A Recommended Method for Teaching Information Resources of English Chinese Translation Based on Deep Learning

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Abstract. In the context of mass industry and innovative education, educational institutions and educators need to focus on cultivating students' innovation ability and creativity, and prepare students for their future employment and career development by providing courses and practical opportunities for innovative education. At the same time, enterprises and industries also need to cooperate with educational institutions to jointly promote the development of innovative education and cultivate innovative talents that meet the needs of the mass industry. In order to ensure the effectiveness of English Chinese translation teaching information resource recommendation and improve the accuracy of English Chinese translation teaching information resource recommendation, a deep learning based English Chinese translation teaching information resource recommendation method is proposed. By analyzing students' demand for teaching information resources in English Chinese translation, convolutional neural networks are used to extract the characteristics of teaching information resources in English Chinese translation. By utilizing the self coding neural network in deep learning methods, the correlation between English Chinese translation teaching information resources is excavated, and a recommendation model for English Chinese translation teaching information resources is constructed to achieve English Chinese translation teaching information resource recommendation. The experimental results show that the method proposed in this paper has a good recommendation effect on teaching information resources for English Chinese translation, and can effectively improve the accuracy of teaching information resource recommendation for English Chinese translation.

Keywords: Deep Learning · Convolutional Neural Network · English Chinese Translation Teaching · Information resource recommendation · Self Coding Neural Network

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1 Introduction

In today's era, internet technology, especially mobile internet technology, is rapidly developing, and mobile terminals, especially smartphones, have become popular, which has had a huge impact on people's production and life. College students are willing to accept new things, and mobile internet has become a part of their lives [1, 2]. The rich content and convenient application of internet resources greatly enhance students' access to various academic materials. In this context, teachers should consider how to guide students to use the Internet reasonably and promote teaching and learning. Due to the popularity of Jin Yong's martial arts, discussions and reviews surrounding Jin Yong's books have also emerged, leading to the emergence of "Jinology". In the 1980s, with the development of the internet, Jin Yong's works continued to be disseminated overseas. In 1993, the first overseas research network on metallography, alt.chinese.text (ACT), developed to this day, and a large number of overseas readers have joined the study of metallography and Chinese martial arts culture. It can be seen that martial arts novels have an audience and a market overseas. As the world's largest lingua franca, English translation of martial arts novels is essential for cultural exchange with the world. Therefore, systematizing and standardizing martial arts translation is beneficial for improving translation quality and speed, while also facilitating readers' retrieval, inquiry, and understanding. To achieve good English Chinese translation, one must have a solid foundation in both English and Chinese languages; To have extensive cultural knowledge, especially familiarity with the background knowledge of the translation topic; Be able to flexibly apply various translation methods and techniques; Be familiar with the use of various reference books. Online resources provide a rich material foundation for cultivating the above translation literacy [3]. With the development and application of information technology, the construction and use of teaching resources have become a hot topic in the field of education. In the teaching of English Chinese translation, the traditional teaching model faces many challenges, such as the difficulty for teachers to meet the personalized needs of students in teaching, and the difficulty for students to effectively access and utilize teaching resources in the learning process. Therefore, researching appropriate methods for recommending information resources in English Chinese translation teaching is of great significance for improving the effectiveness of English Chinese translation teaching and promoting the reform of English Chinese translation teaching.

At present, scholars in relevant fields have conducted research on the recommendation of English Chinese translation teaching information resources, and reference [4] proposes a smart recommendation method for learning resources under the information-based teaching mode. With the continuous rise and application of information technology teaching methods, individual differences such as learning habits have led to diverse preferences for resources and activities provided by information technology teaching platforms. It is urgent for the system platform to actively recommend resources and activities that meet students' interests and needs. Through the information-based teaching platform, the collection and acquisition of student user behavior data, data mining and analysis using big data technology, and modeling of student portraits in the information-based teaching platform. Identify students' needs and preferences using methods such as labels and weights. Utilizing matrix decomposition algorithm to update user profiles

