Research on the Design of Oral English System Based on Content Recommendation

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Abstract—The rapid development of artificial intelligence has made changes in all walks of life. Most of the current English learning platforms use traditional collaborative filtering algorithms to make recommendations. However, students' knowledge is dynamic. Their knowledge is constantly increasing, and traditional collaborative filtering algorithms cannot capture students' knowledge status in time. Therefore, in order to solve this problem, this paper proposes a comprehensive spoken English recommendation system that combines word network and recommendation algorithm. The recommendation of content to users in this system is based on the content recommendation algorithm, which is analyzed in detail in the second part of this paper. The content-based recommendation focuses on calculating the similarity between the product feature vectors, reading the user interest vectors and the product feature vectors, and calculating them based on the similarity calculation formula. The system can dynamically adjust the recommended content as the user's knowledge increases. It can not only improve the learning effect, but also improve the students' learning interest and enthusiasm.

Keywords-word network; content recommendation; recommendation technology; spoken English system; Recommendation Principle

1 INTRODUCTION

Due to the rapid development of artificial intelligence and big data, the informatization and intelligence of education are also rapidly updated [1]. The Ministry of Education pointed out that it is necessary to coordinate the development relationship between information technology and education. This will be a major reform. It is necessary to create a good online teaching environment and promote the combination of online education and offline education [2]. Many learning software do not track the latest learning status of students in time, so they cannot change the recommended teaching content, resulting in low quality of recommendations. Many existing platforms cannot make personalized recommendations based on students' own cognitive ability and the difficulty of the questions, resulting in unreasonable course arrangement and affecting students' interest in learning [3]. How to solve the above problems and how to make full use of artificial intelligence and big data technology to recommend appropriate resources for English education is a topic of great research significance, which not only has guiding significance for online education, but also helps students improve learning efficiency, find learning methods, and cultivate good study habits. Therefore, this paper studies it in depth.

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2 PRINCIPLES AND STEPS OF CONTENT-BASED RECOMMENDATION ALGORITHM

The basic workflow of the recommender system is shown in Figure 1. The user and the recommendation algorithm have a relative two-way data exchange relationship, which can be understood as: On the one hand, the recommendation system obtains the user's historical data, and then establishes the user's interest set model [4]. On the other hand, the recommendation system pushes the corresponding suitable user object. The core of the recommendation algorithm is the calculation of similarity [5]. For the content-based recommendation algorithm, it is the calculation of the similarity between objects, and for the collaborative filtering algorithm, it is the calculation of the similarity between users [6].

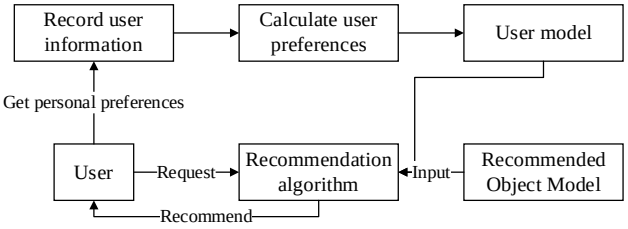

Figure 1. Basic workflow of a recommender system

The content-based recommendation algorithm is further extended and extended on the basis of information filtering technology [7]. It mainly recommends items to users by analyzing the similarity of item content information. Therefore, content-based recommendation does not need to analyze the user's comments on items, operation behaviors and other information. This method mainly relies on machine learning to analyze the similarity between items. The main principle of the algorithm is that when user A likes to watch movie A, and movie A and movie C are both sci-fi genres, then it can be judged that user A may also like to watch movie C, and movie C will be recommended to user A [8]. Its working principle is shown in Figure 2 below.

Content-based recommendation algorithms can effectively solve the "cold start" problem. The so-called "cold start" problem is that when a newly registered user logs in to the system for the first time without performing any operations on the page, there will be no historical operation information of the user, so it is impossible to analyze the user's operation behavior [9]. The recommendation algorithm based on association rules mentioned in the previous subsection cannot work properly at this time. The content-based recommendation algorithm can effectively avoid this problem. It can be recommended directly through the correlation between items, and it is easy to explain why these items are recommended. It can also recommend the newly added content of the system, so that there will be no new content. In addition, the technology related to classification learning is relatively mature, which is very conducive to in-depth mining and analysis of the content.

