

A Review of Opinion Mining in Twitter Streams

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Sentiment analysis refers to the application of natural language processing, computational linguistics and text analysis techniques on the documents to recognize and dig out hidden patterns. Sentiment analysis is generally desired for a variety of utilities, ranging from advertising to user profiling. Sentiment analysis behavior of a user based users judgment or assessment, effective state, or the expected emotional communication. In this paper, we present a review of opinion mining techniques and discover pertinent qualities and shortcomings of various sentiment analysis techniques. The motivation behind this review is to analyze and assess different sentiment analysis techniques and discover their strengths and demerits. This comparison serves as an impetus to conduct further research to explore better approach for future exploration and insights in the area of sentiment analysis.

Keywords: Text Mining, Sentiment Analysis, Political Opinion Mining, Tweets, Natural Language Processing.

1. INTRODUCTION

Social media plays a vital role to share content and public opinion among the communities. It is a tool that can instantly and effectively embrace the public's dialogue. Social media has turned into a dynamic stage for the web users to share their views about social activities, sports events and political occasions and so forth. Subsequently, social media contains a monstrous amount of information that can be utilized for supposition mining and wistful investigation. On certain social and political issues, governments and NGO's seek rapid input of the masses; and in this regard, social media offers a convenient solution. Individuals can candidly participate in dialogs about an event e.g., political situation in a country, general elections, terrorist attacks, sports events, release of a movie and so on. Advancements in data analysis have expanded social networks. Social media is a stage where individuals talk about and share data unreservedly. The verity of occasions are celebrated on online networking, for example, Twitter, Facebook, Google+ and so forth. Social media events are classified as arranged events and spontaneous events.

Twitter is a popular informal communication platform launched in 2006 which now has huge number of users. Due to its accessibility through PCs and smart phones, social media offers the facility of quick data sharing and getting most recent updates about an event. Twitter users can send and get a "tweet" which is a short message of maximum 140 characters. Tweets can be categorized as open or private. The tweets marked as private can only be accessible to a selected group of people. Twitter offers its users to follow anyone and get his/her updates straightforwardly on the home page. A tweet can have multiple sentences and hash-tags (the "#" symbol used to tag buzzwords). A tweet can be re-tweeted to spread it among the followers.

This paper consists of four sections. An introduction to the topic is presented in the first section. The second section discusses literature review on the social opinion mining. A critical analysis of different sentiment analysis techniques is provided in Section 3. Finally, we conclude in the last section.

2. LITERATURE REVIEW

Zavattaro et al. [2015] state that only measuring the positive and negative tones do not encompass real essence of the sentiment. There should be a neutral or negative tone for sentiment

analysis for marking the tweets. Objective of this study was to identify whether sentiments can affect participation of citizens in political events through social media. The authors designed a framework which evaluates the sentiments with the help of machine learning techniques. The proposed framework uses three metrics namely transparency, participation and collaboration to assess use of social media within the government agencies. The proposed framework is based on interviews with directors of social media in the United States department. In addition, this framework also introduces a system called SMTAS (Social Media Analysis and Tracking System) which aims at finding the level of sentiments. In this study, two algorithms for sentiment analysis are used to codify sentiments of the tweets. Using randomly selected 125 US urban communities, the study finds that positive sentiment might create affiliation with government. The findings further show that government agencies generally use neutral tone on social media.

Mohammad et al. [2015] describe the procedure to annotate large set of tweets and analyze the sentiments. Based on the tweets pertaining to 2012 presidential elections in the United States, the study explores various attributes relating to sentiments, emotions, purpose, and style through crowd sourcing. More than one hundred thousand crowd source reactions were observed for thirteen survey questions on sentiment, style, and purpose. The study automatically analyzes the electoral tweets with respect to sentiment, emotions and purpose through questionnaire analyses. Authors in this study, examine electoral tweets to articulate the information more precisely such as sentiment, purpose and style. The study obtained over 100,000 responses from 3000 annotators and automatically identified emotions (positive or negative) in political tweets.

Stieglitz and Dang-Xuan [2013] examine the emotion diffusion role in social media and addresses the impact of emotions with respect to velocity and volume of information sharing. The study used a tool "SentiStrength" to break down the level of estimations in politically significant tweets. SentiStrength uses a human-outlined vocabulary of passionate terms with phonetic rules for refutations, promoter words, enhancements and emotions. The study is the first of its kind to consider the aspect of diffusion in a social media milieu by examining user's information sharing behavior.

Ceron et al. [2014], the tweet and other Internet content are not sufficient for analyzing sentiments. The study performs a comparison of field survey results and the online sentimental analysis. The authors performed sentiment analysis for Italian political situation in 2011 and French presidential elections in 2012. The study obtained an estimate of frequency distribution of opinions relating to the above mentioned political scenarios using Hopkins and King strategy for sentiment analysis which is a two-stage process. The first step codes tweets/blogs downloaded from Internet. In the second step, the measured calculations obtained through Hopkins and King strategy is stretched out to the whole population of tweets/posts by taking into account the suppositions communicated on the web. The study concludes that online networking analysis should supplement to the traditional offline surveys.

