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Engineering
Intelligent Systems

Design of Film and Television Personalized Recommendation System Based on Artificial Intelligence Technology

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With the continuous development of artificial intelligence (AI), high-tech-based industries are being transformed. As an art based on scientific and technological innovation, film is also being offered opportunities as well as facing new challenges. At the same time, intelligent system engineering is also applied in all aspects of life. This paper introduces the background of recommendation system design. This paper reports on the academic research conducted on two key elements of film and television: personalized recommendation system (PRS) and AI technology, and then summarizes them in combination with intelligent system engineering. After establishing the algorithm model, various algorithms were proposed to provide a theoretical basis for the design of film and television PRS based on AI technology, and then it was proposed to use AI technology to design the film and television PRS. At the end of the article, the simulation experiment was carried out, and the experiment was summarized and discussed. The experimental results show that the matrix processing efficiency of the new film and television PRS is higher than that of traditional film and television PRS, and the satisfaction of film and television PRS using artificial intelligence technology is 24% higher than that of traditional systems. Although the application of intelligent technology in the customized recommendation system for film and television has been mature, the application of intelligent technology in the field of engineering still lags far behind other fields.

Keywords: system design; artificial intelligence; engineering intelligence; personalized recommendation

1. INTRODUCTION

In the age of big data (BD), intelligent recommendation systems have brought great convenience to people's lives. It can provide users with corresponding functions, products and services according to their browsing habits, thus improving the users' efficiency. On the Internet, movies are an essential part of people's lives, and movie recommendations are also a key factor in the intelligent recommendation system. On the other hand, although many intelligent machine communication systems are used in film and television media, there is still a gap in practical applications.

Many scholars have studied AI technology. Park Seong Ho found that the key technical point involved in clinical contexts is the application of AI technology in medical treatment, especially in high-dimensional or over parameterized diagnosis and prediction models which require the use of deep neural networks [1]. Bin Yi believed that the automatic scoring of English compositions is a natural result of the rapid development of BD and artificial intelligence, which

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has made the automatic evaluation system of research papers more reasonable and feasible in theory [2]. Lasmar used the machine learning algorithm of AI to analyze the subjective evaluation of users so as to obtain the personal data of different users [3]. In recent years, Raj Manav conducted research on AI and robots in the economy and management fields, and summarized the main methods adopted by scholars [4]. Based on previous research, Yang Ran proposed an educational philosophy based on AI to address the current problems by effectively reforming the art curriculum. AI technology cannot completely replace humans and potentially transfer the power over subject definition to the generation of social relations and algorithms [5]. Shinners Lucy believed that the combination of AI and digital medical system is an important strategy, which can effectively reduce medical costs to support clinical decision management of chronic disease burden [6]. Gao Peng believed that with the rapid development of information technology, the era of AI and big data was imminent, and the development of new technology would lead to a new era of education [7]. The above research has achieved good results, but with the continuous updating of technology, there are still some problems.

The design of recommendation systems has been analyzed at different levels by many scholars. Tan Hao designed an optical recommendation system based on the wide-angle Cassegrain correction system [8]. Jugovac Michael found that automatic recommendation has become a common network user experience. Some suggestions given through these systems make it clear what can be bought in online stores, and people can seek what they want to know through social networks [9]. Ali Haider Talib Mohammed analyzed the characteristics and advantages of the designed system, discussed the most important results of using the unemployment job search system, and compared the results with the systems used for this purpose[10]. Cui Zhihua believed that recommendation technology is a very critical algorithm in the Internet of Things, which can provide users with better services and also enable users to obtain information anytime and anywhere [11]. Deldjoo Yashar stated that in the movie recommendation system, project features play a very critical role, which can make use of users' explicit or implicit preferences for traditional features in order to generate a recommendation [12]. Zhou Xiangmin proposed a new community recommendation strategy based on video content and sharing of user information. A new solution is to allow a large number of videos to be recommended to multiple new users, and optimize subunit extraction [13]. Zhang Jiang believed that there are many personalized film recommendation schemes, which are based on the published film materials and fed back to the film's performance index. However, there are two fundamental problems in the film recommendation system that have not been addressed [14]. Although this previous research has achieved good results, there are still some problems with the continuous progress of society.

