

Overview of usefulness analysis of online reviews

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Abstract: With the prosperity of Internet services, the content of online reviews is also growing. As an important part of online word of mouth, how to efficiently and automatically select from the mass comments can help potential consumers to buy the desired products / services have become an urgent problem to be solved. This paper focuses on the research of domestic and foreign scholars in the field of usefulness (quality) of online reviews, and briefly introduces the common research methods and factors.

1. Definition of online reviews

In recent years, the development of network social technology and the transformation of user communication mode have also had a great impact on the field of electronic commerce: on the one hand, a good network environment provides a broader development space and a more convenient way for the development of electronic commerce.

Online Comment (online review) is an important form of online reputation and an important information of great value in the field of electronic commerce in the WEB2.0 era. Chatterjee^[1] first put forward the concept of "online comment" when studying whether consumers will refer to the comments made by previous buyers in the purchase process^[2]. Park and Kim define online review -s as previous, current, or potential consumer representations of goods positive or negative, which can be acquired by most people via a web platform. Mudambi and Schuff define online reviews as the comment information of items that users publish on company or third party websites^[3].

User-generated online reviews have the characteristics of a large amount of data, strong pertinence, high subjectivity, low standardization and fast updating. Therefore, providing fast, accurate and concise reviews to readers of reviews and service applications at the next level can help potential consumers to have a deeper understanding of the goods and make effective purchase decisions.

The research on the usefulness of online comments is mainly based on the analysis of the text pattern spread by computer, and discusses the correlation between the content characteristics of the text and the characteristics of the form of comments. Mudambi and Schuff defined the usefulness of online reviews as the perceived value of online reviews in consumer decision-making.

Example 1:

A: "I feel great service!"

B: "the environment is very good, flowers and trees, considerate service, there are local bands singing, the atmosphere is very active."

Of the above two comments, comments have a strong personal tendency, and the information is relatively thin, which does not have a greater reference value for most readers, while B comments are relatively objective and targeted. Usually readers perceive higher value.

In computer science, the process of comment usefulness analysis is to construct an automated method to assist in identifying online comments. Generally speaking, the evaluation of the usefulness of online reviews mainly starts with the following characteristics: Comment characteristics, reviewer characteristics and reader characteristics (i.e., consumer characteristics).

(1) Comment Features

Comment features include comment length, comment star, semantic feature of comment, readability of comment, writing style of comment and timeliness of comment, among which, comment length and comment stars are the two most used features.

(2) Commentator Characteristics

Commentator characteristics include: disclosure of personal identity information, reputation credibility and professional knowledge or experience.

(3) Characteristics of readers

Review readers, i.e. consumers, whose level of prior knowledge of the goods affects the process of searching for information, evaluating information and making decisions, so that consumers with different levels of knowledge or experience perceive different levels of usefulness of comments

At present, in the field of electronic commerce, there are many studies on the usefulness of online reviews at home and abroad. In addition to the common features mentioned above, some other factors affecting the usefulness of online reviews and research models are given.

2. Purpose of study

With the development of e-commerce, more and more user-generated content appears in the application of online commerce, while user comments are rich in user's views and have a greater proportion of influence in the decision-making of e-commerce and consumers.

However, with the increasing number of online reviews on e-commerce platforms, the problems of network anonymity, low communication costs and uneven user level are gradually exposed. Some users publish comments at will, or submit some comments unrelated to the goods, resulting in mixed quality of comments.

At present, the main way for most websites to measure the quality of comments is to count according to the users' votes on the usefulness of comments (such as comment stars), but this evaluation method must appear the situation that fairness can not be guaranteed. This injustice may come from user bias, Matthew effect of information dissemination, and misleading and ambiguous comments themselves.

The reasons for unfairness in comments can classify into three categories:

- (1) Users prefer to vote useful;
- (2) Comments that receive more useful votes tend to receive more votes;
- (3) Early-released comments are easy to get more useful votes.

