ISSN(Online): 2320 - 9801
ISSN (Print) : 2320 - 9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 6, June 2016

A Tool for Twitter Data Analysis using NLP

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ABSTRACT: With increasing data on Social Media Networks, analytical tools are also getting evolved to analyse the data present on different media to derive useful information. The tool described in this study helps in analysing Twitter data regarding a specific brand. Twitter data is streamed for a specific brand and analyzed to generate user sentiments for that brand. The classification techniques used is stanford NLP Classification.

KEYWORDS: Dimensions, Reach; Engagement; ROI.

I. Introduction

Mobile AS we all know it takes a lifetime to build a brand but takes only a few minutes to destroy it. But with social media playing an important role in peoples life, it can be just a post which can harm the reputation of a brand. It therefore becomes very important to continuously monitor the brand reputation in social circles for a product and it also is able to market the new features and offer with social media networking sites like Twitter and Facebook etc. [1]. The project focuses on Twitter because of its 140 character limitation and only textual data. The advent of Internet is long past thing now and the new term that is coined is minute Internet where we are focusing on events happening per minute in Internet space. Internet generates a lot of data (normally in gigabytes) per day from different social channels. The openly available data on Internet can be used to work on analytics that provide user sentiments pertaining to a brand at a specific time. The need is to acquire a brands reputation and can use this information to build the same for new features or releases that will be offered for the product. The data thus generated is unstructured and needs to be analyzed real time as data even older than 2-3 days might not be helpful for gauging sentiment. Thus the challenge is to analyze a huge amount of data real time and derive conclusions from this data. Nowadays products are being marketed on social media as well and feedback for these products is also available on Social Networks. These feed backs are analyzed to get the brand reputation for a product on a particular time space and the tweets thus obtained can be categorized according to geographical locations or specific user groups and similar categorizations. A lot of research is going on the field of Sentiment Analysis nowadays which can be used for following [2] -

1) Brand monitoring and campaigning.
2) Stock markets.
3) News and current events.
4) Movie Reviews and Box office collection.
5) Election Campaign and predictions.
6) Weather Forecasts.

Sentiment Analysis also referred as Opinion Mining on Big Data is a current topic for research as this leverages an opportunity to use already present data in open and analyze the same. Also there are open libraries available for Sentiment Analysis for example SentiWordNet that uses WordNet for its dictionary. This paper focuses on using Sentiment Analysis techniques for building and monitoring a brand though tweets available on Twitter. Twitter provided us the API in Twitter 4Js which can be used get Twitter data for past 4-7 days. This data can be filtered to get the tweets for a particular brand. This classified data then can be used to carry out the sentiment analysis for a brand. The launch of new features or offers can be done through Twitter and then the user feedback can be checked be analyzing this data. The tool also helps in targeting specific user category like users form a particular locality, age, gender or existing customers etc.

II. Related work

Sentiment Analysis is gauging the current sentiments that are prevailing on the social media sites for a particular brand at a particular time- frame. The data though filtered for a specific time will always be huge and thus the term Big data analytics is used for analyzing this huge dataset. Apart from size the other complexities of analyzing this data is its form which is mostly unstructured in nature. The major player in market for Big data analytics are Google Analytics, IBM Cognos suite, Hotsuite and SalesForce etc. Different Sentiment Analysis methods can be used for analyzing social data that gives different results. A good comparison of all these methods for carrying out sentiment analysis is given in [5]. The research was focused on comparing eight popular sentiment analysis methods namely LIWC, Happiness Index, SentiWordNet, SASA, PANAS-t, Emoticons, SenticNet and SentiStrength. Even with presence of many players the analysis of tweets does not target on new measures such as retweet count or leader of the tweets. If the analysis process can identify the tweets that are influencing the user sentiment in a time space, the reason for that sentiment flow can also be deduced. Thus companies can come up with offers that can target a specific location or a specific set of users and these users can be approached through Social Media which in our case is Twitter. The customer then can share the feedback on same social channel which will help us get the sentiment for the offer provided. This will also help us in deduce the ROI for the new feature. The previous work was majorly focused in trying various sentiment analysis techniques like SVM, Maximum Entropy and other more accurate algorithms. The stanford university has come up with new NLP algorithms that can be used for analysis. Therefore the need of the hour is to enhance the same algorithm and achieve better performance. The major task of the Sentiment Analysis layer can attain a better performance if the pre processing of data is also done properly. The noise level reduction and analyzing the emoticons and POS tagging are thus required to prepare a good quality database for running the sentiment analysis algorithm. The paper thus focuses mainly on introducing new techniques for pre processing data.