With the rapid development of society and the economy, engineering categories are gradually becoming intelligent. At the same time, with the continuous development of network technology and computer technology, the combination of various entertainment modes and services has created a new network form. The film PRS based on AI technology involves applying network technology and computer technology to film services.

2. ESTABLISHMENT OF ALGORITHM MODEL FOR PERSONALIZED RECOMMENDATION SYSTEM DESIGN

(1) Personalized recommendation algorithm

The main purpose of personalized recommendation is to assist users to select the most ideal content for better results [15–16]. Personalized recommendation algorithms usually include federated filtering, content-based recommendation algorithms and context-aware recommendation algorithms. These algorithms perform well in relevant knowledge fields. For film and television recommendation, it includes not only evaluation, content relevance and user recommendation, but also user model, knowledge characteristics, knowledge model and other aspects. Therefore, a recommendation algorithm is developed to enable movie and TV users to make personalized recommendations. The model structure is shown in Figure 1.

It is assumed that, currently, there are several movie users. In order to distinguish between users and movies, users are represented by x and y, while movies are represented by n and m. The recommendation result of user x to movie n is represented by $res(x, n)$.

$res(x, n)$ is affected by the following factors: the similarity between i, the number of user x's evaluations of course p, the number of overlapping evaluations, user y's evaluation $r_{x,p}$ of course p, etc. The recommended method after filtering is called:

$$res(x,n) = \left(co_y \cdot r_{xp} + \sum_{x=1x\neq y}^{i} hy_{x,y} \cdot p_{x,y} \cdot b_{x,n} \right) \quad (1)$$

where $p_{x,y}$ is the similarity between i; $b_{x,n}$ is the user rating vector, and $hy_{x,y}$ is the weight factor. Formula (2) consists of wf_1 and wf_2.

$$hy_{x,y} = wf_1 \cdot wf_2 \quad (2)$$

$$wf_1 = \left\{ \frac{n_{x,y}}{100}, n_{x,y} < 100 \right\} \quad (3)$$

$$wf_2 = \frac{2m_y m_x}{m_y + m_x} \quad (4)$$

$$m_n = \left\{ \frac{i_x}{\underset{A}{100}} \times A, i_y < 100 \right\} \quad (5)$$

where A is a constant value.

$$B_{x,n} = \left\{ \begin{array}{c} x_{x,p} \\ c_{x,p} \end{array} \right\} \quad (6)$$

User x has scored n, so the score vector B $r_{x,p}$. If there is no score, then $c_{x,p}$ is used as the score vector.

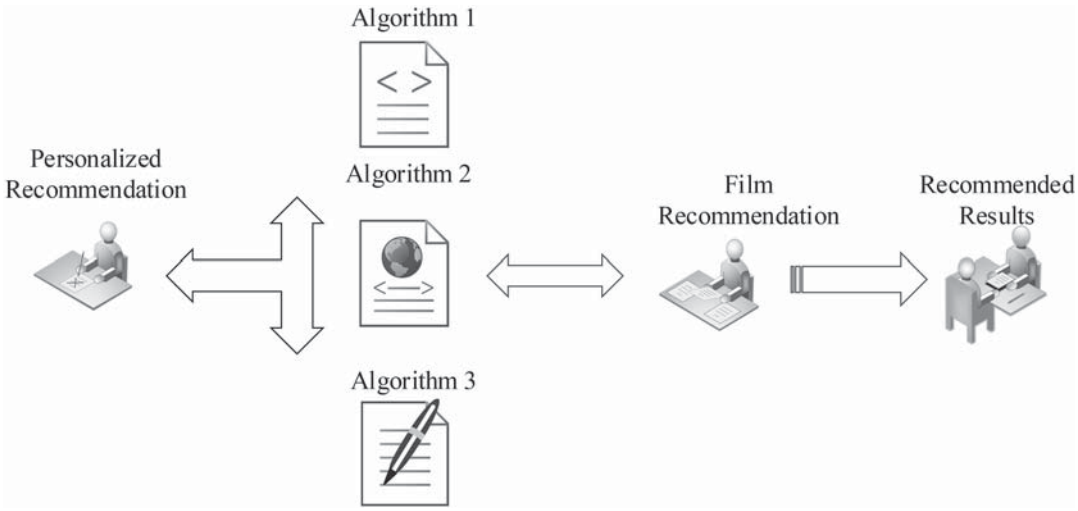

Figure 1 Model structure of personalized recommendation algorithm.