Ceron et al. [2014] state the difficulties to establish genuine importance of text evaluation due to the fact that political talks usually bear dual meanings, humor and sarcasm. The study discusses the effectiveness of results obtained from sentiment analysis of electoral campaigns pertaining to United States and Italy using Hopkins and King technique. The significance of the study is that it emphasizes the worth of sentiment analysis to influence public opinion on some political issue during a political campaign.

Taddy [2013] states that text based sentiment analysis is a challenging task in political events. The study employs sentiment scoring to analyze whether the posts are positive, neutral and negative. The study employs political tweet contextual investigation and examination through inverse regression. Text data are based on counts of phrase occurrences for every document. These phrases use multinomial inverse regression (MNIR) to estimate how multinomial distribution on text counts changes with sentiments.

Burnap et al. [2016] consider that a pre-election forecast through sentiment analysis is a major issue observed nowadays. However, the biasness and inclination of users towards certain political

party or group pose a challenge to analyze sentiments. The objective of the study is to use the Twitter for predicting election results in the environment of multi-parties based elections. The study assume that joint sentiment analysis and prior party support can be helpful to produce a genuine forecast of parliament seat allocations. After gathering the Tweets, authors performed online sentiment analysis by using software developed by The lwall which assign +5 and -5 score to positive and negative tweets respectively. Authors initially counted sentiment scores for every tweet and make a list of tweets having the same scores. Objective behind calculating all the tweets was to record various levels of sentiments. Forecast of electoral tweets through the proposed approach was significant as it precisely made predictions about the results of electoral campaign in UK.

Hu et al. [2013] classify main themes of tweets related to political events and find degree of praise and criticism in these tweets. The study employs two-stride approach by splitting the entire events into several time windows use time window to extract the events themes with respect to sentiments described in the tweets. The study introduces a framework called SOCSENT to generate various factors of segments themes and sentiments.

Groshek and Al-Rawi [2013] argue that genuine substance of online networking is tremendous but, to some extent, remains undefined and understudied element. This study inspects conclusion defined in the huge number of online networking posts on Facebook pertaining to Mitt Romney and Barack Obama as well as #election2012 hash-tag on Twitter. The study presents various theories to understand the nature of online networking content and the opinion it passed on for the US elections of 2012. Textual content were imported to a database and were analyzed using WordStat a flexible and easy-to-use text analysis software. The proposed system made it plausible to track not just the most widely recognized watchwords, terms, and expressions but also facilitated to gauge the measurable separations among the specific subjects. The study successfully drew comparisons for various keywords to analyze and forecast results of the presidential election.

Jahanbakhsh and Moon [2014] analyzed 32 million tweets related to the US presidential elections by using a blend of machine learning methods. The study objective was to extract unseen subjects discussed on Twitter by mining substantial amount of irregular specimen of tweets. The study employed an assortment of machine learning and natural language processing (ML-NLP) techniques and implemented it in Java language. The ML-NLP engine accessed MySQL database through the Hibernate Object-relational Mapping to convert data between relational databases and object oriented programming languages such as Java language. This approach helps to run experiments through REST API. The ML-NLP engine comprised four segments: statistical component to process essential measurement, text analysis for running fundamental content examinations, Naive Bayes classifier for assessment of the investigation, and LDA (Linear discriminant analysis) for pattern recognition. The main contribution of the study is that the ML-NLP engine helped run content examination on a large number of tweets.

Nooralahzadeh et al. [2013] investigated how online networking posts and tweets affect the natural process of elections. The study compared the nature of social media campaigns before and after the presidential elections in the US and France in 2012. The study discovered common words used in the tweets for both the elections by applying two types of analysis Word Cloud and Hash Tag Analysis. Using data mining and NLP techniques, the study discovered sentiments for each presidential candidate and performed histogram and time series analysis to extract meaningful statistics and pertinent characteristics of data. The histogram analysis shows symmetry, trends and gap among sentiment for each candidate.

Shi et al. [2012] examine how we can use Twitter to forecast general assessment about an issue. For this purpose, the study analyzed large number of tweets related to American republican presidential decision results. The study used document-oriented database MongoDB to store the tweets. The sentiment analysis obtained through tweets was compared against the survey results published on Real Clear Politics website. They study concludes that Real Clear Politics results

were in conformance with the results obtained through analysis of the tweets. In this study, the authors build a linear regression model to make forecast based on the sentimental analysis.

