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Service Quality Based on Text Analysis

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Abstract: How to dig latent and useful logistics information resources from massive comment data of e-commerce logistics service is the foundation and key to improve logistics management and service quality. This paper aims to deal with text contents of E-commerce logistics service comments based on Chinese word segmentation, and uses LDA theme model to discover the potential topics in the comment texts of e-commerce logistics services, then applies the method of word frequency statistics to extract the key words of logistics service comment texts and makes its results visible, so as to accurately discover the key factors and information of logistics service comments. The paper uses the part of the logistics company's 3178 evaluation data on dianping.com, which automatically grabs through the web crawler technology as an example, and makes a comparative analysis of the text of logistics service comments on the dimension of company by using this text analysis method.

Keywords: logistics service comments; Chinese word segmentation; LDA model; word frequency statistics; visualization; text analysis

1.   INTRODUCTION

The data of e-commerce logistics service shows the characteristics of large amount of data, variety of types, low value density and fast growth and so on [1]. Facing these massive data, it is a main problem to timely and accurately find some useful logistics information in order to provide customers with accurate logistics services. The research of the evaluation method of traditional e-commerce logistics service quality is generally through the construction of evaluation system of e-commerce logistics service quality and the method of questionnaire investigation. Nan Jianfei (2013) analyzed the current situation of logistics service quality evaluation, and constructed the evaluation system of logistics service quality from the logistics enterprise's service result, the service process and the service ability, so as to attract more customers and enhance the core competitiveness of logistics enterprises [2]. Hou Zhenxing (2016) established a model of O2O e-commerce service quality evaluation based on the perspective of interaction through the method of questionnaire survey, exploratory factor analysis and confirmatory factor, it can effectively enhance the user's perception of O2O e-commerce service quality [3]. However, there are many limitations of obtaining the lack of logistics service by using the methods of the traditional e-commerce logistics service quality evaluation. With the rapid development of Natural Language Processing [4-6], the method of text analysis has more and more application in all fields. Based on the text segmentation of the online comments. Zhang Li (2011) extracted the text keywords by using the method of text word frequency statistics, which can help readers to find the valuable book information quickly [7]. Siersdorfer S (2014) further studied reviews and comment ratings of published videos and news stories on YouTube and Yahoo, provided a comprehensive understanding of community comment behavior [8]. Hong (2015) used LDA to automatically extract topics from e-mail and grouped them into the same folder according to common themes, so that the burden of the user's own organization of e-mail is reduced [9]. Tong (2016) proposed

two experiments on the basis of the introduction of text mining and probability subject model LDA theory, that is, establishing a document theme model for the Wikipedia article to find and explore the solution of the recommended article theme perspective , and establishing the user topic model for the speaking of users to provide a full study and analysis for the interests of Twitter users [10]. However, there is no research about the evaluation method of e-commerce logistics service quality by applying text analysis. Aiming at this problem, the paper makes comments of e-commerce logistics service as the breakthrough point and subject, expecting finding a new method to improve the quality of logistics service.

2.   ANALYSIS PROCESS

This paper analyzes the text analysis process of e-commerce logistics service quality evaluation in three stages, as shown in Figure.1. Firstly, the data acquisition, that is, access to comment texts of the e-commerce logistics service. Secondly, the data analysis, including data preprocessing, Chinese word segmentation, analysis of LDA theme model and analysis of word frequency statistical and so on. The third step, results exhibition, that is, it will show the logistics hot topic and the results of word frequency statistical.
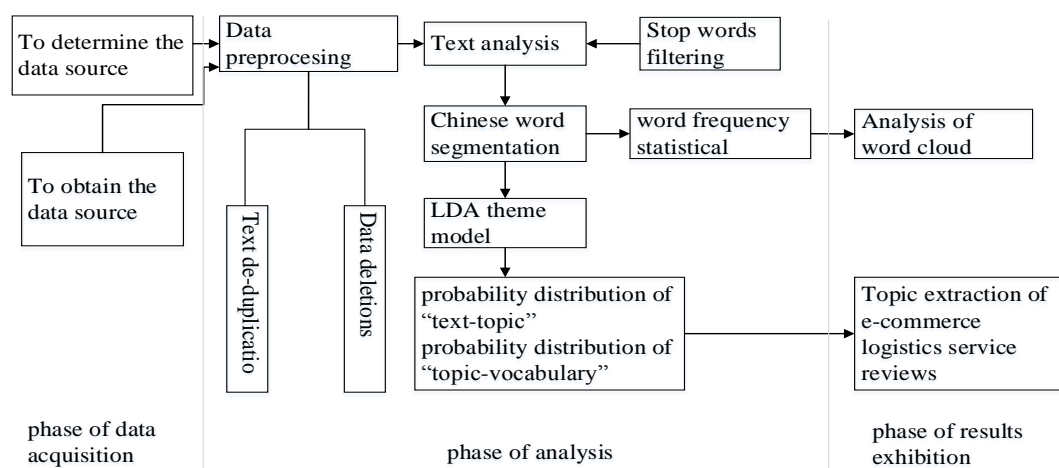