(2) Collaborative filtering algorithm

The core of collaborative filtering technology is to determine the adjacent set of current users by calculating the similarity between users, and then classify them according to the size of similarity to select the most interested users at present [17].

For a current user x, the similarity $sim(x, x_n)$ between it and any user x_n in the user group is calculated by P correlation or the vector space similarity commonly used currently, and is arranged according to size to generate the nearest neighbor set of user x as Formula (7):

$$nb \in \{sim(x, x_1), sim(x, x_2), \ldots, sim(x, x_n) \quad (7)$$

In this case, the correlation degree P is used to calculate the similarity between users. The calculation formula is:

$$sim(x_n, x_b) = \frac{\sum_{i \in U_{ab}} (x_{ai} - x_a)(x_{bi} - x_b)}{\sqrt{\sum_{\in U_{ab}} (x_{ai} - x_a)^2 \cdot \sum_{i \in U_{ab}} (x_{bi} - x_b)^2}} \quad (8)$$

This set represents the users a and b score the element; x_{ai} and x_{bi} represent the scores of user a and user b in the common scoring item set i.

The formula of project similarity is calculated according to the project properties:

$$rel(x_a, x_b) = 1, \sum_{m=1}^{k} i_m \quad (9)$$

$$\text{Pre}_{xi} = \overline{x} + \frac{x_a \in \sum_{nb} sim(x, x_a) * (r(x_a, i)) - x_a}{\sum_{x_a \in nb} sim(x, x_a)} \quad (10)$$

$r(x_a, i)$ represents the score of user a in any adjacent area to process the expected score item i.

Two elements can share several attributes at most. If the value exceeds this value, it is the absolute similarity, and then there are:

$$rel(i, i_p) = 1 \quad (11)$$

3. DESIGN OF FILM AND TELEVISION PRS WITH AI TECHNOLOGY

(1) AI technology

Artificial intelligence technology usually refers to the technology of achieving human intelligence through ordinary computer programs [18–19]. AI technology includes automation, machine learning, computer vision, robotics and natural language processing, which are shown in Figure 2.

i) Automation is the operation of a system or process to achieve automated production. For example, robotic process automation can be programmed to perform many repetitive tasks typically performed by humans. The difference between RPA (Robotic Process Automation) and IT (Internet Technology) automation is that RPA can be adjusted according to changes in the environment.

ii) Machine learning is a science that allows computers to work without programs. Deep learning is a kind of machine learning and, in popular terms, it involves automatic prediction and analysis. There are three machine learning algorithms. Guided learning: in this method, a group of data is marked to enable it to detect different patterns and label new data. Unsupervised learning: in this kind of learning, there are no labeled data sets, and they are classified according to similarity or difference. Reinforcement learning: the data set is not labeled, but the AI system receives feedback when one or several behaviors have been executed.

iii) Computer vision is a science that studies how to make machines "see". Computer vision is a science that studies how to make machines "see". Computer vision captures and analyzes visual information through the analog-to-digital conversion and digital signal processing of cameras. This method is usually compared to human vision, but computer vision has no physiological limitations

