Sentiment Analysis: A Survey

Rahul Tejwani
University at Buffalo
Buffalo, New York
rahultej@buffalo.edu

ABSTRACT

Sentiment analysis (also known as opinion mining) refers to the use of natural language processing, text analysis and computational linguistics to identify and extract subjective information in source materials. Mining opinions expressed in the user generated content is a challenging yet practically very useful problem.

This survey would cover various approaches and methodology used in Sentiment Analysis and Opinion Mining in general. The focus would be on Internet text like, Product review, tweets and other social media.

1. INTRODUCTION

Humans are subjective creatures and opinions are important. Being able to interact with people on that level has many advantages for information systems. Comparatively few categories (positive/negative, 3 stars, etc) compared to text categorization Crosses domains, topics, and users Categories not independent (opposing or regression-like) Characteristics of answers to opinion-based questions are different from fact-based questions, so opinion-based information extraction differs from trad information extraction.

Some of the challenges in Sentiment Analysis are: People express opinions in complex ways, in opinion texts, lexical content alone can be misleading. Another challenge can be in the form of Intra-textual and sub-sentential reversals, negation, topic change common. Humans tend to express a lot of remarks in the form of sarcasm, irony, implication, etc. which is very difficult to interpret. For Example- “How can someone sit through the movie” is extremely negative sentiment yet contains no negative lexographic word. Even if a opinion word is present in the text, there can be cases where a opinion word that is considered to be positive in one situation may be considered negative in another situation. People can be contradictory in their statements. Most reviews will have both positive and negative comments, which is somewhat manageable by analyzing sentences one at a time. However, in the more informal medium like twitter or blogs(Social media), the more likely people are to combine different opinions in the same sentence which is easy for a human to understand, but more difficult for a computer to parse. Sometimes even other people have difficulty understanding what someone thought based on a short piece of text because it lacks context. A good example would be

“The laptop is good but I would prefer, the operating system which I was using”.

There is a huge demand of sentiment analysis. Before buying any product its a practice now, to review its rating as rated by other persons who are using it. Online advice and recommendations the data reveals is not the only reason behind the buzz in this area. There are other reasons like the company wants to know “How Successful was their last campaign or product launch” based upon the sentiments of the customers on social media. Sentiment analysis concentrates on attitudes, whereas traditional text mining focuses on the analysis of facts. There are few main fields of research predominates in Sentiment analysis: sentiment classification, feature based Sentiment classification and opinion summarization.

Main research in the area of Sentiment Analysis and opinion mining are: sentiment classification, feature based Sentiment classification and opinion summarization. Sentiment classification deals with classifying entire documents or text or review according to the opinions towards certain objects. Feature-based Sentiment classification on the other hand considers the opinions on features of certain objects. For example, in reviews related to laptops classifying the sentiments only on the basis screen quality. The task of Opinion summarization is different from traditional text summarization because only the features of the product are mined on which the customers have expressed their opinions. Opinion summarization does not summarize the reviews by selecting a subset or rewrite some of the original sentences from the reviews to capture the main points as in the classic text summarization.

Languages that have been studied mostly are English and in Chinese. Presently, there are very few researches conducted on sentiment classification for other languages like Arabic, Spanish, Italian and Thai. This survey aims to focus on English only.

2. TASK SUB-DIVISION

The task of Sentiment Analysis can be broadly classified into three levels: document level, sentence level, and feature based approaches (aspect level).[Bing Liu]

2.1 Document level Sentiment Analysis

classification of the overall sentiment of a document based on the overall sentiment of the opinion holder. This problem is basically a text classification problem. Here in general it is assumed that the document is written by a single person and expresses opinion about a single entity. One of the major challenge in the document level classification is
that all the sentences in a document may not be relevant in expressing the opinion about an entity. Therefore subjectivity/objectivity classification is very important in this type of classification. The irrelevant sentences must be eliminated from the processing works. Both supervised and unsupervised learning methods can be used for the document level classification. Any supervised learning algorithm like naïve Bayes classifier, Support Vector Machine, or Maximum Entropy etc can be used to train the system. For training and testing data, the reviewer rating (in the form of 1-5 stars), can be used. The features that can be used for the machine learning are term frequency, adjectives from Part of speech tagging, Opinion words and phrases, negations, dependencies etc. Labeling the polarities of the document manually is time consuming and hence the user rating available can be made use of. The unsupervised learning can be done by extracting the opinion words inside a document. The point-wise mutual information can be made use of to find the semantics of the extracted words. Thus the document level sentiment classification has its own advantages and disadvantages. Advantage is that we get an overall polarity of opinion text about a particular entity from a document. Disadvantage is that the different emotions about different features of an entity could not be extracted separately.

2.2 Sentence level Sentiment Analysis

Here polarity of each contributing sentence is derived. Again, here the assumption is that each sentence is written by a single person and expresses a single positive or negative opinion/sentiment. Sometimes Document-level sentiment classification is too coarse for our purpose. One of the reason can be, the size of the document is too large or a more granular level of sentiments needs to be derived. A lot of early work in the region osentence level analysis focuses on identifying subjective sentences. Most techniques use supervised learning. This can be devided into two task: first identify which sentence old opinion (subjective sentences) and then classify each sentence as positive/negative or the star rating. But there will be complex sentences also in the opinionated text. In such cases, sentence level sentiment classification is not desirable. Knowing that a sentence is positive or negative is of lesser use than knowing the polarity of a particular feature of a product. The advantage of sentence level analysis lies in the subjectivity/objectivity classification. Some challenges in this approach could be: many objective sentences can imply sentiments or Many subjective sentences do not express positive or negative sentiments/opinions. A single sentence may contain multiple opinions and subjective and factual clauses.