and achieve intelligent recommendation services for massive educational and teaching resources, providing impetus for promoting personalized education. Reference [5] proposed a research on a recommendation system for ideological and political education resources in courses based on big data. To address the issues of long server response time and low user preference for system recommendation results in practical applications of knowledge graph based recommendation systems, a research on a curriculum ideological and political education resource recommendation system based on big data has been carried out. In the hardware part, design the selection of underlying physical hosts and database servers. In the software section, the reading and searching of ideological and political education resources for courses based on big data were designed. Comparative experiments showed that the designed recommendation system can provide users with higher accuracy and faster recommendation services in practical applications. Reference [6] proposes a teaching information resource management method based on Distributed File System (HDFS) and user interests. This method uses HDFS technology of Hadoop platform to solve the problem of cloud storage of network teaching resources, and analyzes the corresponding HDFS cloud storage architecture. Among them, the teaching resource recommendation function module adopts the LDA user interest topic mining model and introduces a student rating matrix to generate student course attribute preference similarity, improving the quality and accuracy of recommendations. The feasibility of the proposed method was verified by the simulation results of an instance on the Hadoop 2.2.0 platform. In addition, compared to recommendation methods based on standard association rules, the proposed mining recommendation method exhibits higher accuracy. However, the above resource recommendation methods still have problems of poor recommendation effectiveness and low accuracy.

In response to the above issues, a deep learning based recommendation method for English Chinese translation teaching information resources is proposed. The structural description studied in this article is as follows:

Step 1: Based on students' previous browsing content and frequency of English Chinese translation teaching information resources, analyze students' needs for English Chinese translation teaching information resources;
Step 2: Convolutional neural network is used to extract the characteristics of English Chinese translation teaching information resources;
Step 3: Use deep learning methods to explore the correlation between English Chinese translation teaching information resources and construct a recommendation model for English Chinese translation teaching information resources;
Step: 4: Experimental analysis;
Step 5: Conclusion.

2 Design of Recommended Methods for Teaching Information Resources in English Chinese Translation

In order to effectively recommend teaching information resources for English Chinese translation, a deep learning based method for recommending teaching information resources for English Chinese translation is proposed. Analyze students' demand for

teaching information resources for English Chinese translation, and extract the characteristics of teaching information resources for English Chinese translation. On this basis, a recommendation model for teaching information resources in English Chinese translation is constructed to achieve the recommendation of teaching information resources in English Chinese translation.

2.1 Analyzing Students' Needs for Teaching Information Resources for English Chinese Translation

This article analyzes the needs of students' English Chinese translation teaching information resources based on their previous browsing content and frequency. The specific operation process is shown in Fig. 1.

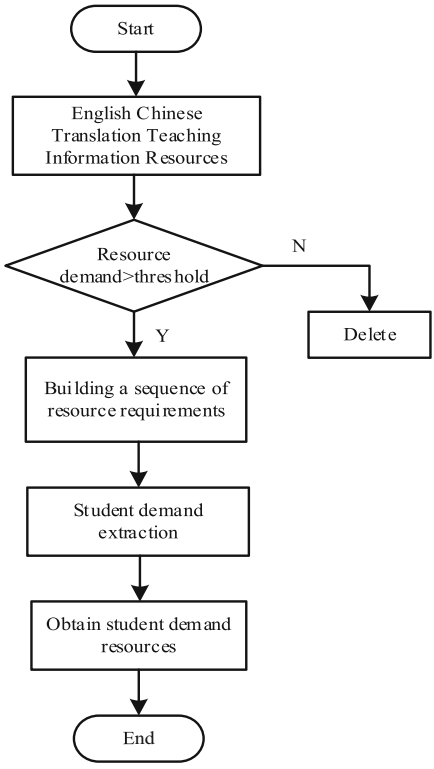

Fig. 1. Analysis process of students' demand for English Chinese translation teaching information resources

In order to independently reflect students' needs for English Chinese translation teaching information resources, based on the content of Fig. 1, a binary function is constructed, which includes:

$$f_q(a_i) = \begin{cases} 1, q = \alpha_1, \alpha_2, \alpha_3 \\ 0, else \end{cases} \quad (1)$$

In formula (1), α_1 represents save, α_2 represents favorite, and α_3 represents download. If $f_q(a_i) = 1$, then it indicates that students have a demand for this type of English Chinese translation teaching information resource; If $f_q(a_i) = 0$, then it indicates that students do not have a demand for this type of English Chinese translation teaching information resource.

