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A Lexical Approach for Opinion Mining in Twitter

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Abstract

The blossoming of a significant number of social networking sites, blogs, and microblogs has given a podium for general masses to voice their opinion regarding social topics, economic issues, political matters, market trends etc. However, this sudden eruption of review data had opened floodgates to unmanageable records as it is almost impossible for any individual or organization to manually extract any useful information from it. Opinion mining or sentimental analysis is a natural language processing which can obtain the opinion or feeling of people about any particular product or subject. The main focus of this paper is to find a method to perform sentiment analysis of Twitter which is one of the most prevalent microblogging sites. The lexical method proposed in this paper classifies the tweets as positive, negative or neutral depending on the polarity of the words in it. Also, the role of negation words has been investigated.

Index Terms: Opinion Mining; Machine learning; Lexical Analysis; Sentiments; Polarity.

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1. Introduction

A critical part of the decision-making process is to identify "what people think" or "how was their experience". Prior to the evolution of the internet, before buying anything we would ask our friend, family or an expert for their advice, however with the sudden outburst of online review data, the trend has significantly changed. Now we can have a vast pool of people; beyond our known circle, who can provide their opinions and suggestion about the subject and help us to take better decisions.

Not only is the consumption of goods and services a major reason for people to look for other's opinion but also people want to know the political attitude and economic trend of the masses. The consumer thirst and dependence upon the online advice and recommendations are some of the key reasons behind the rush of interest in systems that deal with opinions [1]. However due to this exponentially growing review data, it becomes difficult, almost impossible for people to conceive the aggregated and summarized opinion result. The

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discovering, analyzing and filtering of the information on the opinion sites remains a daunting task because of the purification of the diverse site.

Opinion mining or sentimental analysis is a kind of natural language processing for analyzing the attitude, feeling or evaluation of the public about a particular topic, product, service or subject. It is also known as review mining or subjectivity analysis [7]. Opinion mining can be very useful to business organizations, political parties, and individuals since they get to catch the pulse of the customers about their services and products which can be further exploited for product quality enhancement; evaluate customer preferences; benchmark databases; market research and facilitate future work.

Opinion mining finds its applications in business intelligence, recommendation systems [22] [23], online reputation evaluation systems, review generating websites (e.g. Rotten Tomatoes), advertisement industry and support technologies due to which it has attracted the attention of corporate giants and researchers [24][25]. Amongst the various microblogging sites, Twitter has become the most popular. Since twitter's launch in 2006, it has grown at an unbelievable rate. Lately, Twitter has been massively used for opinion mining since it has short and precise messages which are easy to collect and analyze. Many politicians, actors, celebrities use it to connect to millions of followers, who respond back with comments, tweets, likes, tags, share, and posts. Twitter hashtag (#) is a kind of label or metadata tag used in Twitter which makes it easier for users to search messages with a specific topic.

The basic terms used in this area are; opinion holder, opinion, and entity.

Opinion holder or opinion source is the writer who posts the opinion. Opinion holder can be a person or any organization [3]. An entity, e is a product, service or an issue about which the opinion is expressed. An entity is coupled with two components, T , and W where T is a hierarchy of components and sub-components and W is the attribute of the entity. Components may additionally have their own set of attributes also [4]. Example a particular brand of laptop is an entity e.g. Dell. It has a set of components e.g. battery, RAM, screen, processor etc and also a set of attributes like weight, resolution, size.

The battery component may further have its own attributes such as battery size, life, type. Opinion is the emotion or sentiment which an opinion holder has with an entity. An opinion is a quintuple, $(e_i; a_{ij}; o_{ijkl}; h_k; t)$, where e_i is the entity's name, a_{ij} is an aspect of e_i , o_{ijkl} is the polarity of the opinion about feature a_{ij} , t is the time when the opinion is posted and h_k is the opinion holder. The orientation can be positive, negative or neutral. It can also be expressed with different levels of strength [4]. Example "The Cassino camera has very good picture quality" Times of India on 13 June 2015. Here Cassino camera is an entity e , the picture quality is the feature or aspect a , *good* is the positive orientation with *very* as the strength of the opinion (o), *Times of India* is the opinion holder (h) and *13 June 2015* is the time(t).

