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Application of Personalized Recommendation System in Music Platform*

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Abstract

This paper introduces the basic framework of the personalized recommendation system, the typical model of the music recommendation system and the main methods. At the same time, it analyzes the problems in the current recommendation technology and finds out the future optimization direction of the music recommendation system by discussing the solution of the problem.

Keywords: Recommended System; Content Characteristics; Collaborative Filtering

1 INTRODUCTION

With the rapid development of the Internet, large data age quietly coming. According to International Data Corporation (IDC), 90% of the total global data is generated over the past two years. By 2020, the size of the world's data will reach 40ZB[1]. So how to quickly get the information you want is one of the major needs of Internet users. When the users are clear about their own preferences, they can use the search function by entering the song name or singer name to find their favorite music. But with the process of information technology speeding up, in the information volume growth environment, the user needs to invest a lot of time to find their favorite music, especially when they don't have a clear positioning or a deep understanding of the music, the input time will be more. This leads to a personalized recommendation system that pushes the user's most wanted content directly to the user.

In mobile music field, massive audio data and user data have also brought great challenges to the mobile audio industry. If the music recommendation system can effectively carry out audio data mining and analysis, they not only can accurately predict the users' preferences, find potential users, provide users with favorite audio, improve user experience, enhance customer loyalty; but also can carry out precise directional marketing, such as advertising business, can help advertisers and companies lock the target audience more efficiently and more accurately, not only to achieve the targeted advertising, but also to ensure the user's playback experience.

2 THE BASIC FRAMEWORK OF PERSONALIZED RECOMMENDATION SYSTEM

Personalized recommendation system is the product of Internet and e-commerce development, it is a high-level business intelligence platform based on massive data mining, which to provide personalized information services and decision support for customers. Refer to the percentage of the company's recommended system framework[2], based on the framework of the personalized algorithms, the recommendation engine of the personalized recommendation system also introduces the scene engine, the rule engine and the display engine, thus forming a new technical framework of the recommendation engine. The system recruits the user's preferences and needs by synthesizing and utilizing the user's interest preferences and attributes, the attributes, content and classification of music, and social relations between users, actively recommend music to users. As shown in Figure 1:

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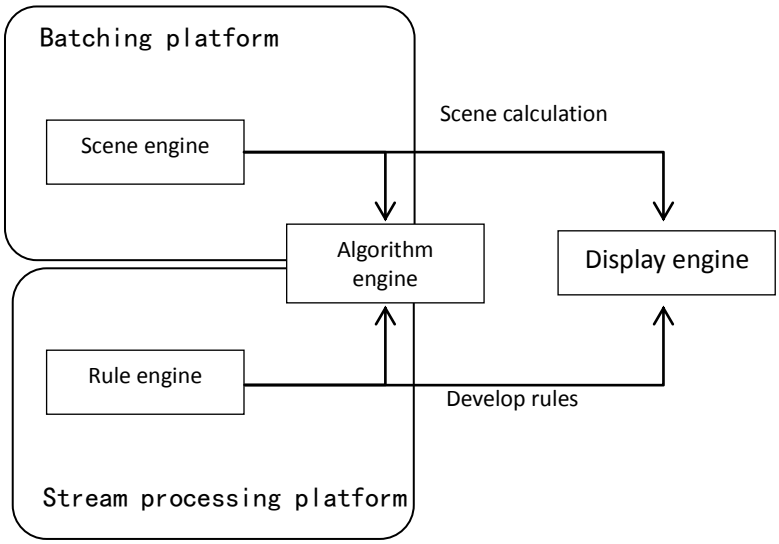

FIGURE 1 RECOMMENDED BASIC FRAMEWORK FOR THE SYSTEM

The recommendation engine is composed of four parts: scene, rule, algorithm and display. The scene engine is used to detect what state the user is dealing with, whether there is a purposeless wandering or a specific goal, what kind of preferences they have; the rule engine makes the corresponding rules for the system according to the state of the user; the algorithm engine provides a variety of algorithmic results for the system; the display engine presents the results to the user with the most moving form.

