Sarcasm Analysis Using Social Media: A Literature Review

Shagufta Masroor[1], Dr. Mohd. Shahid Husain[2]
[1,2]Integral University, Lucknow, INDIA

ABSTRACT

An expression of resentment, criticism, and mockery by using harsh words that intended to offend someone or something can be called Sarcasm statements. It is one of the most difficult problems faced by authors while doing sentiment analysis. The most difficult sentences are those whose literal meaning differs from the emotion of the concerned individual.

Sarcastic comments can be done vocally as well; the work is done under Audio mining Techniques. In studying social media websites, Twitter comes up as a core site for all types of users. The sentiments of these people are studied in order to extract the real emotions from their non-sarcastic as well as sarcastic tweets. Since this is a survey paper, we are trying our best to show up the valuable work of various authors who have invested their time in studying the sentiments of different people and their sarcastic comments.

Keywords-: Sarcasm Detection, Twitter, Tweets, sentiment analysis, Hashtags

I. INTRODUCTION

Sarcasm is a type of emotion which people share with each other and whose literal meaning differs from the actual meaning. If people make sarcastic comments openly in front of one another, it can be easily understood and evaluated, but digitally recognizing the actual meaning of the context is quite a difficult task. As social media is a free platform available for everyone to express their true emotions, they feel and write their thoughts in the best possible way. Example: "Nothing I love more than a crowded library with no vacant seats" :-) #sarcasm. Here the example has no negative word yet the feelings of the person are captured correctly by everyone except the digitally which will convey the literal meaning of the sentence. In this example, people use to express the positive sentiment (love) but overall tweet reflects negative sentiment toward the library.

Definition of sarcasm is defined differently in different dictionaries, Macmillan English dictionary, defines sarcasm as "the act of saying or writing the opposite of what you mean, or of speaking in a way intended to make someone else feel stupid or show them that you are angry" [16], The Random House dictionary [17], defines sarcasm as "a harsh or bitter derision or irony" or "a sharply ironical taunt; sneering or cutting remark". The Collins English dictionary [18] states it as "mocking, contemptuous, or ironic language intended to convey insults or scorn". There are many definitions of sarcasm defined in different dictionaries, including Merriam-Webster dictionary, [19] which define sarcasm as "a mode of satirical wit depending for its effect on bitter, caustic, and often ironic language that is usually directed against an individual". Also, there are various approaches which are being used in recognizing sarcasm. Such as various researchers used behavioral modeling approach [4], pattern-based approach [12], rule-based approach [13] etc. sarcasm detection dataset used in the research papers varies and includes Facebook, Twitter, Blogs, movie reviews, feedbacks by customers, etc. and types of techniques used includes machine learning [1], [2], [6], [5], supervised learning [7] etc.

In this paper, we discuss the sarcasm detection mechanism proposed by different researchers. The rest of the paper is organized as follows: in Section II, related work is presented. Types of sarcasm are given in Section III. Feature set analysis is discussed in Section IV. Various approaches for sarcasm detection are given in Section V. Comparative table of some research papers is given in Section VI.. Finally, in Section VII, we conclude with some final remarks and present some future works.

II. TYPES OF SARCASM

The study of work done by the researchers in this domain reflects that there are different categories of sarcastic comments. The types of sarcasm being studied by

researchers are based on distinct features and structure of the text.

Reganti *et al* [10] have discussed four types of satire that are present in the English language that are:

Exaggeration: It is to enlarge, accentuate or portray something beyond mundane limits so as to highlight faults, e.g.: "I'm super exhilarated today!! So much that I'd kill myself"

- **Incongruity:**

It signifies to present things that are malapropos or preposterous in cognation to its circumventions, e.g.: "The back camera of the phone is so good that I can capture every atom of scenery".

- **Reversal:**

Which is presenting diametrical to what is to authentically convey by the user, e.g.: "I'm profoundly disappointed. Not as expected! It's just astounding how the flash works!"

- **Parody:**

Which is to imitate the demeanor/slang and/or style of some person, place or thing.

Jena *et al* [2] defines Six types of sarcasm which are discussed that occur in the text-

T1- Contrasting comments between positive view and negative view.

T2- Contrasting comments between negative view and positive view.

