

## Research Article

# Research on the Influence of Service Quality of Hotel Intelligent System on Customer Satisfaction Based on Artificial Intelligence Evaluation

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In this paper, we analyze the service quality problems of hotels from the perspective of customer satisfaction and service, and propose corresponding solution strategies. This paper elaborates on the word vector of model input, and then focuses on the structure and calculation process of the two-channel RNN triplet block model proposed in this paper. According to the expression habits of daily emotional tendencies, the RNN ternary block structure is set up to capture the structure of emotional tendency expressions and strengthen the dependency relationship between emotional tendency expression words. Provide suggestions for the improvement of service quality of Guido Hotel based on the results of satisfaction analysis and customer questionnaire. By comparing the experimental results, the effectiveness of the two-channel RNN ternary block model in the hotel review sentiment tendency analysis task is verified.

## 1. Introduction

In the current social and economic development, service enterprises play an increasingly important role and position in the service enterprises' profits are generated by the continuous purchase brought by customer satisfaction, so that customers gain more and more market choice and dominant power. As a result, whether the products and services provided by service companies can be accepted by consumers is directly related to whether the customers are satisfied with the products and services provided by the companies [1–3]. In such a product and service sales process, which originates from customer demand and ends in customer satisfaction, a high level of customer satisfaction is a key factor for customers to buy or even repeatedly buy enterprise products and services [4].

The hotel industry is a service industry, but also an industry that requires quality service. On the one hand, the hotel in the process of providing products or services, high-frequency contact with consumers, or even zero distance contact, the consumer's feelings and perceptions of the hotel

environment, products and services are more subjective, on the other hand, the supply and demand relationship in the hotel industry market has changed, only consumers who are satisfied with the service can become loyal consumers, in order to continue to buy hotel services, in other words, consumer satisfaction [5]. In other words, the higher the degree of consumer satisfaction, the greater the possibility of repeated purchases, the greater the market share of the hotel, the better the benefits, and will continue to bring profits to the enterprise [6].

With the economy hotels, local speciality restaurants to capture the low-end accommodation, catering market, customer choice has increased, the daily operation of star-rated hotels have been greatly impacted. In addition, star-rated river-bend stores are still the main object of local governments to attract investment, resulting in the number of star-rated hotels in fourth-tier cities also continue to expand, and the market demand for local star-rated hotels continues to decline. In such an environment, how local star hotels in fourth-tier cities can seize the psychology of customers under the new situation and new consumption,

and provide service initiatives and service levels corresponding to customers' expectations become the main consideration for hotel management [7, 8].

The market competition in the hotel industry is becoming increasingly fierce, with the arrival of quasi-five-star standard hotels such as Regalcombo and Fengguan Holiday [9]. In the critical period of the conversion of the old and new dynamics, how to explore the return of the industry's original position, as a major hotel, how to ensure the good performance of the local senior hotel, become the hotel managers have to consider the issue [10].

## 2. Related Work

With the development and enrichment of customer satisfaction theory and service quality theory, the theory has received more and more attention from enterprise managers, especially those in the service industry. Based on the theory of customer satisfaction, this paper analyzes the situation of customer satisfaction in hotel service, finds the weak nodes of service quality, builds the service evaluation model of customer satisfaction, and discusses the service quality gap and remedial measures [11].

At present, there is no standard expression of customer satisfaction, but its essence can be summarized as follows: customer satisfaction is a subjective and independent evaluation of consumption, a measure of satisfaction, and good customer satisfaction can prompt customers to repeat purchase [12]. Reference [13] proposed the concept of customer satisfaction, pointing out that if customers are satisfied with a product or service, they will be motivated to buy the product or service repeatedly. From the viewpoint of customer expectation and perception, we propose the viewpoint of customer satisfaction. Reference [14] constructed the Fennell logic model, the Swedish customer satisfaction index model, based on customer expectations and perceptions, and subsequently, the United States, Europe and some countries, successively put forward their own customer satisfaction index measurement models, making the theory a new operational culture and management model. In the hotel industry, [15] pointed out that staff service attitude, facility cleanliness and equipment tidiness are the three main factors affecting customer satisfaction; the price of hotel rooms and food and beverage, service speed and service quality are the three main factors triggering customer complaints. Reference [16] found that air conditioning equipment, wireless network, and price were the main factors affecting customer satisfaction. Through the study of service factors in the hotel industry, it was concluded that managers in the hotel industry should first pay attention to the basic factors in hotel services, such as the convenience of hotel facilities and the service level of staff [17].