3 ANALYSIS OF MUSIC PERSONALIZED RECOMMENDATION SYSTEM

Music personalized recommendation system[3] usually consists of the user preference model, music resource description and recommendation algorithm. As shown in figure 2.

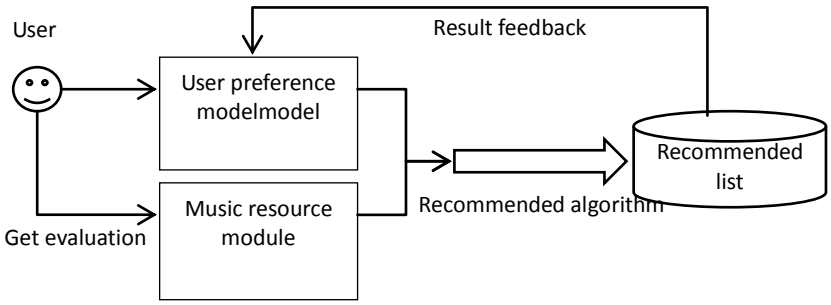

FIGURE 2 A TYPICAL MODEL OF MUSIC PERSONALIZED RECOMMENDATION SYSTEM

Among them, the user preference model can model the user's interest according to their different habits and application features, and through this preference model it can accurately obtain the user's interest information and actively recommend to them, so as to support personalized information services. Based on the different construction methods, Duan Lijun[4] has classified and compared the typical user preference model in current service discovery research.

The music resource description mainly refers to the organization and management of music resources (songs, singers, albums, rhythms, melodies, etc.), by defining different levels of complexity and abstraction, construct the music signature database to provide valid input data for the music recommendation model. Zhang Yan[5] and some others sum up that there are many features were extracted to describe the music, including frequency domain energy, sub-band energy, frequency domain center, pitch frequency and MFCC coefficient, the main idea is to describe the music pitch (frequency), sound length (rhythm), loudness (stress) and so on. Li Juan[6] et al. proposed that the construction of the music feature library is mainly divided into three types: using the pitch extraction method to build the database, using the music information to build the database and the use of MIDI analysis method library. From the shrimp network on the classification of music resources, there is a relatively rough classification: language,

region, style and mood, there is also a more detailed and professional style of music classification which emphasizes the perception and acceptance of musicians and consumer users: rock, rap, Jazz, electronics, blues, classical and so on. This article mainly focuses on the introduction of the recommended algorithm and its improvement.

3.1 The Main Method of Music Recommendation

Music has the following unique features:

- Large amount of data. Mainly relative to books and movies;
- The cost of consumption is small. For mobile music platform, most of the online music does not need to pay to listen;
- Rich variety;
- Time cost is small. Relevant research shows that listening to background music at work is a very common phenomenon, the study also pointed out that more than half of college students when work and use of computers will listen to music[7];
- High repetition rate. The probability of the user repeatedly listen to the same song;
- Music player has a certain order. The above characteristics determine the digital music is suitable for personalized recommendations.

Common music recommended methods are the following:

1) Content-based Recommendations

Content-based recommendation is the continuation and development of information filtering technology. The theoretical basis is mainly from information retrieval and information filtering[8]. The so-called content-based recommendation[9] refers to by analyzing the acoustic characteristics of the music that the user has previously listened to, such as the frequency of sound, amplitude, sound quality, by calculating the similarity between two different music, recommend to users with higher degrees of music. Each song has its own label, such as language, scene, style, theme, etc., content-based recommendation method is to obtain the user's preference for a particular number of labels according to the tendency of the user usually on the song playback, collection, download and other aspects, and then recommend the song or song list that matches the feature label to the user.

The content-based recommendation method has the following advantages[10]:

- Do not need the data of other users, no cold start problems and sparse problems;
- Can be recommended for users with unique interests;
- Can recommend new or not very popular songs;
- By listing the content characteristics of the recommended song, you can explain why those songs are recommended;
- Technology development has been quite mature.

