Scholar Publishing Group
International Journal of Neural Network
https://doi.org/10.38007/NN.2020.010402
ISSN 2790-2692 Vol. 1, Issue 4: 10-17

Human Resource Recommendation Algorithm Relying on Decision Tree

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Keywords: Decision Tree Algorithm, Human Resources, Model Training Optimization, Recommendation Algorithm

Abstract: In recent years, the employment problem is a social problem that needs to be solved urgently. With the rapid development of network technology, the trend of human resources networking is gradually increasing, and human resources recommendation faces the problem of information overload. Traditional recommendation algorithms cannot adapt to the phenomenon of information expansion in the era of big data. A large amount of job information makes job seekers easily fall into information review fatigue, so that they cannot clarify their job search needs, which leads to more energy to find the one that really suits them job information. This paper aims to study the application of human resource recommendation algorithms relying on decision trees. This paper takes human resources recommendation as the application scenario, and propose an improved human resources recommendation algorithm. The main work includes the following points: (1) Research and implement streaming distributed Data collection technology is used to collect job seeker information, job position information and user behavior information. Combined with the characteristics of human resources, the collected data is preprocessed such as data cleaning, data extraction and data conversion. (2) A human resources recommendation algorithm combining is proposed. First, the feature conversion ability of gradient boosting tree is used to complete the screening and encoding of original features, and then the converted features are input into the design of this paper. The hybrid convolutional neural network uses convolution operations for high-level feature learning, and realizes personalized human resources recommendation.

1. Introduction

With the growth of the number of users of the recruitment platform, the amount of data information has increased exponentially. While bringing colorful information, human resources recommendation also faces the challenge of "information overload". In the "data scarcity" period

when the scale of data was small in the past, the traditional recommendation method used by major recruitment platforms at home and abroad was to classify according to the nature of work and search by keywords. Classification by job nature means that when an enterprise publishes job information, it will first classify jobs according to the nature of the job, and then users will view relevant types of job recruitment information according to their own job-seeking wishes, which requires users to filter a lot of energy and time; keyword search refers to The key is to match the keywords of the job-seeking intention provided by the user himself, and query the information of the position, which requires the user to clarify his job-seeking needs[1-2] .

In the research on the application of human resource recommendation algorithms relying on decision trees, many scholars have studied them and achieved good results. The academic community pays close attention, from the initial collaborative filtering algorithm to the recommendation algorithm based on demographics, to the recommendation algorithm based on content information and the hybrid recommendation algorithm, the recommendation algorithm has been greatly developed [3]. Wang G et al. used the feature conversion ability of decision tree to apply recommendation technology to advertising recommendation conversion by combining category features and logistic regression calculations [4].

The main research content of this paper is to use the knowledge of gradient boosting tree and deep learning to optimize the effectiveness of recommendation algorithms in the field of human resources through model integration, improve the quality of human resources recommendation, and provide effective and feasible optimization for personalized recommendation of human resources program. The specific research contents mainly include: (1) Research on streaming distributed data collection technology, which is used to collect job seeker information, job position information and user behavior information. Combined with the field characteristics of human resources, data cleaning, data extraction and Data conversion and other related preprocessing. (2) Research gradient boosting tree and convolutional neural network technology, and realize human resources recommendation algorithm with the advantages of both.

2. Research on Application of Human Resource Recommendation Algorithm Relying on Decision Tree

2.1. Overall Design of Recommendation Algorithm

The recommendation algorithm can effectively deal with the recommendation dilemma caused by today's information overload phenomenon. The recommendation algorithm can analyze and calculate the user behavior data, build the user's interest model, calculate the relevant recommendation rules in the field of recommendation, and make appropriate recommendations according to the rules recommended items or information [5-6].

Although deep learning technology has related research results in many fields, it has not received much attention in the field of human resource recommendation. However, the research results combined with emerging technologies are still relatively small [7-8].

The focus of this paper is to design and implement the algorithm by analyzing the characteristics of the human resources field and drawing on the research results of improved recommendation algorithms in other fields, combined with technologies such as convolutional neural networks and gradient boosting trees field feasibility [9]. This paper uses the advantages of emerging technologies to improve the quality of human resources recommendation and alleviate the current employment problem of "mismatched positions". It hopes to provide research cases with reference value for enterprises engaged in Internet human resources recruitment, and also hopes to improve the

industrial and academic circles [10].

2.2. The Overall Process of the Algorithm

The design of the recommendation algorithm needs to be combined with the corresponding business scenarios. Different fields have their unique characteristics, and the corresponding input data requirements and data preprocessing processes are different. A certain recommendation algorithm cannot be perfectly adapted across fields. The same is true in the field of resource recommendation. However, at present, the development of human resource recommendation has not received sufficient attention. Most of the recommendation algorithms used are based on traditional implementation methods, and there are few innovative algorithm improvements, which have great limitations. Commonly used recommendation algorithms do not use many attributes for model training, because too much computational attribute information will lead to a lot of computational cost, which requires too much computational time, and cannot perform high-level feature abstraction learning and cannot be fully extracted implicit associations between data. However, if the basic information cannot be fully utilized and only interactive data such as ratings and collections are relied upon, it will easily lead to problems such as cold start and data sparseness, and cannot provide high-quality personalized recommendation services [11-12].