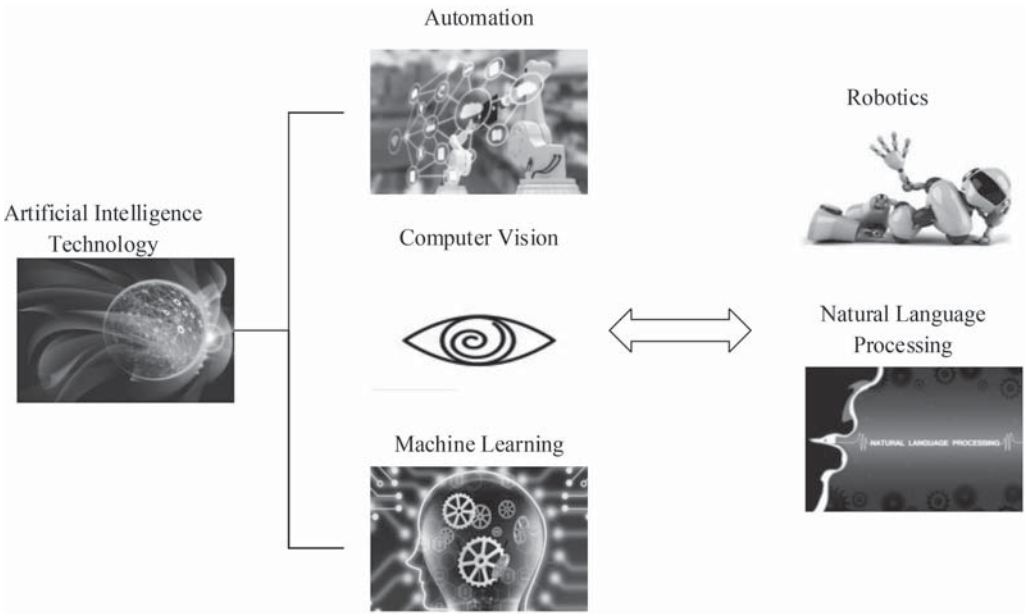

Figure 2 AI technology.

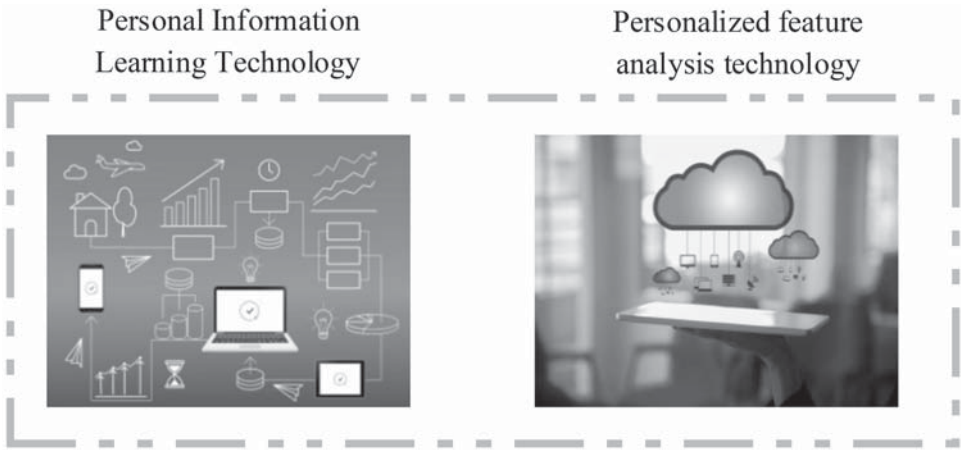

Figure 3 Personalized intelligent recommendation system under AI technology.

and can observe walls through programs. It is widely used in feature recognition and medical image analysis.

iv) Robotics is an engineering discipline with robotics as its core. Robots are often used to perform difficult tasks. They are used in assembly lines and by NASA (National Aeronautics and Space Administration) to move large objects in space.

v) A well-known example of the Natural Language Processing (NLP) is spam detection, which checks the title and text of emails to determine whether they are spam. Current natural language processing algorithms are based on machine learning used to handle text translation, emotion analysis, and speech recognition.

(2) AI technology for the design of film and television PRS

The design of personalized intelligent recommendation system under AI technology mainly involves self-learning technology of personal information and personalized feature analysis technology [20]. The system is shown in Figure 3.

1) Personal Information Learning Technology

This technology is based on the number of users' clicks for different types of movies. It is used to create a personalized web browsing list to understand users' clicking habits and characteristics. When recommending films, the film itself and the individual user's preferences should be taken into account; hence, the film material and the user's information should be aligned. Finally, the relevant rule information is generated by using information retrieval technology. Users can extract data from the database through the recommendation system, and then make appropriate suggestions after comparison. The video selected by the user is a data selection, and the information about each selection is traceable. The use of the CBW (Critical Band Width) algorithm can speed up the search and quickly find the corresponding information according to the user's data structure.

2) Personalized feature analysis technology

In the construction of an intelligent recommendation system, the application of customized feature analysis technology includes finding the connection between the film itself and the information required by the users. Film information includes directors, male and female actors, etc. User behavior includes trial viewing, clicking, payment, etc. These items of information are associated to form association rules through personalized analysis technology.

