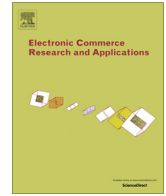




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Discovering Chinese sentence patterns for feature-based opinion summarization



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ABSTRACT

This study discovers part-of-speech (POS) patterns of sentences that express opinions in Chinese product reviews. The use of these patterns makes it possible to identify opinion sentences, feature words, and opinion/feeling words. Degree words and negation words are used in determining the orientation of opinions as well as the degree of their intensity. In order to identify the subject of opinions, the associations between opinion/feeling words, feature words, and corresponding features were ascertained. An algorithm for feature-based opinion summarization is then proposed based on these patterns and association rules. Both car and movie reviews were collected for discovering patterns and testing of the patterns and algorithm. The experimental results demonstrate that the proposed algorithm and approaches perform well on Chinese product reviews.

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1. Introduction

The rapid growth of the Internet has made it possible for people to easily share their feelings and opinions on the Web. Online customer reviews have thus become a source of information that is very useful to both potential customers and sellers of products. Thus, how to automatically summarize opinions from online reviews is an important issue. Feature- or aspect-based opinion summarization is useful to understand both positive and negative aspects of a product. Such summarization generally involve three tasks (Hu and Liu 2004, Liu 2011): (1) extracting product features from reviews; (2) identifying opinion sentences and determining whether their semantic orientations are positive or negative, as well as the degree to which these opinions are felt; and (3) summarizing customers' comments and calculating the opinion score for each feature. The automatic generation of feature-based summaries reduces the amount of human effort that is required to read and organize the results of thousands of reviews, and it enables Internet users to quickly understand the advantages and disadvantages of products.

Prior studies on feature-based opinion summarization did not pay attention to the patterns of opinion sentences (Eirinaki et al. 2012, Hu and Liu 2004, Ku and Chen 2007, Liu et al. 2012, Thet et al. 2010, Zhuang et al. 2006). Typically, the nouns and noun

phrases that frequently appear in reviews are identified as candidate product features. Adjectives near feature words are extracted as opinion words. The shortcomings are that two separate phases are needed to identify feature words and opinion words, and an opinion sentence may not contain a noun and an adjective. These shortcomings can be eliminated if we know the patterns of opinion sentences. For instance, if we found that a sentence containing a noun followed by a verb and an adverb is an opinion sentence, in which the noun is a feature word and the adverb is an opinion word. Based on this pattern, a feature-based summarization system can identify the sentences “the actors played well” and “the story flowed perfectly” as opinion sentences in a movie review and recognize the feature words “actors” and “story” as well as the opinion words “well” and “perfectly” in only one phase (one scan of review).

Some opinion sentences do not explicitly express features. Limited research has been done to address the problem of implicit features (Liu et al. 2005, Su et al. 2008, Yu et al. 2011). In addition, people commonly use different words or phrases to describe the same feature. How to group feature words indicating the same features is an important issue (Guo et al. 2009, Liu et al. 2005, Liu et al. 2008a, Yu et al. 2011, Zhai et al. 2011). Moreover, little research has been done to consider the effects of degree words on sentiment tendency (Gui and Yang 2013, Yang et al. 2010). Degree words can modify opinion intensity and even change orientations. The present study proposes a feature-based summarization approach that identifies opinion sentences, feature words, opinion/feeling words

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according to the patterns of opinion sentences. These patterns are sequences of parts of speech (POS) with the positions of feature, opinion/feeling, negation, and degree words. The proposed algorithm infers features from feature words or opinion words by applying association rules. Thus, the problems of synonym and implicit features can be solved. This study considers the effects of degree words in calculating opinion scores that denote opinion orientations and intensity. Moreover, we differentiate between opinion words and feeling words to understand how people use feeling words to express their opinions. Both utilitarian and hedonic products are considered in this study to ensure that the proposed approach and discovered patterns can be used in different domains.

In contrast with prior studies that mainly focused on English reviews, this study deals with Chinese reviews. According to Internet World Stats, Chinese is the second most used languages on the Internet. TechnAsia referred to the statistics offered by Smartling and predicted that Chinese is going to overtake English as the web's number one language very soon. Since Chinese and English have different syntax and grammar the prior approaches cannot be applied directly to Chinese reviews (Peng and Shih 2010, Ye et al. 2006). This study provides a good solution to automatically summarize opinions from Chinese reviews.

2. Related work

Feature-based summarization is a major task involved in opinion mining (Liu 2011). It operates at the sentence level to determine what aspects of an object reviewers liked or disliked. A summary that indicates the number of positive sentences, the number of negative sentences, or the opinion score of each aspect is ultimately produced.