Lida Kermanidis and Maragoudakis [2013] focused on establishing linkage between decline in the national spending and the unemployment rates. The study processed tweets pertaining to political affairs in Greece particularly the general parliamentary elections of Greece in May 2012. The principle objective of the study was to examine the level of agreement between web-based and real world political opinions. The authors used names of the most prominent party pioneers and leaders to form keywords for accumulating tweets. Based on this approach, the occurrence of keywords in each tweet was determined. Tweets which were neither negative nor positive were considered as nonpartisan. This study also analyzed post-election tweets and investigated the effect of the election results on web-based sentiments as well as the sentiment drift caused due to the major political occasion, i.e., the elections.

Ullah et al. [2015] describe that during the election time numerous politicians tap the continuous flow of information and exploit it for their personal gains. This study explored how twitter information influenced Pakistan local government elections in the capital Islamabad. The tweets were characterized into subjective tweets and objective tweets. Subjective tweets were further characterized into positive, negative and impartial tweets. Tweets were then classified into individual groups based on the party names, their leaders some other pertinent information in the tweets such as party slogans and mottoes.

Maynard and Funk [2012] examine variety of issues linked with sentiment analysis of micro-posts, and the difficulties they pose on NLP framework. This study built an underlying application for sentiment analysis using GATE an open source software capable of text processing as well as creating robust and maintainable text processing workflows for dialect handling. The study employed a corpus of political tweets gathered for UK pre-election period in 2010. The Twitter Streaming API was used to acquire tweets for this period. Further, etymological pre-processing e.g., tokenization, grammatical form labeling and morphological examination were carried out. The study also applied ANNIE, the default named entity recognition system accessible as a component of GATE, to recognize named elements in the web content.

3. CRITICAL EVALUATION

In this section, we present a critical analysis of different sentiment analysis techniques studied and discussed in the previous section.

Table I: Critical Evaluation Table

Ref#	Focused Area	Technique Used	Algorithm /Tool(s) Used	Number of Tweets	Country/ Area	Validation Parameters
Zavattaro et al. [2015]	Identification of types of tone for sentiment analysis	SMTAS	Sentiment classification using machine learning model	17,222	US Local Govt.	Accuracy
Mohammad et al. [2015]	Annotate tweets to analyze sentiments	Crowd Sourcing	Questionnaire analysis	100,000	United States	Accuracy
Stieglitz and Dang-Xuan [2013]	Establishing relationship between emotions and information dissemination	Indigenous approach	SentiStrength	165,000	Germany	Effectiveness

Ceron et al. [2014]	Comparison of survey results and online sentiment analysis	Hopkins and King	Questionnaire based approach	107,000 (Italy) 244,000 (French presidential ballot) 79.300 (French general elections)	Italy and France	Exactness
Ceron et al. [2014]	Perform sentiment analysis pertaining to electoral campaigns	Hopkins and King	-	500,000 (for Italy)	US and Italy	Effectiveness
Taddy [2013]	Analyzing sentiments by scoring positive, negative and neutral posts	MNIR	D-optimal	2.1 million	Unites States	Efficiency
Burnap et al. [2016]	To forecast pre-election results	Indigenous approach	Twitter	13,899,073	UK	Accuracy
Hu et al. [2013]	Identifying themes from political events and identify degree of praise and criticism	SOCSSENT	Sentiment lexicon	181,568 (US presidential debate) 25,921 (Obamas middle east speech)	Unites States	-
Groshek and Al-Rawi [2013]	Analyzing Internet campaigns	Jaccard's co-efficient	Content based assumption, WordStat Questionnaire	923611	Unites States	-
Jahanbakhsh and Moon [2014]	Analyzing tweets to predict sentiments	ML-NLP	LDA	32 million	Unites States	Accuracy
Nooralahzadeh et al. [2013]	Comparing US and France presidential election to discover similarity	NLP and Data Mining Strategies	-	196,000 (US) 10000 (France)	Unites States & France	-
Shi et al. [2012]	Forecast popularity of candidates by comparing tweets and traditional opinion polls	Linear Regression Model	Location Recovery Algorithm & Scoring Model/RCP	10 million	Unites States	-
Lida Keramidis and Maragoudakis [2013]	Analyze political tweets to relate it to the real political opinion	Tokenization	-	57424	Greece	-
Ullah et al. [2015]	Determining local Govt. elections in Islamabad	NER	-	2588	Pakistan	Accuracy
Maynard and Funk [2012]	Sentiment analysis based on emotions	GATE	-	4 million	UK	Precision

4. CONCLUSION

Evaluation of sentiment analysis strategies play an essential role in the areas of data mining, marketing, customer services, Natural Language Processing, computational linguistics, text analysis and trend analysis. This study aims at actualizing a new crossover system as an operational strategy that focuses on strengths and weaknesses of various sentiment analysis techniques. Such an hybrid system is envisaged to facilitate sentiment analysis in an efficient manner.

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