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A Literature Review on an Emotion Based Music Recommendation System

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***Abstract*— Emotion-based music recommendation systems improve user experience by suggesting songs that reflect the listener's mood. Techniques such as deep learning, facial emotion recognition, and wearable sensors to capture emotions from facial expressions, heart rate, or other signals are used. Convolutional Neural Networks (CNNs) isolate features from images for accurate emotion classification, while probabilistic models like Bayesian networks interpret uncertain emotions. By combining real-time emotion detection with recommendation algorithms, the system personalizes playlists instantly based on the user's emotional state. This ensures a seamless and emotionally engaging listening experience for users.**

I. INTRODUCTION

In today's digital era, personalization is pivotal in enhancing user experiences, particularly in music streaming. Traditional recommendation systems rely heavily on user history, preferences, and collaborative filtering, often lacking adaptability to a user's current emotional state. To address this limitation, an Emotion-Based Music Recommendation System is introduced, leveraging deep learning and real-time facial emotion recognition to dynamically tailor music choices.The process begins with Image Capture, where a camera collects real-time facial data from the user. This input is fed into a Convolutional Neural Network (CNN) specifically trained for emotion detection. The CNN decodes facial expressions into categories like happiness, sadness, anger, and surprise. Detected emotions are then mapped into music-related mood tags (e.g., happy → upbeat, sad → mellow) via a Mood Mapping module. These tags guide the Dataset Filtering process, which selects suitable tracks from a music database or streaming platform based on mood, genre, tempo, and lyrics. A Playlist Generation engine then compiles songs matching the emotional and contextual profile, delivering a personalized and emotionally resonant playlist. Integration with services like Spotify ensures a seamless playback experience, enriching user engagement in real time.

II. LITERATURE SURVEY

In this section, Researchers have investigated a variety of strategies for identifying emotions. This literature survey reviews existing methods for detecting emotions and personalizing music playback in real time.

Emotion-Based Music Recommendation System Using Deep Learning

Methodology: Combines facial expression recognition using ResNet50V2 and VGG16 with semantic analysis of song metadata and lyrics using BERT. It creates an emotional mapping that links user moods with specific genres. **Advantages:** High accuracy achieved through the integration of computer vision and NLP techniques. Offers real-time adaptive playlists and scalable performance via transfer learning.

Disadvantages/Limitations: Emotion recognition accuracy (~66.8%) is moderate. The system is resource-intensive and may be sensitive to environmental variables such as lighting and occlusion.

2. Emotion-Based Personalized Music Recommendation using HDBN

Methodology: Introduces a Heterogeneity-aware Deep Bayesian Network (HDBN) to model inter- and intra-user emotion variability and music preferences. Uses Bayesian neural networks with stochastic sampling for prediction. For each user interaction, the model performs variational inference to update the user's latent emotion . The music mood prediction process involves stochastic weight sampling, enabling the network to learn uncertainty in mood preferences and recommend music that reflects likely emotional needs. **Advantages:** Captures nuanced emotional and preference patterns, improving personalization. Outperforms existing models on custom datasets.

Disadvantages/Limitations: Highly complex and computationally intensive. Requires detailed emotional history and rich interaction data for effective functioning.

3. Music Recommendation and Generation Based on Face Emotion Detection

Methodology: Employs CNNs for emotion detection, RNNs for emotion-to-track mapping, and LSTM networks for generating emotionally aligned music. Integrates with Spotify API for live playback.

Advantages: Aims to detect deepfakes by identifying inherent patterns or anomalies introduced during the generation process, which could aim for a more comprehensive approach than merely scanning for visual inconsistencies.

Disadvantages/Limitations: The snippet is very brief on the technical specifics of the methodology, making it hard to ascertain specific disadvantages or limitations, such as its generalizability across different GAN architectures or the visibility of these traces in highly compressed images.

4. Music Recommendation System using Facial Detection Methodology: The process begins by identifying the user's face through Haar Cascade and classifying emotions into seven categories with a CNN model after preprocessing the images (grayscale conversion, resizing, and normalization). It then maps each emotion to specific music features like tempo, pitch, volume, rhythm, and harmony, based on psychological research. **Advantages:** This system provides personalized music recommendations based on the user's current emotional state, enhancing the listening experience. It offers real-time feedback, making interactions more engaging and emotionally supportive. **Disadvantages/Limitations:** The system's accuracy depends on lighting, camera quality, and facial expressions, that may result in incorrect emotion detection. It may also struggle with privacy concerns since it

continuously processes live video data.

5. Music Recommendation Based on Facial Emotion Recognition

Methodology: The system applies the ResNet50 CNN model to classify facial emotions into seven categories using both the FER dataset and real-world images. It enhances accuracy by focusing on the eye region with Haar cascades and a specialized model. GRAD-CAM is used to highlight key facial features that influence predictions, and detected emotions are matched to curated song lists to provide personalized music recommendations in real time.

Advantages: The system provides accurate emotion recognition and personalized music suggestions in real time. Explainable AI and eye-focused detection improve transparency and help capture subtle expressions more effectively. **Disadvantages/Limitations:** The system relies solely on facial expressions, which may not fully capture a user's emotions. Performance can be affected by lighting or dataset limitations, and constant camera access raises privacy concerns

6. Emotion-basis Music Recommendation System

Methodology: The system uses a CNN-based model to classify emotions by analysing either text features, like song lyrics, or visual cues such as facial expressions, employing preprocessing methods like tokenization and embedding. Songs are labeled with emotional tags, and a combination of collaborative and content- based filtering is applied to match music with the user's current emotional state. For secure data management and user confidence, the Alchemy Blockchain API is integrated to store emotion data and recommendation history.

