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A Survey on Opinion Mining on Twitter Data: Tasks, Approaches, Applications and Challenges for Sentimental Analysis

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Abstract- Social media produces huge amounts of data every minute, which is caused by its conventional implementation over the past years. Modernization in the industry have facilitated new ways of communications between people and created many business prospects. Big Data in social media need efficient and sophisticated processing technologies. Rationale of data mining analyses is to discover valuable patterns and insights from Twitter data. In today's world, Social Networking websites like twitter, Facebook, tumbler, etc plays a very significant role. Twitter is a micro-blogging which provides tremendous amount of data which can be used for various applications of sentimental analysis like predictions, reviews, elections, marketing etc. Also for a business to execute successfully it is supportive to identify the opinion viewpoints or reviews of the consumers and make amendments in the tactics and services accordingly. Similarly for the consumers it is very valuable to distinguish about the eminence of the products and services in advance. Sentimental Analysis also called opinion mining is a process of extracting information from large amounts of data and classifies them into different classes called sentiments. Opinion mining is a technique of refining the information and revising the emotions associated with a exacting review and consequently discovering the polarity of the review. In this paper, a study on different perception and move towards of Twitter data analysis performed in recent years by means of opinion mining is prepared by taking into consideration the words, retweets, hash tags and emotions.

Keywords- *micro blog, twitter, retweet, hash tag, opinion mining, sentimental analysis, predictions*

1. Introduction

During many years, the quantity of data produced from the Internet services have increased drastically. Modernization in the field of Information Communication Technologies have facilitated new business prospects for creating services capable of managing enormous data volumes. Technology arrived at the level, where individuals are interrelated with social media on every day basis and are able to distribute their life over social networks. Social networking over Internet has turned into accepted in the last years, which is too defensible with the enlarged data volumes. New challenges emerged in relation to data storage architectures with scalability characters and successful processing algorithms. Data mining analysis has a immense prospective in discovering momentous insights within social networks data. Twitter social network is a service developed in order to facilitate communication between people by distributing short messages. [1][2]According to research, Twitter as the second major social media platform, right after Facebook, produces approximately 350, 000 tweets each minute, or 21 million per hour. Such volumes of data present challenges for engineers to develop innovative solution for effective data architecture and processing capabilities in order to apply data mining. The importance of Big Data implementations within enterprises in various sectors, such as health industry, retail, telecom or social networks plays crucial scenario in optimizing business processes and creating new value propositions for revenue streams. According to Accenture research [3], 87% of enterprises believe that Big Data will reshape the industry in the next years. Therefore, the early adoption of this trend may create additional value to enterprises in sense of data mining of customer's opinions about company in the Twitter use case. Knowing what customers think about the services or how services can be innovated in the future gives

companies insights and strategies for development. Furthermore, survey also found that 89% of respondents said that companies who do not adapt to this Big Data trend would risk losing market share. [3] Twitter has big potential for data mining as its users produce Big Data that can be processed. In addition, there are requirements for architecture development that can scale to continuous new-streamed tweets and also ability to integrate with advanced machine learning algorithms. Knowing what users think or how they feel about products is valuable proposition for companies. Sentiment analyses are part of data mining, which monitors public perceptions about various topics. It can analyse what people think about business products and quality, brands, pricing strategies or worldwide trends. Moreover, it can identify business opportunities and thus become an effective factor for companies to innovate their services. [4] Twitter as micro blogging platform backed with its active users create opportunities for data mining and more particular sentiment analyses based on tweets. Twitter users often express their opinions about various topics within their posted tweets. And so by applying text-processing data mining technique can serve companies as feedback or for brand management. On the other hand, since Twitter generates massive volumes of data every day, sentiment analyses can help with marketing related campaigns to research public opinions about newly released product, for example blockbuster movie and analyse sentiment about users satisfaction, whether they felt positive or negative about movie. According to [4] consumers are willing to pay from 20% to 99% more for movie rated with 5/5 stars. This research discusses that positive comments or reviews on product are great influencers and will indicate success among consumers.