Due to the uncertainty in the application process of this function, it needs to be optimized. Considering the content of the English Chinese translation teaching information resources themselves, the time length of the English Chinese translation teaching information resources is set to G_I. The larger this value, the lower the demand for English Chinese translation teaching information resources among students. Assuming N represents the number of times students click on English Chinese translation teaching information resources, this parameter is positively correlated with students' demand for such English Chinese translation teaching information resources. When N is greater, it indicates that students have a higher demand for this type of English Chinese translation teaching information resources. Assuming T_I represents the query time of students' English Chinese translation teaching information resources, there is a positive correlation between students' demand for this type of English Chinese translation teaching information resources, but it is not that the higher the T_I value, the higher the students' demand for it. When evaluating T_I, it is necessary to set $\max T_I$ to constrain it. Based on the above analysis results, the demand of students for a certain English Chinese translation teaching information resource can be calculated using the following formula:

$$f_q = \delta \frac{N}{G_I \max T_I} r^{-|T_I - \max|} \tag{2}$$

In formula (2), δ represents the adjustment factor during the calculation process, and r represents the demand coefficient. Based on the above analysis, students' interest in a specific English Chinese translation teaching information resource can be expressed as:

$$f_q' = \min\{1, f_q(a_i) + f_q\} \tag{3}$$

According to the above formula, when a student's demand for a specific English Chinese translation teaching information resource exceeds f_q, it can be used as a decision-making factor for extracting English Chinese translation teaching information resources.

2.2 Extracting the Characteristics of Teaching Information Resources for English Chinese Translation

After analyzing the needs of students for teaching information resources in English Chinese translation, convolutional neural networks are used to extract the characteristics of teaching information resources in English Chinese translation.

Convolution neural network is a kind of deep neural network widely used in image recognition, speech recognition, natural language processing and other fields. It is a typical method commonly used in deep learning. It uses multiple sets of convolution kernels to extract and abstract features, and ultimately achieves efficient classification of input data [7–9]. Convolutional neural networks mainly focus on convolutional operations, which are a special linear weighting operation that extracts local features from

input data through sliding windows, effectively sharing parameters and reducing model complexity. In addition, the convolutional neural network also includes pooling, activation function and other modules. In the process of continuous feature extraction and abstraction, the size of the feature map is constantly reduced and the ability of feature identification is enhanced. Convolutional neural networks have excellent feature extraction and abstraction capabilities, are suitable for processing high-dimensional data, and have a certain degree of translation invariance and the ability to automatically learn features.

Convolutional neural networks are composed of single-layer and double-layer hierarchical structures, including input layer, convolutional layer, pooling layer, fully connected layer, and output layer. The middle three layers are multi-layer structures, and the remaining two layers are single-layer structures. The structure of Convolutional neural network is shown in Fig. 2.

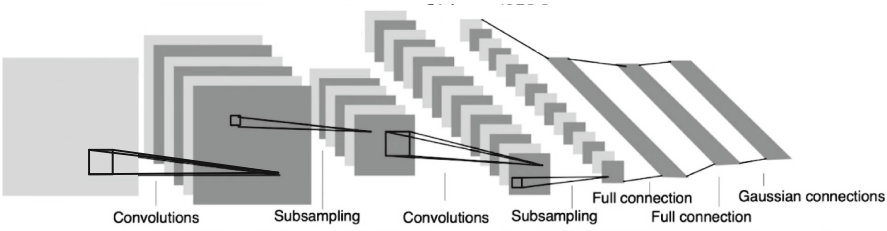

Fig. 2. Structure of Convolutional neural network

If M and C correspond to the height, width, and number of channels respectively, then the English Chinese translation teaching information resource input in the input layer is $M \times M \times C$. After inputting teaching information resources for English Chinese translation, convolution operations are performed on them through convolutional layers. If $N \times N$ represents the size of the convolution kernel and its quantity is K, the convolution calculation can obtain the feature $(M - N + 1) \times (M - N + 1)$ of English Chinese translation teaching information resources. The convolution formula is:

$$X_j^l = f_q'\left(\sum_{i \in M_j} X_i^{l-i} W_{ij}^l + b_i^j\right) \tag{4}$$

In formula (4), X_j^l represents the characteristics of English Chinese translation teaching information resources after convolution, and X_i^{l-i}, W_{ij}^l and b_i^j represent vector, offset and activation function respectively.