Figure 1.   The text analysis process of e-commerce logistics service quality evaluation

2.1 Text data acquisitiong.

The acquisition of review data of e-commerce logistics service is mainly in the following two ways: the first is the API open platform which is provided by electronic business, but using this approach to acquire data has two shortcomings: first, accessing to this process is quite troublesome, and the consumption of time is very long. Second, the amount of comment data obtained in this way can not reach the research volume of this paper, and the data obtained is not comprehensive, which will directly affect the mining results. The second approach is to use a web crawler that does not have to rely on manual searching to collect data, thus greatly reducing the cost of acquiring information and improving the collection efficiency. Therefore, this paper obtains comment data of e-commerce logistics service by the way of web crawler.

2.2 Text data preprocessin.

After obtaining the comment information about the logistics service, it is necessary to preprocess the text data. Because there are a lot of contents in review data with low value or even no value contents, if these comment data are also introduced into the Chinese word segmentation operation, it will inevitably have a great impact on the analysis. The result is bound to be a problem. The text data preprocessing process includes: text de-duplication, is to remove duplicate parts of comment data to prevent the Navy. Data deletions, such as removing comments about constitute of the non-essential alphanumeric a-Z, 0-9, to prevent them from

interfering the data.

3. TOPIC EXTRACTION OF E-COMMERCE LOGISTICS SERVICE REVIEWS BASED ON LDA
3.1 Introduction to the LDA topic model.

The comment texts of e-commerce logistics service is not subject information, but the statement one by one, these statements need to be analyzed and dealt with, then it can be built the theme model for training. The latent Dirichlet distribution (LDA) is a generative theme model proposed by Blei in 2003 [11]. LDA model is also called three-layer Bayesian probability model. It contains document (d), subject (z) and word (w). Compared with traditional space vector model (VSM), LDA model adds probability information, which can effectively model the text. LDA considers that each document is a mixture of multiple topics, and each topic is a polynomial distribution on the fixed word table. The document to the topic is influenced by the Dirichlet distribution, and the topic to the word is affected by the polynomial distribution. It is a typical word bag model, each document as a word frequency vector, that is, a document is composed of a group of words, there is no prioritized relationship between words and words, and the text information is transformed into easily modelable digital information. In LDA, a document is generated in the following way [12-13]:

- Generating the subject distribution θ_i of document i from the Dirichlet distribution α.

- Generating the topic $z_{i,j}$ of the jth word of document i from the subject polynomial distribution θ_i.

- Generating the word distribution $\varphi_{z_{i,j}}$ for topic $z_{i,j}$ from the Dirichlet distribution β.

- The final word $w_{i,j}$ is generated by sampling the word of polynomial distribution $\varphi_{z_{i,j}}$.

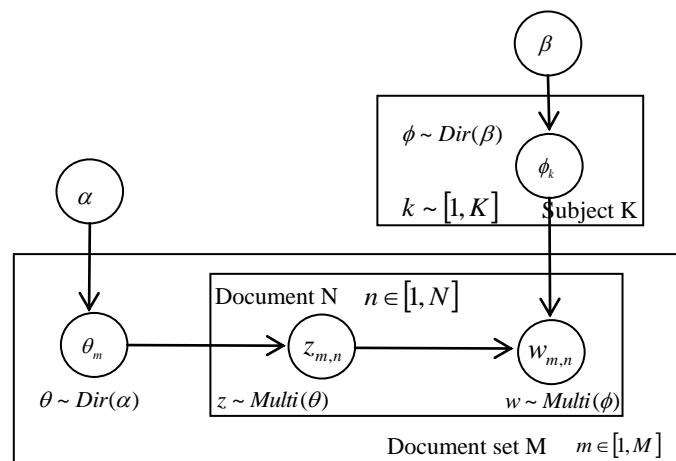LDA theme of the text information modeling is shown in figure 2.

