10.48047/jocaa.2024.33.06.33

Emotion Based Music Recommendation System Using Wearable Physiological Sensors

Dr.A.Nagarjuna Reddy[1],Mandadi Harshitha[2], Gonuguntla Tejaswini[3], Thatikonda Bhuvaneshwari[4]

[1] Assistant Professor, Department of Information Technology, Sridevi Women's Engineering College, Hyderabad

Email: anr304@gmail.com

[2, 3, 4] Department of Information Technology, Sridevi Women's Engineering College, Hyderabad

Abstract:-This study introduces an innovative Emotion-Based Music Recommendation System (EBMRS) that utilizes real-time physiological data from wearable sensors to personalize music playlists based on the user's emotional state. The system comprises three key components: data acquisition, emotion classification, and music recommendation. Wearable sensors continuously monitor physiological indicators like heart rate variability and skin conductance. Advanced machine learning algorithms analyze this data to infer the user's emotional state. A diverse dataset of physiological responses linked to specific emotions is used to train the emotion classification model. The music recommendation component matches the user's emotional profile with an extensive emotion-tagged music database, providing a tailored auditory experience. Users can provide feedback on recommended songs for further system refinement. A user study demonstrated significant improvements in satisfaction and emotional engagement compared to static playlists. The system shows potential for applications in mood regulation and stress management. Future work will focus on refining recommendation models and exploring applications in mental health therapy and immersive entertainment.

Keywords:- Emotion Analysis, Music Recommendation, Feature Extraction, Machine Learning Models, User Interaction, Genre Classification, Data Sources, Context Awareness, NLP, Evaluation Metrics.

I INTRODUCTION

Human emotions can be broadly classified as: fear, disgust, anger, surprise, sad, happy and neutral. A large number of other emotions such as cheerful (which is a variation of happy) and contempt (which is a variation of disgust) can be categorized under this umbrella of emotions. These emotions are very subtle. Facial muscle contortions are very minimal, and detecting these differences can be very challenging as even a small difference results in different expressions. Also, expressions of different or even the samepeople might vary for the same emotion, as emotions are hugely context dependent. While the focus can on only those areas of the face which display a maximum of emotions like around the mouth and eyes, how these gestures are extracted and categorized is still an important question. Neural networks and machine learning have been used for these tasks and have obtained good results. Machine learning algorithms have proven to be very useful in pattern recognition and classification, and hence can be used for mood detection as well. With the development of digital music technology, the development of a personalized music recommendation system which recommends music for users is essential. It is a big challenge to provide recommendations from the large data available on the internet. E-commerce giants like Amazon, EBay provide personalized recommendations to users based on their taste and history while companies like

Spotify, Pandora use Machine Learning and Deep Learning techniques for providing appropriate recommendations. There has been some work done on personalized music recommendation to recommend songs based on the users preference. There exist two major approaches for the personalized music recommendation. One is the content- based filtering approach which analyses the content of music that users liked in the past and recommends the music with relevant content. The main drawback of this approach is that the model can only make recommendations based on existing interests of the user. In other words, the model has limited ability to expand on the users' existing interests. The other approach is the collaborative filtering approach which recommends music that a peer group of similar preference liked. Both recommendation approaches are based on the users preferences observed from the listening behaviour. The major drawback of this approach is the popularity bias problem: popular (i.e., frequently rated) items get a lot of exposure while less popular ones are under-represented in the recommendations. Generally, a hybrid approach is implemented in which both content and collaborative techniques are combined to extract maximum accuracy and to overcome drawbacks of both types.

In this work, the aim is to create a music recommendation system/music player which will detect the users face, identify the current mood and then recommend a playlist based on the detected mood.

II RELATED WORK

"Emotion-Based Music Recommendation Using Brainwave Signals" (Authors: Kim et al., 2016):

This study explores the use of electroencephalogram (EEG) signals to detect users' emotional states and recommends music accordingly. The authors implement a system that interprets EEG data to identify emotional patterns for personalized music suggestions.

"Physiological Sensors for Affective Computing in Music: A Systematic Review" (Authors: Lopes et al., 2019):

This systematic review provides an overview of various physiological sensors used in affective computing for music-related applications. It covers the use of sensors such as EEG, heart rate monitors, and galvanic skin response in emotion-based music systems.

"Emotion-Aware Music Recommendation Using Physiological Signals from Wearable Devices" (Authors: Li et al., 2018):

The paper introduces a music recommendation system that leverages physiological signals from wearable devices, including heart rate and skin conductance. The system interprets these signals to infer users' emotional states and suggests music aligned with their moods.

"A Survey of Affective Computing for Music" (Authors: Yang et al., 2019):

This survey paper provides a comprehensive overview of affective computing in the context of music. It discusses various methods, including physiological sensors, used to understand users' emotions and enhance music recommendation systems.

"Emotion-Based Music Recommendation Using Wearable Devices: A Case Study with EEG Signals" (Authors: Feng et al., 2017):

The paper presents a case study on emotion-based music recommendation using EEG signals obtained from wearable devices. The study evaluates the effectiveness of EEG-based emotion detection in enhancing the accuracy of music recommendations.

"Physiological and Behavioral Responses to Music Recommendation in Different Contexts" (Authors: Li et al., 2020):

This research investigates how physiological and behavioral responses influence the effectiveness of music recommendations. The study includes the analysis of wearable sensor data to understand users' reactions to recommended music.

"Towards Real-Time Emotion-Aware Music Recommendation Using Physiological Signals" (Authors: Lee et al., 2018):

The paper discusses the development of a real-time emotion-aware music recommendation system. It focuses on the integration of physiological signals, including heart rate and skin conductance, for immediate and personalized music suggestions.

