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A framework for Review Categorization using Appraisal words

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Abstract: Due to the high increment in the usage of internet nowadays e-commerce is getting very popular. The online shopping is becoming more convenient and prominent. As well as the number of online consumer reviews are increasing very fast. It is a challenge for the organizations and consumers to go through these reviews for the decision making process. Mining the necessary information from these reviews is beneficial to consumers and organizations. Sentiment mining can be very helpful for customer relation management, marketing and identifying the opinion and popularity of the product. In this paper we present a novel framework for review classification using sentiment analysis. The framework uses appraisal words lexicon and product feature extraction for review categorization.

Keywords: Sentiment mining, Review mining, Text analysis, Review categorization, Appraisal words

I. INTRODUCTION

With tremendous increase in online shopping, the internet is populated with huge number of reviews. Moreover the reviews are much unstructured which makes it very difficult to mine the required knowledge from them. A preprocessing step is necessary to transform the review data into structured format. In our proposed framework we aim to generate the summary of product reviews in electronics product domain based on the specific features of that product. The features of the products are nothing but the attributes of the products. With such fine grained feature level approach the user can easily focus on the specific feature of the product of his or her interest.

Classifying the sentiments as positive or negative simply based on positive and negative words is not sufficient as reviews have multiple dimensions like affect and polarity. To make our framework more sentiment aware we create a sentiment aware feature set based on appraisal words lexicon discussed in [3].

A. Sentiment Analysis

Sentiment analysis is the computational study of emotions or sentiments, attitude expressed by the author in the piece of text. This attitude or opinion expressed by the author may be his or her regarding a topic or any entity like some product. Now a day's internet has provided a wide platform to customers and people in general to voice their opinions. As online shopping is being accepted widely the customers also provide their feedback, evaluations or judgments regarding the products through reviews. These reviews can provide cognizance about the customer opinions about the products. A sentiment can be annotated as a set of various entities including opinion holder id, time when the opinion is expressed, the entity about which the opinion is expressed and the actual opinion statement. Sentiment mining can be achieved on document level as well as sentence level. Document level sentiment analysis aims to find the general sentiment of the author in an opinionated text [10] whereas sentence level sentiment analysis is more fine grained.

B. Feature Extraction

Feature based sentiment mining determines the target words on which the opinions are expressed. Here the targets are the features, attributes of the product. The aim is to identify the frequent and most talked about features of the product and identify the orientation of the sentiments about that feature. For example, in the review comment, "*The touch screen of this phone is amazing.*" the feature touch screen is

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commented on and the orientation is positive. This level of detailed analysis is required because in order to make product improvements one needs to know what components and/or features of the product are liked and disliked by consumers. Such information is not discovered by sentiment and subjectivity classification.

C. Review Categorization

Due to the tremendous increment in e commerce huge number of reviews is posted about the products regularly. These online reviews have significant influence on the sales of products [2] and decision making of other customers. The large number of reviews also makes it difficult for the customers to identify the sentiments expressed by the reviewers. Review categorization helps in classifying the reviews into some predefined categories. Review categorization can be also viewed as text classification problem. A wide range of classifier like Naive Bayes, Support Vector Machines, Decision trees are used for this purpose.

D. Appraisal groups

Most of the work done in the field of sentiment analysis focuses on only two types of sentiments i.e. positive and negative. Using Appraisal groups word is fine grained approach for semantic distinction [Using Appraisal Groups for Sentiment Analysis].In their word Whitelaw et.al. tackle the sentiment analysis problem by creating a lexicon of appraisal words. These adjectival appraisal words are classified as attitude, graduation, orientation and polarity.

II. RELATED WORK

Most of the research done in the field of sentiment mining is focused on considering the review either at the document level or sentence level. The aim of sentiment analysis or mining is to identify the orientation of the sentiments expressed in the reviews. Mostly the sentiments are oriented as positive, negative and neutral.

In the early work of sentiment analysis semantic orientation of the text was the main focus .These studies attempted to learn a positive/negative classifier at the document level. In their work Pang et al. [3] apply three machine learning approaches(Naive Bayes, Maximum Entropy, and Support Vector Machine) to label the polarity of IMDB movie reviews.

In their pioneering work Whitelaw et al.[4] introduced the concept of adjectival appraisal groups. Each appraisal group was further assigned four type of features: attitude, orientation, graduation, and polarity. A good classification accuracy is reported using these adjectival appraisal groups. Our framework uses the same words and phrases from the appraisal groups to compute the reviews feature vectors. Turney [5] measures the strength of sentiment by the difference of the Mutual Information (PMI) between the given phrase and excellent and the PMI between the given phrase and poor.

Inspired by [1] we propose a framework for review categorization using appraisal groups. Although, our work is fundamentally different in various ways. Our work considers electronic products as domain for review collection and classification. The dataset generation is automated using a simple and efficient technique. Feature set generation is incorporated to achieve the review categorization at a finer level. The review categorization is based on attitude and polarity of the adjectival words for the frequent features of the product.

III. PROPOSED FRAMEWORK

Online product reviews are un-structured and unrefined text. Many people make their choices by taking the suggestions and considerations of others into account. This poses a necessity for processing user opinions, so that it can be used in decision-making processes by other customers. In this work, we propose a framework that will extract the review comments from amazon.com. The framework consists of four main steps web crawling, generation of structured review data, sentiment analysis and finally classification.

Figure 1. shows the proposed framework.

