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Emotion Based Music Recommendation System

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Abstract: *We describe a music recommendation system based on emotion analysis in this research that tries to address this problem by giving personalized music choices based on individual emotions. Our system analyses user's emotions via image processing and music information to create accurate and diverse recommendations using content-based filtering approach. To obtain and convert relevant data for successful recommendation creation, we use data collecting and pre-processing approaches. The system's performance is assessed using standard criteria such as accuracy metrics and mean average errors, with a user-friendly interface and intuitive user experience being prioritized. Our mission is to improve music discovery by allowing users to discover new songs, artists, and genres, as well as to build a deeper relationship between users and their favourite songs.*

Keywords: Emotion analysis, Image processing, Music recommendation system, Convolutional Neural Networks, Deep Learning

I. INTRODUCTION

Music is now more accessible than ever before in today's digital world. Users are frequently overwhelmed by the sheer volume of information accessible, thanks to a multiplicity of streaming platforms and an ever-expanding music library. Navigating this large musical landscape and discovering new songs that correspond to individual likes and preferenceshas become difficult. A music recommendation system can help with this.

Our primary goal in this project is to create a music recommendation system based on customers' emotions. Our system strives to give personalized music suggestions by leveraging advanced algorithms and approaches, assisting users in discovering new songs, artists, and genres that resonate with their own mood. Music recommendation systems have the potential to transform how people interact with music.

To provide reliable and diverse recommendations, our music recommendation system will use a content-based filtering approach. We will acquire relevant information such as music metadata, user'semotions through data collection and preprocessing. This data will form the basis for our recommendation algorithms, which will analyse and extract patterns, similarities, and correlations in order to give precise and appropriate recommendations. Finally, our music recommendation algorithm aims to connect consumers to the enormous world of music. We hope to revolutionize the way people discover and engage with music by providing accurate, diversified, and personalized suggestions, encouraging a deeper connection between users and their favourite tunes.

We anticipate interesting insights and challenges as we delve into the complexities of constructing this music recommendation engine. This project's conclusion will not only provide a novel solution, but will also help to develop recommendation systems and analyze the user's emotions.

Let us go on this adventure with excitement and resolve to re-imagine how music is explored, experienced, and appreciated.

II. LITERATURE SURVEY

This section provides a brief review of various papers we used for reference that addressed various methodologies for emotion based music recommendation system.

This research paper[1] focuses on the classification of emotions from speech using Fisher's Discriminant Analysis and Bayesian Classifier. A large number of features were obtained from speech to classify emotions, which were then projected into different spaces using principal component analysis and Fisher's discriminant analysis. Classifications were performed in those spaces using a Naïve-Bayes classifier, and the results were compared. The highest accuracy obtained in

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the Fisher space was 57.87%, while it was calculated as 48.02% in the principal component space. This study provides insights into the effectiveness of these methods for emotion recognition from speech.

This research paper[2] focuses on, emotion-based music classification and present an affective cross-platform music player, EMP, which recommends music based on the real-time mood of the user. The music player contains three modules: Emotion Module, Music Classification Module and Recommendation Module. The Emotion Module takes an image of the user's face as an input and makes use of deep learning algorithms to identify their mood with an accuracy of 90.23%. The Music Classification Module makes use of audio features to achieve a remarkable result of 97.69% while classifying songs into 4 different mood classes. The Recommendation Module suggests songs to the user by mapping their emotions to the mood type of the song, taking into consideration the preferences of the user. The main objective of this paper is to design a music player which automatically generates a sentiment aware playlist based on the emotional state of the user.

In this work[3], we describe a music recommendation system based on the identification of personality traits, moods and emotions of a single user, starting from solid psychological observations recognized by the analysis of user behavior within a social environment. In particular, users personality and mood have been embedded within a content-based filtering approach to obtain more accurate and dynamic results. Several experiments are then reported to show effectiveness of user personality and mood recognition recommendation, thus encouraging research in this direction. It uses Big Five psychological model and its accuracy is calculated based on R^2 measurements. It has an average accuracy of 72.4% for emotion analysis and 59.4% for music recommendation.

The writers of this research report[4] have emphasised the relevance of mental health and how a music recommendation system might be useful. In this research, the authors offer an effective annotator that recognises the emotions in music by combining deep learning (DL) with support vector machines (SVM). The music is divided into segments and then converted from auditory impulses to visual graphics using this process. The images are then modelled and recognised using a convolutional neural network (CNN). Following that, the findings of CNN are used as input for SVM. Finally, with unknown music, the SVM predicts top-k emotions. The authors used the real dataset CAL500 as the experimental set to evaluate the suggested annotator.