Reference [18] analyzed the hospital patient service, emphasizing the special characteristics of emotional, interactive and social aspects in the service process, and explained the importance of developing quality management measures, strengthening detail management, key time management, effective communication, taking positive

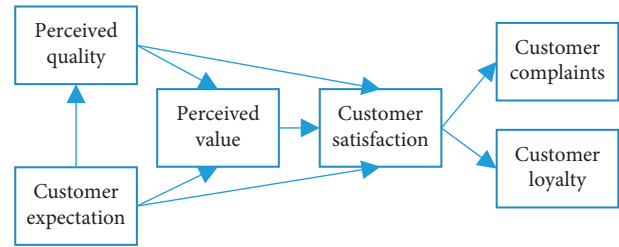


FIGURE 1: American customer satisfaction index ACSI.

remedies and focusing on service quality evaluation to improve the level of customer satisfaction. Reference [19] analyzed and studied customer satisfaction in online shopping. Based on the perspective of Taobao, Jingdong, Gome and other e-commerce websites, [20] combined with the theory of customer satisfaction to build the conversion model of "satisfaction website trust-loyalty" of e-commerce website customers, and studied the path relationship of customer satisfaction to customer loyalty.

In terms of model construction, [4] used AHP hierarchical analysis to construct an evaluation system of customer satisfaction in economy hotels, to study the degree of customer needs and satisfaction, and then analyzed the factors influencing customer satisfaction in economy hotels. Reference [5] concluded that customer satisfaction determines the competitiveness of the hotel itself, and used principal component analysis to study and analyze 17 influential indicators, pointing out that five factors, namely hotel environment, hardware construction, staff quality, hotel brand image, and system support, are the key to improve customer satisfaction. Reference [6] concluded that the interaction between employees and customers is one of the important forms of hotel services and is the basis for customers to evaluate the service quality, service value and satisfaction.

Reference [7] believes that the personalized development of service is the embodiment of the core competitiveness of hotels in the future, and the technological facilities of hotels can bring guests a different living experience and enjoy more thoughtful comfort, convenience and fun. Enhancing hotel technology and creating intelligent hotels can improve the quality of hotel services and is a trend to improve customer satisfaction. And technology can also improve the efficiency of staff, reduce customer waiting time, effectively control the hotel's operating costs, bring great economic effect to the hotel and enhance brand awareness.

## 3. Theories Related to Customer satisfaction

**3.1. Concept of Customer satisfaction.** Customer satisfaction is a measure of customer satisfaction, which is a subjective evaluation of the performance of a product or service, as well as the product or service itself. The gap between the customer's own expectations and actual perception, that is, the degree of customer satisfaction to be measured, including below or beyond the level of customer satisfaction, below the sense of satisfaction, satisfaction is low; above the sense of satisfaction, satisfaction is high.

