



Application of Recommendation Algorithms in Product Art Design: Challenges and Applications

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Abstract. Recommendation algorithm is a kind of artificial intelligence technology which is widely used in all walks of life. In the field of product art design, recommendation algorithms can help designers better understand user needs and quickly provide design solutions that meet user needs. However, the application of recommendation algorithm in product art design also has some challenges, such as data collection, algorithm selection, model optimization and so on. In this paper, the application of recommendation algorithm in product art design is deeply discussed, aiming to provide reference and enlightenment for practitioners in related fields.

Keywords: Recommendation algorithm, product art design, user requirements, data collection, algorithm selection, model optimization

1 INTRODUCTION

With the development of technology and digitalization, recommendation algorithm has become one of the widely used artificial intelligence technologies. By analyzing users' historical behaviors and interest preferences, recommendation algorithm can quickly and accurately recommend content or products that users may be interested in. Therefore, recommendation algorithm has been widely used in e-commerce, video, music and other fields [1]. In the field of product art design, recommendation algorithm has also been applied. Based on the analysis of user needs and preferences, the recommendation algorithm can help designers better understand user needs and quickly provide design solutions that meet user needs, thus improving the efficiency and design quality of designers. At the same time, recommendation algorithm can also help enterprises better understand user needs and market trends, improve product sales and market competitiveness. At present, the application of recommendation algorithm in product art design has made some achievements. For example, some websites and platforms have begun to use recommendation algorithms to recommend designs or products that users might be interested in [2].

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However, there are still some problems and challenges in the application of recommendation algorithm in product art design, such as: Data collection problems: recommendation algorithms require a large amount of user data and design data, but in the field of product art design, these data are often difficult to obtain, and the quality and authenticity of the data should be guaranteed. Algorithm selection problem: Among many recommendation algorithms, how to choose the recommendation algorithm suitable for product art design and how to adjust the algorithm parameters is a problem that needs to be considered. Model optimization problem: The recommendation algorithm model needs to be continuously optimized and adjusted to improve the recommendation effect [3]. In the field of product art design, how to optimize the model to improve the recommendation effect is also a problem that needs to be discussed.

2 Jewelry design model based on recommendation algorithm

Data collection and preprocessing. In this step, user and design data needs to be collected and preprocessed. Among them, user data includes information such as historical behaviors, interests and preferences of users, and design data includes various attributes and characteristics of jewelry design. In addition, you need to clean, de-duplicate, and standardize data to ensure data quality and reliability. Feature engineering In this step, meaningful features need to be extracted from the collected data. For example, it can extract the color, shape, material and other attributes of the jewelry design, as well as the user's purchase history, collection records and other information. At the same time, the features need to be processed and transformed for the use of subsequent algorithms [4]. Model selection and training. In this step, it is necessary to select a suitable recommendation algorithm model, and train and tune it. As shown in Figure 1, the execution process of genetic algorithm:

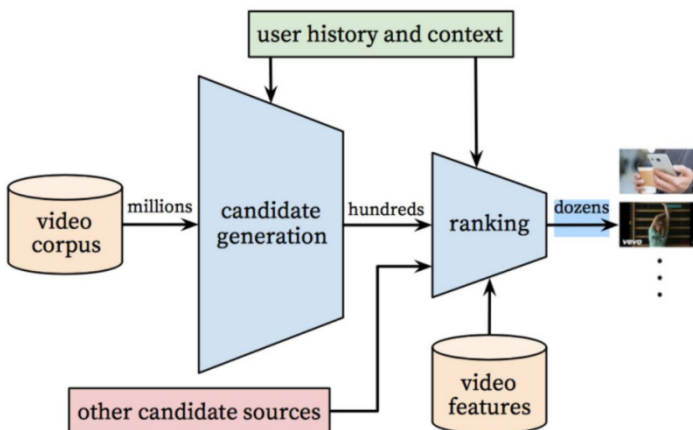


Fig. 1. Genetic algorithm flow

Common recommendation algorithm models include collaborative filtering based model, content-based recommendation model and mixed recommendation model. When training the model, the collected data should be divided into training set and test set, and the model should be optimized and adjusted to improve the accuracy and efficiency of the model. Recommendation algorithm application. In this step, the trained recommendation algorithm model needs to be applied to the actual jewelry design [5]. When users input their preferences and needs, the recommendation algorithm model can automatically analyze and recommend jewelry design schemes that meet users' needs. Model evaluation and optimization. In this step, the recommendation algorithm model needs to be evaluated and optimized. As shown in Announcement 1, it is an iterative algorithm for model convergence:

$$y = \sigma(\omega x^T + b) \quad (1)$$

Common evaluation indexes include accuracy, recall rate, coverage rate, etc. If there are some problems in the model, it is necessary to adjust and optimize the model to improve its performance and effect. In short, the jewelry design model based on recommendation algorithm can provide users with jewelry design schemes that meet their needs by analyzing users' historical behaviors and interests and preferences. Meanwhile, it can also help designers better understand users' needs and market trends and improve designers' efficiency and design quality [6].