Figure 2. LDA topic model

The LDA model assumes that each document review is a random mixture of topics from a number of subjects, and that the mixture ratio follows a multinomial distribution, denoted as:

$$Z|\theta = Multinomial(\theta) \qquad (1)$$

And each topic is composed of a certain proportion of the words in the vocabulary, and the proportion of the mixture is also subject to a number of distributions, recorded as:

$$W \mid Z, \varphi = Multimomial(\varphi) \tag{2}$$

The probability of generating w_i under the condition d_j is expressed as:

$$P(w_i / d_j) = P(w_i / z = s) \times P(z = s / d_j) \tag{3}$$

Among them, $P(w_i / z = s)$ denotes the probability that the word w_i belongs to the model of the s-th theme, and $p(z = s / d_j)$ denotes the probability of the r-th theme in the comment d_j.

The advantages of the LDA theme model include: 1. LDA topic model can not only measure the semantic similarity between documents, but also solve the problem of ambiguous words by calculating the "word-topic" probability distribution. 2. LDA theme model excludes the impact of noise in the document by ignoring the document in the secondary theme. 3. LDA theme model is unsupervised, fully automated, we only need to provide training documents, you can automatically train a variety of probabilities through the LDA, more suitable for processing large-scale text corpus. Therefore, this paper mainly through the LDA theme model to discover the potential theme of mass logistics review texts.

3.2 LDA subject model estimation.

In this paper, LDA topic model is used to analyze the potential texts of the comments of logistics service. From the LDA topic model, we need to approximate the LDA model parameters θ、φ. In this paper, we use Gibbs sample [14] to estimate the parameters according to the following formula:

$$p(z_i = s / Z_{-i}, W) \propto \frac{(n_{s,-i} + \beta_i)}{\left(\sum_{i=1}^{v} n_{s,-i} + \beta_i\right) \times (n_{s,-j} + \alpha_s)} \tag{4}$$

In the formula, $z_i = s$ represents the probability that the word w_i belongs to the s-th theme, Z_{-i} represents the probability of all other words, $n_{s,-i}$ represents the number of the current word w_i that is not included in the current subject z_s, $n_{-j,s}$ represents the number of objects that are assigned to the current topic z_s which does not contain the current document d_j. By deriving formula (4), we can get the estimated parameter $\varphi_{s,i}$ of the distribution of the word w_i in the subject z_s, the parameter $\theta_{j,s}$ of the multinomial distribution of the subject z_s in the comment d_j:

$$\phi_{s,i} = (n_{s,i} + \beta_i) \Big/ \left(\sum_{i=1}^{v} n_{s,i} + \beta_i\right) \tag{5}$$

$$\theta_{j,s} = (n_{j,s} + \alpha_s) \Big/ \left(\sum_{s=1}^{k} n_{j,s} + \alpha_s\right) \tag{6}$$

Among them, $n_{s,i}$ represents the number of occurrences of the word w_i in the subject z_s, and $n_{j,s}$ represents the number of subjects z_s contained in the document d_j.

4. ANALYSIS OF COMMENT TEXTS OF THE E-COMMERCE LOGISTICS SERVICE BASED ON THE STATISTICS OF WORD FREQUENCY AND IT'S VISUALIZATION

4.1 Method of the statistics of word frequency.

Term Frequency (TF) [3, 15] refers to the number of occurrences of a given word in a file. The importance of a word t_i in a particular document can be expressed as:

$$p(t_i) = \frac{\sum_j n_{ij}}{\sum_i \sum_j n_{ij}} \tag{7}$$

In formula (7), n_{ij} is the number of occurrences of the word t_i in the file d_j , and the denominator is the sum of the occurrences of all the words in the file d_j. At present the method of the statistics of word frequency is mainly in the following two ways: the first is to use the search function of the word processing software to replace the space between the word segmentation for the newline based on the completion of word segmentation, and then copied to excel for classification summary. However, this approach is not appropriate to deal with a large number of text data. The second is to read the text data for statistical analysis by using statistical software. Using this method for word frequency statistics is faster and more efficient. Therefore, this paper adopts the method of statistical software R language for word frequency statistics.

