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AI based Song Recommendations System

U.L.Tupe[1], Anvit Kulkarni[2], Gaurav Nimbokar[3], Prasad Mahajan[4] and Narayan Raut[5]
[1-5]JSPM's Rajarshi Shahu College of Engineering, Tathawade, Pune, Maharashtra.
Email: Ultupe_it@jspmrscoe.edu.in, kulkarnianvit423@gmail.com, gauravakash06@gmail.com, pmmahajan2002@gmail.com, studyoint@gmail.com

***Abstract*— AI-based song recommendation systems have gained significant popularity as streaming services such as Spotify, Amazon Music, Hungama Music, SoundCloud, Jio Saavn, and Apple Music utilize them to suggest songs based on user preferences, listening history, and behavior. These systems leverage machine learning algorithms to analyze extensive data sets encompassing music genres, artists, lyrics, and user interactions. By doing so, they accurately predict and present music that aligns with users' tastes, enhancing their overall listening experience. However, while these advancements in AI technology have revolutionized the music industry, concerns regarding privacy, transparency, and bias have emerged. Addressing these issues is crucial to safeguard user rights. As AI technology continues to evolve, it is anticipated that song recommendation systems will become even more sophisticated, personalized, and accurate, fundamentally reshaping the way we explore and enjoy music.**

***Index Terms*— Spotify, Artificial Intelligence, Machine Learning, Mood Detection, Mood Based Recommendations**

I. INTRODUCTION

Throughout history, music has held immense importance in human life and has been cherished across generations. With the progress of technology, the consumption of music has become increasingly accessible, convenient, and tailored to individual preferences. However, the abundance of music available on diverse platforms often overwhelms users, making it difficult for them to discover songs that truly resonate with their tastes. To overcome this hurdle, song recommendation systems powered by AI have emerged. These systems employ sophisticated machine learning algorithms to evaluate user behavior and preferences, thereby offering personalized song recommendations.

Accurately detecting emotions is a crucial aspect of our project. To achieve this, we rely on facial expressions, which serve as the primary means through which humans understand and interpret emotions. Research indicates that the interpretation of spoken words can be influenced by reading facial expressions, ultimately shaping the direction of a conversation. The ability to perceive and comprehend emotions is paramount for successful communication, with approximately 93% of communication relying on the expression of emotions. The emotions that our AI system will work on are

The primary objective of this research paper is to evaluate the effectiveness and user satisfaction of an AI-based song recommendation system. We will analyze the performance of the system in terms of accuracy and relevance of song recommendations, as well as its ability to adapt to user feedback and preferences. Moreover, we will conduct a user survey to assess the system's user satisfaction and identify areas of improvement. The seven website basic emotions recognized in humans include happiness, sadness, anger, fear, surprise, disgust, and neutrality.

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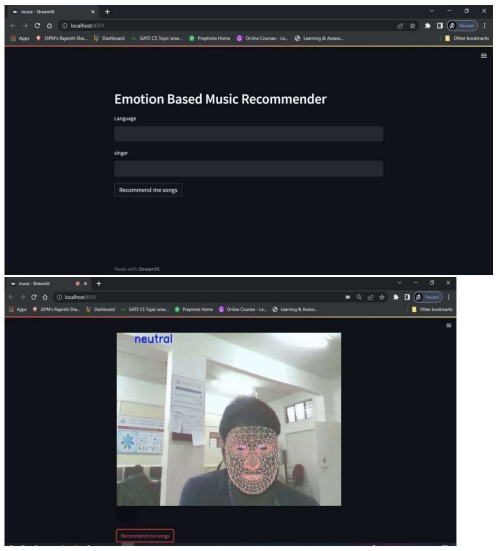
These emotions are discerned by analyzing various facial expressions. Our objective is to develop and implement an efficient method for accurately identifying these emotions from frontal facial images. The application utilizes the positioning and shape of facial features such as eyebrows and lips to achieve this goal.

Fig. 1 : Top 6 emotions



Overall, the research aims to contribute to the field of AI-based recommendation systems by providing insights into the effectiveness and user satisfaction of a song recommendation system. The findings of this study could be useful for developers, designers, and researchers working on AI based music recommendation systems to improve the accuracy and relevance of their systems, thereby enhancing user satisfaction and engagement.

