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Entertainment (Music) Suggestion for Handicap Dumb (Speechless) People using EEG Signal

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Abstract: *A mood-based music recommendation system that uses Brainwaves is the latest way to recommend music based on people's brainwaves, based on their current mood. The technology records brain wave activity using electroencephalogram (EEG) signals and uses machine learning algorithms to categorize the user's mood. This system provides music recommendations based on the user's mood, which increases listening enjoyment and emotional endurance. The proposed method can revolutionize music recommendation systems, providing a more personalized and natural listening experience. DREAMER and GUINEA BISSAU EEG data is the database used in this research. Both data were obtained by measuring the Emotive EPOC device with 14 channels. After further processing, classification and recommendation, playlists are automatically created and played based on the user's current mood. Both methods provide better performance in terms of computing time compared to existing literature algorithms. The accuracy of the first approach was 94%, and the classification accuracy of the second approach using PCA and SVM was 96.8% and 96% for valence and passion, respectively.*

Keywords: EEG, music recommendation, SVM, KNN, PCA, classification, Spotify database

I. INTRODUCTION

Music has long been known to have a profound effect on human emotions and all well-being. As personalized music recommendation systems become increasingly popular, these systems need to make recommendations based on a person's listening history, taste, and mood. At the same time, most of these systems rely on indirect mood assessments, such as user input or music characteristics, which may not always accurately reflect the actual emotional state of the user.

In this paper, we present a novel method to create a mood-based music recommendation system using brainwave data acquired using channel 14 of the Emotiv EPOC device. Emotiv EPOC, a wireless EEG device, records brain waves Temporal control of cognitive and emotional processes as shown in Figure 1. This strategy can provide a more intuitive and accurate assessment of the user's mood, allowing for more personalized and appropriate music selection. This method can improve the efficiency of music streaming services and listening experience.

The main goal of this project is to improve the mood of users by playing music based on their preferences. By examining electroencephalography (EEG) data, which records electrical activity in a person's brain, scientists can learn more about a person's neurological performance. By looking at EEG patterns, they can determine a person's mental and emotional response to different genres of music.

By taking into account a person's interests and emotional state, this method creates personalized music recommendations that suit their needs. Changing your mood can help you cope with difficult situations like depression and sadness. Many health problems can be solved by analyzing expressions and actions can be taken to improve the user's mood.

This new approach to developing a mood-based music recommendation system using brainwave data from the Emotive EPOC has the potential to revolutionize personalized music recommendations. By offering a more relevant and personalized selection of music, it can enhance the user's listening experience, thereby improving their mood and well-being.

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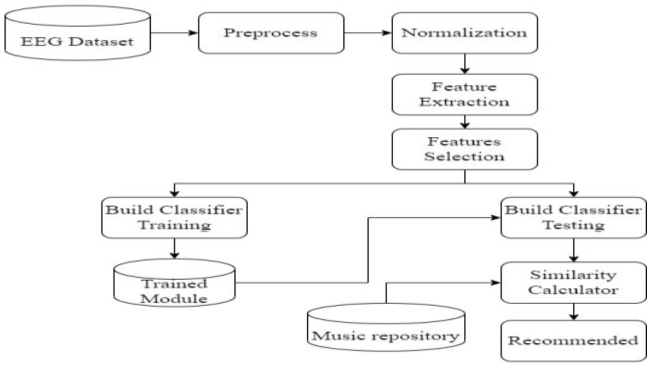

Figure 1 : Proposed system architecture

In this study, we applied two different approaches to two databases.

The first method involves the analysis of EEG data from 97 citizens of Guinea Bissau. Data that has been processed for publicly available online data to arrive at a general mood categorization score. Data were classified as "very low", "low", "high" and "very high". The first, second, and third volumes of EEG data are used to calculate this level. Based on EEG data, it is expected to be able to more objectively and accurately assess the emotional state of the people by classifying their mood. This method can improve the accuracy of applications such as mood monitoring in hospital settings and personalized music consultation systems.

In the second approach, DREAMER, a well-known dataset for physiological signal processing and emotion analysis, is used. Data were pre-processed and feature extracted to reduce noise and artifacts. Then, support vector machine (SVM) and K-nearest neighbors (KNN) classification methods were used to classify individual and arousal values from EEG data. Each piece of music is assigned to a different emotion category after detecting the user's emotional state to provide music recommendations. This allows the system to provide personalized music recommendations tailored to the user's emotional state. This strategy aims to provide a more accurate and personalized music recommendation system using machine learning techniques and EEG data analysis. Since this strategy can improve the efficiency of music streaming and improve the overall listening experience, there are many possible applications. This technique can also have an impact on mental health, as it can help with conditions such as depression and anxiety by offering a personalized selection of music that can lift your mood.

