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Emotion Based Music Recommendation System

Prof. Pranali Faye[1], Ms. Samruddhi Sonar[2] , Ms. Sakshi Shahare[3], Ms. Rakshata Ambhore[4], Ms. Vaishnavi Chafle[5]

[1]Assistant Professor, Department of Computer Engineering, SCET, Nagpur, Maharashtra, India
[2,3,4,5]UG Student , Department of Computer Engineering, SCET, Nagpur, Maharashtra, India
[1]pranalifaye5739@gmail.com , 8668531298
[2]samruddhisonar24@gmail.com , 8623030324
[3]sakshishahare72@gmail.com , 9373549149
[4]rakshataambhore311@gmail.com , 9359365886
[5]vaishnavi.chafle24@gmail.com , 7775070437

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Abstract

The growing demand for personalized music recommendations has highlighted the importance of integrating emotional intelligence into music recommendation systems. Traditional systems primarily rely on content- based or collaborative filtering approaches, which fail to consider users' emotional states. This research aims to design and develop an emotion-based music recommendation system that matches music tracks with the user's current emotional state. The system uses natural language processing and machine learning techniques to analyze user input, such as text, voice, or facial expressions, to detect emotions. It then suggests music that aligns with the detected mood, providing a more tailored listening experience. A hybrid approach employing convolutional neural networks for emotion detection from facial expressions and recurrent neural networks for processing textual or speech input was used. The emotion detection dataset was drawn from diverse, publicly available sources. The recommendation engine combined collaborative filtering with user emotion data to improve the accuracy of suggestions. Results show that the emotion-based system outperforms traditional algorithms in user satisfaction, with users reporting a stronger emotional connection to the recommended tracks. The system's ability to understand and adapt to emotional states enhances the music discovery experience. The proposed emotion-based system offers a personalized, emotionally intelligent alternative to traditional methods, with applications in music streaming, mental health support, and entertainment.

INTRODUCTION

Welcome to a new frontier in music discovery—where cutting-edge technology meets the depth of human emotion. In this project, we reimagine how music recommendation systems work by integrating emotional intelligence into the selection process. Music is more than just sound; it is a mirror to our emotions, a companion to our experiences, and a powerful medium of self-expression.

Traditional music recommendation models have primarily relied on factors like genre, artist, and popularity. While effective, these approaches fail to capture the emotional depth that truly defines our musical preferences. Our project aims to close this gap by developing an intelligent system that understands the listener's emotional state and suggests music accordingly. By leveraging machine learning, sentiment analysis, and real-time emotion detection, we strive to create a personalized listening experience that resonates on a deeper level. This system will not only recommend songs but also enhance the way users interact with and relate to music—helping them find the perfect soundtrack for every mood.We envision a future where music recommendation is more than just a convenience; it becomes an intuitive, empathetic, and transformative experience. With this project, we seek to forge stronger connections between listeners and the music they love, enabling moments of reflection, joy, comfort, and inspiration. Join us on this journey as we unlock new dimensions of music discovery, where emotion and technology harmonize to create truly unforgettable listening experiences.

LITERATURE SURVEY

Kartbayev & Aldeshov (2025) [1] propose a novel emotion-based music recommendation system that leverages fuzzy logic to classify and analyze emotions. The system integrates a Fuzzy Nearest-Mean (FNM) classifier for music emotion classification and a Fuzzy Inference System (FIS) for facial emotion recognition. By combining these two approaches, the system provides more intelligent, personalized music recommendations. The research demonstrates the effectiveness of fuzzy logic in handling the subjectivity of emotions and improving user engagement.

Gandolkar & G (2022) [2] propose a music recommendation system that utilizes face expression detection to suggest songs based on users' emotional states. The system integrates real-time facial analysis to classify emotions and recommend appropriate music. The study highlights the effectiveness of emotion-based filtering in enhancing user engagement and experience in music applications.

Bhutada et al. (2020) [3] develop an emotion-based music recommendation system that employs deep learning techniques to process facial images and detect emotions. The system categorizes music into different emotional clusters and suggests playlists accordingly. The study demonstrates the feasibility of automating music selection using facial emotion recognition.