T3- Fact Negation – i.e. text contradicting a fact.

T4- Likes and Dislikes Prediction – i.e. behavior based.

T5- Lexical Analysis – i.e. sarcasm hashtag based.

T6- Temporal Knowledge i.e. Extracting tweets contradicting facts about the event.

Liu *et al* [4] introduced the concept of Sarcasm which is discussed below-

- Contrast of various sentiments
- A complex form of expression
- Means of assigning emotion
- Possible function of ease
- A form of written manifestation

- **Sarcasm as a contrast of various sentiments**
1. **Contrasting connotations**

A mundane denotes of expressing mordancy is to utilize words with distinct construals within the same tweet. In the example, I dote getting spam emails!, spam conspicuously has a negative connotation while love is Overwhelmingly positive and to model such occurrences, they construct features predicated on affect and sentiment scores.

2. **Contrasting present with the past**

Sometimes, the utilizer may set up a contrasting context in his antecedent tweet and then, opt to utilize a mordacious verbalization in his current tweet. To model such demeanor, they obtain the sentiment expressed by the utilizer (i.e., positive, negative, neutral) in the antecedent tweet and the current tweet. Then, the type of sentiment transition

taking place from the last tweet is included in the current tweet (for eg, positive ! Negative, negative! Positive) as a feature (1 feature).Sarcasm as a complex form of expression Readability

As sarcasm is widely standardized to be hard to read and understand, the author adapts identical readability tests to measure the degree of complexity and understandability of the tweet.

- **Sarcasm as a means of assigning emotion**
1. **Mood**

Mood represents the utilizer's state of emotion. Naturally, the mood of the individual may be indicative of his propensity to utilize mordancy; if the utilizer is in a deplorable (negative) mood, he could opt to express it in the form of a sarcastic tweet. Consequently, his mood is judged utilizing sentiment expressed in his past tweets... They captured the mood utilizing last tweets.

2. **Affect and sentiment**

Sarcasm is a coalescence of affect and sentiment expression, and consequently, the effect and the sentiment expressed in mordant tweets are examined.

- **Sarcasm as the possible function of ease**
1. **Familiarity with the language**

Naturally, one would expect a utilizer who utilizes a form of language as intricate as sarcasm to have good command over the language. Consequently, the author measures the utilizer's language skills with features that are inspired by standardized language proficiency Cloze tests. In cloze tests, proficiency is evaluated predicated on lexicon, grammar, dictation, and reading levels.

2. **Familiarity with the environment**

The users can express sarcasm better when they are well acquainted with their environment. Just like people are less liable to utilize sarcasm in an incipient, unfamiliar setting, users take time to get habituated with Twitter afore posting mordant tweets. Author measure a utilizer's familiarity with Twitter in terms of his utilization familiarity, parlance familiarity, and convivial activity.

- **Sarcasm as a form of written manifestation**
1. **Prosodic variations**

The users often reiterate letters in words to stress and over accentuate certain components of the tweet (for example, sooooo, awesomeeee) to denote that they mean diametrical to what is indited.

2. **Structural variations**

It is observed that mordant tweets sometimes have a certain construction wherein the commentor's views are verbalized in the first few words of the tweet, while in the later components, an explication of a particular scenario is put forth, e.g., I dote it when my friends ignore me.

III.   FEATURE EXTRACTION PROCESSES

To analyze the sarcasm in texts posted on social media, researchers suggested different features which can be used to distinguish the sarcastic comments from normal text.

Lunando et al[5] have given several features which are taken from the pre-processed text which are Unigram(According to the author unigram is more suitable for Indonesian social media text since the grammars used in Indonesian social media texts are various and informal.), Negativity (This feature represents the percentage of the negative sentiment in the topic of the text message.) ,Number of interjection words (This feature shows the number of interjection words from the text such as "aha", "bah", "nah", "wew", "wow", "yay", "uh", etc.).