4.2 Visualization of comment texts of the e-commerce logistics service based on the statistics of word frequency.

After getting the results of word segmentation, it is very important to use word frequency to visualize text data of logistics service in order to find out the key elements of e-commerce logistics service comment texts accurately. In this paper, the method of text visualization is presented in the form of word cloud, that is, the text font size is used to show the frequency of vocabulary. If the keyword appears less frequently, it means that the logistics problem which reflected by the keyword is not enough to represent a trend, therefore, in this paper, we mainly focus on the frequency of the top 100 key words as the observation object. Then showing the top 100 key words using the way of word cloud. By observing the word cloud, we can see the word frequency condition of comment texts of the logistics service, and understand the key elements of the customer's logistics situation, and take corresponding measures according to the specific situation, timely solve the logistics problems, we can also improve the core competitiveness of logistics enterprises.

5.   CASE ANALYSIS

5.1 Data Acquisition.

In this paper, the comment data of logistics service is collected from dianping.com by the octopus collector. Selecting 3178 comment data of the A, B and C logistics company in Beijing. The research purpose of this example is to discover the potential topic and key factors of logistics service reviews, so as to understand the key factors of user's attention, and making a comparative analysis of the text of logistics comments on the dimension of company. The collected data includes four fields: user name, comment content, comment time, and name of the logistics.

5.2 The results of analysis

5.2.1 LDA theme modeling results

According to the method of LDA theme model proposed in this paper, after preprocessing the crawled data, the Chinese word segmentation package "jiebaR" of R language is used to carry out Chinese word segmentation of A, B and C logistics company, calculating the frequency of words in each comment can get the "text - word" matrix, we use the LDA theme model and use the Gibbs sample method to estimate the parameters of the LDA model. Through the training of the "text-word" matrix, we can get the "text-topic" and "topic-vocabulary" matrix so as to find the potential words in the comment texts of logistics service. From the above LDA topic model introduction we can see that the model need to determine the optimal values of the three variables the priori parameters α and β of the Dirichlet function, and the subject number . Here, we mainly set α and β as empirical values, $\alpha = 0.2$ and $\beta = 0.1$ respectively, and the theme number $K = 5$ when the subject is more clear division. After the LDA theme analysis, the comment texts were clustered into 5 themes, each of which likely generates the 10 most words and the corresponding probability, table 1 shows the underlying theme of A, B and C logistics company's comment texts.

Table 1.   Top 10 key words of the latent theme of A, B and C logistics company's comment texts

Topic1	Topic2	Topic3	Topic4	Topic5
speed	express	attitude	service	phone
garbage	receive	sent	very	none
not bad	sign in	delivery	indeed	customer service
price	shipments	bad	select	complaint
quickly	time	indeed	be at ease	pick up
service attitude	arrive	particularly	friend	problem
cheap	information	address	sent	require
love	pick up	quality	guarantee	inform
service	parcel	poor	packaging	matter
place	Can't send	disappointing	convenience	at that time

From the clustering results of LDA topic in Table 1, we can see that topic1 is the subject about logistics speed and price, which reflects the garbage of speed and the price is cheap; Topic2 is about the problem of express receipt and received information, showing most of the logistics of the shipment can inform information, and the logistics is more reliable, most of the logistics of the shipment can be a normal sign; Topic3 is about the problems of attitude and delivery personnel quality, showing the attitude of logistics delivery staff is not good, poor quality; Topic4 is about the problem of service, reflecting the logistics services are guaranteed, can be assured; Topic5 is about the phone complaints, showing the logistics enterprise does not pay attention to customer's phone complaints.