METHODOLOGY

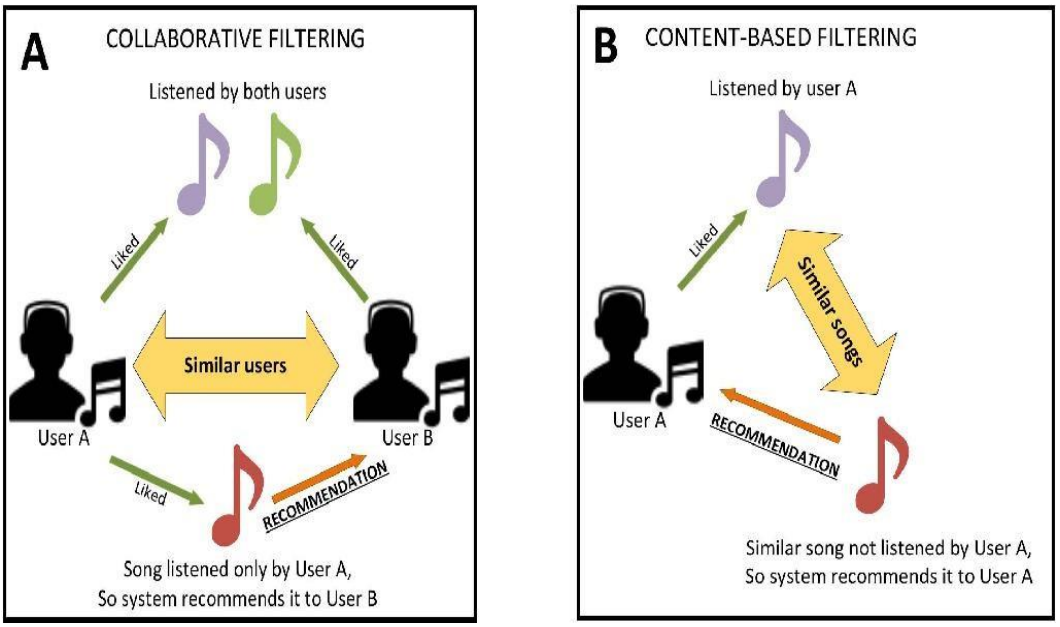
To ensure comprehensive representation across all emotional states, a diverse dataset of images labeled with emotions such as happiness, sadness, anger, and surprise was collected from multiple sources. This dataset was designed to include a wide range of human facial expressions, ensuring robust emotion recognition across different demographics. To maintain consistency, the music dataset was labeled with emotion categories that corresponded directly to those in the image dataset, facilitating accurate music recommendations. For efficient emotion detection, a pre-trained deep learning model, VGGFace, was utilized due to its proven accuracy in facial recognition tasks. The dataset was then divided into training and validation sets, with the training data being used to fine-tune the model for enhanced precision in emotion classification. The performance of the trained model was evaluated using key performance metrics such as accuracy, precision, recall, and F1-score to ensure optimal results.

To match detected emotions with suitable music tracks, an algorithm was designed that analyzes facial expressions and associates them with songs or genres that evoke similar emotional responses. For improved personalization, both content-based filtering and collaborative filtering techniques were incorporated, allowing for context-aware music recommendations. The entire

development process was implemented using TensorFlow, which was used for training and deploying the deep learning model. Additionally, OpenCV played a crucial role in image preprocessing, handling tasks such as resizing and normalization to prepare facial images for analysis. The scikit-learn and TensorFlow Recommenders libraries were employed to implement the recommendation algorithm effectively.

To provide a seamless user experience, the trained emotion recognition model was integrated into a real-time interactive interface, enabling users to upload or capture images for instant emotion-based music suggestions. The front-end of the system was developed using HTML, CSS, and JavaScript, ensuring a visually appealing and user-friendly interface. The system architecture follows a Convolutional Neural Network (CNN) structure, with multiple layers optimizing the recognition process. Feature extraction and visualization techniques were applied to better understand how the model processes facial features, ultimate refining the accuracy of the emotion classification and music recommendation system

SYSTEM ARCHITECTURE



IMPLEMENTATION

Data Collection and Processing

In the development of an emotion-based music recommendation system, the effectiveness of the system heavily relies on robust data collection and processing mechanisms. The data collection module integrates various sources, including wearable physiological sensors that capture biometric signals such as heart rate variability (HRV), electrodermal activity (EDA), and facial expressions.

These sensors continuously track real-time emotional responses, allowing the system to infer mood fluctuations. Additionally, contextual data such as location, time, user activity, and environmental factors is gathered through GPS, calendar events, or direct user input, further refining the emotional analysis.

Once data is acquired, the processing module employs advanced algorithms to extract meaningful insights from the raw physiological data. Feature extraction techniques transform these biometric signals into numerical representations of emotional states. Machine learning models, including classification and regression techniques, are then trained on annotated datasets to map these features to specific emotions such as happiness, sadness, anxiety, and relaxation. Moreover, sentiment analysis of user-generated content, such as text interactions or activity logs, is incorporated to enhance emotional profiling. Together, these processes establish a data-driven foundation that enables the system to accurately determine user emotions and provide music recommendations that align with their mood and preferences.