(3) Functional design of PRS

The function of movie PRS is dependent on its functional modules which are embedded into three layers:

- Interface layer content: users can log in to view the personalized recommendation interface, which is an interface layer that allows internal and external services to connect.
- Content of business logic layer: the business logic layer is the core of this PRS. It can apply various algorithms to obtain many types of information and manage information about the various functions involved. Here, information management also includes user information management and film management.
- Core data layer content: this part carries and stores a large amount of information about system applications and key business data as well as a large database which allows users to search for accurate, fuzzy and similar information under various classifications.

(4) Power engineering intelligent system based on AI technology

Artificial intelligence is an emerging technological discipline that mainly studies and develops new technological disciplines for simulating and expanding the theories, methods, technologies, and application systems of human intelligence. Artificial intelligence technology can react and make judgments in a way similar to human thinking, and is therefore widely used in fields such as robotics, image recognition, expert systems, and so on.

The core of AI is data mining and learning, data processing and human-computer interaction. The application of AI technology to a power grid can maximize its advantages such as low cost, high energy efficiency and networking. First of all, AI technology can be used to save the purchase and maintenance costs of a system without servers. Secondly, the computer is used for calculation to ensure the safe storage of data and reduce manual operation to achieve intelligent and automatic operation. Finally, various types of watch straps are submitted and matched to complete the data exchange and transmission between various departments through the network platform. The energy system uses expert system, artificial network, uncertainty theory and other AI technologies to judge, reason, prove, identify, understand, design and plan power grid projects, so as to achieve the purpose of auditing power grid projects. The AI model is shown in Figure 4.

AI technology enables the energy system to analyze and reorganize various data in the project engineering field, and establish a database, methodology and corresponding model base. At the same time, the energy system allows managers to perform data operations such as retrieval and recommendation based on AI technology.

4. SIMULATION EXPERIMENT OF FILM AND TELEVISION PERSONALIZED RECOMMENDATION SYSTEM

Experimental description: Design and use quantitative analysis methods to analyze the effects of traditional film and television PRS and new types of film and television PRS based on artificial intelligence technology. Collect data samples, which include films and television works with the top 50 revenue rankings in a region in 2019. The serial numbers are A, B, C, D, and so on. Finally, this article analyzes and compares the satisfaction of the new film and television PRS system (based on artificial intelligence technology) and the traditional film and television PRS system. Table 1 shows the six film and television films selected from the data sample for revenue, market quantity, and label analysis, for experimental reference.

(1) Data preparation

The AI technology algorithm was used to compile the crawler, and the word frequency statistics were compiled for the official introduction of film and television productions and the evaluation of X and Y. The three keywords with the highest word frequency were used as exclusive labels for films and movies. The labels of all films and films were counted, and two public labels with the most occurrences were selected as the ones to be recommended. Figure 5 shows the similarity analysis of five tags in the film and television PRS conducted by X and Y.

In Figure 5, according to the statistics for five labels (genres), namely, science fiction, love, comedy, martial arts and urban, it can be seen that science fiction and love were private labels and the remaining three were public labels. Among them, the similarity of sci-fi tags in X and Y's movie recommendation system were 69% and 14% respectively, and the similarity of love tags in X and Y's movie recommendation system were 11% and 71% respectively. The similarity of comedy tags in X and Y's movie recommendation system were 4% and 8% respectively, while the similarity of martial arts tags in X and Y's movie recommendation system were 6% and 2% respectively. The similarity of urban tags in X and Y's movie recommendation system were 10% and 5% respectively. It can also be seen from the data that the similarity between the private tags of X and Y in the movie recommendation system was still high.