First, the human resources data collection is carried out, and then the data preprocessing is carried out in combination with the relevant properties of the human resources field, and then the implementation of the human resources recommendation field is implemented algorithm and finally produce the recommended results. Subsequent content will give a general description of the above links, and the overall flow chart of the specific algorithm is shown in Figure 1 below [13-14].

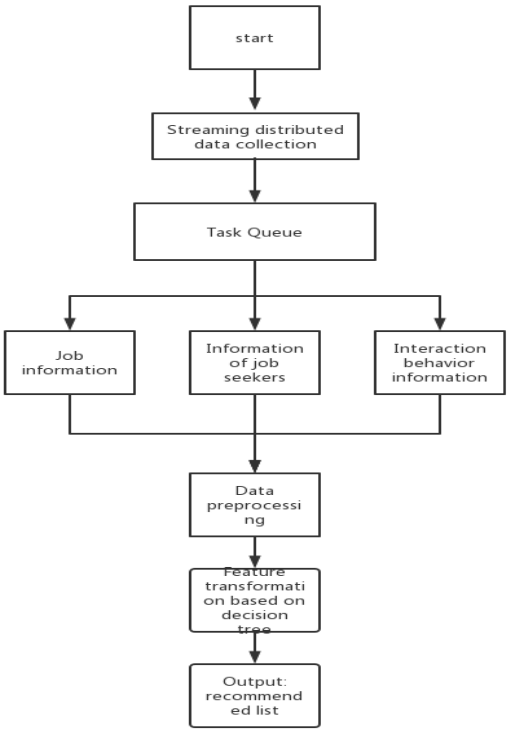

Figure 1. Overall flow chart of the recommendation algorithm

2.3. Xgboost Model

XGBoost is an optimization method for gradient-enhanced decision trees. While the traditional gradient propulsion decision tree uses only the first derivative information in the optimization, XGBoost performs a second Taylor expansion of the cost function using both the first derivative and the second derivative information, whose algorithmic formula is shown in Eq (1) [15-16] .

$$\tilde{L}^{(t)} = \sum_{i=1}^{n}\left[hift(X_i) + \frac{1}{2} gif_t^2(X_i)\right] + \Omega(ft) \tag{1}$$

Among them, hi is the first-order derivative, the specific mathematical expression is shown in formula (2), gi is the second-order derivative, and the specific mathematical expression is shown in formula (3), yi represents the true category of the ith sample, representing the ith $\hat{y}_i^{(t)}$ sample The predicted class of the sample at iteration t .

$$h_i = \partial_{\hat{y}(t-1)} l\left(y_i, \hat{y}_i^{(t-1)} \right) \tag{2}$$

$$g_i = \partial^2_{\hat{y}(t-1)} l\left(y_i, \hat{y}_i^{(t-1)} \right) \tag{3}$$

In order to make full use of the high-level feature learning ability of convolution processing, this paper uses XGBoost to transform original features in feature transformation processing, and constructs new features for convolution processing [17-18].

3. Research Design Experiment of Application of Human Resource Recommendation Algorithm Based on Decision Tree

3.1. User Behavior Transformation

In the past, a large number of researches by researchers mainly focused on user explicit rating data, such as movie ratings on MovieLens, requiring users to give a rating of 1 to 5 for movies, 1 means dislike, and so on, 5 means very like. And on this basis, the user's rating data is converted into a user-movie rating matrix that is easy to calculate, and on the basis of this matrix, the user's rating for unrated movies is predicted by using the relevant recommendation algorithm.

In the research of this paper, we mainly use the implicit behavior of users, for job seekers, including which job they have seen and not seen, and for recruiters, including which job applicant they have seen or not seen. Here we use 0 for not seen and 1 for seen. After obtaining this data, we convert it into a 0-1 matrix, and on the basis of this matrix, use existing recommendation algorithms to predict which job candidates will look at and which job applicants will recruiters look at Information.

3.2. Experimental Design

This paper conducts experiments on the human resources recommendation algorithm based on the decision tree algorithm designed in this paper. First, it analyzes the different convolution

channels, and compares its recall rate and F1-Score performance. The second is to tune the learning rate and select the best experimental learning rate.

4. Experimental Analysis of the Application of Human Resource Recommendation Algorithm Based on Dependency Decision Tree

4.1. Convolution Channel

This article will conduct experimental comparisons of single-channel convolution, two-channel convolution and three-channel convolution. The convolution kernel sizes used are 1×2, 1×3, and 1×4, and the performance comparison is performed by recall rate and F1-Score. , to find the most suitable number of convolution channels. The specific experimental results are shown in Table 1 below.