Recommender Model

The recommender model is a critical component of the emotion-based music recommendation system, leveraging a multi-layered architecture to ensure precise and personalized music suggestions. The data acquisition module is responsible for gathering physiological signals from wearable devices, capturing biometric indicators like heart rate variations, skin conductivity, and body temperature. This raw data is then passed through the data preprocessing module, where noise reduction techniques, normalization, and feature extraction are applied to enhance accuracy and reliability.

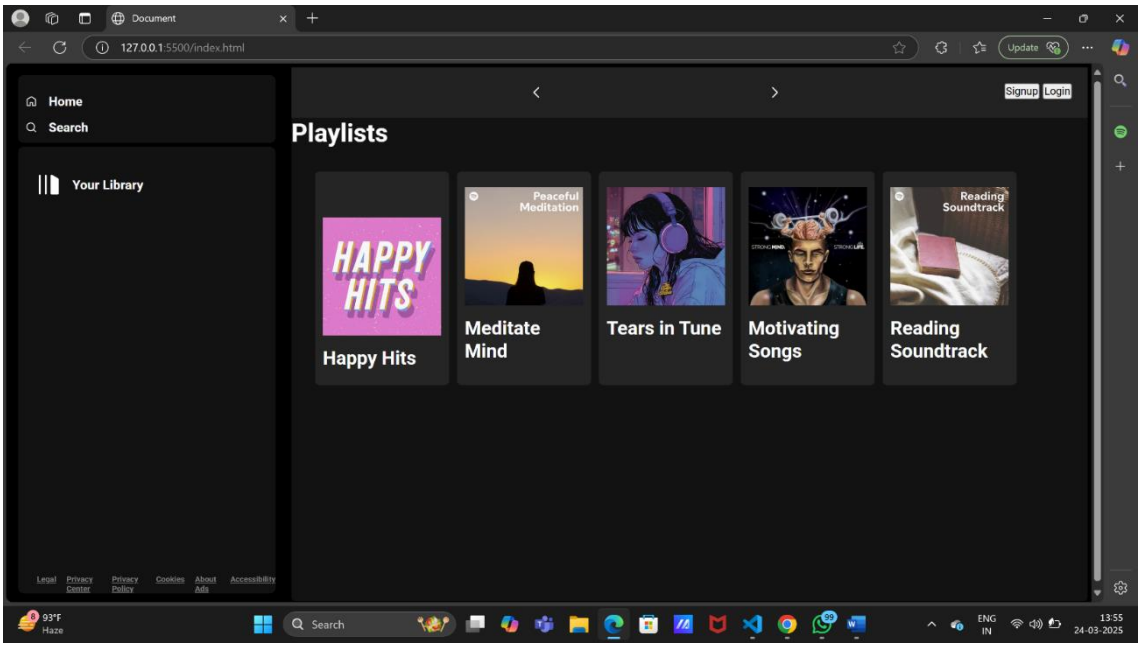
Next, the emotion recognition module utilizes deep learning and machine learning algorithms to process the preprocessed physiological signals, accurately identifying the user's current emotional state in real time. Based on the detected emotions, the recommendation engine module selects music tracks from a curated database, considering factors such as tempo, rhythm, melody, and lyrical sentiment to match the user's mood. Finally, the feedback and adaptation module ensures continuous learning by refining recommendations over time based on user preferences, interaction patterns, and feedback loops. This structured framework ensures a dynamic, emotion-aware music recommendation system that adapts to the user's evolving emotional state.

Recommendation Post-processing

The Recommendation Post-processing module enhances the overall quality and effectiveness of music recommendations by applying optimization techniques before delivering final suggestions to the user. This module refines music selections by filtering, prioritizing, and personalizing tracks based on the user's real-time emotional state, ensuring a highly contextualized experience. By analyzing additional factors such as location, time of day, and user activity, the module adjusts music recommendations to suit specific moments—for example, suggesting calm instrumental tracks at night or energetic beats during workouts.

To maintain diversity and novelty, the post-processing module balances familiar favorites with new music discoveries, preventing repetitive recommendations. Additionally, adaptive learning algorithms monitor user engagement, refining the recommendation model based on explicit feedback (likes, skips) and implicit feedback (listening duration, replays). By integrating user interaction data, the module enhances long-term recommendation accuracy, creating a more engaging, emotionally responsive music experience. Ultimately, this post-processing module serves as a critical enhancement layer, ensuring that music suggestions are context-aware, user-centric, and continuously improving over time.