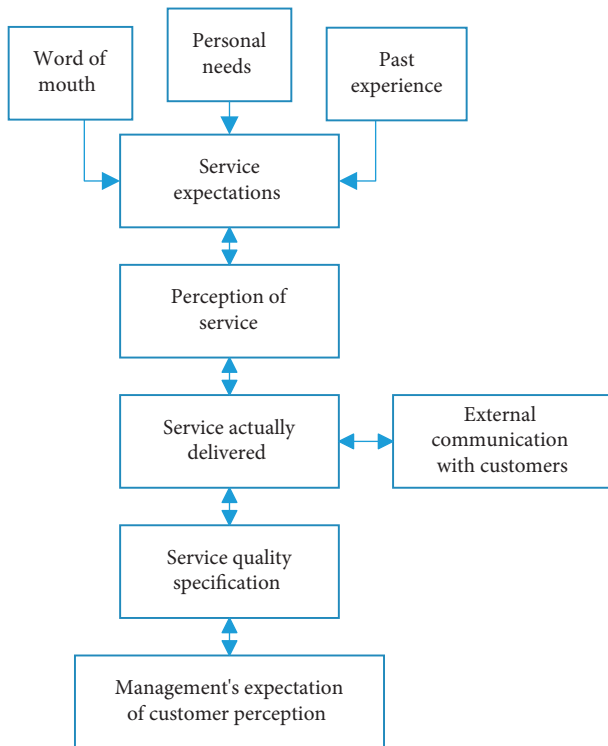


FIGURE 2: Service quality gap model.

3.2. *Customer Satisfaction Index.* The Customer Satisfaction Index ACSI (see Figure 1) is based on the SCSB model with the addition of perceived quality to the antecedent variables compared to it, distinguishing quality perception from value perception. The index model is a model consisting of six potential variables: perceived quality, perceived value, customer expectations, customer satisfaction, customer complaints and customer loyalty. Customer satisfaction is at the center and is jointly determined by customer expectations, perceived quality and perceived value, while customer satisfaction determines customer complaints and customer loyalty.

3.3. *The Concept of Service quality.* Service quality is the quality of the customer’s subjective perception of the service evaluation, is the result of the comparison between the customer’s service expectations based on personal experience, cognition and the actual service received. If the actual service received is higher than their own service expectations, customers will give a higher evaluation to the service quality; on the contrary, they will give a lower evaluation to the service quality.

Reference [15] proposed a service quality gap model (see Figure 2). This model believes that service providers need to try to eliminate five gaps in the service process in order to achieve a balance between the expected quality and the actual perceived service quality of customers, and then obtain a high level of customer satisfaction.

The perceived gap arises when customers exceed or fail to meet their own expectations in terms of receiving the services provided by the hotel management or comparing

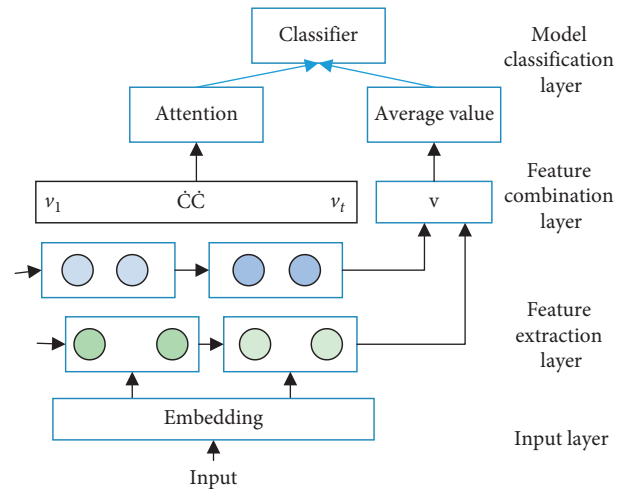


FIGURE 3: Structure of two-channel RNN triplet block model.

the overall environment and internal facilities of the hotel with their own expectations. Among these five gaps, the service quality gap is the core of the whole model, and the impact of other gaps on the customer’s perceived service quality gap varies according to the actual service level. For the hotel management, only by analyzing the causes of the four gaps (gaps 1, 2, 3 and 4) can the current situation of hotel service quality be clarified, and targeted service improvement measures be taken to promote the sound development of hotel management.

#### 4. Two-Channel RNN Triplet Block Model

In the prior art, the sequence information needs to be vectorized before entering the model, i.e., the text data is converted into vector form, and each word has a vector representation. In order to solve the problem of capturing structural features with varying local sentiment expressions and differentiating processing information, a two-channel RNN triplet block model is proposed as shown in Figure 3.

As can be seen from Figure 3, the model consists of four parts, which are: input layer, feature extraction layer, feature combination layer, and model classification layer.