On the other hand, due to the low constraints of the major e-commerce platforms on the reviewers and the content of the comments, some bad merchants will find people to write false, deliberately exaggerate the function of goods and the level of service, or write malicious comment -s that denigrate their competitors' goods or services. These comments are of very low reference value to consumers and even lead consumers to make incorrect decisions.

In practical research, the usefulness analysis of comments is essentially very difficult, mainly because:

- (1) The usefulness of comments is generally defined as a subjective perception, with different measures of usefulness for different users;
- (2) Lack of validated benchmarks or imperfect validation benchmarks.

In the face of the above practical problems, how to use computer technology to scientifically and efficiently help consumers to screen comments with high reference value for decision making, and guide consumers to consume correctly online comments usefulness came into being.

Ever since the concept of online comment usefulness was put forward, the topic of the study has been increasing year by year. Tian Yilin et al^[4] research found that online comment usefulness research has evolved from word-of-mouth communication, opinion mining model adopted at the beginning of influence factors research, text features, text analysis, ELM model, satisfaction research.

In terms of experimental techniques, the methods commonly used to determine validation benchmarks are:

- 1) Manual tagging;
- 2) Use the usefulness of comments to vote;
- 3) Method based on replica detection;
- 4) make use of external comment resources (such as some authoritative comment sites), etc.

Different models and techniques have different effects on different data sets.

As there is currently no standard data set for research on the usefulness of reviews in the field of e-commerce, the relevant influencing factors on different data sets (review sites) are also different, such as the information contained in the reviews, the sparsity of the ratings, the form and scale of the ratings, and other characteristics of the datasets. For different problems and methods, the commonly used evaluation indexes are: prediction accuracy, classification accuracy and ranking accuracy. In the existing research, on the one hand, it is based on the text characteristics of the comment itself, on the other hand, it also deals with other characteristic factors such as comment writer, comment reader, usefulness voting and so on.

With the development of machine learning and deep learning in recent years, a large number of models have been applied to deal with the usefulness of online reviews. In the traditional machine learning method, the word bag (bag-of-words) framework is usually used to describe the comment text. After determining the feature type and feature function, the comment text is represented as a vector, and then the traditional machine learning SVM model, decision tree model and so on are used for regression analysis. While in the use of deep learning models, LSTM models, GRU models, improved CNN models, Doc2Vec text analysis models and so on have been adopted and studied by scholars, and some scholars have improved on the basis of previous studies. Wu Fan et al. add attention mechanism to deal with the useful influence of user information on comments.

Although the usefulness analysis of online reviews has been studied by a large number of scholars at home and abroad, there are still many factors to be added and considered. Due to the increasing interactivity of the Internet world, the continuous refinement and perfection of e-commerce platform information, the influence factors, the brand influence, the reviewer friend information influence, the merchant information influence and the consumer characteristic influence which has rarely been dabbled in the previous research.

Common influencing factors

Among the commonly used studies, Kim and other studies show that the usefulness of comments is influenced by many factors (characteristics), according to which the usefulness of comments can be graded or sorted.

From the perspective of the characteristics of the review text, the main factors affecting usefulness include:

1. Grammatical features: mainly consider the number / proportion of words in various parts of speech (part-of-speech), whether they contain modal verbs, interjections, comparative (superlative) adjectives or adverbs, interrogative words, etc;

2. Semantic features: the number of subjective or objective words, the number of sentences, words or sentences containing positive / negative emotions in the comments, the number of commodity features involved in the comments, etc;

3. Comments: the user's score in the comments, the average score of the corresponding item in the comments, the difference between the user's score and the average score of the item, the time of publication of the comments, the usefulness of the votes, etc;

4. The statistical characteristics of the text: the number of words, sentences, paragraphs, the proportion of upper and lower case letters, the number of hyperlinks, etc

5. Readability: can be measured by the number of spelling errors, the length of comments, the average length of sentences, etc., or by means of various readability indicators, such as ARI index (automated readability index), SMOG score (simple measure of gobbledygook score), Gunning-Fog index, etc;

6. Similarity characteristics: this kind of feature mainly compares the similarity between current comments and other comments. The commonly used metrics include cosine similarity, KL distance, etc. generally speaking, the higher the similarity between the review texts, the lower the usefulness.