III. Proposed SYSTEM

The architecture of the proposed system is 3 tier where the tiers are namely Database tier, Analysis tier and Result display. All the three tiers can be distributed and can sit on different nodes in an implementation. The Results display is a web interface which can be extended to mobile devices as well. Therefore the Results page can be deployed on a client machine which can be accessed on many terminals from a same server location as well.

A. Database

The data is streamed from the Twitter through Twitter4J APIs in real time manner[6]. The paper explains a simple procedure for streaming data from Twitter and analyzing it. The data is streamed through Spark API where connection can be established on the fly. The data currently taken is first 100 tweets currently going on Twitter data space. The tweet collection count can be increased and also can be modified to take just a particular time window. Also we categorize the tweets on subject. The analysis will be done in considering there tweet count and followers as well. The data is an expression by different users sitting in different locations on the planet and thus can have terms and words which are linguistically different. In our case, we are analyzing only English text but these can also have a lot of colloquial usage in the tweets posted from separate regions. Thus it becomes very important to preprocess the data before analyzing.

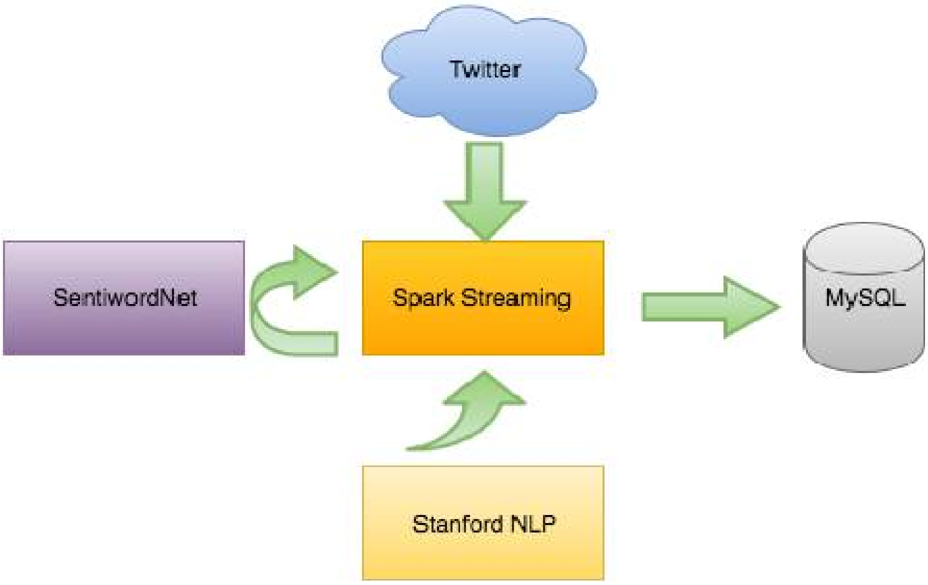


Fig. 1. Streaming Architecture

B. Sentiment Analysis Layer

Sentiment Analysis can be carried out in two ways namely supervised and unsupervised [3]. The supervised learning requires a training dataset and assumes a finite number of categories for an item to fall into. Some supervised learning algorithms are Naive Bayes, SVM or KNN etc. Unsupervised learning is based on getting Semantic Orientation (SO) of the document. The algorithm used in the tool uses standard NLP algorithm which has desired accuracy. A sentiment analysis dictionary is also used for comparing bag of words. The analysis targets and works such that any document can be classified in a finite set of categories which in this case is 4 (positive, negative and neutral) by calculating features in the document. The feature count is taken as the frequency of occurrence of words in the document i.e. more the occurrence of a particular word, more will be its probability . The tweets collected in database will be analyzed with and will be classified in one of the 3 categories as positive, negative and neutral. The tweet can contain both positive and negative sentiments and thus the category neutral is for such tweets which can be categorized from existing sentiments. The Sentiment analysis is performed after pre possessing the data for removal of stop words, noise and interpreting emoticons.

