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Music Recommendation System Using Machine Learning

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ABSTRACT

Music recommendation system is like musical friend that understands listeners preferences and Suggests songs and playlists to the listeners. Music recommendation based on past data suggests songs to the listeners according to the listeners choice. However, customers often face challenges in selecting the most suitable song from such an extensive music collection. Various methods exist for developing song recommendation systems, including collaborative filtering, content-based filtering, and hybrid method. Initially, the system collects large amount of user data, including listening history and ratings to create a detailed profile. To construct a music recommendation system, we can use different machine learning algorithms, such as cosine similarity, K-nearest neighbor, Weighted Product Method. Hybrid System with Singular Value Decomposition, Factorization Machine will be used.

Keywords: Machine Learning, collaborative filtering, content-based filtering, Hybrid Method, cosine Similarity, k nearest neighbor, User-based collaborative filtering, item-based collaborative filtering, Weighted Product method.

Introduction

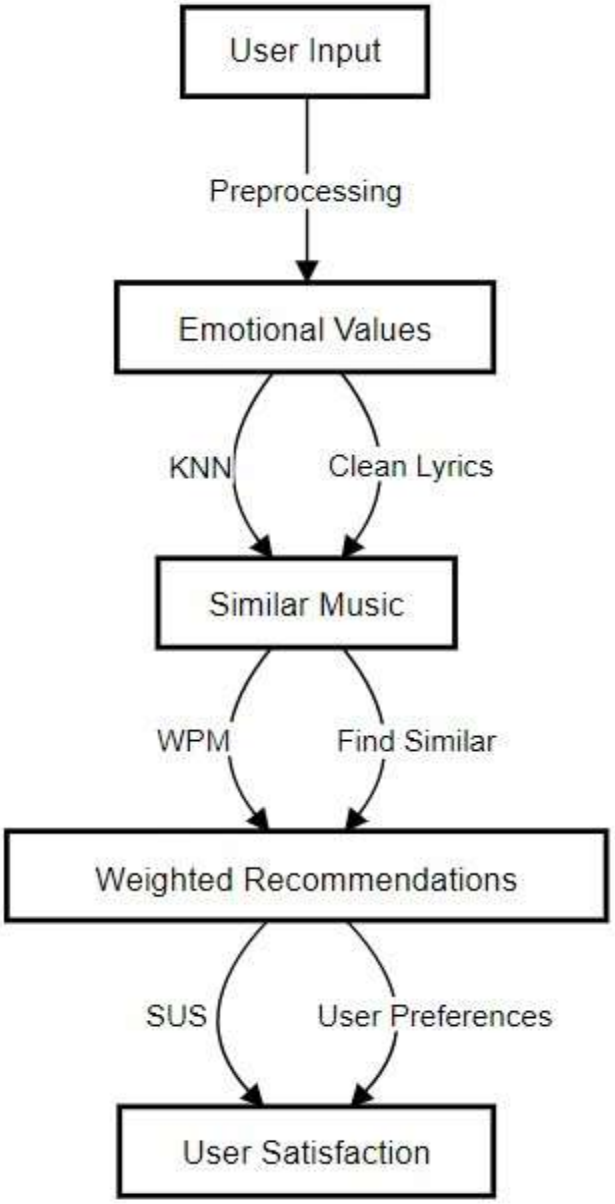
Music recommendation system works on history of listener's data using deep learning techniques have gained significant attention in recent years. Researchers have explored various approaches to extract features from genres, artist, tempo for these prediction. Different models on Deep Convolutional Neural Networks (DCNN) have been proposed to improve accuracy and efficiency. Music becoming a part in our life such as relaxation, concentration, and entertainment. The system evaluated using classification rate, precision, and recall on datasets.It uses Machine learning algorithms, such as Factorization Machine, Singular Value Decomposition to suggest songs to listener's. Different methodologies have been used to recommend songs based machine learning. If they continue to like it for a month, we give it a score of one; otherwise, it's zero. We've used different methods like content-based filtering, collaborative filtering, and factorization machines. Our factorization machine approach has proven to be the most accurate. The accuracy of the factorization machine model was approximately 0.7482, which was higher than the item-item based filtering (0.71) and user-user based filtering (0.67) models.