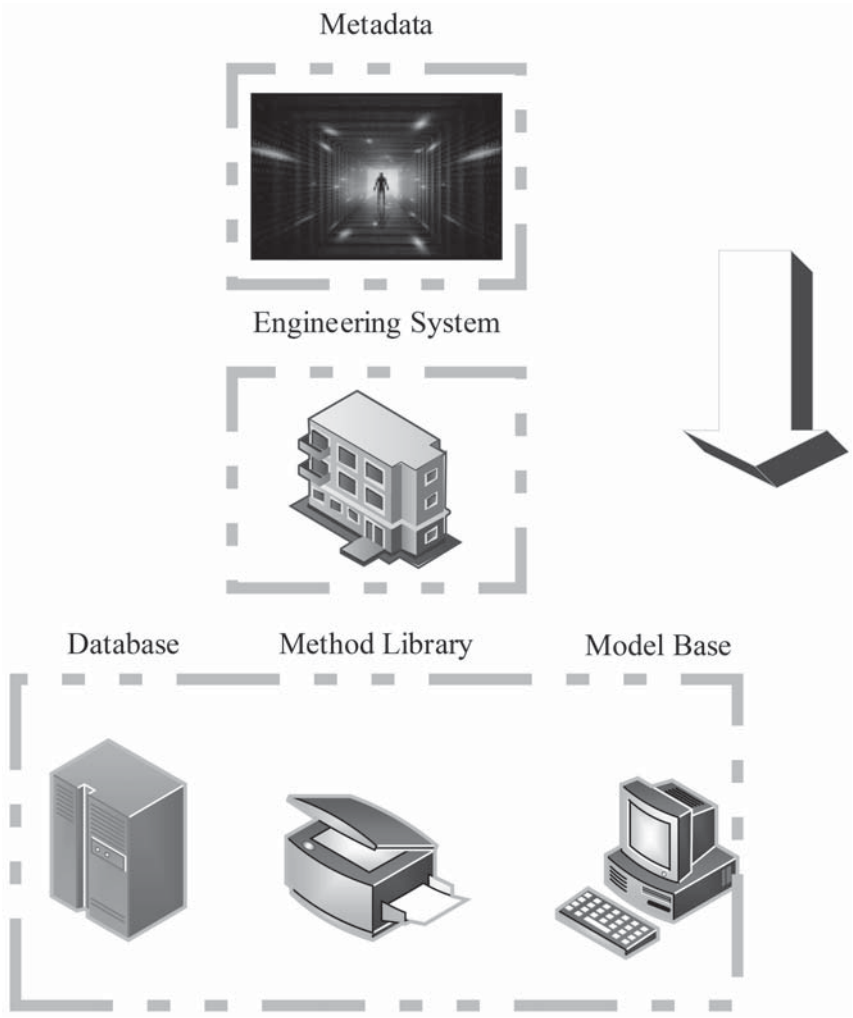

Figure 4 Electric power engineering intelligent system based on AI technology.

Table 1 Income, Market Number, and Label Analysis of Film and Television Production.

/	Income/10000 yuan	Number of markets	Label
A	64751.12	39	love
B	78413.31	43	action
C	54798.27	34	science fiction
D	84541.97	51	Suspense
E	54104.46	35	comedy
F	47684.69	28	Warfare

(2) Adjacency matrix

The tag adjacency matrix between films was calculated according to tag similarity, and the similarity matrix was calculated using the correlation degree of private tags, common tags and formal tags between films. Four films A, B, C and D were taken as examples to illustrate the similar matrix algorithm. The final degree of correlation is the sum of the tag order in slice A multiplied by the tag order in slice B, and then regularized the correlation matrix. Figure 6 shows the analysis of the matrix processing efficiency of film and television productions A, B, C and D in the new system and in the traditional system.

As shown in Figure 6, the matrix processing efficiency of the new film and television PRS is higher than that of the new film and television PRS, whether it is in the matrix processing efficiency of film and television work A or in the matrix processing efficiency of film and television works B, C, and D. From an average perspective, the average matrix processing efficiency of the new film and television PRS is 95.75%, while the average matrix processing efficiency of the traditional system is 84.125%.

(3) System satisfaction analysis

Based on the analysis results of the above experiment, a satisfaction comparison was conducted between the artificial intelligence based film and television PRS and traditional PRS for the recommended 50 film and television works. The results are shown in Figure 7.