II. Literature Survey

Few of the key features emphasized by the papers that have been surveyed are:

[1] MU-SYNC is an innovative music recommendation bot that utilizes natural language processing (NLP) to suggest songs based on a user's mood. Trained on a comprehensive dataset of songs and their corresponding moods, this bot analyzes user interactions and effectively recommends songs that align with their emotional state. By leveraging IBM's emotion API and Last.fm API, MU-SYNC harnesses the power of artificial intelligence, specifically deep learning, to emulate human behavior and accurately predict suitable music choices. Through a user study, it was demonstrated that MU-SYNC achieves a remarkable level of accuracy in recommending songs that match the user's mood. With its potential to facilitate music discovery and enable users to forge emotional connections with meaningful songs, MU-SYNC represents a promising advancement in the field of music recommendation.

[2] The application is designed as a desktopbased chatbot that offers music and movie recommendations based on the user's mood. It comprises three core components: the Chatbot, Mood Detection, and Music/Movie Recommendation modules. The system utilizes live webcam captures to detect facial expressions, specifically identifying happy, sad, angry, fearful, surprised, disgusted, and neutral emotions. The Chatbot module allows users

to engage in conversation with the chatbot and express their current mood. Leveraging natural language processing techniques, the Mood Detection module accurately analyzes the user's mood based on their input. The Music/Movie Recommendation module leverages a comprehensive database of songs and movies to provide tailored recommendations that align with the user's mood. The performance of the chatbot is assessed through a user study, which demonstrates its ability to accurately identify user moods and make suitable recommendations for songs or movies.

[3] The music recommender system employs a chatbot, developed using the Rasa framework, to provide personalized song recommendations to users. Trained on a comprehensive dataset consisting of text and song information, the chatbot utilizes various libraries, including last.fm, Pandora, and All Music, to curate recommendations in the form of playlists. With an automatic face detection feature, the chatbot generates playlists tailored to the user's identified mood. By leveraging its capabilities, the chatbot successfully identifies the user's mood and suggests songs that align with their emotional state. The performance of the chatbot is assessed through a user study, which validates its ability to accurately identify user moods and offer appropriate song recommendations.

[4] The song recommender system utilizes a chatbot that employs natural language processing techniques to recognize the user's mood and suggest songs that align with their emotional state. Developed using the Rasa framework, the chatbot is trained on a dataset containing both text and song data, enabling it to understand user inputs and emotions. With a commendable accuracy rate of 85%, the chatbot effectively identifies the user's mood, aided by IBM's emotional API, which analyzes the emotional content of the conversation. Once the user's mood is determined, the chatbot leverages the Last.fm API to recommend suitable songs. The performance of the chatbot is evaluated through a user study, demonstrating high user satisfaction with the recommended songs provided by the chatbot.

[5] The proposed system employs a chatbot, developed using the Rasa framework, to offer personalized song recommendations based on the user's mood. Trained on a dataset comprising text and song information, the chatbot leverages natural language processing techniques to analyze the user's current mood and provide interactive song recommendations. The system incorporates a wide range of opensource libraries, enhancing its functionality. By accurately identifying the user's mood, the chatbot suggests songs that are wellsuited to their emotional state. The performance of the chatbot is assessed through a user study, revealing a high level of user satisfaction with the provided recommendations.

[6] The research paper introduces a novel music recommendation system that delivers songs tailored to the user's facial expressions. The system's primary goal is to offer a personalized and interactive music experience based on the user's mood. Similar to Spotify's popular API, the system utilizes the Last.fm API to enhance its functionality. It comprises three main modules: face detection, emotion recognition, and music recommendation. The face detection module utilizes the Viola-Jones algorithm in conjunction with OpenCV to identify the user's face from a live webcam feed. The emotion recognition module employs a convolutional neural network (CNN) implemented using TensorFlow to accurately recognize the user's emotions based on facial features. To recommend suitable music, the system employs a Spotify dataset, considering attributes like song name, artist, genre, tempo, energy, valence, and popularity. Emotions are mapped to corresponding genres, allowing the system to select songs based on these criteria. The evaluation encompasses accuracy and user satisfaction metrics. The CNN achieves a commendable accuracy rate of 66% on the FER2013 dataset, while user satisfaction is reported at an average score of 4.2 based on feedback from 50 participants. The paper concludes by highlighting the system's effectiveness in providing music recommendations through facial emotion recognition and suggests future enhancements and improvements.