In this paper, we start with the description of opinion mining and the other parameters related to it in detail. In the second section, we discuss the classification and levels of opinion mining. In the third segment, we put light on the sources for gathering the data and the available tools present. In the fourth section, various techniques for analysis and then the challenges associated with it are discussed. In the sixth section, the proposed approach is discussed along with the algorithm. Finally, we conclude our work along with result and future possibilities.

2. Classification and Levels of Opinion mining

An opinion is said to be positive, negative or neutral based on the orientation of the keywords. Good, wonderful, amazing, exciting express positive opinion while bad, boring, awful, worse denote negative sentiments. Negations are the words that reverse the polarity of the given sentence, words such as not and no come under this category. [11]

Opinion sentences may be also categorized into two type; direct and comparison. Direct sentence gives a straight opinion about an entity without any comparison to another similar entity. Example "The battery backup of Zolo laptop is amazing". When we compare the given entity with one or more similar entities it is known as comparison sentence. Example "The battery backup of Zolo laptop is better than that of HP laptop". The

superlative or comparative forms of adjectives or adverbs are used in such sentences [2].

Based on granularity, there are three main levels on which opinion mining is based.

1. *Document level mining*: This level assumes that each individual document expresses an opinion about a single entity and holds opinion from a single opinion holder [8]. Document level opinion mining is about classifying the overall opinion offered by the opinion holder in the entire document as positive, negative or neutral about a certain object [9] [10]. Document level analysis is not desirable in forums and blogs since comparative sentences may appear and authors may compare one product with another that has similar characteristic [5].
2. *Sentence level*: The aim at this stage is to go down to sentence level and determine its polarity. It is coupled with two main goals; one is to identify whether the given sentence is subjective or objective and second is to discover the opinion articulated in it [13] [14]. The main hypothesis taken at this stage is that a sentence contains only one opinion, however, it is not applicable to compound sentences [15].
3. *The entity or feature level*: Document and sentence level do not determine what exactly people like or dislike. This level performs a finer grain analysis where instead of looking at language constructs, aspect level looks at the opinion itself [5]. It has three goals; identify and extract the object features; determine the polarity of the opinion and finally produce a feature based opinion summary of multiple reviews [12].

3. Data Source And Tools

Various online sources are available for providing data for mining. The quality of the end result is directly dependent on the quality of the data input to the system. Many microblogs, social networking sites, blogs and review sites, provide ample amount of review data for analysis [5].

1. *Social networking sites*: Web-based services that allow people to make a profile create a list of users with whom they can share connections and view the acquaintances within the system are called social networking sites [16]. Social networking sites such as Google+, Facebook, Flickr and microblogs like Twitter, Pinterest, and Friend Feed have become an active source of review data.
2. *Review Sites*: E-commerce websites such as Amazon, Rotten Tomatoes, and Epilion provide a podium for individuals to express their opinions. [6] These reviews may be in the form of posts, comments, star ratings or the number of views of the product. Many buyers make their decisions based on the recommendations.
3. *Blogs*: A blog is a journal or a discussion site available online and consisting of distinct posts or articles. Bloggers generally note the daily happenings in their lives and express their feelings, and emotions in a blog. Wordpress and Tumblr are some of the examples.

The tools which are used to analyze the polarity from the user contents are:

1. *Review Seer tool* – This tool uses the Naive Bayes classifier method to analyze the product and obtain the polarity based on the specified features.[6]
2. *Opinion observer*-This tool is used for evaluating, comparing and analyzing opinions present on the Web. The output is obtained in the form of a graph depicting feature-level opinion mining. [17]
3. *Web Fountain*- it depicts broad effort to index and understand the unstructured data on the internet in an uninterrupted manner. Base Noun Phrase (bBNP) heuristic approach is used in Web Fountain for obtaining the features of the given product. [26]
4. *Red Opal*– is a kind of search tool that allows users to find products easily on the basis of certain features and also determines the polarity of sentiments associated with it. [27].