4.1. *Input Layer.* In the output layer, the main purpose is to transform the text information into word vectors. One-hot word vectors, vector space model, and word2vec word vectors are all commonly used vector representation methods. Among them, vector space model represents the text content into a mathematically processable form analytically [4]; word2vec is an open source word vector tool proposed by Google in 2013, which can make a similarity between words through corpus training and can determine other words that are similar to the input word and their similarity [4].

4.2. *Feature Extraction Layer.* From Figure 3, the feature extraction layer of the model is mainly composed of RNN basic units and a square block structure, which is called

“RNN triplet”. The model is mainly based on the RNN triplet structure, and the RNN basic unit is supplemented. In channel 1, the RNN triplet starts processing data from the first moment, while in channel 2, the RNN triplet starts processing data from the second moment, and the data from the first moment of channel 2 is processed by the RNN basic unit, and only the implied state of the output of the unit is taken as the implied state input of the first RNN triplet of channel 2. Structures process the sequence information in a staggered moment-by-moment manner, in order to be able to capture the local sentiment tendency expression structure of the sequence information more completely.

For the data processing at the tail end of the sequence. If the last data length is less than 3, the RNN basic unit is used to process the remaining data, and only the global features of the channel are output in the RNN basic unit that processes the last data; if the tail data length is exactly equal to 3, the RNN triple block structure is used to process the data, and a local feature and the global features of the channel are output at the end. If the length of the data at the end is exactly equal to 3, then the RNN ternary block structure is used to process it, and finally a local feature and the global feature of the channel are output.

**4.3. Feature Combination Layer.** After the feature extraction layer in the previous layer, two types of feature vectors are obtained, the local feature vectors extracted from the RNN triplet block on the two channels and the global feature vectors finally output by the two channels. The purpose in the feature combination layer is to combine the local features extracted from the RNN ternary block structure on the two channels and the global features output from the channels for processing [21].

In the feature extraction layer, the RNN triplet structure extracts the structure of conventional or unconventional sentiment tendency expressions, and of course, some information that does not have sentiment tendency is extracted from the RNN triplet structure in the process. The effect of redundant information is minimized. To achieve this effect, an attention mechanism is added to the feature fusion layer to process the features extracted from the RNN triplet. By adding the attention mechanism, the useful information is retained in the information processing part, the influence of invalid information is reduced, and different information is distinguished [22].

**4.4. Classification Layer.** After the feature extraction layer to obtain the sequence information feature representation  $V$ , in the model classification layer needs to be processed with a classifier in order to analyze the data for sentiment tendency. For the sequence  $X$ , this paper uses the softmax function as the final classifier, which can obtain the predicted classification result  $\hat{y}$  value, and the sequence label  $y$ , which can be calculated to get  $\hat{y}$ . See Equations (1) and (2).

$$\hat{p}(y|X) = \text{soft max}(W_m \cdot V + b_m), \quad (1)$$

$$\hat{y} = \arg \max_y \hat{p}(y|X). \quad (2)$$

**4.5. Model Network Structure.** The model network structure is shown in Figure 4, where the data is vectorized and fed into a two-channel RNN ternary block model, and the model outputs two parts of vectors. One part is the local features extracted by the RNN ternary block structure, and the feature vectors of this part are combined by the attention mechanism; the other part is the global feature representation of the two channels in the model, and the global feature representation of the text sequence is taken as the average of the global feature representation of the two channels; the vectors of the two parts are connected together as the feature representation of the sequence. Finally, the input text sequences are analyzed for sentiment tendency by softmax classifier.

## 5. Experiments and Analysis

**5.1. Experimental Data.** The dataset of this thesis is the hotel review corpus as the dataset, which is sized as 10,000 hotel review documents and divided into two categories: positive affective tendency and negative affective tendency. The positive affective tendency category accounts for 70% and the negative affective tendency category accounts for 30%. There are 35,950 words in the dataset, and the detailed data information is shown in Table 1.

**5.2. Data Pre-Processing.** For each of the above-mentioned corpora, pre-processing is performed, and the original corpus is divided into words, deactivated words, and cleared of punctuation [5]. First of all, the disambiguation is done by stuttering disambiguation, in which “exact mode” is used. The deactivation table is used with the deactivation table of Harvard University, and for this task, which is a hotel review sentiment analysis task, the deactivation needs to retain the degree adverbs that express the degree of sentiment, so the adverbs that can express the degree of sentiment are manually eliminated on the basis of this deactivation table. After the pre-processing, the distribution of the document length of the dataset was calculated in terms of words, as shown in Figure 5.