Literature Survey

Nofal, M. H., & Dharayani, discusses the use of Machine learning, The Weighted Product Method (WPM) is used in this study for music criteria data processing due to its efficiency. The NRC Lexicon based on Emotion Analysis is used to convert music lyrics into numerical values. K-Nearest Neighbors (KNN) is used in this study to find similarities between music data and provide recommendations. The System Usability Scale (SUS) method is used to evaluate user satisfaction with the recommender system, using a Likert scale with 10 questions Improved User Satisfaction: The study evaluates user satisfaction using the System Usability Scale (SUS), and the obtained score of 83.65 indicates a high level of user satisfaction with the system [1]. Sheikh Fathollahi, M., & Razzazi, proposed a comprehensive Music recommendation model was developed using CNN approach, The paper focuses on designing a music similarity measurement and recommendation system using convolutional neural networksThe authors propose a method for extracting high-level features from intermediate layers of the neural network for music genre classification .They employ cosine similarity and Euclidean distance as similarity and distance metrics for measuring music similarity The paper highlights the use of both max and average pooling in the architecture of their models to obtain a good feature vector. [2]. J. Singh and M. Sajid The paper compares different recommendation systems.The FMA recommendation system aims to improve overall accuracy and reduce specific policy problems by utilizing the properties of factorization matrices.FMA recommendations can combine social and content-based recommendations in various configurations [3]. J. Singh, The paper discusses the use of collaborative filtering, content-based filtering, singular value decomposition (SVD), and factorization machines (FM) in building a hybrid music recommendation system. [4]. Hssina, B., Grota, A., & Erritali, authors review a The paper applies two algorithms, k-nearest neighbors (KNN) and the matrix factorization algorithm of collaborative filtering, based on the method of singular value decomposition (SVD). The hybrid approach used in this paper aims to improve the quality of the recommendation system without requiring a new algorithm for calculating predictions [5]. Chirasmayee, B. V. S., Sharmila, G., Sahithi, D., & Prabhakar, V. proposes This paper utilizes the Spotify API and spotipy package for authentication and accessing song data, Python scikit-learn module for building machine learning models, and Flask module for web development. The Spotify API's playlist feature is popular among users, as it allows

