



A Recommender System Based on Genetic Algorithm for Songs on Web

Mrs. Manjula Athani, Prof. Asif Ullah Khan
CSE, T.I.T, RGPV Bhopal,
India

Prof. Neelam Pathak
IT-Dept, T.I.T Excellence, RGPV, Bhopal,
India

Abstract: While the growth of the world Wide Web a large amount of music data is available on the Internet. A recommender System should also be able to provide user with useful information about the items that might interest them. This paper present an innovative recommender System for music data that combines two mythologies, the content based filtering technique and interactive genetic algorithm. The music object are first analyzed. For each music object, the representative track is first determined & some features are extracted from this back. According to the features the music object are properly grouped. For users, the access histories are analyzed to derive user interest. The experiments conducted in an objective manner exhibit that our system favorite of each individual user.

Keywords: recommender system user preference, interactive genetic algorithm, user profile, recommendation methods.

I. INTRODUCTION

Concerning a large amount of various data available on the Internet, there exit websites which provide services for users to look for useful data. For text data in web pages, the websites providing keyword-based searching or recommendation are developed such as the search engine of Yahoo! [Yahoo] and the book recommendations of Amazon [Amaz]. Recommender systems are useful for people living in these days. After the 1990s of the 20th Century, the Internet technologies, especially World Wide Web, have grown with astonishing speed. With this change there are numerous resources, such as document, photo and music data, which are accessible on the Internet. Many of the end users or customers will face the problem that which resource is more suitable than the others. Many of the largest commerce websites, thus have already been using recommender systems to assist their customers in searching items they would like to purchase, such as E-commerce website Amazon.com and the search engine of Google.com These systems provide with search results tailored to user's own preference. However, the websites providing such kinds of services are still limited. In this paper we propose new recommender system for music data by combining the content-based filtering technique with the interactive genetic algorithm. We consider user ratings favorite, user profiles, admin can add songs dynamically for music data by combining the content based filtering technique with the interactive genetic algorithm. We consider unique properties of each music track, such as tempo, pitch & duration and loudness which can be directly extracted from music objects. We use music feature extraction tool to analyze these properties. The results of extraction consists in the database of our proposed system. We expect that the proposed system will provide more suitable information, which adapts to the preference of each user, by applying the genetic algorithm to the system. The user preferences are obtained from their access history. After acquiring records, the recommender system analyzes and recommends items that are appropriate with their own favorite. This paper is organized as follows, In Section II reviews related works. Section III describes the structure of our recommender and explains how to operate the genetic algorithm in this system. finally, section IV implementation of proposed system

II. RELATED WORK

The recommender system is viewed as a powerful tool for people to obtain useful information on product and services. The recommender systems also has to recognize and provide items corresponding with favorite of users. In order to resolve this matter there are two approaches in a recommendation system have been discussed in the literature i.e, content based filtering approach[1] and the collaborative filtering approach[2]. In the collaborative filtering approach ,the recommender system provides recommendation by collecting users profiles and discovers relations between each profile. After identifying correlation of each profile, the system classifies users having profiles that are similar to the others The system then recommends items derived from other profiles in the same group. The advantage of this approach, thus, is that it has a high possibility to recommend items corresponding with user's preference by providing environments in which each user can share his own profile[7][8].

In content based filtering approach the representation of data items are based on information about and characteristics of the items that are going to be recommended i.e, data items which have been accessed in the past are used as the user profiles. Based on the user profiles, the system recommends only the data items that are highly relevant to the user profiles by computing the similarities between the data items and the user profiles. In this approach the properties of a

song or artist in the order to seed a “station” that plays music with similar properties. User feedback is used to refine the station the results. The collaborative approach computes the similarities between the user profiles. User of similar profiles will be grouped together to share the information in their profiles. The main goal of the collaboration approach is to make recommendation among the users in the same group. One of the example is item-to-item collaboration filtering[3] (people who buy x also buy y) an algorithm popularized by amazon.com’s recommender system. However, the content-based system approach has limitation such that it focuses on only the accessed items and is not prompt to immediate changes in the potential interest of users. To overcome these limitations, we combine the content-based filtering approach and the genetic algorithm in our proposed system .