A. Introduction to sentimental Analysis

Sentimental Analysis is a process of collecting and analyzing data based upon the person feelings, reviews, and thoughts. Sentimental analysis often called opinion mining as it mines the important features from people opinions. Sentimental analysis is done by various machine learning techniques, statistical models and natural language processing for the extraction of feature from large text data. Sentiment Analysis can be done at document, phrase and sentence level. In document level, summary of the entire document is taken first and then it is analyze whether the sentiment is positive, negative or neutral. In phrase level, analysis of phrases in a sentence is taken in account to check the polarity. In Sentence level, each sentence is classified in a particular class to provide the sentiment. Sentimental Analysis has various applications. It is used to generate opinions for people of social media by analyzing their feelings or thoughts which they provide in form of text. Sentiment Analysis is domain centered, i.e. results of one domain cannot be applied to other domain. Sentimental Analysis is used in many real life scenarios, to get reviews about any product or movies, to get the financial report of any company, for predictions or marketing. Twitter is a micro blogging platform where anyone can read or write short form of message which is called tweets. The amount of data accumulated on twitter is very huge. This data is unstructured and written in natural language. Twitter Sentimental Analysis is the process of accessing tweets for a particular topic and predicts the sentiment of these tweets as positive, negative or neutral with the help of different machine learning algorithm.

B. Data Mining Heirarchy

This era is of automated systems and digital information every field of life is evolving rapidly and generating data. As a result huge volumes of data produce in field of science, engineering, medical, marketing, finance, demographic etc. Automated systems are needed to automate analysis, summarization, and classification of data. It also helps at enterprise level to take related decisions. Multiple research fields like statistics, machine learning, artificial intelligence and visualization are involved to develop such automated systems.A number of efficient ways are available to store the huge volumes of data, computational techniques and models are required to extract the hidden patterns and knowledge. These techniques and tools are used to transform the data into useful information, to make market analysis, fraud detection and find the customer intentions etc. Such computational tools and techniques are the subject of Knowledge Discovery in Database and Data Mining.

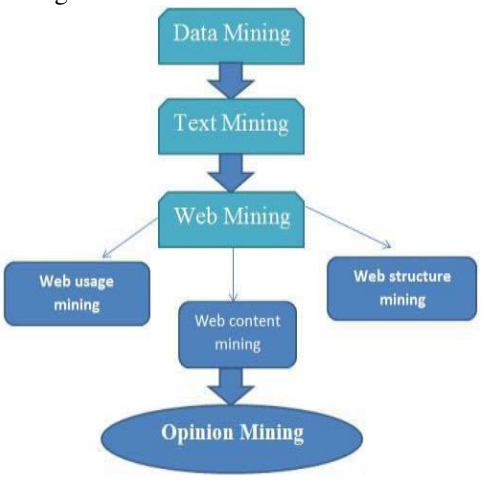

Figure. 1. Data Mining Hierarchy

2. Opinion Mining and Sentimental Analysis

A. Introduction

Opinion mining is a technique which is used to detect and extract subjective information in text documents. In general, sentiment analysis tries to determine the sentiment of a writer about some aspect and also the overall contextual polarity of a document. The sentiment may be his or her judgment, mood or evaluation. A key problem in this area is sentiment classification, where a document is labeled as a positive or negative evaluation of a target object (film, book, product etc.)The evaluation of opinion can be done in two ways:

Direct opinion gives positive or negative opinion about the object directly. For example, "The picture quality of this camera is poor" expresses a direct opinion.

Comparison Opinion means to compare the object with some other similar objects. For example, "The picture quality of camera-y is better than that of Camera-x." expresses a comparison.

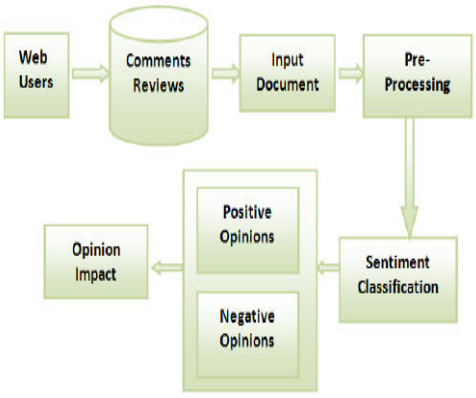

Figure. 2. Workflow of Opinion Mining

Fig. 2 have a workflow of Opinion Mining of how the opinions are being extracted from people review over their comment Opinion feature extraction is a sub problem of opinion mining with the vast majority of existing work done in the product review domain.

B. Sentiment Classification

Document level

Document level sentiment classification executed on the overall sentiments expressed by authors. Documents classified according to the sentiments instead of topic. It is to summarize the whole document as positive or negative polarity about any object (mobile, car, movie, and politician etc).