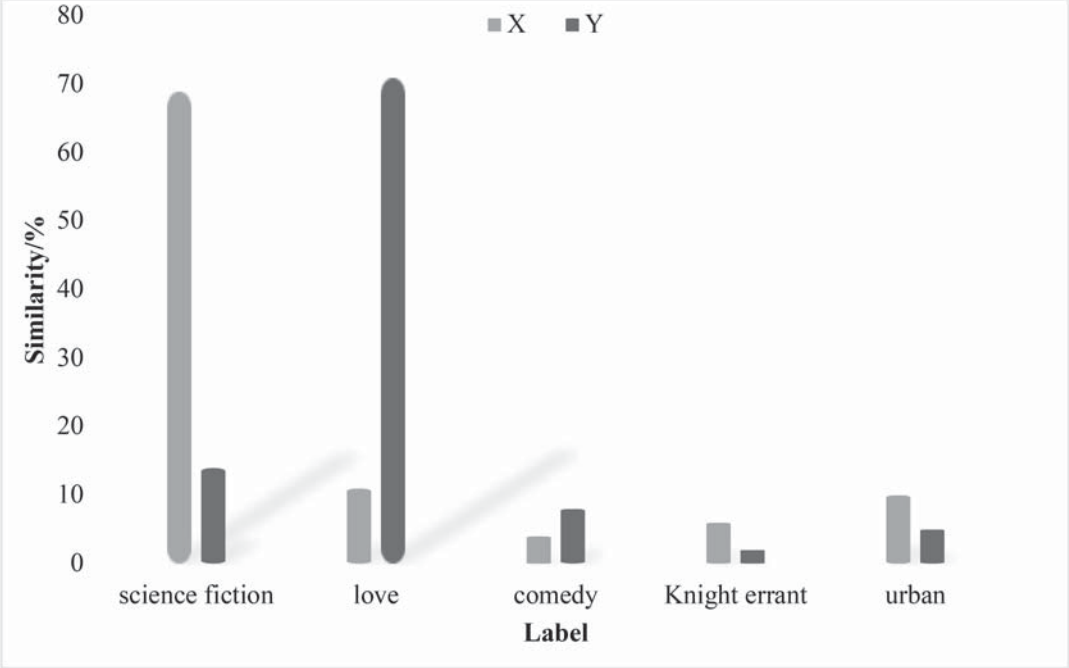

Figure 5 Similarity analysis of the five labels in the recommendation system.

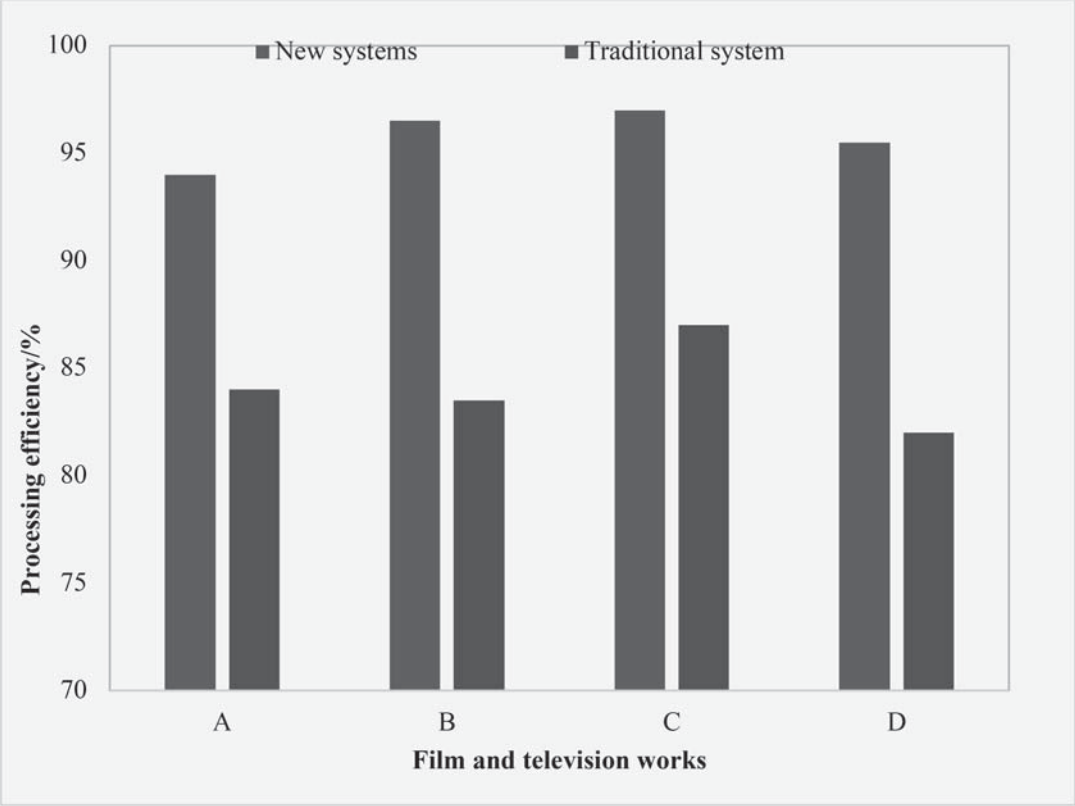

Figure 6 Matrix processing efficiency of film and television works in new systems and traditional systems.