From the point of view of reviewer characteristics (user information), the main factors affecting the quality of comments are:

1. Reviewers. The average score obtained by the reviewer for all comments;
2. The authenticity of the reviewer information, such as whether the real name is registered, whether there is a website recommendation / certification, the number of comments, the average number of comments of all reviewers and the standard deviation;
3. Average usefulness and the difference between the average usefulness and the average number of votes obtained from all reviewers: the difference between the average usefulness of all comments and the average number of votes obtained from all reviewers can reflect the reviewer's scoring habits;
4. The social characteristics of the reviewer: If there is a social network relationship between the reviewers, the relationship between the reviewers can be modeled by a graph. Such characteristics may include the entry, exit and Page Rank value of the reviewer node, etc;
5. Reviewer's experience knowledge: the commodity comment is usually influenced by the reviewer's experience, and the degree of understanding of different commodities is also different.

Therefore, the above factors should be taken into account in designing the prediction model of the usefulness of comments. At the same time, for different types of goods, the factors affecting the quality of comments are also different. Nelson divide goods into two categories: experiential goods (experience goods) and search goods (search goods). Experiential goods refer to goods that must be tried or purchased to obtain quality information, such as movies, music, etc. Search goods refer to goods that customers can collect quality information before buying. When consumers choose different types of products, the information needs are different, and the regulation of other variables by product types is mainly studied.

3. Research Status

At present, many scholars continue to study the commodity / service reviews generated on various e-commerce websites at home and abroad, and update the influencing factors and technical means. Taking the Amazon website, which is commonly used to study the usefulness of online reviews, as an example, the form and content of comments generally include shopping scores, review titles, subjective text evaluations, voting on the usefulness or futility of comments, and responding to the evaluation of others.

(1) Text analysis

Previous research on online comment mainly focuses on the different characteristics that affect the usefulness of comment by using the text information of comment itself. For example, Kim and other studies have shown that the time of publication of comments is a metadata feature that significantly affects the quality of comments.

Ghose etc., Li etc., Liu etc.^{[5][6][7]} point out that the main linguistic features that affect the quality detection of comments should include the number of words, sentences, words of different parts of speech (nouns, verbs, adjectives, etc.), etc.

The Mudambi and Schuf of Fox Business School of Temple University in the United States defined the usefulness of online reviews from the perspective of perceived value. Based on the analysis of 1587 reviews on Amazon, it is shown that the polarity, Depth and product type of reviews will affect consumer usefulness perception.

Ghose and Ipeiritis explore the important influence of comments on sales volume and usefulness perception from the aspects of subjectivity, information, readability and linguistic correctness.

Pan and Zhang^[8] believe that the titer and length of comments will have a great impact on the usefulness of comments, but under the adjustment of product types, there are differences in relevant conclusions, and there is a curve relationship between the innovation and usefulness of comments.

Hu Xuegang et al.^[9] proposed an online review quality prediction model based on multivariate linear regression algorithm by synthesizing three influencing factors: text attribute, reviewer attribute and shop attribute.

Korfiatis and so on^[10] based on the three-element theoretical model of content integration, comprehensibility and expressiveness of comments, it is pointed out that there is a positive relationship between the readability and average length of neutral and extreme comments and usefulness.

Duan^[11] uses text mining technology to extract semantic features from comment texts, pointing out that comments with extreme opinions can get more usefulness votes.

Archak etc.^[12] point out that the extreme nature of the comment, the depth of the comment, the product type of the comment will have an impact on the quality of the comment.