From the above figure, it can be seen that this dataset has the highest number of documents in the interval of 0–20, with 3755 documents, accounting for 37.55% of the entire dataset; followed by 2954 documents in the interval of 20–40, accounting for 29.85% of the entire dataset; and 1484 documents in the interval of 40–60, accounting for 14.84% of the entire dataset. The number of documents in the 40–60 interval is 1484, accounting for 14.84% of the entire dataset. The number of documents in the length range of 0–60 is 8193, accounting for 81.93% of the dataset. In the entire dataset, 80% of the documents are in the 0–60 range, and only a few sentences are long, while the average length of the documents in the entire dataset is about 41 words.

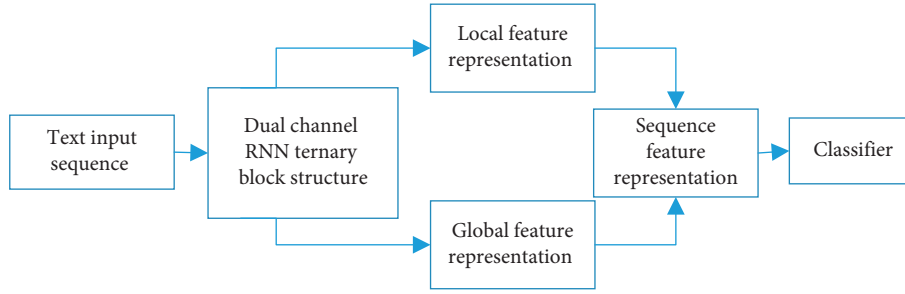


FIGURE 4: Model network structure diagram.

TABLE 1: Table of the content of the corpus.

Corpus name	Number of documents	Corpus size (M)	Dictionary size	Category proportion
Tan songbo hotel Comment corpus	1000	2.5	35950	Normal: 70% Negative category: 30%

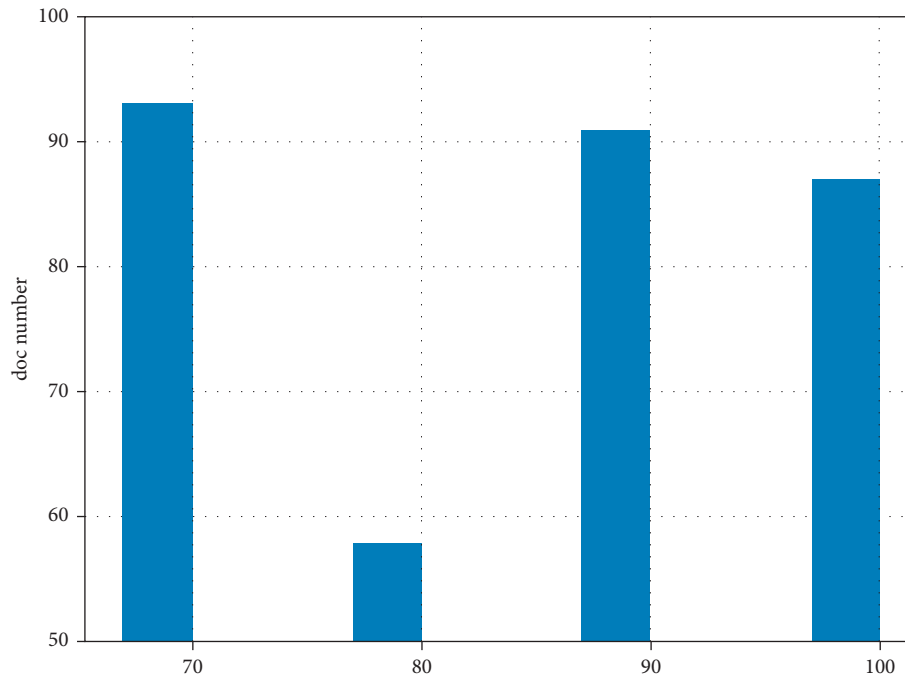


FIGURE 5: Distribution of document lengths.