IV. ALGORITHM

The algorithm used in Sentiment Analysis layer for classifying sentiments in positive, negative or neutral tweets in POS tagging. The sentiment analysis is performed through Maximum Entropy technique in which we categorize a sentiment by identifying nearest similarity with either positive or negative sentiment. The distribution is conditional which gives the document class. The dictionary used to train the tool is SentiWordNet. The Maximum Entropy algorithm can be defined as follows

$$P(c|d) = \frac{1}{Z(d)} exp(\sum_i \lambda_i f_i(d,c)) \qquad (1)$$

where feature fi(d; c) is being searched for parameter λi and Z(d) provides stability to equation.

$$Z(d) = \sum_c exp(\sum_i \lambda_i f_i(d,c)) \qquad (2)$$

Maximun Entropy which is used widely in POS tagging and natural language processing. Maximun Entropy is used generally for estimating probability distributions from a given data set. It works on a set of features and calculates constraints for the given set of features. Apart from classification the text will be filtered on following

1) Stop word removal - All words that are not particularly useful in accessing sentiment will be removed from the text. Examples are at, and or, are etc.
2) POS tagging - Part of speech tagging enables us to identify the literal meaning of the text with the context in which it is used where ambiguity can appear.
3) Negation Handling - As the tweets might contain negative words twice we will count to negative words as a positive.
4) Emoticons - The emoticons will be interpreted and this will help in gaining the sentiment weight appropriately.
For example, instead of using a smiley to show happiness we add the word happy for the smiley.
5) Laplacian Smoothing The algorithm assumes that all the words are present in training data set. Laplacian smoothing handles the case when this might not be true.
The POS tagging is a document analysis technique where we have Subjectivity and Polarity classification. This is an enhanced way of sentiment analysis as a sentiment of word can be different from a sentiment of sentence. Thus a sentence taken from Twitter i.e. text data of Twitter is tagged as Nouns, Adjectives and Verbs. These forms a pair of 2 tags and 3 tags. Thus the polarity is identified according to tags rather than on words.

IV. IMPLEMENTATION
V.

The project implementation is done in scala where tweets are streamed real time by establishing connection through Twitter4J APIs. Sentiment Analysis is executed in Map Reduce framework so that all the performance of analysis is good. The no of clusters used for executing query parallely can be user configured.

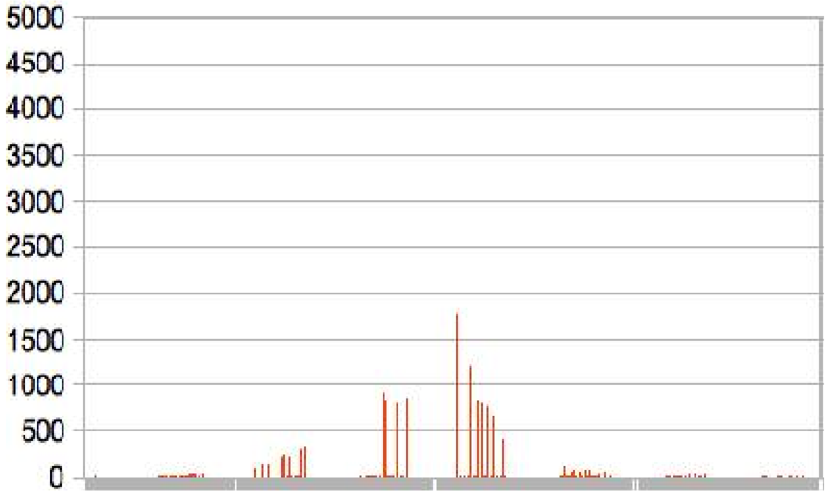


Fig. 2. Accuracy with increasing tweets.