Overall, the accuracy of the first approach was 94%, and the classification accuracy of the second approach for valence and passion using PCM and SVM was 96.8% and 96%, respectively.

II. PROBLEM STATEMENT

Music has been recognized as a powerful tool to improve mood, and researchers have put a lot of effort into developing more precise and effective ways to use music to improve mood. This research focuses on improving the user's mood by providing music that suits their specific needs. This approach uses electroencephalography (EEG) data, which captures the electrical activity in our brain, to gain insight into people's neurological responses to music. By analyzing EEG patterns, we can better understand an individual's mental and emotional response to different genres of music. This understanding makes it possible to create personalized music recommendations that take into account individual interests and emotional states. Deliberately changing your mood from time to time can also help in coping with difficult situations such as depression and anxiety. In addition, the use of expression analysis and active interventions can help solve various health problems and improve mood.

III. LITERATURE SURVEY

EEG, sometimes called electroencephalography, is an invasive technique to monitor the electrical activity of the brain. Combining EEG with music recommendation algorithms has been shown to improve users' listening experience by offering more relevant and personalized music choices. This literature review explores recent findings and advances in EEG-based music recommendation systems. Researchers have proposed several methods, including emotional music selection, real-time music recommendation, music emotion detection and recommendation, and personalized music recommendation based on the user's preferences and emotional state. This technique uses collaborative filtering

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algorithms, deep learning models, and machine learning techniques to extract information from EEG data and provide personalized music recommendations. EEG-based music recommendation systems have the potential to change the way people discover music.

The emotional music selection system was developed by Koelstra et al. (2011) [1], who tracked the emotional reactions of users using EEG data. In the past, systems used machine learning algorithms to recognize EEG data and make music recommendations based on the user's expected emotional state.

related to emotional state. However, Jin et al. (2013) [2] developed a real-time music recommendation system using a brain-computer interface (BCI) to collect EEG data and create a recommendation model based on user preferences. Both studies show promising ways to improve user experience by creating more relevant and effective music recommendations. Developing a music recommendation model that can reflect the emotional state of listeners is possible by combining EEG data with a music recommendation system.

Using EEG data, Lin et al. (2014) [3] developed a system to classify music emotions and provide music recommendations based on the user's emotional state. They identified emotions and music recommendation based on the user's emotional state using feature extraction techniques to extract emotion-related features from EEG data. However, Ma et al. (2018)] combine these techniques to create a more accurate and intuitive recommendation system that takes into account the user's listening behavior and current emotional state in addition to their musical taste.

To overcome the challenges faced by personalized recommender systems, Zhang et al. (2022) [5] developed a model aimed at studying social interactions and trust relationships between users. The main goal of the model is to recommend places of interest to users based on social interactions between users and tourist destinations and geographic information. The results obtained from the data analysis show the feasibility and effectiveness of the proposed model algorithm, showing a higher prediction accuracy compared to other recommendation algorithms.

Based on the concept of social communication, Bi et al. (2021) [6] presented an innovative social reference network model. This model combines attentional mechanisms with two-dimensional Long-Short-Term Memory (LSTM) in a multi-layered perceptual framework. By combining these techniques, they try to improve the accuracy and performance of social media based recommendations.

Lee et al. (2018) [7] focused their research on automatic music extraction using deep learning. They proposed an algorithm that uses feature images generated by energy bands extracted from chord audio files. Using deep learning techniques, their algorithm aimed to automate the process of extracting sound from music data.

Recently, EEG-based music recommendation systems have received much attention. The ability to recognize emotions has been greatly improved by a combination of deep learning techniques. Although a long-term project, the EEG-based music recommendation system requires constant innovation and development. Personalized music recommendations can be made accurately by recognizing music sentiment. Individual differences can be effectively addressed, and music browsing patterns can be differentiated by tailoring music to listeners' emotional preferences. In recent years, the effectiveness of music-based psychotherapy has increased due to the proliferation of emotion-based music counseling systems in the medical field. In the end, The study of EEG-based music theory is important for the development of the basis of many disciplines

IV. METHODOLOGY

We applied two different approaches to two total databases, namely the Guinea-Bissau EEG data and the DREAMER database.

A. DREAM DATA SET

The DREAMER dataset is a freely available multimodal dataset designed for emotion recognition research. It consists of data from physiological symptoms, auditory and visual symptoms, and participants' self-reports when exposed to various emotional stimuli. After each stimulus, 23 subjects recorded their cues as well as their affective state ratings in terms of valence, arousal, and dominance. Participants were shown 18 different film clips. This film clip served as stimuli during the data collection phase and was carefully selected to evoke different emotions. Participants'

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physiological signals, auditory and visual stimuli, and self-report data were recorded while viewing these 18 film clips, and these recordings form part of the data set.