III. METHODOLOGY

- Importing Modules: The model starts by importing the necessary modules such as numpy, streamlit, pandas, cv2 (OpenCV), Counter, and specific modules from the TensorFlow library. These modules are essential for data manipulation, real-time video processing, and deep learning operations.
- Reading Data: It then reads a CSV file named 'muse_v3.csv' using the pandas library and stores the data in a DataFrame named 'df'. This CSV file contains music data, including song names, artists, emotions, and pleasantness ratings.It also renames and selects specific columns from the DataFrame.
- Sorting Data: The DataFrame 'df' is sorted based on the 'emotional' and 'pleasant' columns in ascending order.This sorting ensures that songs with similar emotional and pleasantness ratings are grouped together. This sorting ensures that songs with similar emotional and pleasantness ratings are grouped together.
- Dividing Data: The sorted DataFrame 'df' is divided into different subsets based on emotional values. These subsets are created for specific emotions such as sadness, fear, anger, neutrality, and happiness. This division allows for easier retrieval of songs based on a particular emotion.. Five subsets are created: 'df_sad', 'df_fear', 'df_angry', 'df_neutral', and 'df_happy'.

Defining Functions: Two functions are defined in the code:

- The 'fun' function takes a list of unique emotions as input and returns a DataFrame containing 30 rows of songs based on those emotions.
- The 'pre' function takes a list of emotions (possibly containing duplicates) and returns a unique list of emotions sorted based on their occurrence count.

- Creating the Model: A Sequential model is created using the Keras API from TensorFlow. The model consists of several Convolutional Neural Network (CNN) layers, including Conv2D, MaxPooling2D, Dropout, Flatten, and Dense layers. The model architecture is designed for emotion detection from facial images.

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- Loading Model Weights: Pre-trained weights of the emotion detection model are loaded into the created model using Haar cascade algorithm. These weights have been previously trained on a large dataset and allow the model to perform accurate emotion detection.
- Webcam Capture and Emotion Detection: The model captures video frames from the first webcam and performs real-time emotion detection using the loaded model. The detected emotions are appended to the 'list' variable.
- Recommendation Generation: The 'fun' function is called with the list of detected emotions to generate a DataFrame of recommended songs. Each recommended song's name, artist, and a link to the song's website are displayed using the Streamlit library.
- Displaying Recommendations: The Streamlit library is utilized to create a web application for displaying the recommended songs. The application provides a user-friendly interface for users to explore and listen to the recommended songs.

The recommended songs are displayed on the Streamlit web application. Each recommended song's name is presented as a clickable link, allowing users to access additional information about the song.

Along with the song names, the corresponding artist names are also displayed. This provides users with the necessary details to identify and connect with their preferred artists.

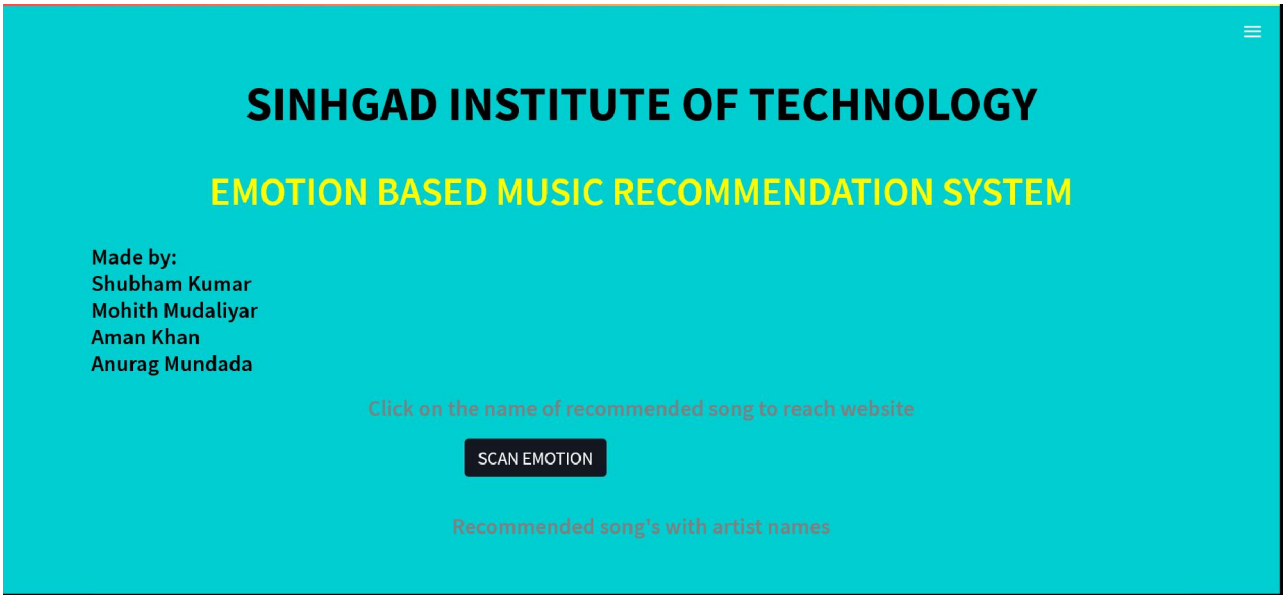
The Streamlit application allows users to interact with the recommended song list dynamically. They can click on the song links to access the song's website or streaming platforms for listening.