The main steps of the content recommendation algorithm are:

1) Establish a product feature model: fully consider the structural attributes of the item, extract the features of the item, and establish a feature map. When uploading items in the background,

the corresponding features are bound according to the attributes of the items. The item is represented by a feature vector, and the representation is shown in Equation (1).

$$P = (f_{11}, f_{12}, \dots, f_{1k}, \dots, f_{i1}, \dots, f_{ij}) \tag{1}$$

In formula (1), i represents the feature quantity of the product, and j is the jth feature value corresponding to i.

2) Record user interest model: By recording and analyzing user clicks, favorites, likes and other interactive actions, the user's interest vector is obtained. Users only need to browse web products without explicitly submitting interest data, and the user interest vector can be continuously updated. The user interest model describes the user's interest in each feature, and the user's interest in a single feature is expressed as formula (2).

$$CTI_{(n)}^{ij} = \frac{\sum f_{ij}}{T} \tag{2}$$

$CTI_{(n)}^{ij}$ can describe the user's recommendation weight for different features. The formula expresses each user's interest in features, which is the basis for personalized recommendation.

3) Calculate similarity: Read the user interest vector and product feature vector, take the proportion of the number of feature records in the user interest vector to the total number of feature records as the weight, and traverse and calculate the similarity between the user interest vector and the product feature vector. Rank the top-N products, and then generate the user's personalized recommendation list.

The similarity calculation methods of two vectors mainly include Manhattan distance, cosine acquaintance and Euclidean distance. The calculation formulas are as follows.

Manhattan distance:

$$d(x, y) = |x_1 - x_2| + |y_1 - y_2| \tag{3}$$

Cosine similarity:

$$similarity = \cos(\theta) = \frac{A - B}{\|A\|\|B\|} = \frac{\sum_{i=1}^{n} A_i \times B_i}{\sqrt{\sum_{i=1}^{n} (A_i)^2} \times \sqrt{\sum_{i=1}^{n} (B_i)^2}} \tag{4}$$

Euclidean distance：

$$d(x, y) = \sqrt{(x_1 - y_1)^2 + (x_2 - y_2)^2 + \cdots + (x_n - y_n)^2} \tag{5}$$

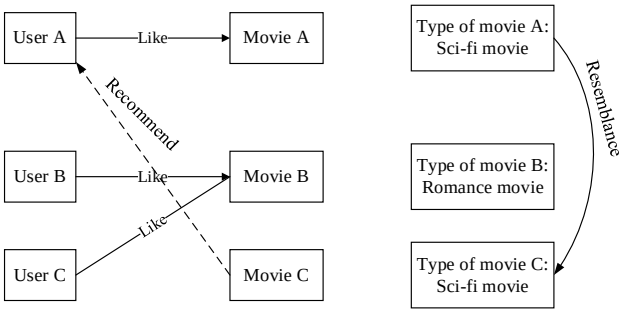

Figure 2. The working principle of the content-based recommendation algorithm

3 RESEARCH ON THE OVERALL FUNCTION DESIGN OF THE SYSTEM AND THE DESIGN OF MAIN MODULES

3.1 Overall function design of the system

As an oral practice system, teachers mainly edit English articles and issue questions, and students mainly practice oral English on the speaking side. The student's client is a small program, students can practice oral English online, and the system recommends the content according to the students' learning situation. The overall functional design of the spoken language system is shown in Figure 3.

