicate their current mood through nonverbal means such as hand movements, facial expressions, and voice tones. For this project, the face is our main point of focus because it is so important. Mood and music are frequently related. Depending on the song, we may feel joyful, depressed, energized, or relaxed. Due to the significant impacts that music may have on a person's outlook and wellbeing, for managing a range of medical conditions, mood enhancement, and anxiety/stress reduction, music therapy has been explored. This program will use a camera to take real-time facial images and conduct face feature detection, mood interpretation, and emotion prediction before connecting to the music playing module which will recommend the user a playlist that will enhance their mood. Here we use the 7 basic emotions Anger, Disgust, Fear, Happy, Sad, Neutral and Surprise.

## 2. LITERATURE REVIEW

The strategies suggested by many studies are discussed here.

Borui Zhang, et al[19] have suggested that the Gabor Wavelet Transform filter can be used to extract features from the facial image across five scales and eight rotations in order to capture the key visual characteristics.

Shahli, et al[14] proposed a music recommendation system implemented in MATLAB with an average accuracy of 94%. The used Bandlet Transformation on the detected face area by Viola Jones algorithm to extract geometric structures of the face.

Ankita Mahadik, et al[3] intended to create an application to recommend music based on the user's mood. They used Viola-Jones algorithm for face detection, Using keras, deep learning is applied to detect facial expressions. For recognizing the facial expressions and a hybrid approach of music recommendation.

Prof. Jaychand Upadhyay, et al[2] proposed a CNN model whose accuracy on the training set was 97.42% thanks to batch normalization.

Krupa K S et al[7] proposes a system for detecting the user's emotions during interactions with an emotionally intelligent chatbot using facial landmarks and semantic analysis.

Renuka S. Deshmukh, et al[16] conducted research that suggests a system to describe human emotions. Here, automatic facial emotion recognition is used as a general approach for the facial emotion recognition system. In this paper, motion of the facial parts for each of the emotions is mentioned.

Aurobind V. Iyer, et al[17] have used the Adaboost Learning Algorithm to construct strong classifiers by weighing the multiple weak classifiers and they are in turn used while cascading classifiers for face detection.

A. Phaneendra, et al[1] proposed that songs will be played once the emotion has been identified in this case. Here, the client side uses an API call to request songs from the Spotify app.

M.Keerthana, et al[4] proposed that the system has three modules namely Emotion extraction, Audio feature extraction and emotion audio recognition. Here they used a technique called Audio emotion recognition (AER) that classifies audio signals into moods.

Shlok Gilda, et al[18] have used the stochastic gradient descent ML technique to construct an adaptive music player. The user has the option to modify the class of a certain song, and SGD is applied for those users only while taking the new label into account.

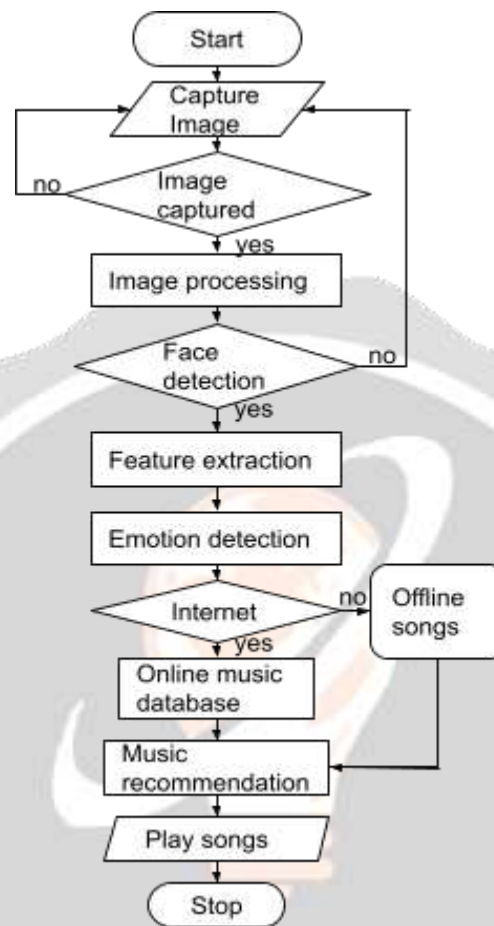
## 3. METHODOLOGY

Our proposed system is divided into five submodules namely Real time Image capturing, Face detection, Feature extraction, Emotion Detection, Music Recommendation.