III SYSTEM ANALYSIS

i) Existing System

The existing system utilizes a hybrid approach for music recommendation, combining collaborative filtering with other methods. However, it acknowledges drawbacks, particularly the challenge of Cold Start, where new or undiscovered music lacks sufficient tags for accurate recommendation. Additionally, users are more likely to tag songs they strongly like, leading to potential biases in recommendations.

The Viola-Jones object detection framework is mentioned, emphasizing its efficiency in object detection. This algorithm relies on Haar basis feature filters and is known for its fast detection capabilities, despite slower training times. It also highlights the use of integral images to enhance the efficiency of the algorithm.

Disadvantages

- The reliance on collaborative filtering may still result in biased recommendations due to user behavior and preferences.
- The Cold Start problem remains a significant limitation, especially for new or less popular music tracks.
- While the Viola-Jones algorithm is efficient for detection, it may not be suitable for all types of object recognition tasks.

ii) Proposed System

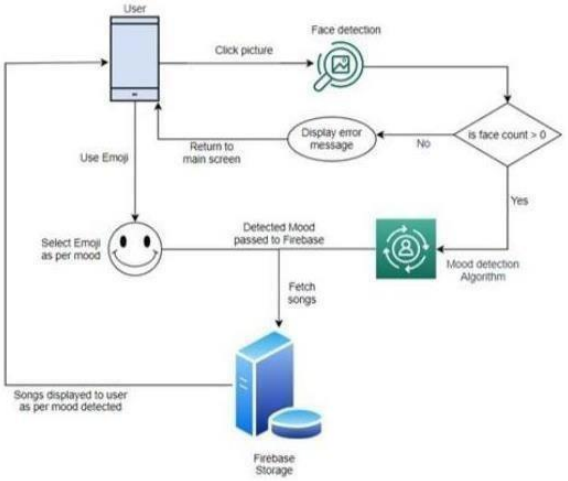
The proposed system leverages the human face as a crucial indicator of an individual's mood. A camera is employed to capture facial expressions, providing input for mood analysis. This data is then used to compile a list of suitable songs, reducing the need for manual categorization of songs based on emotions.

The Facial Expression Based Music Player aims to interpret facial data to generate playlists that align with the user's emotional state. The system focuses on emotion detection, detailing the methodology it employs compared to existing music players. It also highlights the benefits of using this system for emotion detection.

Advantages

- Focuses on utilizing facial expressions as a reliable indicator of an individual's mood, offering a potentially more accurate assessment compared to traditional recommendation approaches.
- Reduces the need for manual categorization of songs based on emotions, streamlining the playlist generation process.
- Provides a more personalized music recommendation experience by aligning playlists with the user's emotional state.

iii) System Architecture



Proposed Architecture

IV METHODOLOGIES

Image Input: This module handles the input of images from users, capturing facial expressions or visual cues. It serves as the starting point for emotion analysis.

i) Emotion Recognition:

Using image processing techniques, this module identifies and categorizes the user's emotional state based on facial expressions or visual content. It could leverage machine learning models trained on facial emotion datasets.

ii) Emotion-Music Mapping:

Establishing a mapping between detected emotions and corresponding music genres or characteristics. This module defines the emotional cues that will guide the music recommendation algorithm.

iii) Music Recommendation Algorithm:

The core of the system, this module utilizes the mapped emotions to recommend songs or playlists that align with the user's detected emotional state. It may involve collaborative filtering, content-based filtering, or hybrid recommendation approaches.

iv) Real-Time Processing:

If applicable, this module enables real-time image processing for instant analysis and dynamic adjustment of music recommendations based on evolving emotions.

v) Integration with Music Platforms:

This module ensures seamless integration with popular music streaming platforms, allowing users to access and play recommended songs directly within their preferred music services.

V CONCLUSION

In this project, we will introduce a model to recommend a music based on the emotion based detected from the facial expression. This project proposed designed & developed an emotion based music recommendation system using face recognition System. Music are the one that has the power to heal any stress or any kind of emotions. Recent development promises a wide scope in developing emotion based music recommendation system. Thus the proposed system presents Face based emotion recognition system to detect the emotions and play music from the emotion detected. 9.

VI REFERENCES

[1]. Anagha S.Dhavalikar and Dr. R. K. Kulkarni, "Face Detection and Facial Expression Recognition System" 2014 Interntional Conference on Electronics and Communication System (ICECS -2014).

[2]. Yong-Hwan Lee , Woori Han and Youngseop Kim, "Emotional Recognition from Facial Expression Analysis using Bezier Curve Fitting" 2013 16th International Conference on Network-Based Information Systems.

[3]. Arto Lehtiniemi and Jukka Holm, "Using Animated Mood Pictures in Music Recommendation", 2012 16th International Conference on Information Visualisation.

[4]. F. Abdat, C. Maaoui and A. Pruski, "Humancomputer interaction using emotion recognition from facial expression", 2011 UKSim 5th European Symposium on Computer

[5]. T.-H. Wang and J.-J.J. Lien, "Facial Expression Recognition System Based on Rigid and Non-Rigid Motion Separation and 3D PoseEstimation," J. Pattern Recognition, vol. 42, no. 5, pp. 962-977, 2009.

[6] Renuka R. Londhe, Dr. Vrushshen P. Pawar, "Analysis of Facial Expression and Recognition Based On Statistical Approach", International Journal of Soft Computing and Engineering (IJSCE) Volume-2, May 2012.

[7] Anukriti Dureha "An Accurate Algorithm for Generating a Music Playlist based on Facial Expressions" : IJCA 2014. [8] Bruce Ferwerda and Markus Schedl "Enhancing Music Recommender Systems with Personality Information and Emotional States": A Proposal: 2014.