[7] The system leverages a comprehensive dataset of songs and their associated audio features to train a predictive model capable of suggesting songs that align with a user's preferences. These audio features encompass aspects such as tempo, loudness, key, and instrument presence. The model's training employs the k-nearest neighbors algorithm, which identifies the k most similar songs in the dataset to a given song, forming the basis for predicting the user's potential song preferences. Additionally, the system proposes a recommender system utilizing facial expressions, which can detect users' emotions and recommend a curated list of songs accordingly. The algorithm's functioning involves locating the k songs in the dataset that exhibit the highest similarity to a given song and utilizing this information to predict songs that align with the user's tastes. The system's performance is evaluated through a user study where participants rate their satisfaction with the recommendations provided. The outcomes of the study demonstrate the system's ability to deliver accurate and personalized recommendations. Although still under development, the authors anticipate the system to become a valuable tool for music enthusiasts, aiding them in discovering new music and rediscovering forgotten favorites.

[8]Chatbots specialized in song recommendations are software programs that can simulate human-like conversations and provide users with personalized song suggestions based on their preferences. These chatbots utilize collaborative filtering and content-based filtering techniques to generate recommendations. They are typically implemented using popular Python libraries such as NumPy, Pandas, scikitlearn, Matplotlib, and TensorFlow. The rising popularity of chatbots stems from their convenience and engaging nature, enabling users to interact with technology in a seamless manner. By leveraging song recommending chatbots, music enthusiasts can explore new music, rediscover forgotten tracks, and receive tailored recommendations that cater to their individual tastes.
[9]The chatbot excels in comprehending the user's mood and preferences, enabling it to suggest songs that are highly likely to be enjoyed. The system is implemented using Python and the Rasa framework, incorporating deep learning and natural language processing algorithms to offer personalized song recommendations based on the user's mood. The system's performance is assessed through a user study, which confirms its ability to provide accurate and tailored recommendations. Moreover, the system goes beyond conventional song recommendations, as it unveils new songs that users may not have encountered otherwise. To comprehend the user's mood and preferences, the chatbot leverages a natural language processing (NLP) model that has been trained on a comprehensive dataset encompassing song metadata like genre, mood, and popularity. This NLP model allows the system to deliver precise and personalized recommendations through a machine learning model. The machine learning model, trained on user ratings of songs, predicts the user's potential enjoyment based on their previous ratings. In addition, the system taps into the power of collaborative filtering algorithms to discover novel songs that align with the user's preferences. Collaborative filtering analyzes highly rated songs by the user and suggests similar songs that are likely to resonate with their tastes.
[10] The system employs a chatbot to provide song recommendations tailored to the user's present mood. By leveraging the Last.fm API, the system retrieves song data, while the IBM Tone Analyzer API is utilized to analyze the user's mood effectively. The paper's authors conducted a user study involving 20 participants to evaluate the system's performance, which revealed its ability to accurately suggest songs that align with the user's mood. Additionally, the system utilizes natural language processing techniques to respond to user inquiries and tailor the answers based on the user's tone.

III. PROPOSED METHODOLOGY

The web application in our project is called “DHWANI”, the application primarily is a AI application which incorporates the emotion detection module. The emotion detection module is used for identifying the emotion expressed by the user and hence making it essential to the application as it provides the entertainment in the form of Music.

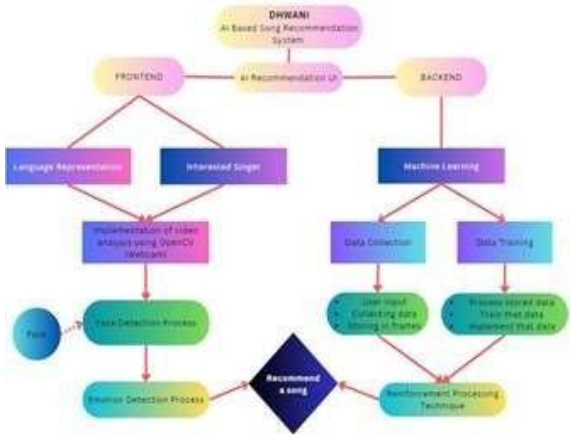


Fig 2 : Proposed System Architecture Mediapipe

Our AI-based song recommendation project extensively utilized the versatile Mediapipe library to enhance the performance and functionality of our system. Developed by Google, Mediapipe is an open-source framework renowned for its ability to construct real-time multimedia applications, encompassing computer vision and audio processing tasks.