Hu and Liu (2004) proposed a system that generates feature-based summaries of customer reviews of products. This system first identifies the nouns and noun phrases that frequently appear in reviews as candidate product features. Next, two types of pruning are used to remove unlikely features. Adjectives in those sentences that contain one or more feature words are then extracted as opinion words. Using a set of seed adjectives, their semantic orientations become known and this set is then expanded by searching for synonyms and antonyms in WordNet. The orientations of opinion sentences are determined by the orientations of the opinion words and negation words contained in these sentences. Finally, a feature-based summary that shows product features and the number of positive and negative sentences about these features is generated. The experimental results obtained from customer reviews of five electronics products on Amazon and CNET showed that the precision and recall values of the feature generation method were 0.79 and 0.67, respectively; the precision and recall values of the opinion sentence extraction method were 0.642 and 0.693; and the accuracy of the sentence orientation identification was 0.842.

Zhuang et al. (2006) focused on movie review summarization. First, WordNet, movie casts, and labeled training data were used to generate a keyword list for finding features and opinions. Then, they used dependency grammar graphs to mine the relations between feature words and the corresponding opinion words. These relations were then applied in order to identify the valid feature–opinion pairs. Finally, the opinion sentences were reorganized according to the extracted feature–opinion pairs to generate the summary. Experimental results obtained on the Internet Movie Database (IMDB) data set showed the superiority of the proposed method (which achieved a precision value of 0.483 and a recall value of 0.585) to that of Hu and Liu (0.403 for precision and 0.617 for recall) in identifying feature–opinion pairs.

Thet et al. (2010) proposed a method that determines both the sentiment orientation and the strength of the sentiment expressed by a reviewer regarding various aspects of a movie. In this approach, feature words were manually tagged with various aspects of a movie. Two lexicons, a domain specific lexicon and a generic opinion lexicon, were created to store the prior sentiment scores of opinion words. They used Stanford NLP library to create dependency trees for sentences, a sentence was divided into clauses that focus on one particular aspect. The sentiment scores of clauses were then determined by the prior sentiment scores of the opinion words they contained, and by a number of predefined formulas. If a semantic tag representing a specific aspect was found in a clause, it was categorized in that specific aspect. Finally, an aspect-based summary could be generated. The experimental results for movie review sentences extracted from IMDB showed that the accuracy of the clause-level sentiment classification for aspects of a movie ranged from 75% to 90%.

Eirinaki et al. (2012) developed a search engine that makes possible the retrieval of opinions. They proposed an algorithm that can identify important product features. It first located the adjective and the closest noun in each sentence. These adjectives were treated as opinion words, and the nouns that were modified by a greater number of adjectives were considered potential features. Each of the adjectives was manually assigned a score that indicated how positive or negative the opinion was, and the orientation was reversed if a negation word appeared in the sentence. The score of the feature was the summation of the scores of the opinion words associated with that feature. The features extracted from the review titles and texts were scored separately. The researchers' key findings were that the algorithm for identifying feature words outperformed the TF * IDF approach, and that in the scoring of features, the review title should be given a larger weight than the review text.

2.1. Opining mining in Chinese reviews

Extant studies on opining mining in Chinese reviews focus mainly on identification of feature words and opinion sentences (Fang and Huang 2012, Li et al. 2010, Su et al. 2008, Sui et al. 2012, Wang and Fu 2010, Zhu et al. 2011). Few studies pay attention to feature-based opinion summarization (Ku and Chen 2007, Liu et al. 2012).

Ku and Chen (2007) proposed algorithms for opinion extraction, summarization, and tracking. The algorithms dealt with news and blog articles in Chinese. The General Inquirer (translated into Chinese) and the Chinese Network Sentiment Dictionary were used as a source of seed vocabulary to identify sentiment words. In this approach, the scores of sentiment words were determined by the percentage of the characters they share with the positive/negative words in the seed vocabulary. The sentiment score of a sentence was the sum of the scores of the sentiment words obtained in this way, and this score could be weighted by the authority of the opinion holder. The proposed sentiment word mining algorithm achieved a best average precision value of 61.06% and best average recall value of 79.42%. For opinion summarization, a TF * IDF-based method was used to identify topical words. The sentences containing topical words and expressed opinions were extracted, and the tendency of the opinion was determined by the composing sentiment words and negation words. This sentence-level opinion extraction achieved values of 23.48–38.06% for precision, and 50.94–64.84% for recall.

Liu et al. (2012) developed a movie-rating and review-summarization system that uses latent semantic analysis (LSA) to identify product features. The LSA approach enabled the system to obtain related feature words of specific movie features, including scenes, plots, directors, actors, and stories. In this approach, a

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