Advantages: The system offers real-time, emotion-aware music recommendations that adapt to users' moods for a more personalized experience. Blockchain integration ensures secure and transparent data handling, while tailored suggestions and token-based rewards boost user engagement.

Disadvantages/Limitations: The system depends on stable internet and APIs, and emotion detection may be affected by unclear inputs. Blockchain adds complexity and increases processing costs, while it may struggle to generalize across varied emotions without further training.

7. Emotion Based Music Recommendation System Using Wearable Physiological Sensors

Methodology: The system uses wearable sensors like GSR and PPG to measure emotional arousal and valence in real time. It extracts statistical and time-domain features, such as mean, variance, and skewness, from the sensor signals using variable- length windows. These features are fused at the data level to improve detection accuracy. Supervised learning algorithms, such as Decision Tree, Random Forest, k-NN, and SVM, are employed to classify emotional states. Finally, the detected emotions are integrated with user and item profiles to enhance the music recommendation process.

Advantages: The system improves music recommendations by matching suggestions with real-time physiological emotions. Multimodal data fusion improves the precision of emotion prediction, and the approach finds application in areas like mobile applications and therapeutic music solutions. **Disadvantages/Limitations:** The improvements from sensor data fusion are limited and need more optimization. GSR and PPG signals are prone to noise from movement or surroundings, and the need for wearable devices may reduce usability.

III .SUMMARY OF THE LITERATURE SURVEY

The literature survey presents a detailed examination of emotion-based music recommendation systems, emphasizing the integration of deep learning techniques and real-time facial emotion recognition to enhance user experience. Traditional recommendation methods, which rely on historical preferences and collaborative filtering, are shown to be limited in adapting to users' immediate emotional states. In order to address these challenges, researchers have explored systems that map detected emotions from facial expressions to mood-based music selections, using technologies such as CNNs, ResNet50V2, VGG16, and semantic analysis models like BERT. These systems dynamically filter datasets and generate playlists aligned with users' moods, offering a more immersive and personalized experience. Different approaches have proven highly effective at emotion classification and real-time recommendations, with some achieving up to 97.5% accuracy, while others incorporate advanced methods like Heterogeneity- aware Deep Bayesian Networks to model variability in user emotions and preferences. Despite these advancements, key limitations persist, such as reduced performance in low-light or occluded conditions, moderate recognition accuracy, dependence on extensive emotional data, and high computational costs. Overall, the survey underscores the importance of integrating computer vision, natural language processing, and probabilistic modelling in emotion-aware recommendation systems, while also highlighting the need for robust, efficient, and adaptable solutions capable of functioning in diverse real-world environments.

Author	Title	Research Focus / Observations
Swetha Kambham, Shubert A.Johnson,Sai Prathap Reddy kambham	Emotion Detection and Music Recommendation system(2025)	Focuses on real-time emotion-based music recommendation using face detection and recognition with high accuracy, interactive UI, and quick responsiveness.
Ankush Kumar Singh,Durbadal Mandal	Emotion-Based Music Recommendation system Using deep Learning (2025)	Explores emotion-based music recommendations using deep learning and NLP, offering personalized playlists with real-time responses but facing accuracy and resource challenges.

rkanmg Jing,Yezheng Liu,Yidong Chai,Shuo Yu,Longshun Liu,Yuanchun jiang,Yang Wang	motion-Based Personalized Music Recommendation with Heterogeneity- aware Deep Bayesian Network (2024	roposes a Heterogeneity-aware Deep Bayesian Network (HDBN) to model individual emotional variability and personalized music preferences for enhanced ecommendations.
r. K. Reddy Madhavi,Vishnu Chalivendra, Ch Lasya vasantha, R Chandra Lekha, K Dinesh Kumar Reddy	Music Recommendation and generation Based on Face Emotion Detection (2024)	Develops a real-time system ntegrating face emotion detection with music recommendation and generation, using deep learning and Spotify API ntegration.
Manvitha Sri Guthula, Dr. Monali Bordoloi	Music Recommendation system Using Facial Detection Based Emotion Analysis (2024)	roposes a facial emotion-based music recommendation using CNN and Haar Cascade, mapping emotions to musical features in a seamless app.
ajesh B, Keerthana V,Narayana Darapaneni, Anwesh reddy P	Music Recommendation Based on Facial Emotion Recognition (2023)	Uses facial emotion recognition with CNN and explainable AI to map emotions to pre-curated playlists, enabling real-time music ecommendations.
ina Babu, Rekha R nair, Geetha A.	motion-Basis music Recommendation: nhancing UX via Real-Time Context (2023)	Develops a real-time emotion-based music recommendation using CNN with visual and textual inputs, secured via blockchain for enhanced user xperience.

eger Ayata, Yusuf Yaslam, Mustafa E. Kamasak	motion –Based Music Recommendation Using Wearable Physiological sensors (2018)	motion-Based Music Recommendation Using Wearable Physiological Sensors (2018) Deger Ayata, Yusuf Yaslam, Mustafa . Kamasak Non-visual, sensor-driven; applicable to health/music therapy; multimodal sensing GSR & PPG signals for emotion (arousal/valence); ML classifiers (SVM, RF); signal fusion Wearables required; sensitive to noise; modest gains; compute and tuning needed

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