The pooling layer mainly completes the sampling of X_j^l, and if the determined sampling area of this layer is $a \times a$, the feature $\left(\frac{M-N+1}{a}\right) \times \left(\frac{M-N+1}{a}\right)$ of English Chinese translation teaching information resources after sampling can be obtained, the purpose of sampling is to reduce the dimensionality of X_j^l, thereby reducing the complexity of the model and improving its operational efficiency. The sampling formula for X_j^l is:

$$X_j^l = \left(\sum_{i \in M_j} \beta_j^l down\left(X_j^{l-1}\right) + b_i^j\right) \tag{5}$$

In formula (5), $down(\cdot)$ represents the calculation function and β_j^l represents the bias term, which belongs to the feature of outputting teaching information resources for English Chinese translation.

After the above convolution and pooling operations, it is necessary to implement a distributed representation of the characteristics of English Chinese translation teaching information resources. This representation needs to be completed through a fully connected layer and mapped to the sample label space, in order to obtain the categories of English Chinese translation teaching information resources. Namely, X_j^l is transformed into a one-dimensional vector to extract the features of teaching information resources for English Chinese translation. The transformed one-dimensional vector is output by the output layer.

2.3 Constructing a Recommendation Model for Teaching Information Resources of English Chinese Translation

Based on the feature extraction of English Chinese translation teaching information resources mentioned above, deep learning methods are used to explore the correlation between English Chinese translation teaching information resources, and a recommendation model for English Chinese translation teaching information resources is constructed.

Deep learning is a machine learning method that simulates the structure and working mechanism of human brain neural networks. By constructing multi-layer nonlinear neural networks, high-level features are extracted from input data, enabling learning and prediction of multiple complex data types [10–12]. Deep learning can automatically extract features and patterns from data, and has a significant ability to handle high-dimensional and complex data. The self coding neural network in the deep learning technology is a kind of unsupervised learning neural network. Its main purpose is to compress the complex input data into a low dimensional vector through a series of nonlinear transformations, and then re convert the vector into the original input data through the decoder to achieve data reconstruction and feature extraction. Self coding neural networks can represent received data features by capturing data features in low dimensional space, and have strong predictive ability. Therefore, with automatic encoders as the core technology, a recommendation model for teaching information resources in English Chinese translation is constructed. The structure of the self coding neural network is shown in Fig. 3.

In Fig. 2, f, g, and h represent the input gate, output gate, and forgetting gate of the self coding neural network, respectively. Their corresponding teaching information resources for English Chinese translation are represented as R, T, and Y. The input gate and output gate respectively determine the state of the current input sequence and output sequence, while the forgetting gate controls how many units of English Chinese translation teaching information resources will be transmitted to the current state at the final moment.

Through the adaptive encoding and decoding of encoders, the correlation between English Chinese translation teaching information resources is analyzed, and the formula is as follows:

$$y_i = X_j^l f(i)\left[W_i x_i + g(i)h(i)\right] \tag{6}$$

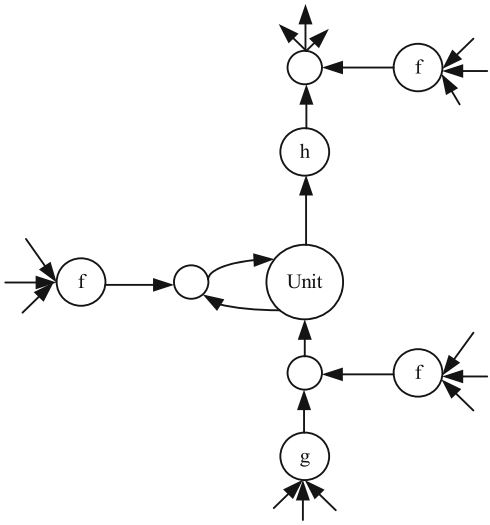

Fig. 3. Self coding neural network structure

In formula (6), y_i represents the correlation between English Chinese translation teaching information resources, W_i represents the weight value of English Chinese translation teaching information resources, and x_i represents the input of English Chinese translation teaching information resources.