Guinea-Bissau EEG data

EEG data from Emotive Epoc X were obtained from the Internet repository at https://www.zenodo.org. The database consists of 5-minute EEG recordings using 14 of 97 channels in rural Guinea-Bissau and Nigeria.

VIEW 1

GET FREE INFORMATION

The data is pre-processed before classification is performed. A digital filter is used in this step to remove unwanted frequency components from the EEG data. Removing unwanted frequencies that may interfere with the analysis helps improve the signal-to-noise ratio of the data. The filter coefficients are generated by the Hamming window function which minimizes the spectral distortion in the frequency domain. A power spectral density (PSD) is applied to the filtered signal. PSD provides details on how power is distributed over the entire frequency range and can provide important information about signal characteristics.

It is associated with different frequency bands (0.5-4 Hz), theta waves (4-8 Hz), alpha waves (8-13 Hz), beta waves (13-30 Hz). gamma waves (30-100 Hz). By calculating the PSD of the EEG signal, we can identify the frequency bands that are most active during different tasks or conditions and use this information to better understand the underlying neural processes. The data is scaled to ensure that each element is the same size. We combine all data into a single data frame to facilitate future analysis. The final dataset generated using the above procedure was divided into two datasets for valence and arousal classification.

CLASSIFIVATION OF EMOTION

The valence and arousal datasets were classified using four supervised machine learning classifiers.

Support Vector Machine (SVM) Classification - Support Vector Machine (SVM) is an efficient supervised learning technique used in regression and classification problems. It tries to find the ideal hyperplane that divides the data points of various classes by the greatest distance. SVM can handle both linear and non-linear data if the data is mapped into a multidimensional space using the kernel method. The algorithm finds the support vector or critical point closest to the decision boundary. Standard functions. The hyperparameter used for SVM is the kernel function. Since the evaluation requires multivariate classification, only the Radial Basis Function (RBF) kernel is considered.

Support Vector Machine (SVM) and Principal Component Analysis (PCA) – Principal component analysis (PCA) is used to achieve dimensionality reduction and after feature adjustment, SVM classifier is used. Features were standardized and dimensionally reduced using PCA. The adjusted features produced by PCA are used to design and train the SVM classifier. The records from the test set are then predicted using the classifier.

K's Nearest Neighbors (KNN) Classifier - A direct and indirect machine learning technique called K's Nearest Neighbors (KNN) is used for classification and regression applications. The prediction of data points in KNN is based on the consensus of the nearest neighbors in the feature space or average. Standard functions. The number of neighbors is the value of the hyperparameter used in this work. Features from the test set are predicted by a classifier trained on the data set.

Principal Component Analysis (PCA) with K-Nearest Neighbors (KNN) - Principal component analysis (PCA) is used for dimension reduction, after which the features are transformed into K-Nearest Neighbors (KNN) classifier. Features were standardized and feature dimensions were reduced using PCA. Both practice and test sets need to change. The number of neighbors is the corresponding hyperparameter value. A classifier is trained on the training data to predict the features of the test set.

MUSIC SUGESSTION

Based on the user's assessed mood, the music recommendation system can recommend customized music. Algorithms can sue

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DATA CLASSIFICATION

The EEG data set obtained from the Emotive Epoc X had to be categorized so that a set of universal values had to be generated. For each of the 97 participants, the value of the first quantile (q1), the second quantile (q2), and the third quantile (q3) was calculated, and the value of this quantile was averaged among all participants. To represent the data distribution, q1 represents the 25th percentile, q2 the 50th percentile (average), and q3 the 75th percentile. By calculating this value for each participant, we can determine the most common range of values in the entire group. This allows us to create a baseline or reference point for each channel, which can be used to classify new data based on how different it is from the values that we have set as standard

After obtaining common values for q1, q2, and q3, the data set is classified using the following criteria:

And the value of $<$q1 is very low if low, then q1 $<$ price $<$ q2

if high, then q2 $<$ price $<$ q3

and the value of q3 $<$ is too high

After grouping the data, we can find the number of each group separately. Since the quantity will be determined using data from a comparable population, this will result in a more accurate representation of the data.

DRYING INTERVAL

Emotive Epoc X 128 Hz or 128 cycles per second. Before calculating the pattern for each of the 128 observations, we categorized the data set for data analysis. The total amount of brain activity for that second is then determined. Through this process, we can get a second set of data that more accurately represents the user's brain activity. At that time, we calculated the sequence of data in 60 seconds to determine the basic mood of the user. Using this method, we determine the typical mood of the user over a longer period of time, which can change over time.