them to save songs they like and create playlists based on their mood . [6]. Girsang, A. S., & Wibowo, A. applied deep learning techniques for Music recommendation. Collaborative recommendation systems rely on two types of input: explicit feedback and implicit feedback.Explicit feedback is obtained from users' input regarding their interest in products, while implicit feedback is observed through user behavior, such as mouse clicks or the number of times a video or music is played .Implicit feedback has no negative feedback, is inherently noisy, and requires appropriate measures for evaluation .The basic needs to create a neighborhood method in collaborative filtering (CF) recommendation systems include identifying similar users based on their preferences and selecting the k nearest neighbors based on user similarity.Matrix factorization (MF) is another popular method in CF recommendation [7]. Schedl, M. proposes Deep learning in music recommendation systems Deep learning (DL) is increasingly adopted in music recommendation systems (MRS) for extracting latent factors of music items from audio signals or metadata and for learning sequential patterns of music items from playlists or listening sessions A common approach to content-based filtering is item-based nearest neighbors, where the ratings of a user for similar items are used to determine the rating for a specific item Wang and Wang propose a hybrid MRS that integrates the output of a deep belief network (DBN) and a probabilistic matrix factorization model (PMF) for collaborative filtering, achieving a low RMSE of 0.255 in warm-start.[8]. Sánchez-Moreno, D., López Batista, V., Vicente, M. D. M., Sánchez Lázaro, Á. L., & Moreno-García, M. N. discussion on The paper focuses on the incorporation of social information into collaborative filtering methods to improve recommendations. Previous studies have modified neighborhood-based CF techniques or matrix factorization methods to include social data processing in rating prediction.[9]. Budiman, M. A., & Giri, G. A. V. M. discussion This paper proposes a music recommendation system based on the similarity of artists that the user likes or has heard. It uses the Collaborative Filtering method with Cosine Similarity and K-Nearest Neighbor algorithm to recommend songs based on related artists [10]. Ferraro, A., Bogdanov, D., Serra, X., & Yoon, proposes The paper analyzes the impact of collaborative filtering recommendations on artist and music style exposure, highlighting the need for a better evaluation methodology for music recommendation algorithms.The paper analyzes the impact of collaborative filtering recommendations on artist and music style exposure, highlighting the need for a better evaluation methodology for music recommendation algorithms.[11]. Sheikh Fathollahi, M., & Razzazi, F. proposes The paper focuses on designing a music similarity measurement and recommendation system using convolutional neural networks. The authors propose a music genre classification system that extracts high-level features from intermediate layers of the neural network. The system employs cosine similarity and Euclidean distance metrics for similarity measurement. The paper highlights the use of both max and average pooling in the architecture of the models to obtain a good feature vector. [12]. Liu, X. discusses a methodology and algorithm for real-time Musi recommendation system. The paper proposes a music trend prediction method based on an improved LSTM and random forest algorithm, which aims to predict the trend of pop music based on user data. The algorithm first performs abnormal data processing and normalization processing on the test data set, then selects important features using the random forest algorithm and corrects them using the rough set compensation system. Finally, the prediction is made by improving LSTM, and the algorithm's performance is evaluated using RMSE and MAER as the performance evaluation indexes. [13]. Islam, M. S., Hasan, M. M., Rahim, M. A., Hasan, A. M., Mynuddin, M., Khandokar, I., & Islam, M. J. discuses about paper focuses on designing a music similarity measurement and recommendation system using convolutional neural networks The authors propose a method for extracting high-level features from intermediate layers of the neural network for music genre classification.They employ cosine similarity and Euclidean distance as similarity and distance metrics for measuring music similarity. [14]. Gunawan, A. A., & Suhartono, D. focuses on deep learning methods, specifically convolutional neural networks (CNNs) The paper presents a comparative analysis of various machine learning models developed and evaluated for music genre classification, including Naive Bayes, Stochastic Gradient Descent, KNN, Decision trees, Random Forest, Support Vector Machine, Logistic Regression, Neural Nets, Cross Gradient Booster, Cross Gradient Booster (Random Forest), and XGBoost .Achieving high accuracy in music genre classification, with the best-performing model (XGBoost) achieving an accuracy of 90.22%.[15].

Methodology



1.Dataset Description:

In this study uses a music dataset is collected from the Kaggle website from 2000 to 2019 taken. The research presents a Multi Criteria Recommender System (MCRS) for music that combines K-Nearest Neighbors (KNN) with the Weighted Product Method (WPM). The system uses music lyrics converted into digital values using the Non-Commercial Research (NRC) Lexicon and KNN to find similarities between music. Additionally, user preferences are incorporated using the WPM to weight music criteria.The dataset spans from 2000 to 2019, sourced from Kaggle, with a focus on measuring user satisfaction through the System Usability Scale (SUS). The SUS score of 83.65 indicates an excellent level of user satisfaction.

2. Data preprocessing:

The system uses music criteria to recommend songs tailored to the user's emotions, utilizing a Kaggle dataset with essential attributes. To ensure data quality, the dataset undergoes preprocessing, which involves removing blank and duplicate entries, eliminating punctuation from lyrics, and verifying attribute completeness to prevent processing errors. The dataset is obtained from Kaggle and undergoes preprocessing to ensure data quality. Music lyrics are used as NRC Lexicon values, with attributes such as romantic, communication, spiritual, sadness, feelings, danceability, valence, and energy.

3.Extracting Lyrics into Emotional Value:

In this study, the NRC Lexicon is used to quantify the emotional value of music lyrics. The NRC Lexicon differentiates words into 10 characteristics, including anger, anticipation, disgust, fear, joy, sadness, surprise, trust, positive, and negative. Sentiment analysis is employed to identify the reactions, attitudes, contexts, and emotions in the extracted information, categorizing words or phrases as positive, neutral, or negative. Next the Mel-spectrograms that are extracted from the sounds which is a frequency domain feature was used. The NRC Lexicon is employed to convert lyrics into digital values based on emotions and sentiments. Emotional values are calculated by summing the emotional values of individual words.