5.3. *Substitution Function.* The loss function plays a very important role in every algorithm of machine learning, which focuses on summarizing the overall pattern from limited data and making the model approximate this pattern. The loss function measures the degree of approximation by calculating the difference between the true value and the predicted value. The loss function allows us to see the strengths and weaknesses of the model and provides us with the direction of optimization. A reasonable loss function not only provides clear quantitative indicators for the problem defined by the task, but also speeds up the training optimization. In the hotel evaluation sentiment propensity analysis task, the cross entropy loss function is chosen. See equation (3).

$$L = - \sum_i \sum_j y_i^j \log \hat{y}_i^j + \lambda \|\theta\|, \tag{3}$$

where  $i$  denotes the index of the text sequence,  $j$  denotes the index of the category of the text sequence,  $y$  denotes the sample label,  $\hat{y}$  denotes the model prediction classification result,  $\lambda$  denotes the L2 regularization, which is the penalty term of the cost function, and  $\theta$  denotes the setting parameter.

5.4. *Experimental Results.* In three sets of experiments based on word2vec word vectors with dimensions of 100, 200, and 300, respectively, the RNN model, LSTM model, and two-

TABLE 2: Table of experimental results.

Experiment No	1 (%)	2	3
RNN model	82.01	82.29%	83.05%
LSTM model	84.50	85.94%	94.94%
Dual channel RNN ternary block model	87.01	89.6%	88.71%

the LSTM model, the accuracy of the two-channel RNN ternary block model was 3.65% higher. The accuracy variation is shown in Figure 7.

The accuracy of the RNN model and LSTM model improves in the first 4 epochs, and stops improving in the 5th epoch. The accuracy of the two-channel RNN ternary

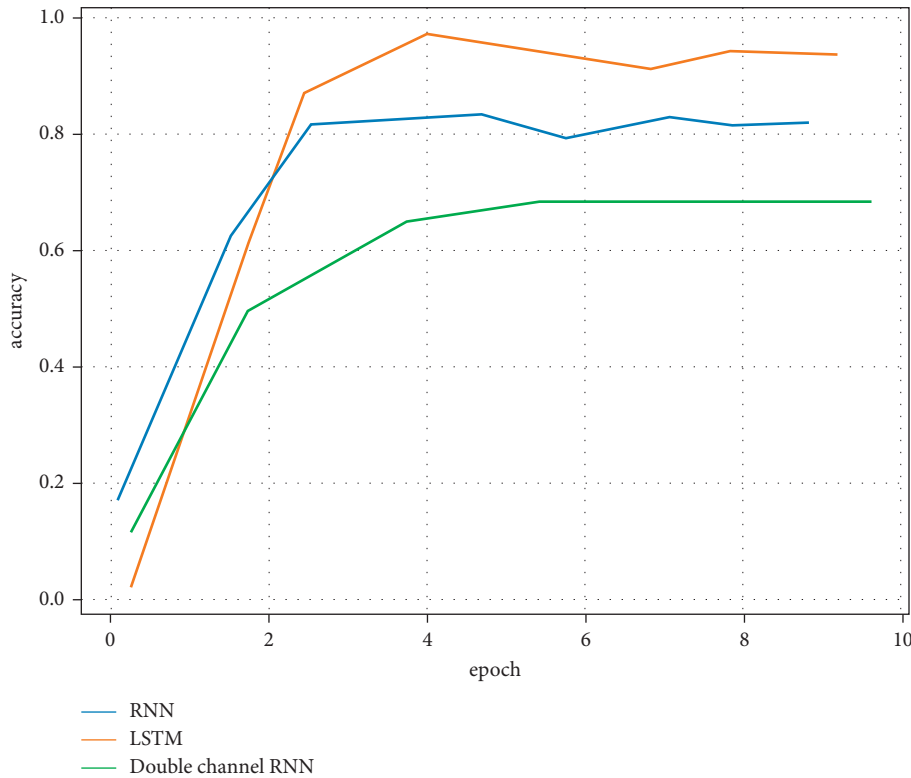


FIGURE 6: Variation of model accuracy of Experiment 1.

channel RNN triple block model were used for the sentiment tendency analysis task of hotel reviews, and the experimental results are shown in Table 2 below.