The application continuously captures the user's webcam feed and updates the recommended song list based on their real-time detected emotions. This enables a personalized music recommendation experience tailored to the user's emotions.

By combining emotion detection from facial images with music data, this code provides an innovative approach to music recommendation systems. It leverages deep learning techniques to analyze facial expressions and matches them with appropriate songs, allowing users to discover music that resonates with their emotions.

IV. RESULTS

After the model is complete, we can deploy the model on our local machine and check the final result. The result is as shown below in the images. After deploying the model, we can view our streamlit app on our default browser. On the homepage we can click on ‘SCAN EMOTION’ button which will allow the model to scan the user’s emotion through webcam. After the Scan is done, a list of 30 songs is generated which shows music name and artist name as shown below. The user can then click on the music of their preference and they will be redirected to the song link on lastfm website where the music can be enjoyed by the user.



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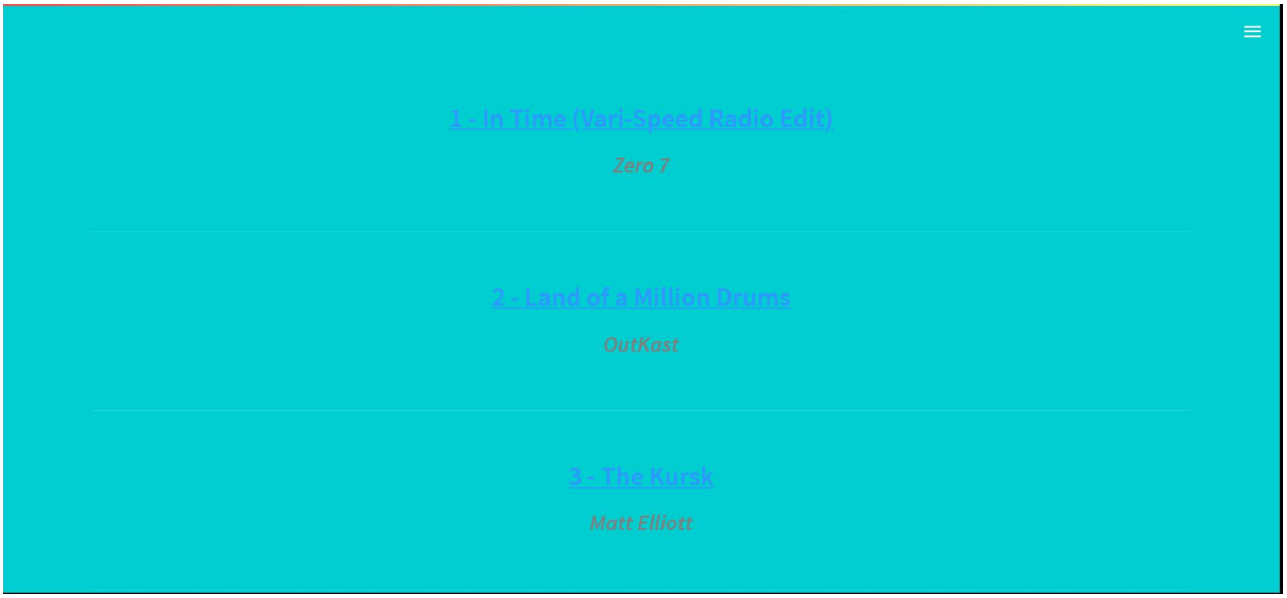

V. CONCLUSION

In this research paper, we have presented a survey and methodology for building the Emotion based Music Recommendation System. To perform this, we first identified various approaches for analyzing emotions. We then evaluated the considered algorithms which are useful in building our system in terms of their ability to work on the recommendation process of the system. We also gathered all the requirements needed for building our system and studied the overall process involved in the system's working. Lastly, we deployed required model of our system. In conclusion, our 'Emotion Based Music Recommendation System' is used to facilitate the music searching process bypeople to automate and give them a better music player experience. The application solves the basic needs of music listeners without troubling them as existing applications do.

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