3.Techniques followed/ Model:

1.NRC Lexicon and Emotional Value Extraction:

The research uses the Non-Commercial Research (NRC) Lexicon to convert music lyrics into digital values based on emotions and sentiments.The Lexicon assigns emotional values such as anger, anticipation, disgust, fear, joy, sadness, surprise, trust, positive, and negative to words. Emotion values for each word in the lyrics are calculated, resulting in an emotional value for the entire song.

2.K-Nearest Neighbors (KNN): KNN is used to find similarities between the digital values of music lyrics.Euclidean Distance is employed to calculate the similarity between data points. KNN is employed to find similarities between music based on their emotional values obtained from the NRC Lexicon. KNN is a machine learning algorithm used for classification and regression tasks. In this paper, it is used to identify similar songs based on the emotional content of their lyrics.

3.Weighted Product Method (WPM): WPM is used to calculate the weight of criteria based on user input.Criteria include romantic, communication, spiritual, sadness, feelings, danceability, valence, and energy.WPM is used to incorporate user preferences into the recommendation system. It assigns weights to different music criteria attributes based on user input. The system then ranks music recommendations based on these weighted criteria. WPM is a multi-criteria decision-making method that combines criteria with user preferences to make recommendations.

4. System Usability Scale (SUS): SUS is used to measure user satisfaction with the music recommendation system. It consists of a questionnaire with 10 questions, with responses on a Likert scale ranging from strongly disagree to strongly agree. The SUS scores help assess the system's usability and user satisfaction. SUS is utilized to measure user satisfaction. Participants answer 10 questions on a Likert scale, and the SUS score of 83.65 is categorized as excellent.

5.Percentile Ranking and Grading: The paper uses percentile ranking to compare SUS scores with a larger database of responses, allowing the evaluation of the system's performance relative to others. Grading is applied to categorize the system's performance as Excellent, Good, Marginal, or OK.

6.Evaluation: Confusion matrix, accuracy, precision, recall, F1-score, and AUC were used as the evaluation metrics.

Results and Discussion

Model	Accuracy
K-Nearest Neighbors, Weighted Product Method	83.65%
Factorization Machine	74.82%
Hybrid Model: SVD, Factorization Machine	74.84%
KNN and SVD algorithms	--------
XGBOOST	90.22%

Conclusion

The paper introduces a Multi Criteria Recommender System (MCRS) for music, addressing the challenges posed by information overload in the rapidly growing music industry. The key innovation lies in combining the strengths of K-Nearest Neighbors (KNN) the Weighted Product Method (WPM) to enhance music recommendations. The study builds upon a previous system that utilized Lexicon's Non-Commercial Research (NRC) to convert music lyrics into digital values. The Multi Criteria Recommender System for music, as presented in the paper, demonstrates a robust approach to personalized music recommendations. The integration of user preferences, coupled with the effective use of NRC Lexicon, KNN, and WPM, results in a system that not only understands the emotional context of music but also tailors recommendations to individual user criteria. The high SUS score and grade classification affirm the system's excellence in usability and user satisfaction. The research sets a foundation for future developments in personalized recommender systems, with the potential for broader applications across various domains. In this study uses a music dataset is collected from the Kaggle website from 2000 to 2019 taken. The research presents a Multi Criteria Recommender System (MCRS) for music that combines K-Nearest Neighbors (KNN) with the Weighted Product Method (WPM). The system uses music lyrics converted into digital values using the Non-Commercial Research (NRC) Lexicon and KNN to find similarities between music. Additionally, user preferences are incorporated using the WPM to weight music criteria.The dataset spans from 2000 to 2019, sourced from Kaggle, with a focus on measuring user satisfaction through the System Usability Scale (SUS). The SUS score of 83.65 indicates an excellent level of user satisfaction.

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