Marketing Grader, Facebook Insights, Twitrratr, Social mention, Google Analytics and Sentimetrics are some of the other online available to analyze the opinions on the internet [18].

4. Techniques

Opinion is thriving research topic recently. The analysis technique can be divided coarsely into the following approaches.

4.1. Machine Learning Approach

It is a field of computer science that gives machines the ability to learn by making predictions on the data set without being programmed explicitly. Various classifiers, such as Maximum Entropy (MaxEnt), Naïve Bayes (NB), Semi-Supervised Classifier, and Support Vector Machine (SVM) can be employed to accomplish the job.

1. *Maximum entropy* is a technique for obtaining probability distributions from given data. The basic principle is that when no information is known then the distribution should have maximal entropy [31]. Labelled training data provides constraints on the distribution; determine where to have minimal non-uniformity.
2. *Naive Bayes classifier* is based on Bayes' theorem which assumes that the value of a particular feature is not dependent on the value of any other feature. This model is easy to build and useful for very large datasets, with no complicated iterative parameter estimation present [32].
3. *Semi-supervised learning* is a class between unsupervised learning and supervised learning that makes use of unlabeled data. Many researchers have found that unlabeled data, when used in combination with a small quantity of labelled data, can produce a significant enhancement of learning accuracy [34].
4. *Support vector machines* are supervised techniques coupled with learning algorithms that examine data used for classification. Given a set of training examples, each distinctly labelled for belonging to one of the types. An SVM training algorithm builds a model that allot novel examples into one category or the other, making it a binary linear classifier which is non-probabilistic [33].

However due to the ever transforming and evolving web data, the training data set are difficult to obtain. One method to overcome this limitation is to generate a training set automatically, but these are not accurate and realistic [8].

4.2. Lexicon Based Approach

In this method instead of using training data, pre-built dictionaries of words with associated sentiment orientations are used. [29] This method works on an assumption that the collective polarity of tweets is the sum of individual tweets polarity.[31] Sentiment Analysis for twitter is more challenging because of the problems such as the use of negations, emoticons, short length status message, informal words etc. Also, the presence of negation words reverses the polarity of a sentence [30]. Positive opinion words are used to express some optimistic states while negative opinion words are used to show some undesired state. Opinion lexicon is a collection of opinion phrases and idioms.

Approaches to compile the opinion word list:

1. *The manual approach* is time-consuming and an exhaustive method to compose a dictionary, thus it is usually combined with one of the other two methods.
2. *Dictionary-based approach*: First a small set of seed words with recognized positive or negative orientations is collected manually. The algorithm then expands this set by searching in an online dictionary for their synonyms and antonyms. The recently found words are then added to the basic word

list and the next iteration takes place. This process continues until no more new words can be found. After the process completes the first iteration, a manual examination is used to clean up the list. The main disadvantage of this approach is that the words collected this way are general and independent of context.

3. *Corpus-based approach*: It can be implemented in two ways. In the first type, a basic seed list of general-purpose sentiment words is present and other sentiment words and their orientations from a domain corpus are obtained [19].

Another way is to set a general-purpose lexicon to a different one using a domain corpus for sentiment analysis applications in the domain. However, the issue is more complicated than just building a domain specific sentiment lexicon because in the same domain the same word can be negative in one context and positive in another. Below, we discuss some of the existing works that tried to deal with these problems [20]. Note that although the corpus-based approach may also be used to build a general purpose sentiment lexicon if a very large and very diverse corpus is available, the dictionary-based approach is usually more effective for that because a dictionary has all words [21].

In this paper, a lexicon-based approach is used to perform sentiment analysis. Even though Machine Learning techniques are more accurate than the lexicon based approaches, it has been observed that they take more time performing analysis as they have to be first trained on a large dataset. Such data sets are on the other hand difficult to obtain. There are certain limitations while doing the Twitter analysis. Firstly, twitter API allows only a fixed maximum number of tweets to be analyzed at a time. Secondly, the numbers of tweets retrieved by the API are sometimes less than the number of requested tweets. Thirdly, twitter API retrieves the latest tweets and ignores all the older ones.