The detailed explanation for our proposed system is as follows:

- 1) At first we capture the real-time image of the user using the device camera and the captured image is sent for image enhancement using Gabor Wavelet transform filter and later sent for face detection which is carried out using Viola Jones and CNN Algorithm.
- 2) If the face is detected then the detected face is sent for feature extraction using Bandlet Transform and LBP, else the app directs you to recapture the image.
- 3) With the extracted features the user's emotion is detected using the Fisherface method.
- 4) After emotion detection, we check if the user has a stable internet connection. If the user is online the online songs database is used, else the songs stored offline are used for song recommendation.
- 5) The detected emotion is sent to the Music recommendation module and a music playlist that will uplift the user's mood is suggested by the application.

The flowchart given below shows the workflow of our proposed system:



a. Flow Chart

Algorithms and techniques used:

**a) Viola Jones Algorithm**

This algorithm helps in locating the position on the colored image after identifying the face on the grayscale image. To detect a face, the method draws a box and looks inside it for a face. In essence, it is looking for certainhaar-like characteristics.

**b) Convolutional Neural Network(CNN)**

For deep learning algorithms used for tasks like image identification and pixel data processing, a CNN is a specific kind of network construction. The ideal network design for classifying andrecognising objects is a CNN.

**c) Gabor Wavelet Transform filter**

To photograph facial characteristics that are aligned at particular angles, we employ a gabor filter. In addition to these, to search the feature space for the ideal feature subset, a binary particle swarm optimization-based feature selection method is used.

**d) Local Binary Pattern(LBP)**

A strong texture descriptor is LBP. In LBP, a threshold is calculated by comparing the segmented image's pixel values to the centerpixel value. The retrieved features depend on the threshold. This technique turned out to be aneffective tool for obtaining texture features.

e) *Fisherface Algorithm*

Fisherface's approach is not sensitive to significant fluctuations in lighting. Additionally, it has a lower error rate than the Eigenface approach and requires less time for computing. Therefore, we favor the Fisherface model to identify emotional states in people.

For music recommendation we use a combination of content based filtering and collaborative filtering approach also known as the hybrid approach.

Most of the pre-existing mood based music recommendation systems focus only on middle-age and teenage users' images to train the model, but in our proposed system we will be focusing on users of all age groups.

None of the existing systems focus on the users wearing spectacles, but our proposed system will be trained to serve the users who wear spectacles as well.

#### 4. SUMMARY ON LITERATURE SURVEY

Author	Technique	Description
Megha Gupta, et al.[6]	CNN,SVM,ELM	An accuracy of 66% with SVM, 63% with ELM and accuracy of 71% is achieved using CNN.
Mr.Akshay Choudhary, et al.[10]	Haar traits	The system's primary advantages are total automation independence.
Chai Kiat Yeo et al.[20]	SVM	An accuracy of 60% with real time responsiveness, while considering 6 basic moods.
Likhyathunisa Syed, et al.[13]	viola -Jones,PCA	Principal component analysis(PCA) is used for detection of emotions.
Karthik Subramanian Nathan et al.[15]	Haar traits,SVM classifiers	The mobile application Emusic, which was created, creates a personalized playlist of music based on the user's emotion through in-the-moment face analysis..
Pranjul Agrahari et al.[8]	Fisherface Machine Learning Algorithm	Different type of expression of Patients can be extracted like Happy, Sad, Neutral, Disgust, Anger, Fear, and Surprise.
Vinay p et al.[5]	SVM, OpenCV, Python.	The suggested system offers a face-based emotion detection system that can identify emotions and play music in response.

Anuja arora,et al.[12]	KNN,MLP,SVM,2D-Valence arousal space	Their approach was to convert audio files of different moods to numerical values where each value holds a feature of the audio..
S.Deebika,et al.[11]	SVM, Point detection algorithm	The system's major goal is to alter or sustain the user's emotional state and match personal musical tastes by investigating musical recordings with particular characteristics.
Ziyang Yu, et al.[9]	CNN, SVM	Accuracy of 62.1% was achieved for face recognition using CNN.

## 5. CONCLUSION

The goal of our project is to create an application which will suggest the user a music playlist to uplift their mood with the use of extracted facial features obtained from the real time image captured. Our application aspires to serve users of all age groups, also to the users who wear spectacles. Our application aims to have better user interface, efficiency and less memory consumption than the existing systems.

