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Aspect based Sentiment Analysis of Online Consumer Reviews

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Abstract

Online reviews are a key source of information to consumers. Text mining techniques are often applied to gain valuable insight from the online reviews. Aspect extraction allows us to identify important aspects that consumers have discussed about in the review. Analysing the sentiments associated with the aspects helps us understand the emotional content of the review. Using syntactical structure of review sentences, we extract aspects based on dependency rules and classify the aspects as one of product, service or utility type. This will help e-commerce firms identify important aspects influencing customer experience. Further, based on aspect and sentiment content, we develop a review classification system to study differences in review content across different product types. The review classification will help e-commerce platforms recommend useful reviews to customers.

Keywords: Aspect extraction, sentiment analysis, online product review, syntactical aspect extraction

1. Introduction

Online shopping has gained much prominence over the last decade. One of the key features of online shopping is the availability of large volume of online reviews. For sellers, the reviews act as an important channel of word of mouth communication. These reviews influence the purchase decision of customers who consider online reviews an important source of information about the product. E-commerce service providers frequently use various text-mining approaches to obtain valuable insights from customer reviews. Aspect and sentiments extracted from reviews provide us with a granular detail of factors affecting customer satisfaction. In this study, we first extract the aspects and emotions and classify the aspects so that we can identify which aspects are causing customer satisfaction (dissatisfaction). Further, using a combination of aspect content and emotion content, we develop a review classification mechanism to understand how review contents differ across product types.

2. Literature Review and Study Objectives

Online consumer reviews are an influential form of word of mouth and have been found to influence sales of different types of products such as, books, movies, video games, travel and tourism products (N. Hu, Koh, & Reddy, 2014). Therefore, to generate an insightful summary of review texts, various text mining methods have been applied of which aspect based sentiment extraction is quite popular and common.

Syntactical approach exploits the dependencies among the various parts of speech in a sentence to extract aspects. Taking cue from one of the earliest works in syntactical aspect extraction (M. Hu & Liu (2004)), several studies have discussed aspect extraction using rules based on syntactical associations ((Poria, Cambria, Ku, Gui, & Gelbukh, 2014);(Liu, Gao, Liu, & Zhang, 2015)). For extracting aspects, we select some of the rules used in these studies and combine them with a few customized rules. After extraction, we classify the aspects as one of product, service or utility type.

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Product Aspects: A major component of online reviews is the consumer evaluation of product aspects (Wang et al., 2014).

Service Aspects: These refer to relevant service attributes between the users and the service provider (Palese & Usai, 2018).

Utility Aspects: These aspects reflect usage experiences of a customer with the product (Chen & Huang, 2013).

This classification of aspects is aimed at quickly identifying which attributes are causing pain and/or satisfaction to the consumers. For example, an e-commerce platform will be able to find if their service levels are not up to the mark or the product selling firm may realize a product attribute is causing unhappiness to consumers. For extracting the aspect level emotion, we extract the sub-part of a sentence relevant to the aspect and measure its sentiment value.

We also aim to categorize the reviews based on their aspect content and emotion content. For predicting review usefulness for consumers, (Qazi et al., 2016) measured number of concepts present per review sentence. We use a similar approach for measuring aspect content by measuring aspect score as: if n represents the number of aspects present in a review text and l represents the number of lines in the review, then aspect score is:

$$A = n/l$$

Emotional score of the review is defined as: for a review with m aspects, for each aspect, the sum of the positive and negative sentiment is divided by the aspect weight:

$$E = \sum_{i=0}^{m} weight\ of\ aspect_i * sent_i$$

$$sent_i = pos_i + neg_i$$

$$weight\ of\ aspect_i = \frac{number\ of\ occurrences\ of aspect_i\ across\ all\ reviews}{\sum_{i=0}^{n} number\ of\ occurrences\ of\ aspect_i\ across\ all\ reviews} \quad ..(1)$$

The weight of an aspect in (1) represents the normalized frequency of its occurrence across all reviews. The aspect score indicates attribute related information content and the sentiment score tells us whether the review contains evaluative information i.e. whether the reviewer has positively (negatively) described the aspect or has just made a neutral comment. Taking a cue from (Ghose & Ipeirotis, 2007), if a review contains a large number aspects per unit line, we consider the review to be objective while if number of aspects is small, we consider it to be subjective. A low sentiment score (close to zero) will signal that the review is neutral and vice versa. Based on aspect and sentiment scores the reviews could be classified in the following way (Fig. 1).