The impact factors of recommended English Chinese translation teaching information resources on non recommended English Chinese translation teaching information resources can be expressed as:

$$L_s = y_i \cdot b_i + K_s \tag{7}$$

In formula (7), b_i represents the bias coefficient of teaching information resources for English Chinese translation, and K_s represents the index value of teaching information resources for English Chinese translation.

Assuming that the number of occurrences of a certain English Chinese translation teaching information resource is N_c, N_c contains k keywords of English Chinese translation teaching information resource, and the calculation formula for the probability of k occurrence is:

$$p = \frac{k \times N_c}{L_s \max z} \tag{8}$$

In formula (8), p represents the probability of frequent occurrences of English Chinese translation teaching information resources, and z represents the number of English Chinese translation teaching information resources containing that keyword.

On this basis, calculate the importance level W_{ij} of the keyword j in an English Chinese translation teaching information resource text D_j, which is:

$$W_{ij} = p \times \log \frac{N_c}{n_j} \tag{9}$$

In formula (9), n_j represents the number of important words in the English Chinese translation teaching information resource text.

Using pre similarity to measure students' demand for English Chinese translation teaching information resources, the calculation formula is:

$$S(a_i, v_i) = \frac{W_{ij}}{|a_i||v_i|} \tag{10}$$

In formula (10), S represents the similarity calculation of students' demand for English Chinese translation teaching information resources, a_i represents the feature vector of students' selection of English Chinese translation teaching information resources, and v_i represents the feature vector of English Chinese translation teaching information resources.

By concatenating the feature vectors of teaching information resources for students' English Chinese translation with the feature vectors of teaching information resources for English Chinese translation, the student's rating vector for teaching information resources for English Chinese translation is obtained, which is the recommended model for teaching information resources for English Chinese translation. The expression is:

$$y\prime = \alpha[S(a_i, v_i) \times \vartheta + \psi] \tag{11}$$

In formula (11), $y\prime$ represents the scoring vector of teaching information resources for English Chinese translation, α represents the original features of teaching information resources for English Chinese translation, and ϑ and ψ respectively represent the amount and allocation of teaching information resources for English Chinese translation to be recommended.

Calculate the rating vector of English Chinese translation teaching information resources using the above formula, sort them in descending order based on the results, and use the list of English Chinese translation teaching information resources ranked in the top ξ as the recommended list of English Chinese translation teaching information resources. Thus, achieve deep learning based English Chinese translation teaching information resource recommendation.

3 Experimental Analysis

In order to verify the feasibility of the recommendation method for English Chinese translation teaching information resources based on deep learning, the following experiment is designed.

Table 1. Setting the Experimental Environment

Project	Parameter
System	Windows 7
CPU	Intel Zhiqiang E5–2600
Development tool	Sublime
Deep learning tools	Theano

3.1 Experimental Environment

Set up the experimental environment as shown in Table 1.

The experiment takes information resources from a certain university's English Chinese translation teaching as the research object to test the application effect of the method in this article. The experimental testing process is shown in Fig. 4.

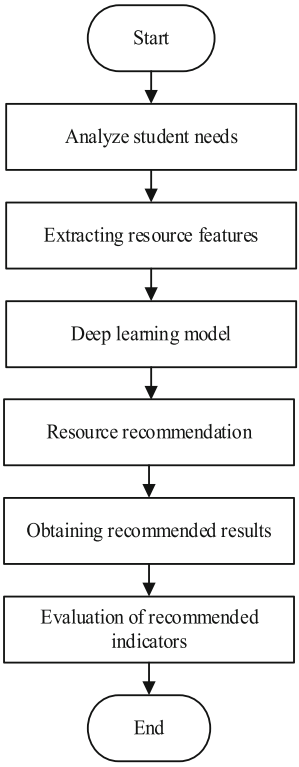

Fig. 4. Experimental Testing Process

The experimental test parameters are shown in Table 2.

Table 2. Experimental Test Parameters Table

Project	Parameter	
Average crawl processing time of web crawler nodes	≤ 2h	
Input data batch size	128 MB	
Training rounds	5 rounds	
Number of different convolutional kernels	70 piece	
Convolutional Kernel Types	3 types	
Hide Layer Size	18 × 2	
Fully connected layer	First level input	128 × L × (18 × 5)
	First layer output	200
	Second layer input	200
	Second layer output	128 × L × (18 × 5)
	Third layer input	200
	Third layer output	200

Note: L represents the feature scale

3.2 Experimental Evaluation Indicators

1) Recall rate:

$$Recall = \frac{R(u)}{T(u)} \times 100\% \tag{12}$$

In formula (12), $R(u)$ is the recommended number of English Chinese translation teaching information resources, and $T(u)$ is the number of all English Chinese translation teaching information resources.