Chen CC^[13] emphasizes that the frequency of product attribute nouns is an important linguistic feature in the nouns contained in comments, and that a certain number of product attribute nouns should be included in high quality comments.

Wu Weifang's paper uses the comment data in the TripAdvisor.com, aiming at the similarity of the content of the text review, using the Doc2Vec model to verify that the higher the similarity between the comments, the lower the usefulness.

(2) Introduction of user information

Forman et al.^[14] pointed out that the disclosure of reviewer identity information is the main basis for consumers to make purchase decisions and evaluate the credibility of online reviews.

Ghose and so on, the reviewer related information is the effective comment quality detection characteristic, for example, the reviewer's previous comments number and the useful rate, the reviewer identity and so on.

Cheng YH et al.'s^[15] research focuses on the analysis of the impact of social factors such as the number of followers of the reviewer, the quality of the comment picture, the number of words of the comment and the surrounding route on the quality of the comment. But these studies have taken advantage of the reviewer's own attributes, such as the number of reviewers' friends, the time of registration, and the number of useful comments sent.

Baek et al. based on the dual process theory, it is pointed out that the evaluation grade, the critical credibility and other external clues and the evaluation content and other central clues all affect the usefulness of the comments.

(3) Emotional mining

Many scholars start from the direction of emotion mining, carry on the emotion mining to the online comment text, have opened up the new idea of usefulness research:

Yin et al.^[16] use the framework in the literature of emotional and cognitive processing to confirm that anxiety and anger in negative reviews are key factors affecting the usefulness.

Salehan and Kim^[17] use emotion mining technology to construct online comment usefulness prediction model, pointing out that comments with higher positive emotions in the title will attract more readers, while neutral comments have a positive impact on consumer purchase decisions.

Schindler and Bickart^[18] find that moderate length and positive reviews are associated with usefulness, non-evaluative product information and reviewer information disclosure are associated with usefulness, while spelling and grammatical errors are associated with lower-value reviews. Expressive slang and humor are associated with higher-value reviews.

(4) The current situation of the study on the usefulness of Chinese comments

In the field of research on the usefulness of Chinese online reviews, there are also a large number of scholars in China who carry out multi-faceted and multi-level research on their influencing factors, they analyzes the influencing factors of the usefulness of comments from the perspective of the content of online reviews, mainly studies the depth of comments, the emotional intensity of comments, the objectivity of comments, the integrity of comments, the richness of comments on product objects consistent with website descriptions, the richness of comments to product characteristics, and the influence of comments on the usefulness of online reviews after using products or services.

Wu Jiang et al.^[19] through the study of using Amazon's data, pointed out that different voting bases on different websites will have an impact on the criterion of usefulness, and stressed that comments that did not get enough useful votes also have research value.

Sun Wenjun et al. from the book field commodity review, the study found that the subjective expression tendency of online review, the positive emotional tendency of comment, the deviation

between comment and average commodity evaluation and the time of comment publication have a positive effect on the usefulness of online commodity review.

Hao Yuanyuan et al.^[20] studied the influencing factors of the usefulness of online reviews in a particular field, and selected film reviews in experiments. Based on the characteristics of film review texts, the article established a model of the influencing factors of the usefulness of online reviews.

Chen Jiangtao^[21] and others took the mobile phone review text as experimental data, analyzed the factors affecting the usefulness of mobile phone reviews, considered the semantics of comment sentences, and analyzed the comment text from a new semantic perspective from three kinds of comments, including words related to the function or performance of mobile phone, related words derived from mobile phone function and words related to mobile phone sellers. At the same time, the experiment also proved the effectiveness of the proposed method.

In the early stage, domestic scholars' research on the influencing factors of the usefulness of Chinese online reviews is generally based on some characteristics of the review text itself.