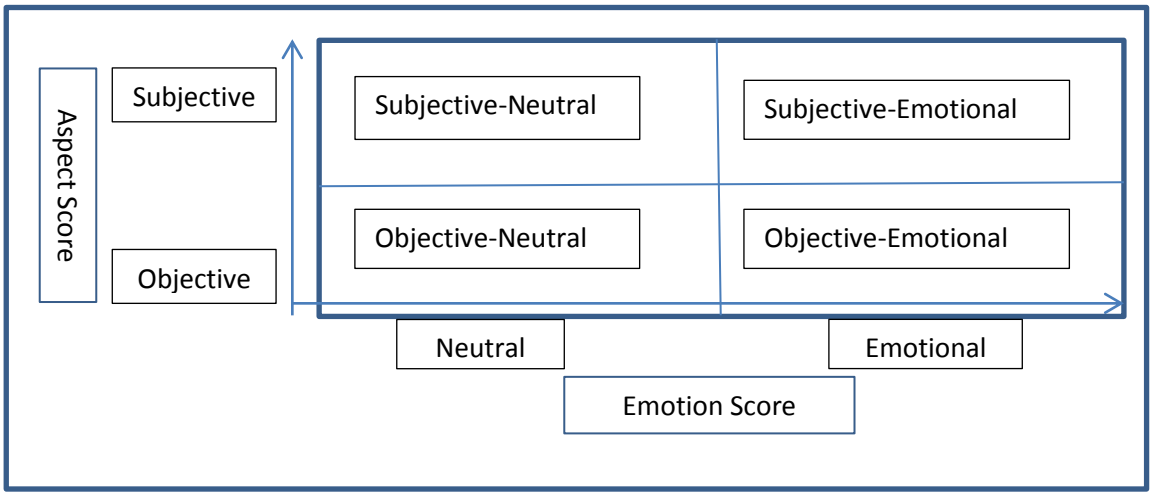

Figure 1

3. Research Methodology

3.1 Aspect and Sentiment Extraction

Based on direct or indirect presence in review sentences, two types of aspects are mentioned in the literature. While explicit aspects directly appear in the review, implicit aspects are to be derived or interpreted (Poria et al., 2014). Explicit aspects are usually present as nouns(s) and can be extracted using subject-noun rules. E.g. "The laptop has a good graphics card." Here, 'graphics card' is an explicit aspect. For identifying implicit aspects, Implicit Aspect Clues (IACs) (Poria et al., 2014) can be used. E.g. "The phone is expensive." Here "expensive" provides clue to aspect price. We use the dependency relationships (using Stanford Dependency Parser) among various parts of speech in review sentences to identify and extract the aspects. For measuring sentiment, we will use Vader Sentiment Analyser.

3.2 Dataset and Analysis

Amazon review dataset consisting of reviews between May 1996 and July 2014 is used for this study (McAuley, Pandey, & Leskovec, 2015).

We will randomly select 200 product reviews for six different product types (laptops, cameras, fashion watches, PDAs, Books and Art & Craft items) for building the reference classification set of aspects. A test dataset of separate 200 reviews will be manually tagged and results will be compared with the result of automated rule based aspect extraction. Precision and recall (Poria et al., 2014) will be calculated for evaluation. Finally, the extraction rules will be run over large datasets (minimum three thousand and maximum ten thousand) reviews each for the six product types.

4. Conclusion

In this study we perform two major tasks. Firstly, we extract aspects and their associated sentiments and classify the aspects as one of product, service or utility type. This fine grained analysis of aspects and their associated sentiments will help organizations understand which set of attributes are consumers satisfied with and which attributes require improvement. Next we develop a classification of reviews based on aspect score and emotion score. This classification is aimed at helping e-commerce platforms understand differences in reviews across product types and consequently recommend useful reviews to information seeking consumers.

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