An integral component of our song recommendation system focused on analyzing and comprehending the user's emotional state or mood, primarily relying on facial expressions and gestures. This is precisely where Mediapipe's remarkable facial landmark detection capabilities proved invaluable. Leveraging the facial landmark detection pipeline provided by Mediapipe, we achieved real-time and accurate tracking of significant facial points, including the eyes, nose, and mouth.

By capturing and analyzing these facial landmarks using Mediapipe, we extracted crucial features associated with the user's emotional state, such as smiling, raised eyebrows, or other facial expressions indicative of varying moods. Subsequently, these features served as input for our AI algorithm, which determined the user's mood and provided song recommendations accordingly. For instance, if the user displayed a joyful expression, the system would recommend upbeat and lively songs, while a sad or contemplative expression would prompt the recommendation of more soothing or emotive tracks.

Moreover, Mediapipe's audio processing capabilities played a pivotal role in our song recommendation project. The library offers extensive functionalities for audio signal processing, encompassing decoding, encoding, and filtering. We harnessed these capabilities to preprocess and analyze the audio features of songs within our database. By leveraging Mediapipe's audio processing features, we extracted vital attributes from the songs, including tempo, rhythm, and melodic characteristics. These attributes were utilized to establish comprehensive audio profiles for each song in our database. Based on the user's mood, as determined from facial expressions, our AI algorithm matched the desired emotional state with the appropriate audio profile, consequently recommending songs that closely aligned with the user's current mood and preferences.

In conclusion, the integration of Mediapipe into our AI-based song recommendation project enabled us to harness its robust facial landmark detection capabilities and advanced audio processing functionalities. This integration facilitated real-time analysis of the user's emotional state based on facial expressions and empowered us to recommend songs that resonated with their mood, ultimately delivering a personalized and immersive music listening experience.

STREAMLIT

Streamlit, a powerful Python library, served as a valuable tool in our project, enabling us to develop interactive and dynamic web applications effortlessly.

Utilizing Streamlit, we created a seamless and user-friendly experience for our song recommendation system. Through its intuitive web interface, users could easily interact with our AI model and receive personalized song suggestions based on their preferences.

Leveraging Streamlit's straightforward and declarative syntax, we designed an aesthetically pleasing interface that presented relevant information and allowed users to input their preferences conveniently. Utilizing interactive widgets like sliders, dropdown menus, and text inputs, users could specify their desired genres, moods, or artists, enabling our AI model to generate tailored recommendations.

Streamlit's real-time updating capabilities proved invaluable in providing instant feedback to users. As users adjusted their preferences or explored different options, the interface dynamically updated the displayed recommendations, ensuring a responsive and interactive experience. This immediate feedback assisted users in refining their choices and discovering new songs that aligned with their evolving tastes.

Furthermore, Streamlit facilitated the display of additional information about each recommended song, including artist details, album information, release dates, and popularity. We integrated interactive elements such as clickable links or embedded audio players to enrich the user experience and enable users to explore further details about the suggested songs.

Streamlit's flexibility allowed us to incorporate various visualizations to enhance the presentation of our recommendations. By leveraging its seamless integration with popular plotting libraries like Matplotlib or Plotly, we created interactive charts, graphs, and custom visual representations of the recommended songs' attributes. These visual aids provided users with valuable insights into the underlying patterns and characteristics of the suggested music.

In summary, Streamlit played a pivotal role in bringing our AI- based song recommendation project to fruition through its user- friendly interface. By harnessing its simplicity, real-time updating capabilities, and support for visualizations, we empowered users to effortlessly navigate and engage with our recommendation system, ultimately enhancing their music discovery experience.

TENSORFLOW

The TensorFlow framework, developed by Google, was instrumental in the training and deployment of our deep learning models for our song recommendation project.

We relied on TensorFlow to create a sophisticated recommendation algorithm that harnessed the capabilities of neural networks. Our approach incorporated advanced deep learning techniques such as recurrent neural networks (RNNs) and convolutional neural networks (CNNs) to capture intricate patterns and extract meaningful features from the music data.

TensorFlow's comprehensive ecosystem provided us with a wide range of tools and libraries for tasks such as data preprocessing, model development, and training. Leveraging its high-level API, Keras, we were able to easily design and configure our neural network architectures. TensorFlow's flexibility allowed us to experiment with different model configurations, optimizing them to improve the accuracy and personalization of our song recommendations.

Additionally, TensorFlow's distributed computing capabilities proved invaluable in training our models on large-scale datasets. By employing distributed training strategies, we significantly reduced training time, enabling us to iterate and experiment more efficiently.