B. Music Feature Extraction

The feature extraction is technique that used in music Recommendation System (MRS)[4][5] website which provides the services of music recommendation based on music data grouping and user interest. The music object in the database of MRS, as well as the incoming music object, are candidates for music recommendation. In our proposed system we employ the content- based filtering to acquire information from music data. The analysis of items is an essential step of filtering approach. We the use a feature extraction tool to analyse the properties of item. In the application development on the audio and music domain, this is audio signal analysis, transformation and synthesis.

C. Interactive Genetic Algorithm

Genetic Algorithm (GAs) are stochastic search methods inspired from the mechanism of natural evolution and genetic inheritance. GAs work on a population of candidate solution; each solutions; each solution has a fitness value indicating its closeness to the optimal solution of the problem. The solutions having higher fitness values than others are selected and also survive to the next generation. GAs then produce better offspring (i.e new solution) by the combination of selected solutions. The methods can discover, preserve, and propagate promising sub-solution [11],[12].

Interactive Genetic Algorithm (IGA) is also an optimization method as the genetic algorithm. In IGA, however, the fitness values of candidate solution are based on the evaluation of users according to their own preferences [13]. Our proposed system uses IGA to recognize user favourite since the user can judge the fitness value of each solution (i.e., music track). The user preference, thus, can be detected and traced.

III. SYSTEM OVERVIEW

The recommender system described in this paper is based on the genetic algorithms. The content-based filtering technique is applied to generate the initial population of genetic algorithm. In the proposed system, we employ the interactive genetic algorithm so that the users can directly evaluate fitness value of candidate solution themselves. Due to the subjective evaluations, our system can recognize and recommend items tailored with different user preferences. The recommender system is divided into three phase as follow: *feature extraction, evaluation and Interactive GA phase,*.

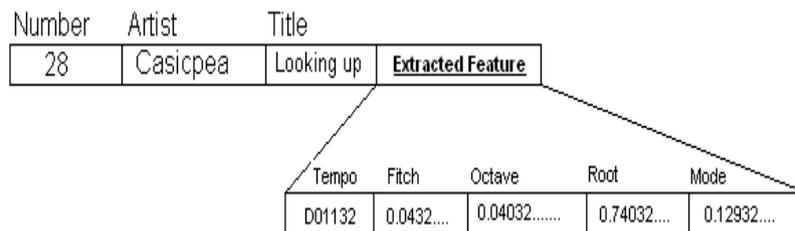


Figure1.The composition of individuals

1. *Feature Extraction Phase*

In this phase, we perform feature extraction to each music track using CLAM; all of music track are formatted as MP3 (Mpeg-1 Audio Layer 3). The CLAM outputs extraction result as XML files containing music feature of each track. The system then parses the XML files to generate initial individuals for IGA. Our proposed system considers five extracted features which consist of real numbers. Fig. 1 shows the example of an IGA’s individual composed of the extracted features.

2. *Evaluation Phase*

The proposed recommender system grants its users the role of evaluation the fitness value of each music track. Each user assigns his or her own rating scores to music track. According to their subjective preferences. By this means of the scoring metric, the users can represent their favour rating to different recommended items. The recommender system evolves a population based on user evaluation data.