MUSIC SUGGESTION

We classified Guinea-Bissau's EEG data using a common score that provides useful insight into a person's emotional state. We're trying to achieve something similar to Spotify Music, allowing us to create music recommendations based on a person's current mood. To achieve this, we defined data variability for Tempo, Dance and Energy sound attributes. This requires finding a quantitative value for each attribute, providing a more accurate representation of the data.

The Spotify data set is divided into four categories - very low, low, high activity and very high - after determining the variability of the data. This makes it possible to create music recommendations by sharing a database based on people's current mood. By checking the auditory characteristics of each song, we can determine which song can improve a person's mood and make it interesting to listen to. This strategy has helped us improve our users' listening experience and provide a more satisfying and personalized music experience.

MUSIC GAMES

Recommended songs are played based on the user's mood by opening the YouTube app. By automating music playback on YouTube, we can provide users with a smooth and enjoyable listening experience.

V. RESULT AND ANALYSIS

Four different algorithms were tested for emotion classification, including SVM, SVM and PCM, KNN and PCA, and KNN and PCA. When arousal and valence were assessed, the study found that PCA and SVM had the highest classification accuracy. The accuracy rates of EEG valence and EEG arousal were 96.8% and 96%, respectively.

User reviews or collaborative filtering can improve the accuracy of music recommendation systems. EEG data provides key information about the user's emotional state, interest level, and attention span, providing more specific and personalized recommendations. The use of EEG-based music recommendation system has the potential to revolutionize the music industry. Music companies can increase user satisfaction and revenue by offering customers personalized recommendations based on their emotional state, engagement level, and attention span.

The study concluded that using SVM and PCA for emotion classification and EEG data for music recommendation can improve the accuracy and skill of recommendation. The potential of EEG-based music recommendation systems and their impact on the music industry should be further investigated.

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VI. CONCLUSION

Developing a mood-based music recommendation system using EEG data from an emotive EPOC headset shows an interesting prospect for providing unique music recommendations based on the user's current emotional state. The system makes accurate recommendations and uses machine learning algorithms to base the user's mood on EEG data, improving the user's music listening experience and the efficiency of music streaming services.

Future research may focus on expanding the framework to include more physiological and environmental factors. These parameters can include changes in heart rate, skin conductance, and environmental temperature to improve the accuracy and usability of recommendations. Additionally, the system can be customized to respond to each user's unique music preferences to further tailor recommendations.

The music industry could experience a significant impact from mood-based music recommendation systems. Users are more likely to subscribe to music streaming services if they offer a more customized listening experience and increase revenue for the company. In addition, music consumption is associated with mood regulation, and specific recommendations may improve mental health and general well-being.

In conclusion, mood-based music recommendation systems have tremendous potential to provide personalized recommendations to consumers based on their emotional state. With further research, it could become an important tool for music businesses to improve user experience and generate new revenue streams.

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REFERENCES

[1]. Shreya, L. and N. Nagarathna. "A highly efficient music-based music recommendation system." 2021 International Conference on New Trends in Electronics, Information, Communication and Technology (RTEICT). IEEE, 2021.

[2]. Lee, Shih-Hsiung et al. "A music recommendation system for EEG-based depression treatment." 2020 IEEE International Conference on Consumer Electronics-Taiwan (ICCE-Taiwan). IEEE, 2020

[3]. Zhang, Ting-Zheng, Tiffany Chang, and Ming-Hao Wu. "A brainwave-based attention diagnosis and music recommendation system to improve reading." 2021 IEEE International Conference on Artificial Intelligence, Robotics and Communications (ICAIRC). IEEE, 2021.

[4]. Asif, Anum, Muhammad Majeed and Syed Muhammad Anwar. "Classification of human stress using EEG signals in response to music." Computers in Biology and Medicine 107 (2019): 182-196.

[5]. Balan, Oana et al. "Emotion Classification Based on Biophysical Signals and Machine Learning Techniques." Symmetry 12.1 (2019): 21.

[6]. Santamaria-Granados, Luz, Juan Francisco Mendoza-Moreno, and Gustavo Ramirez-Gonzalez. "Emotionally Based Travel Recommender Systems - A Scientometric Review." The Future Internet 13.1 (2020): 2.

[7]. Cunha, Joana et al. "Emotional state of musical brain activity." Engineering Proceedings 7.1 (2021): 19.

[8]. Su, Baoguo et al. Continuous hybrid BCI control for a robotic arm using noninvasive electroencephalogram, computer vision, and eye tracking. Mathematics 10.4 (2022): 618.

[9]. Jaafar, Sirwan Tofiq and Mohtar Mohammadi. Epileptic seizure detection using deep learning. Journal of UHD Science and Technology 3.2 (2019): 41-50.

[10]. Kang, Dongwann and Sanghyun Seo. "Personalized smart home audio system with automatic music selection based on emotions." Multimedia Tools and Applications 78.3 (2019): 3267-3276

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