2.3 Feature based or Aspect level Sentiment Analysis

A more granular approach that gives some extra information. For example Sentiment classification at both the document and sentence (or clause) levels are useful, but they do not find what people liked and disliked. The product or the review. They do not identify the targets of opinions. Much of the research is based on online reviews and blog related data. In the case of reviews, where the entity (product or service) is known. Its a easier problem. But for blogs, forum discussions, etc., it much harder because the entity is unknown there may also be many comparisons, and there is also a lot of irrelevant information. This problem is somewhat similar to the problem of Named Entity Resolution. Another interesting approach to solve sentiment analysis was presented in [4] by exploiting concept chains to build a graph model of a text. The model used Part of speech tagging to extract graph relations and performed graph based queries to get the overall sentiment of the text.

3. DATA

Major forms of data available for Sentiment Analysis are: Blogs, review sites, data and lexical dictionaries.

3.1 Data Sets available

Most of the work in the field uses movie reviews data for classification. Movie review datas are available as dataset: movie-review-data. Other dataset which is available online is multi-domain sentiment (MDS) dataset. The MDS dataset contains four different types of product reviews extracted from Amazon.com including Books, DVDs., Electronics and Kitchen appliances, with 1000 positive and 1000 negative reviews for each domain. Review dataset available is http://www.cs.uic.edu/lilab/FBS/CustomerReviewData.zip. Multi-Perspective Question Answering (MPQA) (Stoyanov et al, 2005): News articles and other text documents manually annotated for opinions and other private states (i.e., beliefs, emotions, sentiments, speculations, etc.) consists of 692 documents (15,802 sentences) (http://www.cs.pitt.edu/mpqa/)

3.2 Review Sites

These days almost every e-commerce website have reviews for their product. Some of the famous review sites which have made their data available for research are: www.amazon.com (Product review), www.yelp.com (restaurant reviews), www.CNET download.com (product reviews) and www.reviewcentre.com, which hosts millions of product reviews by consumers.

3.3 Lexical Dictionaries

There are many dictionaries available that have information about, opinion words and polarity. Some of the famous lexicon are: Sentiwordnet 3.0 (http://sentiwordnet.isti.cnr.it/), it assigns to each synset of WordNet three sentiment scores: positivity, negativity, objectivity LIWC: (http://www.liwc.net/). Linguistic Inquiry and Word Count General Inquirer: (http://www.wjh.harvard.edu/~inquirer/). Database of words and manually created semantic and cognitive categories, including positive and negative connotations.

4. SUBJECTIVITY AND OBJECTIVITY CLASSIFICATION

To determine whether a text holds any Subjective information or opinion Subjectivity analysis is performed. The text pieces may or may not contain useful opinions or comments. The subjective sentences are the relevant texts, and the objective sentences are the irrelevant texts. So we must sort out the sentences that are useful for us and those which are not. The subjective sentences are those sentences having useful information for the sentiment analysis. Such classifi-
cation is termed as subjectivity classification. Some works have been done focusing on this particular problem.
In one of the most pioneeer work [1], the authors present a method of subjectivity identification for sentiment analysis. This is important because the irrelevant data from the reviews could be eliminated. This eliminates the processing overheads of a large amount of textual data. The method they propose is using minimum cuts to produce subjective extracts from the text. The work has been focused in the sentence level subjectivity extraction.

5. APPLICATIONS

Sentiment analysis has been a buzz recently and a lot of research is been going on in this area. These days it is used in social media monitoring and VOC (voice of customer) to track customer reviews, survey responses, competitors, etc. However, it is also practical for use in business analytics and situations in which text needs to be analyzed.

Sentiment analysis is in demand because of its efficiency. Thousands of text documents can be processed for sentiment (and other features including named entities, topics, themes, etc.) in seconds, compared to the hours it would take a team of people to manually complete. Because it is so efficient (State of the art being around 80 percent) many businesses are adopting text and sentiment analysis and incorporating it into their processes.

Sentiment analysis also have a lot of applications in Business intelligence, since it is very difficult and expensive process to survey customers. It also answers some of questions such as: Why is the product not selling? What are the specific issues faced by users?

6. CONCLUSION

There are various methods to classify text. Several techniques involves word and phrase classification methods exist. Many Lexical and dictionary based approach [11] are used and have been fairly Successful some of them even showed more than 70 percent accuracy on standard data sets.

Another approach that is more commonly used is Machine Learning. Various Machine learning techniques have been tried and used in the papers mentioned. The most common ones are: Naive Bayesian, Support Vector Machine [9] and Maximum entropy. The success of a machine learning algorithm depends upon how well the features are selected and extracted. Various different features have been used, the ones that are most commonn are Unigrams, Parts of speech tagging, emoticons detection, categories tagging, using graph based techniques. Topic modelling [10] and phases based features [8] are also used.

7. REFERENCES

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