In Experiment 1, using word2vec word vectors of dimension 100, the accuracy of the RNN model and LSTM model compared with the two-channel RNN ternary block model is 5% higher than that of the traditional RNN model on the dataset of hotel reviews; compared with the LSTM model, the accuracy of the two-channel RNN ternary block model is 2.51% higher. The variation of accuracy is shown in Figure 6.

The accuracy of the RNN model, the LSTM model, and the two-channel RNN triple-block model increases in the first 4 epochs, respectively, and tends to level off after the 5th epoch.

Occasionally, there is a little oscillation, but the overall convergence tends to occur. In Experiment 2, using a word2vec word vector of dimension 200, the RNN model was compared with the two-channel RNN ternary block model, and the accuracy of the two-channel RNN ternary block model was 6.3% higher than that of the traditional RNN model on the dataset of hotel reviews; compared with

block model starts to stabilize at epoch 6, and converges in general.

In Experiment 3, using a word2vec word vector of dimension 300, the accuracy of the two-channel RNN ternary block model is 5.66% higher than that of the RNN model and 3.77% higher than that of the LSTM model for the hotel comment sentiment analysis task. The variation of model accuracy for this group of experiments is shown in Figure 8.

From Figure 8, the accuracy of the RNN model and the LSTM model does not change much after 4 training epochs, and gradually stabilizes. In contrast, the accuracy of the two-channel RNN ternary block model starts to stabilize after the epoch of 7, and only varies in a small range, showing a convergence trend.

From the above experimental results, we can see that.

1. The accuracy of each model changes as the dimensionality of the word vector gradually increases. Comparing Experiment 1 and Experiment 2, the accuracy of the three models increased with the dimensionality of the word2vec word vector; however, when comparing Experiments 2 and 3, the accuracy of the models decreased slightly when the dimensionality of the word2vec word vector increased to 300.

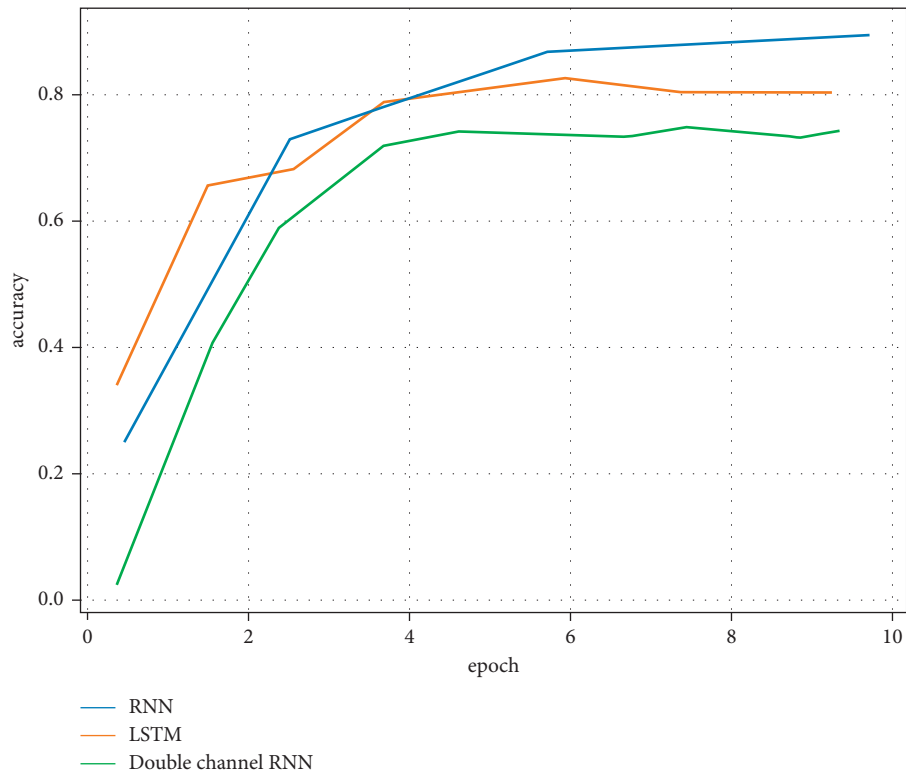


FIGURE 7: Variation of model accuracy of Experiment 2.