There are some shortcomings in the content-based recommendation method, for the user, the recommended results are limited to be only similar to the previous music content, but the user's interest is not single, nor is it immutable, this recommendation is not available to get those music that are not similar to the nature but are likely to become the user's potential interest, the user feel boring. Moreover, the extraction of acoustic features of music is very time-consuming, it is also more difficult to achieve.

2) Collaborative Filtering Recommendation

Collaborative filtering recommendation technology is one of the earliest and most successful technologies in the recommended system. Collaborative filtering recommendations[11] are generally divided into user-based collaborative filtering recommendations and project-based collaborative filtering recommendations. The user-based

collaborative filtering recommendation[12] usually uses the nearest neighborhood technology[13] to calculate the distance between users using the user's historical preferences (collection behavior, like or dislike to choose, etc.), and then take advantage of the weighted evaluation of the music rating by the nearest neighbor of the target user to predict the degree of preference of the target user for a particular music, the system thus recommends the target user according to the degree of preference. Project-based collaborative recommendation generates the recommended results by measuring the similarity between items.

The biggest advantage of collaborative filtering is that there is no special requirement for the recommended object. A collaborative algorithm based on collaborative filtering can theoretically recommend any kind of thing in the world, not just music, everything can be.

Compared with the content-based recommendation method, collaborative filtering has the following advantages:

- Share other people's comments on music, to avoid incomplete and inaccurate analysis of content, and can be filtered based on some complex, difficult-to-express concepts (such as personal taste).
- Have the ability to recommend new songs. You can find content that is irrelevant, but there may be a user's favorite music type. This is also the main difference between collaborative filtering and content-based recommendations. Content-based recommendation of this method, recommend many contents which the users are familiar with, and collaborative filtering can find the user's potential interest preferences but they have not yet found.
- Can effectively use other similar user feedback, through fewer target users feedback, to achieve faster and accurate recommendation.

While collaborative filtering is widely used as a typical recommendation technique, there are still many problems that need to be addressed. The most typical problem is sparse problem and extensible problem. Music made with this recommended method is often rated higher and popular, but some of the newly added music because there is not enough time to get attention, it is difficult to be recommended to the user.

3) Mixed Recommendation

As the various recommended methods have their own advantages and disadvantages, in practice, often use mixed recommendation. Content recommendation and collaborative filtering recommended mixing is the most in research and application. The method of operation is to use the content-based recommendation method and the collaborative filtering recommendation method to produce a recommended prediction result, and then mix the two results with a certain strategy. Although there are many ways to recommend mixing methods in theory, it is not necessarily effective in a particular problem. One of the most important principles of mixed recommendation is to avoid or compensate for the weaknesses of the recommended technology in the mixing process.

3.2 Comparison of Recommended Methods for Major Music[14]

Method	Data source	Advantage	Disadvantages	Music platform
Content-based recommendation	The acoustic characteristics of the music itself	Recommended results are intuitive and easy to explain. The method does not require data from other users.	Complex attributes are not easy to extract, and recommended results lack of novelty.	SongTaste Xiami music, 163Music
Collaborative filtering recommendation	User evaluation of music information	The method can explore potential hobbies.	Cold start problem, sparse problem, extensibility issues,	Xiami Music, 163 Music, Douban Music
Based on expert advice	Expert comment on music	High authority, high credibility.	Lack of personalization, high labor costs, poor scalability.	Pandora
Mixed recommendation	Comprehensive use of the above recommended method data sources	Avoid weaknesses	The process is complex.	

4 THE ROBLEMS AND SOLUTIONS OF MUSIC RECOMMENDATION

At present, personalized music recommendation system has made a certain degree of development at home and abroad. A variety of digital music platform recommended models are also mostly similar, that is, according to the user's hobbies, search behavior, collection recording, recommend music that is similar to its taste. Through the above analysis of the existing music recommendation technology, we found that all of them have shortcomings, which can be summarized as the following four points: cold start, sparseness, extensibility and user emotional mining problems.