Figure 7 shows the trend of the two curves in this graph: the new system curve increases gradually from "dissatisfied" to "average", and then rises rapidly to "satisfied"; finally, it drops sharply to "other". On the other hand, the traditional system curve increases gradually from "dissatisfied" to "average", and then slowly rises to "satisfied"; finally, it gradually drops to "other". The trend of the curve shows that the level of "satisfaction" with the new system is higher than that of the traditional system. Specifically, among the 50 recommended film and television works in the new system, there are 3 "dissatisfied" and "other" film and television works, 5 "average" film and television works, and 39 "satisfied"

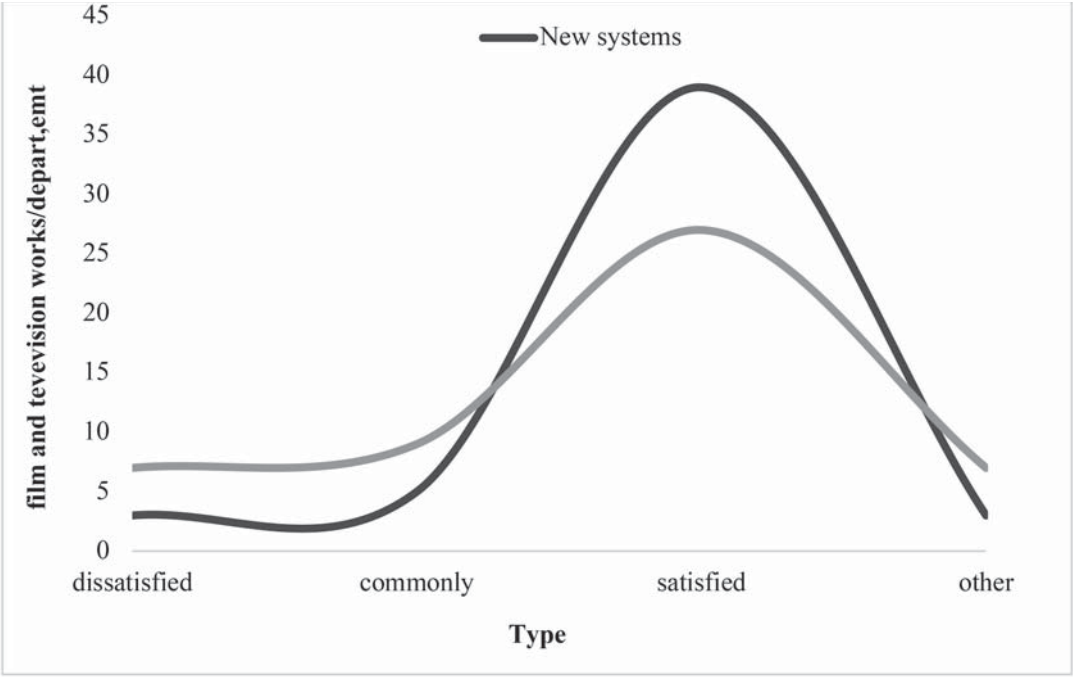

Figure 7 Analysis and comparison of the satisfaction types of the system.

film and television works. The proportion of recommended satisfactory film and television works is 78%. Among the 50 film and television works recommended by the traditional system, 27 are "satisfactory" films and television works, and the proportion of recommended satisfactory film and television works is 54%. It can be calculated that people's satisfaction with the new system is 24% higher than that of traditional systems.

In summary, the purpose of this paper is to find hidden associations between movie project information so as to find potential interests of users and recommend movies that appeal to them. It was concluded that the film and television PRS based on AI technology is more accurate and effectives.

5. CONCLUSIONS

With the progress of science and technology, intelligent engineering is developing rapidly. This paper proposed a movie recommendation algorithm based on user behavior records and movie characteristics to predict users' movie preferences. Among the existing recommendation algorithms, due to the problems of sparsity and cold start, this paper adopted the automatic recommendation algorithm of movie tags based on AI technology. Through the simulation experiment involving model construction, the results of data preparation, adjacency matrix, initial probability distribution and full clothing analysis were obtained. Finally, it was concluded that the film and television PRS which implements AI technology is better than the traditional system.

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