Sentence level

Sentence level sentiment classification models extract the sentences contains opinionated terms, opinion holder and opinionated object. It is one level deep to document level and just concerns to the opinionated words but not the features. Number of positive and negative words counted from sentences if positive words are maximum then opinion about object is positive and if the negative words are more than opinion is negative otherwise neutral.

Phrase level Opinion Mining

The phrase level sentiment classification is a much more Pinpointed approach to opinion mining. The phrases that contain opinion words are found out and a phrase level classification is done. But in some other cases, where contextual polarity also matters, the result may not be fully accurate. Negation of words can occur locally. But if there are sentences with negating words which are far apart from the opinion words, phrase level analysis is not desirable. The process is Identifying Opinion Words, the role of negation words and Clauses.

C. Need of Sentimental Analysis

Industry Evolution

Only the useful amount of data is required in the industry as compared to the set of complete unstructured form of the data. However, the sentiment analysis done is useful for extracting the important feature from the data that will be needed solely for the purpose of industry. Sentimental Analysis will provide a great opportunity to the industries for providing value to their gain value and audience for themselves. Any of the industries with the business to consumer will get benefit from this whether it is restaurants, entertainment, hospitality, mobile customer, retail or being travel.

Research Demand

Another important reason that stands behind the growth of SA deals with the demand of research in evaluation, appraisals, opinion and their classification. Present solutions for the purpose of sentiment analysis and opinion mining are rapidly evolving, specifically by decreasing the amount of human effort that will be required to classify the comments. Also the research

theme that will be based in the long established disciplines of computer science like as text mining, machine learning, natural language processing and artificial intelligence, voting advise applications, automated content analysis, etc.

Decision Making

Every person who stores information on the blogs, various web applications and the web social media, social websites for getting the relevant information you need a particular method that can be used to analyze data and consequently return some of the useful results. It is going to be very difficult for company to conduct the survey that will be on the regular basis so that there comes the need to analyze the data and locate the best of the products that will be based on user's opinions, reviews and advices. The reviews and the opinions also help the people to take important decisions helping them in research and business areas.

Understanding Contextual

As human language is getting very complex day by day so it has become difficult for the machine to be able to understand human language that can be expressed in the slangs, misspelling, nuances, and the cultural variation. Thus, there will be a need of system that will make better understanding between the human and the machine language.

Internet Marketing

Another important reason behind the increase in the demand of sentimental analysis is the marketing done via internet by the business and companies organization. Now they regularly monitor the opinion of the user about their brand, product, or event on blog or the social post. Thus, we see that the sentimental Analysis could also work as a tool for marketing too.

3. Archectecure of Opinion Mining

Opinion Mining also called sentiment analysis is a process of finding user's opinion towards a topic or a product. Opinion mining concludes whether user's view is positive, negative, or neutral about product, topic, event etc. Opinion mining and summarization process involve three main steps, first is Opinion Retrieval, Opinion Classification and Opinion' Summarization. Review Text is retrieved from review websites. Opinion text in blog, reviews, comments etc. contains subjective information about topic. Reviews classified as positive or negative review.

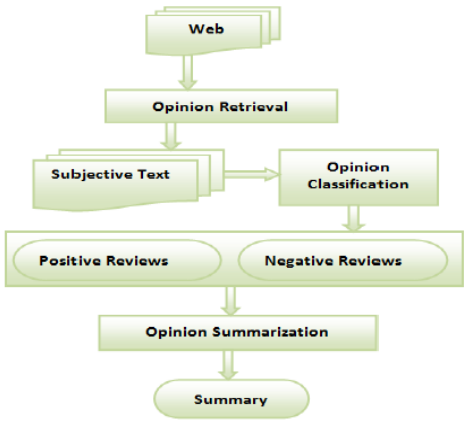

Fig.3. Architecture of Opinion Mining

Opinion summary is generated based on features opinion sentences by considering frequent features about a topic.

4. Preliminary Steps of Sentimental Analysis

Sentiment analysis, opinion mining and subjectivity analysis are interrelated areas of research which use various techniques taken from Natural Language Processing (NLP), Information Retrieval (IR), structured and unstructured Data Mining (DM). Major part of data available worldwide, being unstructured (such as text, speech, audio, video etc.), poses important research challenges. To deal with such unstructured text data, traditional methods of NLP i.e. information retrieval and information extraction came into existence. In order to get a sense of the extracted text, numerous research efforts have been witnessed in recent years leading to automated SA, an extended NLP area of research [23]. Due to wide availability of various online resources, data acquisition is highly subjective to the type of media, data format supported by media, and the type of analysis needed to perform. Some micro-blogging sites like Twitter, Sina-Wiebo etc made available their Application Programming Interface (API) to collect public data from their sites. Twitter has provided Twitter REST API to get static data like user profile information, and Streaming API2 to get streaming data like tweets [19]. Twitter4J API3 has been exploited by [35, 26] to extract streaming tweets.