Zhu Shan et al.^[22] introduced the characteristics of the reviewer. In addition to studying some characteristics of the commentary text, they also considered the attention of the reviewer and the number of comments published by the reviewer. Experimental proof and reviewer related factors also positively affect the usefulness of consumers online word of mouth.

Wang Ping^[23] studied the usefulness of online reviews from the perspective of comment publisher and comment text attribute, and considered the influence factors of online comment usefulness, product type factors, the difference between search commodity and experience commodity comment usefulness. The study found that the ranking of reviewers, whether reviewers bought the product, the number of comments and the objectivity of comments had a significant effect on the usefulness of online reviews. The article also analyzes the interaction effect between product type and each online comment index. The review usefulness of search and experience products has a significant positive correlation between reviewer ranking, whether to buy goods and the length of comments on the usefulness of online reviews. Comment ranking and whether to buy the product has a greater impact on the usefulness of experience goods reviews.

(4) Research methods

From a methodological perspective, Liu JJ, O'Mahony, etc.^[24] Use classification methods to predict the usefulness of comments (quality), They all regard the prediction of the usefulness (quality) of comments as a two-tier problem, That is, predictive reviews are useful / useless (or recommended / not recommended). Liu JJ and so on uses the hard classification, That is, to determine whether the quality (usefulness/value) of a comment is high or low. But O'Mahony and so on are classified with confidence. That is, the probability of belonging to each class is given. The advantage of this approach is that users can sort comments of the same class. Select a different number of comments according to specific needs. For example, recommend the first k high quality comments to readers. In addressing the usefulness of comments using a classification approach, The commonly used models are naive Bayes classification (Naive Bayes), decision tree classification (decision tree) and support vector machine (SVM) (implemented by multiple vector machines in the case of multiple classifications), A SVM Rank model is usually used to sort the usefulness of comments.

Other studies see the usefulness of comments as a regression problem. Kim and Zhang use regression methods to evaluate the quality of comments. The advantage of regression method is that it can directly reflect the relationship between the change of comment quality and the change of various characteristics, And because the regression method outputs a continuous mass score, On the one hand, the user can sort the quality of the comments based on that value, On the other hand, the effect of classification can be achieved by setting threshold, If Liu Y and so on will usefulness (quality) valuation greater than 0.5 as a useful comment. Commonly used models are: (multivariate) linear regression model, polynomial regression model and Logistics regression model.

In addition to the methods of classification and regression, the similarity between the comments to be evaluated and a set of virtual optimal comments is regarded as a useful evaluation index in studies. Among them, virtual optimal comments are determined on the basis of an external general collection combined with the word frequency of each word item in a specific product review set. This

unsupervised method eliminates the process of manual tagging and avoids the subjective problem of human tagging. Lu Y and other studies show that linear regression can be used to predict the quality of comments based on text features, and then the social network information of reviewers can be further used to improve the evaluation accuracy of comment quality.

4. Conclusion

In recent years, the prosperity of e-commerce has led to the research of usefulness analysis of online reviews in related fields. With the explosive growth of comments in the website platform and the recognition of the importance of the usefulness of comments by more and more businesses / enterprises / consumers, the analysis of the usefulness of comments is bound to usher in a new development. The existing research on the usefulness analysis of comments mainly starts with the characteristics of comments. Some new studies gradually introduce the characteristics of reviewers, but the research on the characteristics of readers is still relatively few. In terms of the data sets used, there are inevitable deviations in measurement due to the lack of standard benchmarks and the use of secondary data mostly. In terms of practical models, the commonly used regression and classification are still in the state of continuous improvement in granularity. With the renewal of deep learning, emotion mining and other technologies, more efficient and scientific models will be produced in theory.

As an important source of network word of mouth in the Internet environment, user reviews have important application value for intelligence analysis of potential customers, business, enterprises and government departments. However, in practical applications, the dynamic, loose, mass and quality diversity of these user comment information pose new challenges to the existing technology, and there are many new theories, methods and applications that need further exploration and research.

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