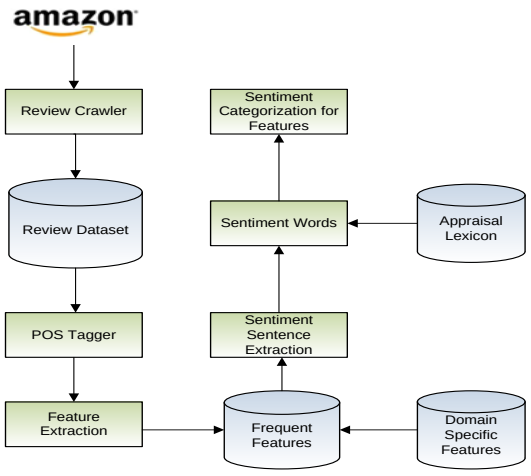

Fig. 1 Proposed framework

A. Dataset Generation

The web crawler is an automated program for collecting the information from web. It collects uniform resource locator (URL) available in a page and store the collected URLs in a cache, known as frontier. Then the crawler starts looking for every URL and caches the corresponding page for further processing.

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Using internet crawling the reviews dataset is built from amazon.com reviews for various electronic products. This is treated as a pre processing required for sentiment analysis. As the internet data is unstructured we must pre process this data to obtain a structured dataset for sentiment analysis. After obtaining the structured data the sentiment analysis of the reviews will be done. Each review is considered as a document.

```
Input: pid -> product id
       n - > no of review pages
Output: Review XMLFile

function getReviews(pid,n)
          for each n
          HTMLtext < - parseHTML(url)
          End
Parse(HTMLtext)
          for <element> productReviews
          get  review from<div>
          List < - add(review)
          end
ReviewXML< - createXML(List)

End
```

B. Feature Extraction

The features are the attributes or metrics of the product. The feature extraction process is done using following steps.
I. Sentence segmentation
II. Part of Speech Tagging
III. Frequent feature extraction

In the first step each review is segmented in sentences. Then each sentence is further tagged into part of speech. The motivation here is that the features are expressed using nouns and noun phrases. The term frequencies of these nouns and noun phrases are calculated.
Finally the frequent features appearing together are extracted. The frequent features are the features appearing together e.g. “touch screen”, “voice quality” etc. Our proposed work aims to find the sentiments about the product expressed in the reviews based on the features of that product. Hence finding out the features of products on which the people have expressed their sentiments is a very important step.

In the context of our work the frequent features are the features most reviewers talked about. To find these frequent features we use Apriori algorithm proposed by Aggrawal *et.al*. The association mining is run on the set of noun and noun phrases generated from the part of speech tagging step.

To further refine the results of the frequent features, it is then compared to the domain specific feature set. The domain specific feature set is a set of features related to the electronics domain.

C. Review categorization

This step is the most important step in the framework. Each review is considered as a document for opinion extraction. The review R is a set of many words. It is absolutely crucial to extract the features from the reviews text. Before any text categorization task, the most important step that needs to be taken is that of feature selection. The most used approach for feature selection is as a bag of words, in which a document is represented as a set of words, together with their associated frequency in the document. Such a representation is essentially independent of the sequence of words in the collection. In this step, we use appraisal words extracted from the appraisal words lexicon [7]. If R is the set of reviews and A is the set of appraisal words then for each review ri we find feature vector fi where fi represents the frequencies of appraisal words. The feature set generated is more sentiment aware as it is prepared considering the adjectival appraisal words.

Review categorization is done by aggregating the sentiments on the features. Given a sentence *S* which contains product feature *f*, the adjectival words in *S* are identified. The polarity of these is identified using appraisal lexicon.

IV. RESULTS

For the evaluation purpose the proposed system is evaluated from various perspectives like the effectiveness of the feature extraction and accuracy of the review categorization.

For experimental setup we extracted 100 reviews for 5 products in electronic product domain. The results obtained for feature extraction are as shown in the below table.

TABLE I

RESULTS OF EXPERIMENTS

Product	No .of Reviews Extracted	No. of noun phrases extracted	No. of frequent features extracted
Samsung UN46EH6000 46-Inch 1080p 120Hz LED HDTV	100	945	38
LG Cinema Screen 47LM7600 47-Inch Cinema 3D 1080p 240Hz LED-LCD HDTV	100	843	32
Apple MacBook Pro MD103LL/A 15.4-Inch	100	1000	52

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Laptop			
Samsung S5830 Galaxy Ace - Unlocked Phone - Black	100	760	41
Canon EOS Rebel T3 Digital SLR	100	965	37

For the evaluation purpose all the results generated by our system are compared with the manually tagged results. For the evaluation of performance criteria we use precision and recall measures. The precision is the ratio of correctly extracted features to the all features. The recall is a ratio of the correctly extracted features to the sum of non product features and the features which are not identified by the proposed system.

TABLE II

RESULTS FOR PRECISION AND RECALL

Product Name	Precision	Recall
Samsung UN46EH6000 46-Inch 1080p 120Hz LED HDTV	77.8	75.5
LG Cinema Screen 47LM7600 47-Inch Cinema 3D 1080p 240Hz LED-LCD HDTV	74.6	69.2
Apple MacBook Pro MD103LL/A 15.4-Inch Laptop	76.3	71.4
Samsung S5830 Galaxy Ace - Unlocked Phone - Black	79.7	70.8
Canon EOS Rebel T3 Digital SLR	73.9	68.1

V. CONCLUSION

The proposed work uses a novel approach to sentiment analysis and classification of reviews based on product features and appraisal words. This work aims to use simple and efficient techniques such as the process of structured data generation and natural processing for sentiment analysis. The proposed work uses sentiment aware attitude for classification of reviews instead of the traditional bag of words approach.

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