First, the cold start problem: mainly divided into user cold start and song cold start[15]. User cold start: When the new user arrives, the system does not have the user's behavior data, the recommendation system can't predict its interest according to its historical behavior, and the user can't search the favorite songs through the effective way; Song cold start: After the new song storage, it needs time to analyze and categorize the new song, and match with the user's preference. The recommendation system can't know how to push the song to users who may be interested in it in a short time. This phenomenon often appears in the collaborative filtering of the recommended method.

Second, the sparseness problem: the number of users and music millions, although the user evaluation data of music will be more and more, but each user's music evaluation often only covers a small part of the music library resources, there are still many songs that have never been evaluated, which is one of the main reasons for the low quality of recommendation.

Third, extensible problem: with the number of users increasing and music resources index rising, the music library to bear the data pressure is growing, which will increase the burden of the recommended system. Not only will increase the calculation time, but also will have an impact on the recommended accuracy. This is the technical bottleneck that restricts the performance of music recommendation systems.

Fourth, emotional mining problems: different from the shopping recommendation, the music itself links with the emotional, situational, psychological and other emotional factors more closely. Different concerts will induce different emotions of the user, and different users will have different emotions to the same music. User mood or psychological changes will lead to changes in music appreciation orientation.

Among them, which to solve the cold start problem is mainly through different dimensions to obtain the user's basic characteristics and operating habits, and then make coarse-grained recommendation. Tencent's QQ music, for example, it can use the data that has been precipitated elsewhere by the user for cold start. QQ music makes use of other Tencent's platform data, such as the recent video in Tencent video, to extract the user's behavior characteristics and determine what type of the user is. Or similar to Netease cloud music and other music platform, after the registration of new users, they conduct a new user tastes test by creating new options, guide users to find their favorite music, and then generate a simple recommendation.

In order to solve the problem of sparseness, the current methods are divided into two categories: one is to improve the accuracy of the algorithm under the premise of sparseness; the second is to use the feasible method to reduce the sparsity of the data set[16]. And with the continuous development of computer hardware and the continuous improvement of computing power, extensible problem is no longer the main problem in the development of collaborative filtering technology.

But for the user emotional mining problem, there is no platform to propose an effective solution. And how to tap the user's emotional state, analyze the user preferences for music in different emotional state is very important. Traditional music recommendations focus on music features and user behavior preferences, the recommended music is difficult to accurately meet the user's individual needs, users often want the recommended system can recommend the right music based on their own emotions, for example, in a low mood, it can recommend Cheerful music. So add the user's emotional dimension to the music recommendation algorithm design, according to the user's emotional state to recommend the appropriate music can better meet the individual needs of users.

5 CONCLUSIONS

At this stage, the competition of each mobile music platform is focused on the personalized service. How to stand

out in need to identify the future optimization of personalized music recommendation system. After synthesizing the above analysis, this paper puts forward a new development direction: A mixed recommendation method that incorporates user emotions and social network behavior analysis.

This direction can be achieved by combining the mobile music platform with QQ, WeChat, Micro Blogging and other social platforms. In recent years, with the popularity of mobile devices, people are more and more frequently through a variety of platforms to publish their own status in time. These states usually contain people's knowledge and emotional state. In addition, the user play some music at the point time of the published state, these on-demand data can also be a good reflection of the user's music preferences in the emotional state or a certain time. Through analyzing the content published by the user to tap the current emotional state of the user, contacting the user's platform-on-demand recording at the same time to analyze the user's music preferences, so the user's emotional status can be well incorporated into the music recommendation, get the user's music preferences in different emotional state to build personalized music recommendation model, and even can recommend the music which is in line with the emotional state of the user according to the user's real-time content, improve the accuracy of the music recommendation system and user satisfaction.

Personalized recommendation system is not only satisfied with the realization of the music precise recommendation, but also should learn to social networking platform such as QQ, launch the function that recommends friends according to the song taste similarity, let the people who have a high listening style coincidence degree become friends. In this way, not only can solve the problem of sparseness to a certain extent, but also can meet the user's social needs, improve user experience.

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