The data thus acquired is unstructured and is in json format. The spark languages provides a resilient database set RDDS which can be used to extract query results in desired format. This data is then filtered and removed of all stop words and undergoes a POS tagging. The sentiment analysis layer then classifies the data in 4 categories namely ”Excited”, ”Happy”, ”Upset” and ”Angry” which describes positive and negative sentiments. Maximun Entropy used for sentiment analysis requires a large training set. As the data is being classified on the fly, the accuracy can be achieved by using large data streams. But as this is time consuming and also memory requirements increases with increasing in streaming, the accuracy generated for this experimental set up was low. For enhancing this accuracy, a combination of algorithms can be used and also historical search can be enabled.

VI. RESULTS

The final result are shown in the tool in graphical format. The classification time for 100 tweets was around 4.2 min. The tweet sentiment will be categorized in 4 classes as shown in the table Table I. The 50 tweets out of which were manually classified which gave an accuracy on 64% for brand ”MacDonalds”. The count of tweets accumulated also depends upon the search keyword and also the popularity of the search phrase. As sarcasm is not encountered for in sentiment analysis some of the data analysed is inaccurate. The accuracy increases as we increase the number of tweets considered but the analysis procedure takes more time and also heap size required by the application increases. The figures 3,4 and 5 shows different screens for Search, Analyze and Result display. The search screen takes a search keyword and on event of Submit button clicks sends the data for analysis to Sentiment Analysis layer. This layer will perform the analysis and display the result in graphical format.

TABLE I. POLARITY LEVELS

Category	Polarity	Display
1	Positive	Excited
2	Strong Positive	Happy
3	Negative	Upset
4	Strong Negative	Angry

The data is also shown in tabular format for the tweets accumulated for the search along with polarity as shown in Results page.

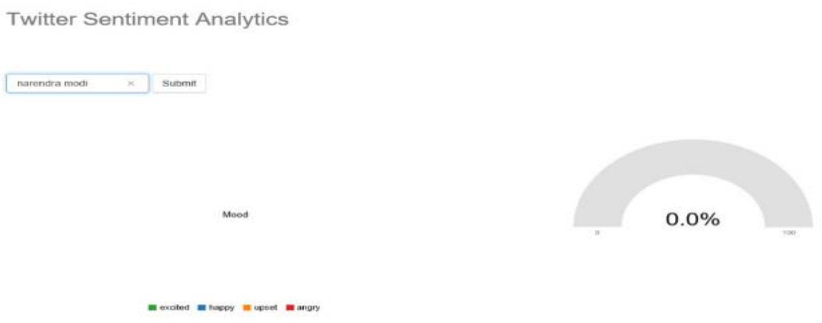


Fig. 3. Search

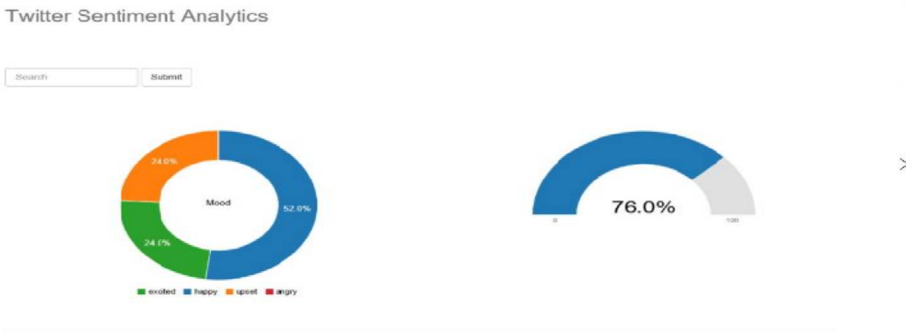
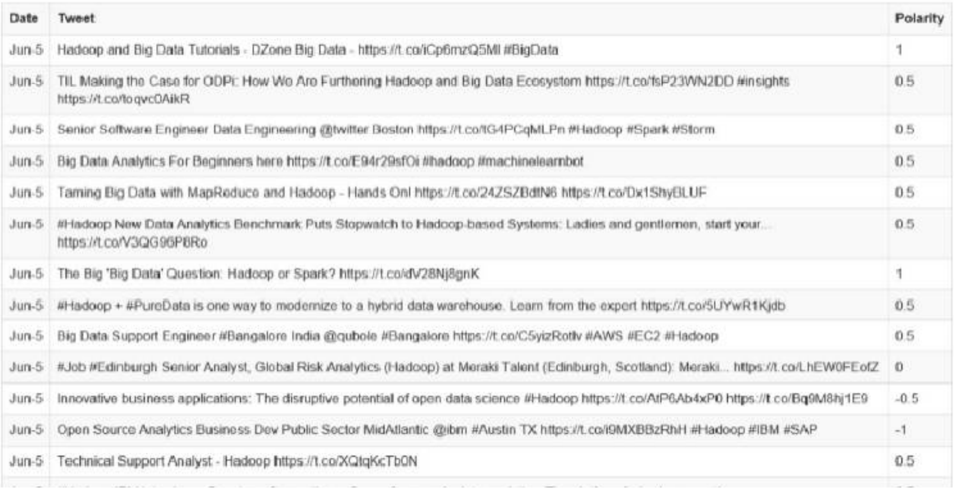