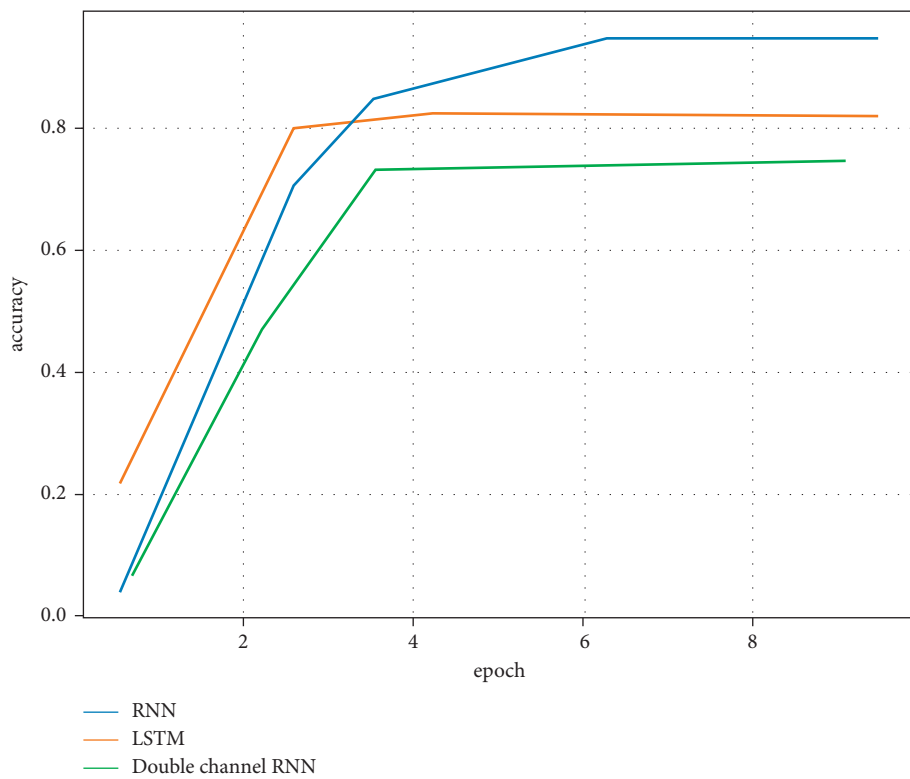


FIGURE 8: Variation of model accuracy of Experiment 3.



The accuracy of the two-channel RNN ternary block model is higher than that of both the traditional RNN model and the LSTM model in all three experiments. The accuracy of the two-channel RNN ternary block model reaches 89.6%, which is 6.3% higher than that of the RNN model and 3.65% higher than that of the LSTM model, indicating the effectiveness of the two-channel RNN ternary block model in the task of sentiment analysis of hotel reviews.

## 6. Conclusions

The hotel must take the customer as the goal to meet the changing service needs of customers. In this paper, we analyze the service quality problems of hotels from the perspective of customer satisfaction and service, and propose corresponding solution strategies. This paper describes the word vector of model input, and then focuses on the structure and computation process of the two-channel RNN triplet block model proposed in this paper in detail. The experiments validate the effectiveness of the two-channel RNN ternary block model in the task of sentiment tendency analysis of hotel reviews.

## Data Availability

The data underlying the results presented in the study are available within the manuscript.

## Disclosure

The authors confirm that the content of the manuscript has not been published or submitted for publication elsewhere.

## Conflicts of Interest

The authors declare no conflicts of interest.

## Authors' Contributions

All authors have seen the manuscript and approved to submit the final version.

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