RESULT



CONCLUSION

In this study, we present an innovative framework that enhances the effectiveness of music recommendation systems by leveraging emotional arousal and valence dimensions. Our research highlights a strong connection between human emotions and music preferences, enabling a more personalized and immersive listening experience. By integrating wearable sensor technology, the system dynamically adapts recommendations based on real-time emotional states, ensuring a more intuitive and emotionally resonant selection of music. Future advancements in sensor technology and artificial intelligence will further refine the system's capabilities, allowing for more adaptive and context-aware recommendations. Additionally, exploring new sensor combinations and failure management strategies will enhance the system's robustness and reliability. These findings contribute to the continuous evolution of multimedia interaction and digital entertainment, providing users with a seamless and deeply personalized music experience that aligns with their emotional needs.

References

1. Ramya Ramanathan, Radha Kumaran, Ram Rohan R, Rajat Gupta, and Vishalakshi Prabhu, an intelligent music player based on emotion recognition, 2nd IEEE International Conference on Computational Systems and Information Technology for Sustainable Solutions 2017. https://doi.org/10.1109/CSITSS.2017.8447743
2. Shlok Gilda, Husain Zafar, Chintan Soni, Kshitija Waghurdekar, Smart music player integrating facial emotion recognition and music mood recommendation, Department of Computer Engineering, Pune Institute of Computer Technology, Pune, India, (IEEE),2017. https://doi.org/10.1109/WiSPNET.2017.8299738
3. Deger Ayata, Yusuf Yaslan, and Mustafa E. Kamasak, Emotion-based music recommendation system using wearable physiological M. Athavle et al. ISSN (Online) : 2582-7006 International Conference on Artificial Intelligence (ICAI-2021) 11 Journal of Informatics Electrical and Electronics Engineering (JIEEE) A2Z Journals sensors, IEEE transactions on consumer electronics, vol. 14, no. 8, May 2018.https://doi.org/10.1109/TCE.2018.2844736
4. Ahlam Alrihail, Alaa Alsaedi, Kholood Albalawi, Liyakathunisa Syed, Music recommender system for users based on emotion detection through facial features, Department of Computer Science Taibah University, (DeSE), 2019.
5. Research Prediction Competition, Challenges in representation learning: facial expression

recognition challenges, Learn facial expression from an image, (KAGGLE).
6. Preema J.S, Rajashree, Sahana M, Savitri H, Review on facial expression-based music player, International Journal of Engineering Research & Technology (IJERT), ISSN-2278-0181, Volume 6, Issue 15, 2018.
7. AYUSH Guidel, Birat Sapkota, Krishna Sapkota, Music recommendation by facial analysis, February 17, 2020.
8. CH. sadhvika, Gutta.Abigna, P. Srinivas reddy, Emotion-based music recommendation system, Sreenidhi Institute of Science and Technology, Yamnampet, Hyderabad; International Journal of Emerging Technologies and Innovative Research (JETIR) Volume 7, Is-sue 4, April 2020.
9. Vincent Tabora, Face detection using OpenCV with Haar Cascade Classifiers, Becominghuman.ai,2019.
10. Zhuwei Qin, Fuxun Yu, Chenchen Liu, Xiang Chen. How convolutional neural networks see the world - A survey of convolutional neural network visualization methods. Mathematical Foundations of Computing, May 2018.
11. Ahmed Hamdy AlDeeb, Emotion- Based Music Player Emotion Detection from Live Camera, ResearchGate, June 2019.
12. Frans Norden and Filip von Reis Marlevi, A Comparative Analysis of Machine Learning Algorithms in Binary Facial Expression Recognition, TRITA-EECSEX-2019:143.
13. P. Singhal, P. Singh and A. Vidyarthi (2020) Interpretation and localization of Thorax diseases using DCNN in Chest X-Ray. Journal of Informatics Electrical and Elecrtonics Engineering,1(1), 1, 1-7
14. M. Vinny, P. Singh (2020) Review on the Artificial Brain Technology: BlueBrain. Journal of Informatics Electrical and Electronics Engineering,1(1), 3, 111.
15. Singh and P. Singh (2021) Object Detection. Journal of Management and Service Science, 1(2), 3, pp. 1-20.
16. Singh, P. Singh (2020) Image Classification: A Survey. Journal of Informatics Electrical and Electronics Engineering,1(2), 2, 1-9.
17. Singh and P. Singh (2021) License Plate Recognition. Journal of Management and Service Science, 1(2), 1, pp. 1-14.