5.2.2   The statistical results of word frequency

According to the method of word frequency statistics proposed in this paper, after preprocessing the data of crawling, Chinese word segmentation and word frequency statistics of A, B and C logistics company are respectively carried out, because the original comment may appear: "slow", "very slow "," too slow "," very very slow "and so on. We need to observe the original comments before word segmentation, and custom vocabulary dictionary, excluding such as "very", "too", "very very" and other noise words, only in this way can we carry out Chinese word segmentation, and the contents of the vocabulary is more pertinent. Finally, showing the contents of the top 100 key words using the way of word cloud, the results are shown in Figure 3-5, and then we can compare and analyze all the comments and the difference between the various logistics comments.

Figure 3.   A logistics company's comments

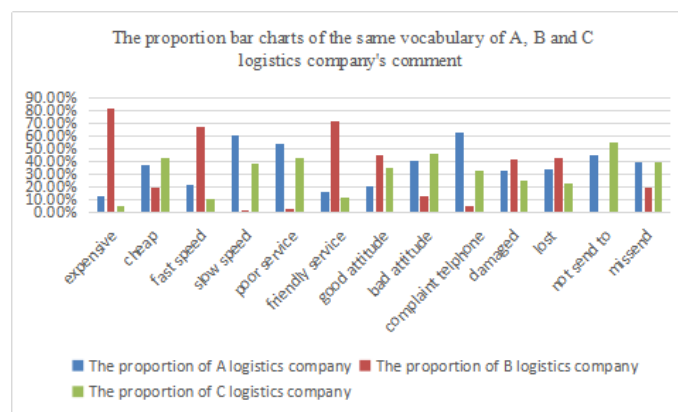**Figure 4. B logistics company's comments**

Figure 5. C logistics company's comments

The size or color of the texts in Figure 3-5 reflects the word's frequency and the importance of the word in the document. From Figure 3-5 we can see:

- In A logistics company's comments, "fast", "good service", "expensive", "good", "rest assured" and other words appear more. We can see that the overall evaluation of A logistics company is more satisfied, such as fast, good service, rest assured, of course, there are some negative evaluation, such as expensive and so on. This shows that the price of the region of this sub-point of A logistics company needs to be adjusted to avoid the loss of customers.

- The comments of B and C logistics company have a lot common points, that is, "garbage", "complaint", "slow", "collapse", "bad", "cheap" and other words appear more. It can be seen that there are more negative comments in the two logistics comments, including slow speed and more complaints, but the price is relatively cheap, and the service, the attitude is also more satisfied. Indicating that a pressing matter of the moment of the region of this sub-point of B and C logistics companies is to understand the problem of the customer complaints, and to put forward reasonable improvement measures, then should further improve the speed of delivery so that the goods can be delivered within the time of customer satisfaction.

Extracting the targeted same vocabulary in the region of this sub-point of A, B and C logistics company's comments, then carrying out a comparative analysis, as shown in figure 6.

Figure 6.   The proportion bar charts of the same vocabulary of A,

B and C logistics company's comments

We can see from Figure 6, compared with B and C logistics company , the region of this sub-point of A logistics company do more to make customer satisfied on speed and service, but in terms of its price, A logistics company is more expensive, and A logistics company does not appear the situation of no sending, the probability of sending wrong and receiving a complaint phone are also very small, so most customers believe that the region of this sub-point of A logistics company is safer than B and C logistics company, in fact, the drop rate of A logistics company is higher than B and C logistics company, indicating that the region of this sub-point of A logistics company do not good enough to meet customer expectations in the security.

6.   CONCLUSIONS

This paper researched the evaluation method of e-commerce logistics service quality on the basis of text analysis. It first applied LDA theme model to model for connotative theme in e-commerce logistics service comments based on Chinese words segmentation for the comments of e-commerce logistics service, it achieved parameter inference through Gibbs sample method and worked out the relations between text contents of logistics service comment and themes, themes and probability distribution of words so as to discover the latent themes in texts of massive logistics service comment. And then it put forward the method of statistics of word frequency, and excavated the key factors of customers' comments on logistics service from massive comments of e-commerce logistics service. This paper put forward three phases of text analysis of the evaluation method of e-commerce logistics service quality: phase of data acquisition, phase of analysis and phase of results exhibition, and described the stages in detail, finally making a comparative analysis of the text of logistics comments on the dimension of company. The conclusion of the research can help the logistics enterprise grasp the valuable information about the customers' comments for logistics service, so as to further improve the evaluation method of its logistics service quality.

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