Fig. 4. Analyze



Date	Tweet	Polarity
Jun-5	Hadoop and Big Data Tutorials - DZone Big Data - https://t.co/iCp6mzQ5Ml #BigData	1
Jun-5	TIL Making the Case for ODPi: How We Are Furthering Hadoop and Big Data Ecosystem https://t.co/fsP23WN2DD #insights https://t.co/toqvcOAikR	0.5
Jun-5	Senior Software Engineer Data Engineering @twitter Boston https://t.co/tG4PCqMLPn #Hadoop #Spark #Storm	0.5
Jun-5	Big Data Analytics For Beginners here https://t.co/E94r29sfOi #hadoop #machinelearnbot	0.5
Jun-5	Taming Big Data with MapReduce and Hadoop - Hands On! https://t.co/24ZSZBdlN6 https://t.co/Dx1ShyBLUF	0.5
Jun-5	#Hadoop New Data Analytics Benchmark Puts Stopwatch to Hadoop-based Systems: Ladies and gentlemen, start your... https://t.co/V3QG96P8Ro	0.5
Jun-5	The Big 'Big Data' Question: Hadoop or Spark? https://t.co/dV28Nj8gnK	1
Jun-5	#Hadoop + #PureData is one way to modernize to a hybrid data warehouse. Learn from the expert https://t.co/5UYwR1Kjdb	0.5
Jun-5	Big Data Support Engineer #Bangalore India @qubole #Bangalore https://t.co/C5yizRotlv #AWS #EC2 #Hadoop	0.5
Jun-5	#Job #Edinburgh Senior Analyst, Global Risk Analytics (Hadoop) at Meraki Talent (Edinburgh, Scotland): Meraki... https://t.co/LhEW0FEofZ	0
Jun-5	Innovative business applications: The disruptive potential of open data science #Hadoop https://t.co/AtP6Ab4xP0 https://t.co/Bq9M8hj1E9	-0.5
Jun-5	Open Source Analytics Business Dev Public Sector MidAtlantic @ibm #Austin TX https://t.co/i9MXBBzRhH #Hadoop #IBM #SAP	-1
Jun-5	Technical Support Analyst - Hadoop https://t.co/XQtqKcTb0N	0.5

Fig. 5. Results

The Sentiment Analysis done by SentiWordNet claims in between 12-70 percent depending upon the quality of text used and training data set.The expected outcome of the sentiment analysis done in the technique used here aims to achieve 70-80 percent precision.

VII. Conclusion and Future Work

The paper thus describes a simple method for analyzing Twitter tweets filtered from some specific keywords that describe a brand and gives us an insight of the sentiments for a brand. Thus the implementation of Maximum Entropy algorithm can be used for analyzing tweets and using this information for building brand reputation on Twitter media.

The tool focuses on Twitter data analysis as the Twitter limits the data size to 140 characters which give us an advantage of size limited dataset. Also another advantage of Twitter is it has only text data. The tool but can be extended to Facebook or other such social media tool which have an added complexities of video data, images and sound files as well. Also the Sentiment Analysis layer can be extend to use multiple algorithm like a combination of many other algorithms as well such as Naive Bayes and SVM instead of using a single algorithm which can increase the accuracy of the proposed model.

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BIOGRAPHY

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