Preprocessing

Raw data acquired from various sources often needs to be preprocessed before launching a fully fledged

analysis. Some popular preprocessing steps are: tokenization, stop word removal, stemming, parts of speech (POS) tagging, and feature extraction and representation. Tokenization is used to break a sentence into words, phrases, symbols or other meaningful tokens by removing punctuation marks. Stop words do not contribute to analysis and hence are dropped during preprocessing step. Stemming is the process to bring a word into its root form, while ignoring other POS of the word. POS tagging is performed to recognize different parts of speech in the text, which is quite essential for natural language processing. The Table1 shows publicly available tools for different preprocessing tasks.

Name of the Tool	Purpose
TweetMotif	Tokenization of tweets
POS tagger	Twitter POS tagger
TweetNLP6	Twitter natural language processing
Lancaster stemming algorithm	Stemmer
GNU Aspell	Spell Checker
Snowball	English stemmer
Stanford Log-linear Part-Of-Speech Tagger	POS tagger
TweeboParser	Tweet Dependency parser

Table1 publicly available tools for reprocessing tasks

The preliminary steps for Sentimental Analysis are described using following diagram.

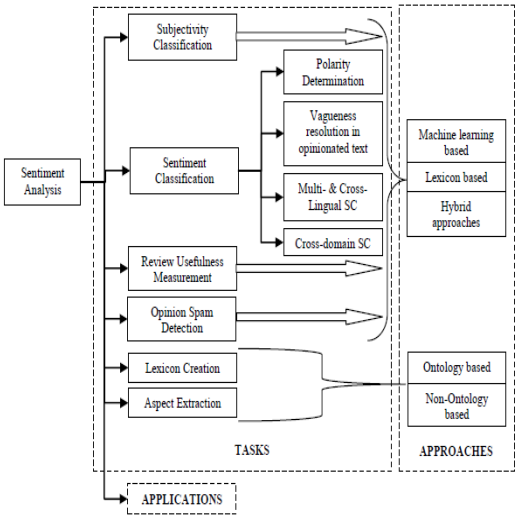

Figure 4. Steps for preprocessing tasks

5. Approaches and Techniques for Sentimental Analysis

A. Approaches

Depending on the task at hand and perspective of the person doing the sentiment analysis, the approach can be discourse-driven, relationship-driven, language- model driven, or keyword-driven [14].

Knowledge-based approach

The main task in this approach is the construction of word lexicons that indicate positive class or negative class. The sentiment values of the words in the lexicon are determined prior to the sentiment analysis work. Lexicons can be created in different ways. It can be created by starting with some seed words and then using some linguistic heuristics to add more words to them, or starting with some seed words and adding to these seed words other words based on frequency in a text. SENTIWORDNET 3.0 is a publicly available lexical resource explicitly devised for supporting sentiment classification and opinion mining applications [5].

Relationship-based approach

In this approach the different relationships between features and components is analyzed for sentiment classification task. Such relationships may be relationships between different participants, relationships between product features. For example, if one wants to know the sentiment of customers about a product brand, one may compute it as a function of sentiments on different features or components of it.

D. Techniques

Sentiment analysis can be implemented using both supervised and unsupervised methods of classification. Supervised methods have shown better performance than the unsupervised methods. However, unsupervised methods are also important because supervised methods demand large amounts of labeled training data that very expensive whereas acquisition of unlabeled data is easy.

Supervised Techniques

Supervised techniques can be implemented by constructing a classifier. This classifier is trained by examples which can be manually labeled. The popular supervised algorithms are Support Vector Machines (SVM), Naive Bayes classifier and Maximum Entropy. Supervised Techniques proved that they provide efficient performance.

Unsupervised Techniques

In unsupervised technique, classification is done by comparing the features of a given text against word lexicons whose sentiment values are determined prior to their use. For example, start with positive, negative word lexicons, analyze the document for which sentiment

need to find. Then if the document has more positive word lexicons, it is positive, otherwise it is negative.