3 Jewelry research simulation experiment

3.1 Data preparation and environment construction

Data collection and preprocessing: Firstly, data related to jewelry should be collected from jewelry websites and other channels, including jewelry attribute information, pictures, etc. Then the data needs to be preprocessed, such as removing missing values, outliers, etc. Feature extraction and selection: Converting jewelry data into a format that can be processed by machine learning algorithms generally requires extracting key features of jewelry, such as material, color, weight, price, etc. At the same time, it is also necessary to select the extracted features and select the features that have a greater impact on jewelry recommendation. Recommendation algorithm selection and training: According to the characteristics and needs of jewelry data, the appropriate recommendation algorithm is selected for training [7]. As shown in Publicity 2, it is an iterative algorithm for model convergence:

$$\partial_j^l = \frac{\partial c}{\partial z_j^l} = \frac{\partial c}{\partial a_j^l} \times \frac{\partial a_j^l}{\partial z_j^l} = \frac{\partial c}{\partial a_j^l} \sigma'(z_j^l) \quad (2)$$

Common recommendation algorithms include content-based recommendation, collaborative filtering recommendation, deep learning recommendation, etc. In the training process, a certain proportion of data should be used as the training set, and another part of data should be used as the test set to evaluate the performance of the model. Model evaluation and optimization: Evaluate the performance of the model by

comparing the error between the predicted results and the real results on the test set. If the performance of the model is poor, it is necessary to optimize the model, such as adjusting model parameters and improving feature selection. Display and feedback of recommendation results: Finally, the model is applied to the actual recommendation scenario, the recommendation results are displayed to users, and the performance of the model is constantly improved according to the feedback of users. In this way, a jewelry simulation system based on recommendation algorithm can be built to provide users with more personalized and accurate jewelry recommendation services [8]. As shown in Figure 2, the experimental process and results of jewelry similarity inspection are as follows:

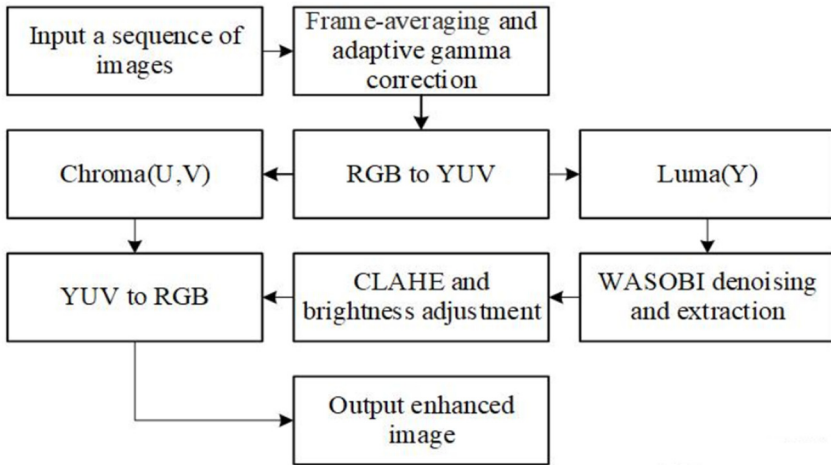


Fig. 2. Jewelry simulation experiment process

3.2 Experimental results and comparison

We carried out a jewelry simulation experiment using a recommendation algorithm based on collaborative filtering. Our experimental data set includes a series of user purchase records and jewelry attribute information. First, we divided the data set into a training set and a test set, where the training set contained 80% of the data and the test set contained 20% of the data. We then use a training set to train our recommendation algorithm and a test set to evaluate the algorithm's performance. We use accuracy and recall rates to evaluate the performance of recommendation algorithms. Our experimental results show that the accuracy of the recommendation algorithm is 0.85, and the recall rate is 0.79.

$$\delta_j^l = \sum_k w_{kj}^{l+1} \delta_k^{l+1} \sigma'(z_j^l) \quad (3)$$

This means that the recommendation algorithm can accurately recommend jewelry that most users will like, and can cover the purchase history of most users. In addition, we also conducted a further analysis of the recommendation algorithm and found that the recommendation algorithm performed better when recommending jewelry with

higher prices and worse when recommending jewelry with lower prices. This may be because high-value jewelry is more noticed by users, while low-value jewelry may be more randomly purchased by users. In summary, our experimental results show that the recommendation algorithm based on collaborative filtering can be well applied in jewelry recommendation, and has good recommendation performance and coverage[9].

4 Conclusions

This paper mainly discusses the application of recommendation algorithm in product art design. Recommendation algorithm is a technology widely used in e-commerce, social media and other fields, which can provide users with personalized recommendation services. In product art design, recommendation algorithm can help designers find design schemes in line with users' preferences among massive design materials, and improve design efficiency and user satisfaction. However, there are also some challenges in the application of recommendation algorithm in product art design, such as data sparsity, recommendation accuracy and user satisfaction. To solve these challenges, researchers have proposed some methods and technologies, such as recommendation algorithms based on deep learning, multi-source data fusion and user portrait. Through case analysis, this paper also shows the practical application and effect of recommendation algorithm in product art design. Finally, the future application of recommendation algorithm in product art design is prospected, and the direction and focus of future research are pointed out, such as further optimization of recommendation algorithm, development of new algorithm suitable for product art design, etc[10].

In the future, the application of recommendation algorithm in product art design still has some challenges and development directions. On the one hand, designers and researchers need to pay more attention to user needs and feedback, and constantly improve the accuracy of recommendation algorithm and user satisfaction. On the other hand, with the continuous development of technology, recommendation algorithms also need to be constantly innovated and evolved. For example, virtual and augmented reality technologies can be combined with recommendation algorithms to provide users with a more realistic and intuitive design experience. Meanwhile, designers and researchers can also explore more data sources and algorithm models to improve the effectiveness and efficiency of recommendation algorithms. In short, the application of recommendation algorithm in product art design will be more diversified and innovative in the future.

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