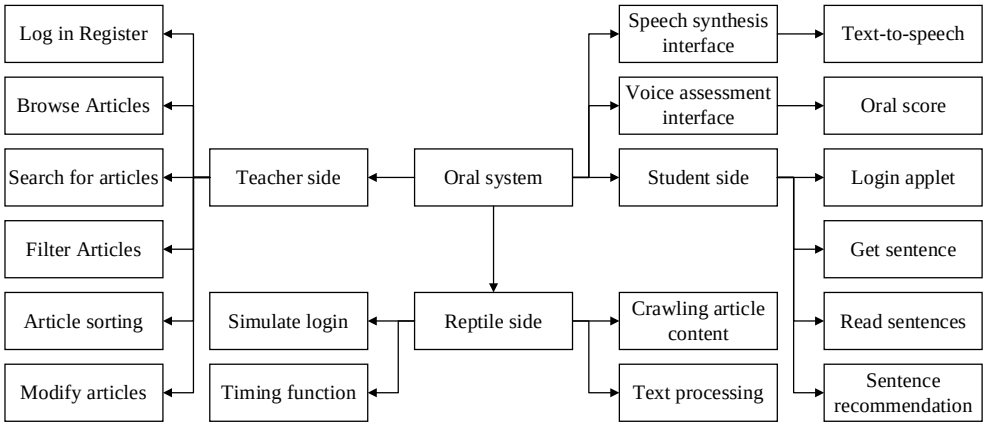

Figure 3. Overall functional design of the spoken language recommendation system

The whole spoken language system consists of the following five parts, namely the crawler end, the teacher end, the speech synthesis interface, the student end and the speech evaluation interface.

The main functions of the crawler include simulated login, timing function, article content crawling and text processing.

The main functions of the teacher terminal include login and registration, browsing articles, searching articles, filtering articles, sorting articles and modifying articles, etc.

The main function of the speech synthesis interface is to synthesize text data into standard speech.

The main functions of the student terminal include logging in to the applet, obtaining sentences, reading sentences aloud, and recommending sentences.

The main function of the voice evaluation interface is to compare the student's pronunciation with the standard pronunciation, and to score the student's pronunciation.

Since the focus of this paper is to recommend content to students based on the similarity of content, this paper mainly analyzes and researches the process of spoken language recommendation, including the construction of word network and the design process of adaptive recommendation system.

3.2 Construction of word network

Since the traditional vocabulary is usually arranged alphabetically without regard to the interrelationships between words. So, we propose a new English vocabulary construction learning strategy, which can build a word network by using the relationship between words, such as synonyms, antonyms, associated words, similar words, etc.

In word networks, the word frequency and degree of each word are also important. The importance of a word depends on two aspects: the first is static factors, including the frequency of word usage and the degree to which it is on its own network. The other is the dynamic learning cost, which changes when learning its associated adjacent words. The occurrence frequency fi of the word Wi represents the number of occurrences in the corpus, which directly indicates the importance of the word in the language used. The higher the frequency of a word, the more important it is to represent that word. If the importance of words is only considered in a static way, the learning order of words can be obtained based on frequency. The frequency of words is an important property. On the other hand, because words are interconnected, they are not an isolated individual. A higher frequency does not necessarily mean that the word should be learned first. This topology information should be used together with frequency information, considering the impact of learning some words among structurally similar words and the possible impact of meaning-related words on that word.

Therefore, we can build a huge word network based on the above analysis, and the importance of each word can also be calculated accordingly. We can judge that the student has not mastered the word by pronouncing some words incorrectly or cannot read them. Then we can get the nearby students through the words. The mastery of connecting words is not necessarily firm, so sentences with nearby words can be recommended to students.

3.3 Design of Oral Adaptive Recommender System

The educational recommendation system is different from the recommendation system in the industry. It should not only consider the interests of the students, but also consider the actual learning situation of the students, and make a comprehensive recommendation.

The self-adaptive recommendation system for spoken language is based on the pronunciation of the students, and then counts the data of the students, analyzes the collected student data, and then maps it to the knowledge point network. Spoken sentences to help students improve their speaking. A complete spoken recommendation system should include one of the following steps.

1) Collect learning behavior data; a system and database for recording learning behaviors are needed, and students' learning behaviors are recorded in the form of logs.

2) Storage and processing of learning behavior; when data statistics are completed, the data needs to be backed up and stored. In addition, it is also necessary to process the data to filter out the dirty data, and it can be judged by the data whether the student has scored or cheated.

3) Update the knowledge point network of students with learning behavior. When initializing, it can be considered that students know nothing, and can be initialized according to the average level of the system. In the topic database, each topic will be marked with the corresponding difficulty, the range of knowledge points and the methods or skills used. There is a certain dependency and combination relationship between knowledge points and knowledge points, so it is very necessary to build a complete knowledge map.

4) Visually display the learning results and continuously change the learning path to form a complete closed loop. Students' learning results should be displayed visually, so that it is convenient and intuitive to understand the students' learning status. In addition, with the increase of learning knowledge, students' ability is continuously enhanced, so it is necessary to constantly change students' learning paths, and constantly fill in students' knowledge loopholes, thereby forming a complete closed loop of learning.