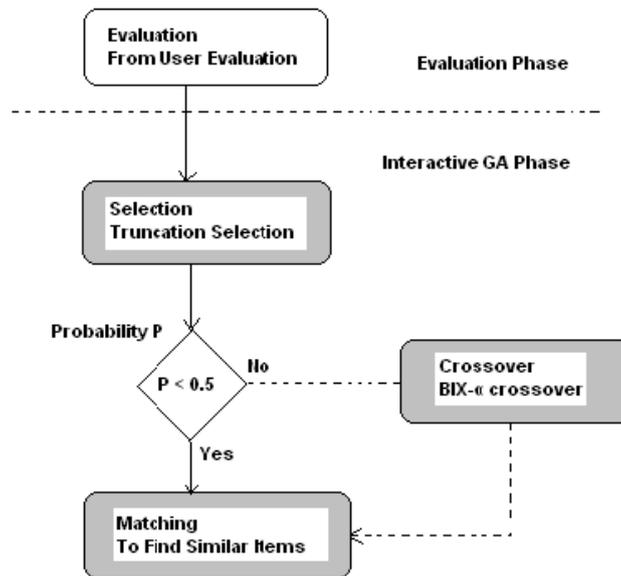
3. *Interactive GA phase*

Interactive GA phase is the fundamental component of our system since it proposes promising items (i.e. music track) to the users based on their own evaluations. Similar to the genetic algorithm, IGA also works on the basis of genetic inheritance and it has evolutionary operators (i.e., selection, crossover and mutation). In this system, we do not consider mutation because we focus on finding items which are most appropriate to user preferences. Since the mutation operator would cause candidate solutions to deviate from the common pattern discovered by the evolution process, it should omit. Fig. 2 shoes how to operate Interactive GA phase in this system.

In our proposed system, IGA works based on user evaluation (i.e., *Evaluation Phase*) and the algorithm executes three separate steps (*Selection, Crossover and Matching*) as shown in Fig. 2.

4. *Selection*: We apply the *truncation selection* method to this system, since the item having lower rating scores should not be considered to make new recommendation.

Furthermore, the truncation selection has the strength of elitism to impose high selection pressure to favor the top T% (the constant variable T) candidate solution having higher fitness values. The remaining items having lower rating scores are then discarded [9] [10]. After the selection, half of the selected items would be applied the crossover operator in a probabilistic manner.



BLX-a Crossover

1. Select two items $X_{(t)}$ and $Y_{(t)}$
 2. Create two offspring $X_{(t+1)}$ and $Y_{(t+1)}$ as follows:
 - For $i=1$ to n (length of chromosome) do
 - (1) Calculate Distance between $X_{(t)}$ and $Y_{(t)}$
 $D_i = |X_{(t)} - Y_{(t)}|$
 - (2) Choose an uniform random real number u from interval
 $< \min(X_{(t)}, Y_{(t)} - (a * D_i), \max(X_{(t)}, Y_{(t)} + (a * D_i)) > X_{(t+1)} = u$
 - (3) Repeat step (2) as same as $X_{(t+1)}$
 $Y_{(t+1)} = u$
- End do

Figure 3. The operation BLX- α Crossover

(2) *Crossover*: In the crossover step, the system executes BLX- α Crossover [11][15], because the music features are represented as real numbers in this system. Fig. 3 shows how to apply BLX- α Crossover on the selected individuals.

(3) *Matching Items*: This step aims to calculate similarity between music features of selected items resulted from the previous operations and all the remaining items in the system storage[16]. Each individual has its own unique properties extracted by CLAM (describe in Feature Extraction Phase). This system, thus, calculate the similarity by checking the distance of the properties of each items (as shown in equation

$$(1). \sqrt{\sum_{i=1}^n \frac{1}{m} \sum_{j=1}^m (s_j - t_j)^2}$$

Where distance(s, t) is the Euclidean distance between two items. The variable n is the number of music feature and m indicates the length of each property.

Note that before calculating distance between two items, the values of music features are normalized to the range of 0 and 1.

IV. THE EXPERIMENT

In this section ,we describe the implementation of our proposed system .

(4) Proposed Implementation

We incorporate with this system, which is implemented in .NET the information gathered in the previous step (*Feature Extraction Phase*). We then build a website providing an experimental environment to make it convenient for the user evaluation. The website provides essential information such as artist name and songs title; users can rate their preferences about each music item by clicking the corresponding icon. The rating is represented by a scale from 0 to 100. Each time a user evaluates a page of 10 items. The initial page is randomly generates according to the uniform distribution. The successive page is constructed based on the user evaluation, we provide a function that users can listen to the music tracks which they are not familiar with it.

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