5. Challenges In Opinion Mining

Even though opinion mining opens the door to a new form of data mining technology which has numerous benefits, it is not as simple to implement as it appears to be. Sentiment analysis techniques have to face numerous challenges:

1. *Sarcastic sentences*: Text may contain mocking sentences or hidden emotions. These expressions are difficult to identify and may lead to erroneous results.
2. *Linguistic issues*: The polarity may change depending on the context. For example, “*long*” can imply a different meaning in different contexts, e.g., “*This phone has a long battery life,*” gives a positive opinion about the battery life but it can also imply negative sentiment in another context, e.g., “*The car takes too long to start.*”
3. *Opinion faking*: Most of the users are allowed to freely express their views anonymously on the web. However, some people or organizations take advantage of this feature and post spam reviews to endorse or discredit other products.
4. *Volatility over time*: The sentiments of people on a subject may change over a period of time. These contradictions and transformations need to be monitored to portray the accurate developments.
5. *Spelling variation*: Due to impulsiveness, the informal environment and length restrictions on the internet, grammar and spellings are not followed correctly by the users. This causes misspellings, abbreviations, emphatic uppercasing, categorical lengthening and the use of jargon.
6. *Special tokens*: Tokens like URLs and emoticons can lead to intricacy when trying to use natural language processing systems.
7. *Multilingual content*: Some users write the opinion in different languages in the same post. This further complicates mining process.

6. Proposed Approach

The proposed system focuses on lexicon based technique. A lexicon consists of a collection of three main types of words; positive words, negative words and negation words. The system first authenticates the user using Twitter API, takes the input as a hashtag and obtains the tweets consisting of the given hashtag. Each tweet is evaluated to give the Score value which can then be categorized into any of the three classes i.e. positive, negative or neutral. The Score value is calculated by using proposed lexical algorithm. The sentiment is analyzed on the basis of the Score variable. If the Score is greater than zero, then the sentiment of the tweet is positive, if the Score is less than zero, then the sentiment of the tweet so processed is negative. Else if Score is exactly zero then the sentiment is neutral.

Also the role of negation words such as not, no, isn't etc in a sentence which reverses the overall orientation of the sentiment associated with it is analyzed. For example, "The hotel has good customer service." is a positive sentence due to the presence of the positive word "good" in it. The Score of the sentence is +1. However, if we evaluate a negation sentence like "The hotel does not have good customer service", here "good" has positive polarity but because of the negation word "not" the polarity is reversed and the Score value becomes -1 i.e. negative.

- 1) *Enter Domain*- Specify the title that you would like to process for sentiment analysis. It is specified using a hashtag.
- 2) *Tweets Retrieved*- Tweets are retrieved from Twitter for which a handshaking protocol for authenticity is required. Twitter API is used for this purpose.
- 3) *Data Pre-Processing*- The number of tweets to be retrieved is specified as 300. These tweets are in unstructured form, they contain stop words, punctuations, emotions, URLs etc. thus basic filtering is required before further processing. An error message is confronted if the hashtag doesn't exist in Twitter.
- 4) *Sentiment Classification Algorithm*- Here the corpus so formed is processed using Lexical analysis algorithm to retrieve the sentiment score.
- 5) *Expression Keywords*- it includes the directory of positive keywords, negative keywords and negation keywords.
- 6) *Tweets Classified* - The tweets are classified into positive, negative, and neutral sentiment.
- 7) *Sentiments Plotted*- The sentiments so classified are plotted as a histogram and a wordcloud is also acquired which contains the words most frequently used words in the searched tweets.