Table 1. Experimental results of different convolution channels

	Recall	F1-Score
1×2	0.6396	0.6786
1×3	0.7485	0.7032
1×4	0.7128	0.6882

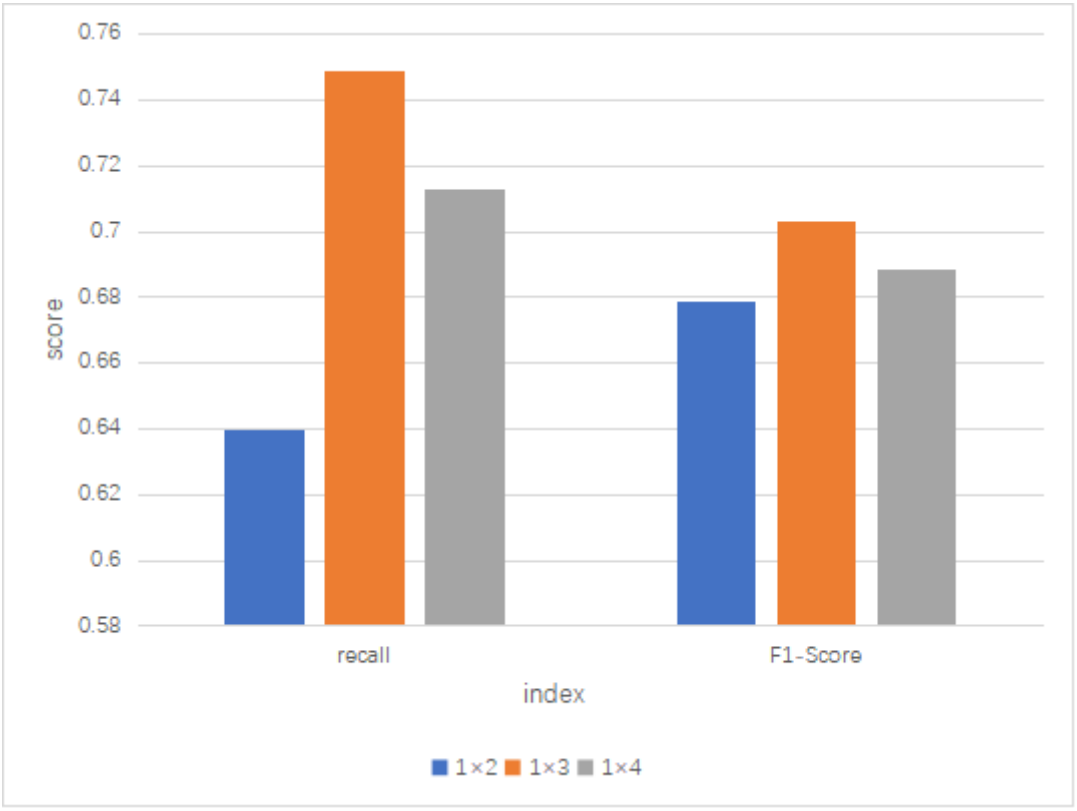

Figure 2. Changes in the recommended evaluation indicators for the different numbers of convolution channels

The experimental results in Figure 2 show that multi-channel convolution results are better than single-channel convolution, demonstrating that feature extraction using multi-channel convolution

can improve the recommended quality. However, too many channels will extract a lot of invalid information, so this paper chooses two-channel convolution.

4.2. Learning Rate Tuning Experiment

Learning rate is important for the stability of the decision tree algorithm model, so the learning rate of different values is selected to modify the simulation, and select the best learning rate by comparing the F1 scores of different learning rates. The experimental data are shown in Table 2

Table 2. F1-Score comparison plots for different learning rates

	0.007	0.05	0.1	0.2	0.3	0.4
F1-Score	0.6907	0.7032	0.7086	0.7111	0.7301	0.7179

Figure 3. Changes in the F1-Score for different learning rates

As can be seen from Figure 3, the highest F1 rate of the algorithm is highest and the most stable when the learning rate is 0.3. Therefore, the algorithm in this paper decided to set the learning rate to 0.3.

5. Conclusion

The main research goal of this paper is to realize an efficient recommendation algorithm, and apply the algorithm to the field of human resources recommendation, optimize the shortcomings of traditional recommendation algorithms in the field of human resources, and serve for the realization

of high-quality human resources recommendation. Aiming at the problems that the current recommendation method is relatively traditional and single, this paper adopts a combination of gradient boosting tree and convolutional neural network to achieve high-quality human resource recommendation. The main contents of this paper are summarized as follows: Research and implement streaming distributed data collection technology, collect job seeker information, job information and user behavior information related to the field of human resources, combined with the characteristics of the field of human resources, Collect data for data cleaning, data extraction and data conversion and other related preprocessing. The generation of personalized recommendation requires a lot of computing tasks. At present, the algorithm only runs in a single-machine environment, and the required running time is long. Therefore, parallel computing optimization needs to be considered in the future to speed up the recommendation tasks faced with massive data required calculation process.

Funding

This article is not supported by any foundation.

Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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