## 6. REFERENCES

- [1] Madhusmitha Muduli, A. Phaneendra,, Siri Lakshmi Reddy, R. Veenasree "EMUSE – An Emotion Based Music Recommendation System" *International Research Journal of Modernization in Engineering Technology and Science*.
- [2] Vaibhav Murari , Prof. Jaychand Upadhyay , Sharan Shetty, Jarvis Trinidade "Mood Based Music Playlist Generator Using Convolutional Neural Network" *International Journal for Research in Applied Science & Engineering Technology* 2022.
- [3] Shambhavi Milgir, Ankita Mahadik, Vaishali Kavathekar and Prof. Vijaya Bharathi Jagan. "Mood based Music Recommendation System" *International Journal of Engineering Research & Technology*, 2021
- [4] M. Shruthi, M. Keerthana, S. Aravind Kumar " Emotion based music recommendation system." *IJCRT Issue 6 June 2021*.
- [5] Bhargav Satish Kumar Y, Vinay p, Raj Prabhu T, Jayanth P, A. SUNEETHA, "Facial Expression Based Music Recommendation System" *International Journal of Advanced Research in Computer and Communication Engineering* 2021.
- [6] ,Megha Gupta, Madhuri Athavle, Deepali Mudale, Upsana Shrivastav. "Music recommendation based on face emotion recognition." *Journal of informatics, Electrical and Electronics Engineering*, 2021.
- [7] Sahil Choudhury, Krupa K S, Ambara G, Kartikey Rai. "Emotion aware Smart Music Recommender System using Two Level CNN" *IEEE Xplore* 2020
- [8] Prof. Pankaj Kunekar, Pranjul Agrahari, Ayush Singh Tanwar, Biju Das, "Musical Therapy using Facial Expressions" *International Research Journal of Engineering and Technology*. 01 Jan 2020
- [9] Yilin wu, Peizhuo Liu, Ziyang yu, Mengda Zhao, Hexu chen. "Research on automatic music recommendation algorithms based on facial micro expression recognition" *39th Chinese Control Conference*, 2020.
- [10] Mr. Akshay Choudhary, Prof. Sumeet Pate, Miss. Poonam Harane, Miss. Shreya Zunjarrao "Mood Based Music Player Using Real Time Facial Expression Extraction" *International Journal for Research in Engineering Application & Management (IJREAM)* 2019.

- [11] S Deebika, Dr. Jesline and K. A. Indira "A Machine Learning Based Music Player by Detecting Emotions." Fifth ICONSTEM 2019.
- [18] Aastha Kaul, Vatsala Mittal, Anuja Arora, "Mood based music player." Computer science department, Jaypee institute of information technology noida, India. IEEE, 2019.
- [19] Likhyathunisa Syed, Alham Alrihaili, Kholood Albalawi, Alha Alsaedi "Music recommender system for users based on emotion detection through facial features." IEEE, DeSE, 2019.
- [20] SHAHLII, ARUN T NAIR "Music Therapy using Face Recognition." Vol.07, Issue.05, May-2018.
- [21] Manasi Arun, Megala S Kannan and Karthik Subramanian Nathan "EMOSIC - An Emotion Based Music Player For Android." IEEE (ISSPIT) 2017.
- [22] Vandana Jagtap, Renuka S. Deshmukh, Shilpa Paygude. "Facial emotion detection system using machine learning approach." ICICCS 2017.
- [23] Viral Pasad, Aurobind V. Iyer, and Karan Prajapati, "Emotion Based Mood Enhancing Music Recommendation" IEEE International Conference On RTEICT, 2017.
- [24] Chintan Soni, Shlok Gilda, Husain Zafar, and Kshitija Waghurdekar. "Smart Music Player Integrating Facial Emotion Recognition and Music Mood Recommendation" IEEE WiSPNET 2017
- [25] Guoqiang Xie, Guangyuan Liu and Borui Zhang "Facial Expression Recognition Using LBP and LPQ Based on Gabor Wavelet Transform" IEEE International Conference on Computer and Communications 2016.
- [26] Chai Kiat Yeo, Bu Sung Lee, Yeon, Seanglidet, "Mood Prediction from Facial Video with Music "Therapy" on a Smartphone" IEEE 2016.