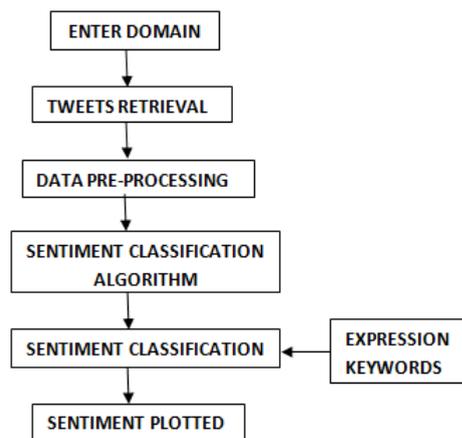


Fig.1. Flow Chart of Proposed System

- **Pre-processing and Filtration of Input Tweets:**

- 1) Delete punctuation marks (, @ [.? “ // !)
- 2) Delete hyperlink (http\)
- 3) Delete numbers, symbols
- 4) Delete digits, tab, @
- 5) Transformation to lower case

- **Prerequisites:**

- 1) File containing list of Positive Sentiment Words
- 2) File containing list of Negative Sentiment Words
- 3) File containing list of Negation Words

- **Algorithm Employed:**

- 1) Score = 0, Positive_Score=0, Negative_Score=0, Negation_Score=0
- 2) If Word== Positive Word then
- 3) Positive _Score = Positive_Score +1
- 4) If Word==Negative Word then
- 5) Negative_Score = Negative_Score +1
- 6) If Word== Negation then
- 7) Negation_Score= Negation_Score+1
- 8) Score= Positive_Score- Negative_Score
- 9) If Negation_Score>1 then
- 10) Score= score * -1
- 11) If Score > 0 then
- 12) print “Positive”
- 13) Else if Score < 0 then
- 14) print “Negative”
- 15) Else
- 16) print “Neutral”

Result: Positive, Negative or Neutral score

7. Result and Evaluation

In this paper, a real-time analysis and implementation of the lexical method for sentiment analysis in Twitter was undertaken. Rstudio is used to execute the code and shiny package provides G.U.I. In Fig 2, hashtag #terrorism is input in the textbox field and searched on twitter. The result is obtained as a word cloud consisting of the words frequently associated with the given hashtag such as security, ISIS, conspiracy etc. Also, a histogram is plotted consists of axis x and y, denoting score of tweets and the count. The score variable shows the tweets with scores ranging from -6 to +2 and count determines the number of tweets having that score. The result shows that there is a lot of negative opinion of people about #terrorism, around 73% tweets have a negative score of -1 and below while around 21% tweets are neutral and around 6% tweets show the positive score.

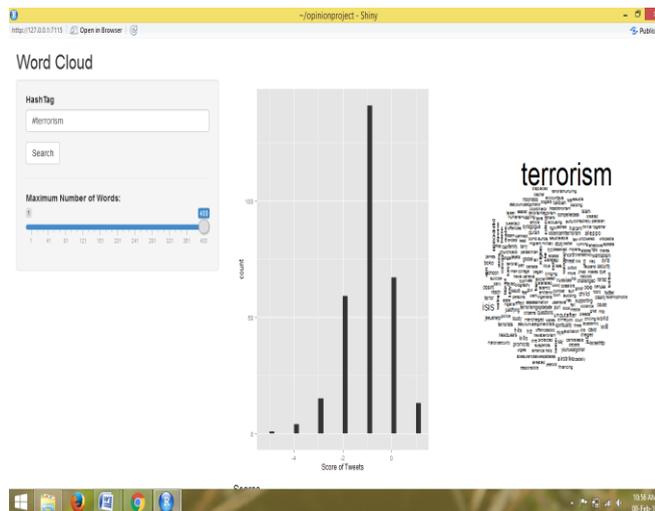


Fig.2. The Result of the Searched Hashtags in the form of a Histogram and Wordcloud

8. Conclusions and Future Work

Opinion mining has a wide variety of applications in information systems like classifying, summarizing and aggregating reviews from the huge volume of data that may be available from customer comments, blogs, feedback and reviews on any product or topic. There are various levels at which this mining technique works such as the document, sentence, and feature level. In this paper, classification of opinions is achieved by lexicon method as it is a simple, feasible and handy approach where no predefined training sets are essential. The role of Negation Words in a sentence is also analyzed. In future, the role of emoticons, blind negations, comparison sentences, sarcasm can be researched upon.

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