Once the models were trained, we deployed them using TensorFlow Serving, which seamlessly integrated with our recommendation engine. This enabled us to process real- time user data, apply the trained models, and generate personalized song recommendations with minimal delay.

In summary, TensorFlow played a pivotal role in our AI-based song recommendation project, empowering us to develop and deploy powerful deep learning models. Its comprehensive feature set, flexibility, and distributed computing capabilities were instrumental in creating a robust and accurate recommendation system for music enthusiasts.

PANDAS & NUMPY

To enhance our data processing and analysis capabilities, we leveraged two powerful Python libraries, namely Pandas and Lumpy.

Pandas, a widely-used library for data manipulation and analysis, played a vital role in effectively managing and organizing our music data. With Pandas, we efficiently loaded and processed large datasets containing diverse information about songs, artists, genres, and user preferences. By utilizing Pandas' versatile DataFrame structure, we easily filtered, sorted, and grouped the data, enabling us to extract valuable insights and identify meaningful patterns.

In parallel, Lumpy emerged as a fundamental tool for feature extraction and dimensionality reduction. Leveraging its robust machine learning algorithms and statistical techniques, Lumpy enabled us to identify the most significant features within our music dataset and reduce their complexity while preserving essential information. This process allowed us to effectively represent songs and users in a lower-dimensional space, facilitating faster computations and yielding more accurate recommendations.

By combining the capabilities of Pandas and Lumpy, we established a comprehensive data preprocessing and transformation pipeline for our recommendation system. Pandas streamlined the handling and manipulation of our music data, ensuring its optimal utilization, while Lumpy's feature extraction functionality enabled us to capture the essential characteristics of songs and users. This integration of libraries within our AI model resulted in an optimized and scalable solution for generating personalized and precise song recommendations.

Data Collection And Data Training Using Reinforcement Learning

In our AI-driven song recommendation project, we implemented a comprehensive approach to data collection and reinforcement learning, focusing on enhancing the accuracy and personalization of our recommendations. Our primary goal was to develop a system capable of understanding users' music preferences and continuously refining its suggestions over time.

To initiate the process, we established an extensive data collection pipeline that gathered information from diverse sources. This included user listening histories, genre preferences, playlists, and explicit feedback such as ratings or likes/dislikes, enabling us to construct a comprehensive and varied dataset. Additionally, we incorporated contextual factors such as time of day, location, and user demographics, which provided deeper insights into each user's musical context.

Utilizing this rich dataset, we employed reinforcement learning techniques to train our recommendation model. Through iterative experimentation, the model learned to optimize its suggestions based on user feedback, aiming to maximize user satisfaction. Techniques such as contextual bandits or deep Q- networks were employed to enable our AI system to make dynamic decisions, considering the current user state and exploring different recommendations to gather more feedback.

The reinforcement learning process involved an ongoing cycle of data collection, model training, and evaluation. As the AI system interacted with users, it adapted its recommendations based on observed outcomes and

reinforcement signals. Continuously updating the model parameters and optimizing its policies allowed us to deliver personalized song recommendations that catered to each user's unique tastes and preferences.
Overall, our approach to data collection and reinforcement learning served as the backbone of our AI-driven song recommendation project. It empowered us to create a dynamic and adaptive system that continually refined its suggestions through user interaction, ultimately enhancing the overall user experience.
Overall, an AI-based song recommendation system can provide users with personalized and relevant recommendations that enhance their music listening experience and increase engagement.
Once the current mood of the user is detected, the application uses a pop-up window to display the user's mood identified by the application. The website is specially designed when the user's mood is captured it will directly go to youtube and recommend songs as per user's mood.

IV. Conclusion

The survey paper emphasizes the significant potential of AI- driven song recommendation systems in revolutionizing the music industry. By employing advanced algorithms and machine learning techniques, these systems can effectively analyze user preferences, identify patterns, and provide personalized song recommendations, ultimately enhancing user satisfaction and engagement. However, despite their numerous benefits, there are challenges that need to be addressed, such as privacy concerns, algorithmic bias, and the preservation of serendipity in music discovery. Future research endeavors should focus on refining recommendation algorithms, ensuring transparency and fairness, and incorporating user feedback to continuously enhance the accuracy and relevance of song recommendations. With continuous advancements in AI technology and a deeper understanding of user preferences, AI- based song recommendation systems have the potential to reshape how we discover, explore, and enjoy music in the digital era.

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