6. Applications of Sentimental Analysis

Sentiment analysis has huge quantity of applications in the Natural Language Processing field. Because of the enhancement in the sentiment analysis, social network data is on sky-scraping claim. Many companies have already approved the sentimental analysis for the method of improvement. Some of most important applications are specified as below:

Word of Mouth

Word of Mouth (WOM) is the development by which the information is specified from one person to another person. It would basically help the people to obtain the conclusions. Word of Mouth has agreed the information about the opinions, attitudes, response of consumers about the correlated business, services and the products or flats the ones that can be common with more than one person. Consequently, this is going to be where Sentiment Analysis comes into depiction. As the online appraisal blogs, sites, social networking sites have provided the great amount of opinions; it has facilitated in the development of decision making so a lot easier for the user.

Voice of Voters

Each of the political parties typically depleted a major portion of the quantity of money for intend of demonstration for their party or for persuade the voters. Accordingly if the politicians recognize the people opinions, reviews, implications, these can be completed with more outcomes. This is how procedure of Sentimental analysis does not only assist political parties but on the other hand help the news analysts beside. Also the British and the American management had previously used a few of the similar practice.

Online Commerce

There is vast number of websites related to ecommerce. Majority of them had the policy of getting the feedback from its users and customers. After getting information from various areas like service and quality details of the users of company users experience about features, product and any suggestions. These details and reviews have been collected by company and conversion of data into the geographical form with the updates of the recent online commerce websites who use these current techniques.

Voice of the Market

At any time a product is to be commenced by a definite company, the customers would to recognize about the product ratings, reviews and comprehensive metaphors about it. Sentiment Analysis can assist in analyzing marketing, advertising and for making new tactics for endorse the product. It offers the customer a chance to prefer the best among the all.

Brand Reputation Management

Sentiment analysis would help to decide how would be a company's brand, service and the service or product that would be alleged by the online society. Brand Reputation Management will be worried about the administration of the reputation of market. It has spotlight on the company and product moderately than customer. Thus the prospects were formed for the rationale of managing and escalating the brand reputation of the organizations.

Government

Sentiment Analysis has facilitated the administration for the purpose of offering a variety of services to the public. Fair outcomes have to be produced for analyzing the negative and positive points of government. Thus sentiment analysis is helpful in many areas like decision making policies, recruitments, taxation and evaluates social strategies. Some of the parallel techniques that offer the citizen oriented government model where the services and the main concern should be presented as per the citizens. One of the attractive problems which can be taken up is applying this method in the multilingual country like the India where content of the generating mixture of the different languages (e.g. Bengali English) is a very common practice.

7. Challenges of Sentimental Analysis

1) **Detection of spam and fake reviews:** The web holds both genuine and spam contents. For efficient Sentiment classification, this spam content is supposed to be eliminated before processing. This can be done by discovering duplicates, by perceiving outliers and by bearing in mind reputation of reviewer.
2) **Limitation of classification filtering:** There is a restriction in classification filtering while shaping most trendy thought or idea. For enhanced sentiment

classification result this restriction should be condensed. The risk of filter bubble [11]
gives immaterial opinion sets and its outcome is false accumulation of sentiment.

3) **Asymmetry in availability of opinion mining software:** The opinion mining software is very costly and at present reasonable only to big organizations and government. It is beyond the common citizen's anticipation. This should be accessible to all people, so that everybody acquires profit from it.

4) **Incorporation of opinion with implicit and behavior data:** For flourishing examination of sentiment, the opinion words should assimilate with implied data. The inherent data decide the actual conduct of sentiment words.

5) **Domain-independence:** The major confront faced by opinion mining and sentiment analysis is the area reliant scenery of sentiment words. One feature set may provide high-quality performance in one field, at the same time it carry out very poor in some other field.

6) **Natural language processing overheads:** The natural language above your head like uncertainty, co-reference, obliqueness, conclusion etc. created difficulty in sentiment analysis too.

8. Conclusion

Opinion miming is an up-and-coming field of data mining to dig out the knowledge from enormous volume of data that may perhaps be customer comments, feedback and reviews on any product or topic etc. Study has been performed to extract opinions in structure of document, sentence and feature level sentiment analysis. It is observed that nowadays opinion mining inclination is touching to the sentimental reviews of twitter data, comments used in Face book on pictures, videos or Face book status. This paper describes a wide-ranging, up-to-date assessment on the research work done in various characteristics of sentimental analysis. This paper summarizes some of the most commonly used applications and challenges in sentiment analysis. Now business organizations and academics are putting forward their efforts to find best system for sentiment analysis.

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