The adaptive recommendation flow chart of the spoken language system is shown in Figure 4 below.

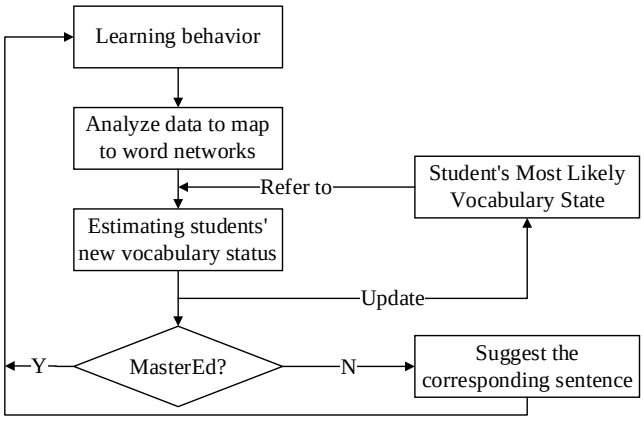

Figure 4. Flow chart of spoken language recommendation system

3.4 Voice Evaluation Scoring

The speech evaluation scoring module is an important module for judging the students' oral English level. It can use the speech evaluation technology to score the user's speech, so as to help users discover their own shortcomings and continuously improve their speaking.

The process of speech evaluation includes basic modules such as data preprocessing, feature extraction and pattern matching. As shown in Figure 5: First, data preprocessing is performed according to the input speech, and the data preprocessing includes processes such as framing and windowing. Then comes feature extraction, where important information is extracted and

calculated. In feature extraction, the parameters of features are very important, and the commonly used parameters are linear prediction system and perceptual weighting system. Sometimes a distorted judgment may also be required, and the commonly used judgment methods are covariance matrix judgment and Bayesian distance judgment.

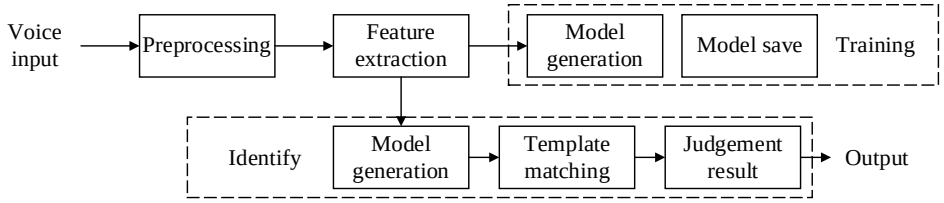

Figure 5. Voice evaluation process

Implementation principle: The first is speech recognition. Given a speech signal O, the machine can recognize its content W. This process is the process of solving $argmax\{P(w_i|O)\}$. where wi is the i-th word, and P(w|O) is the posterior probability of the word given the features of the speech signal. The calculation method of the posterior probability can be solved by Bayesian. Equation 6 can be obtained.

$$P(w_i|O) = \frac{P(w_i|O)p(w_i)}{P(O)} \tag{6}$$

Where $P(w_i|O)$ is the probability of maximum likelihood, which can be obtained from speech training through the hidden Markov algorithm. $P(w_i)$ is the prior probability of word occurrence, which is calculated from a large amount of text training.

In this system, the sentence modified by the teacher will get the standard voice of the sentence through the speech synthesis interface. These sentences and standard voices are stored in the database, and the students can call these sentences and standard voice data. Then, after the students read the sentence aloud, the students' pronunciation and standard sentence pronunciation are sent to the speech evaluation scoring interface, and the score of each word and the overall score will be obtained. Here, the criteria for words with scores above 80 are green, those between 60-80 are yellow, and those below 60 are red.

4 CONCLUSION

At present, the domestic online education and adaptive learning education model is still in the primary state. This system proposes how to recommend spoken English sentences to help students improve their oral shortcomings. Since the current English learning platform cannot dynamically recommend content according to the user's learning situation, this paper designs a system based on the content recommendation algorithm. Calculate and recommend suitable content based on the similarity of objects. Although from the current point of view, the system can dynamically recommend content according to the user's learning situation. However, since the system currently lacks a large amount of data support, there should be areas for improvement in the future. Therefore, this article will continue to pay attention to and optimize and improve the areas that need to be improved.

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