2) Accuracy:

$$Precision = \frac{R(u)}{M(u)} \times 100\% \tag{13}$$

In formula (13), $M(u)$ is the accurate recommended quantity of teaching information resources for English Chinese translation.

3) Normalized cumulative loss gain:

$$NDGG = A_i \sum_{j=1}^{n} \frac{2^{c_j^i} - 1}{\log_2\left(1 + S_j^i\right)} \tag{14}$$

In formula (14), A_i represents the standardization factor, and S_j^i and C_j^i respectively represent the position of student i's j th English Chinese translation teaching information resource recommendation result in the actual English Chinese translation teaching information resource recommendation ranking and the method generated recommendation ranking.

3.3 Experimental Results and Analysis

In order to avoid excessively single experimental results, while maintaining a constant experimental environment, comparative testing was conducted on the methods in this article, the reference [4] method, the reference [5] method, and the reference [6] method. The same English Chinese translation teaching information resources were recommended using these methods, and the recommended comparison results of English Chinese translation teaching information resources for different methods are shown in Table 3.

Table 3. Comparison of Recommended English Chinese Translation Teaching Information Resources by Different Methods

Different methods	Recall rate/%	Accuracy/%	Normalized cumulative loss gain
The proposed method	87.36	97.36	0.3695
The reference [4] method	82.34	90.34	0.3015
The reference [5] method	80.69	91.26	0.3214
The reference [6] method	85.33	89.36	0.3358

By analyzing the results shown in Table 3, it can be seen that compared to the other three methods, the index values of recall, accuracy, and normalized cumulative loss gain of the method proposed in this paper are all relatively large. From this, it can be seen that the recommendation accuracy of this method is relatively high.

On this basis, further comparative testing was conducted on the methods proposed in this paper, the reference [4] method, the reference [5] method, and the reference [6] method. The comparison curves of the hit rates of recommendation results for different methods are shown in Fig. 5.

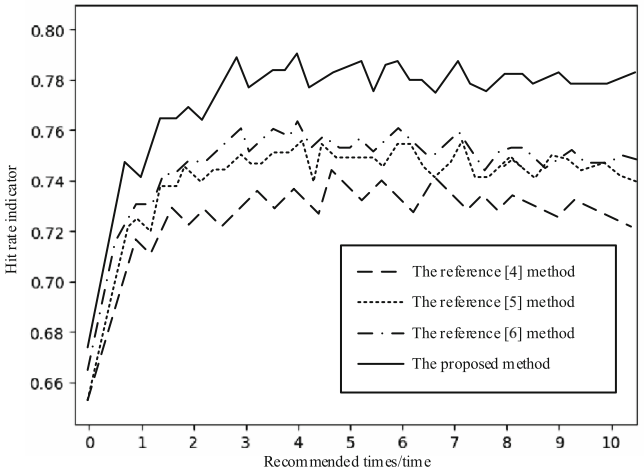

Fig. 5. Comparison Curve of Hit Rate of Recommendation Results for Different Methods

From Fig. 5, it can be seen that compared to the other three methods, the hit rate of the recommended English Chinese translation teaching information resources obtained by applying this method is higher, indicating that this method has a good recommendation effect on English Chinese translation teaching information resources.

4 Conclusion

This article proposes a method for recommending teaching information resources for English Chinese translation based on deep learning. By analyzing students' demand for teaching information resources for English Chinese translation, extract the characteristics of teaching information resources for English Chinese translation. On this basis, deep learning methods are utilized to recommend teaching information resources for English Chinese translation. The method proposed in this article can effectively ensure the recommendation effect of teaching information resources for English Chinese translation, and to some extent improve the accuracy of teaching information resource recommendation for English Chinese translation. However, when new users join the system, due to the lack of personalized historical data, deep learning models may not be able to accurately recommend suitable teaching information resources. Therefore, in the future, it is necessary to address the issue of cold start in order to provide personalized recommendations for new users.

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