Bouazizi et al [3] extract 2 sets of features: one qualified as "non-textual"(Non-textual features: From the "raw" tweets we first extract 6 features by counting the number of positive and negative Hashtags, that of positive and negative Emoticons, and that of positive and negative slang words.) and one qualified as "textual"(the tag "NOT " (e.g., "not", "never", etc.) , positive words such as love, happy, and negative emotional content such as hate, sad etc.), Jena et al [2] used these features, lexical, pragmatics and hyperbole features to recognize sarcasm in text and also discussed the role of different lexical factors, such as lexical feature includes text properties such as uni-gram, bi-gram, tri-gram, and n-gram.

Chao et al[1] worked on various types of features such as age, no. of followers, following/friends, favorites, lists, tweets sent, retweets done by n twitter users, hashtags included, user mentions included, URLs included, no. of characters and no. of digits in a particular tweet also they broadly classified into two categories i.e. user based feature

and tweet based feature. However exclaimed on some other particular type of social graph-based features such as local clustering coefficient, between centrality, and distance, according to them it is not possible for now. Tayal et al [7] worked on features such as used punctuation marks! ,? Characters in the sentence, #sarcasm tag and #irony, emoticons and adjective and verb in conjunction with ! on Twitter. Along with these, they also considered emoticons with verbs and adjectives since the mere use of emoticons like ":P" and ";)". According to the author the emoticons can also be used for humor sentiment analysis.

Liu et al[4] obtained a set of sarcastic tweets using keywords #sarcasm and #not, altering out non-English tweets and retweets they limited their analysis to tweets which contain more than three words as they found that tweets with fewer words were very noisy or clichéd (e.g., yeah, right! #sarcasm). Along with these various kinds of features, Rosso et al[6] focused on various tweets which have #irony , not, and #sarcasm words in their context. The main concern of the author is to differentiate the ironic tweets from sarcastic ones.

IV.   VARIOUS APPROACHES FOR SARCASM ANALYSIS

A. *Time-Based Approach-*

This is an approach which chao et al [1] used in order to predict the behavior of the sarcastic tweets done before and after a certain fixed time and studied the behavior.

B. *Classification Based Approach-*

This approach is commonly used to identify the target word or sentence as sarcastic or literal. Different classifiers mainly machine learning classifiers such as SVM, Naïve Bayes, Maximum entropy, etc. are used, Authors [3], [5], [6] who are using this classification approach.

Table I Different Features extracted in some papers-

Sr. No.	Author	Types of features being worked on
1.	Lunando et al [5]	Unigram, Negativity, No. of interjection words.
2.	bouazizi et al [3]	Non textual(positive and negative (Hashtags, emoticons, slang words)), textual(the tag "NOT " (e.g., "not", "never", etc.) , positive words such as love, happy, and negative emotional content such as hate, sad etc.)
3.	Jena et al [2]	lexical, pragmatics and hyperbole
4.	Chao et al [1]	age, no. of followers, following/friends, favorites, lists, tweets sent, retweets done by n twitter users, hashtags included, user mentions included, URLs included, no. of characters and no. of digits in a particular Tweet

5.	Tayal et al[7]	Used punctuation marks ! , ? , Characters in the sentence, #sarcasm tag and #irony, emoticons and adjective and verb in conjunction with ! in Twitter
6.	Liu et al[4]	a set of sarcastic tweets using keywords #sarcasm and #not
7.	Rosso et al[6]	#irony ,not, and #sarcasm

Table II Glimpse of Algorithms and Techniques used for classification of tweets-

Author	Classification Technique/Algorithm used
Lunando et al[5]	Naïve Bayes, Maximum Entropy, and Support Vector Machine.
Bouazizi et al[3]	Naive Bayes, Support Vector Machine (SVM), and Maximum Entropy classifiers.
Jena et al[2]	PBLGA(Parsing Based Lexicon Generation Algorithm),
Chao et al[1]	Trend Micro's WRS, manual inspection.
Liu et al[4]	SCUBA, Random Classifier, Majority Classifier, n-gram classifier.

Table III. Comparative analysis of some research papers mentioned.

Author	Approach used	problem solved	Tools used	Advantages
Chao et al	Machine Learning	Detection of Spam Tweets	Trend Micro's Web Reputation System	Found that classifiers' ability to detect Twitter spam reduced when in a near real-world scenario since the imbalanced data has brought bias.
Jena et al	Natural Language Processing	Sarcasm Detection in Tweets	TEXTBLOB(python based package)	Achieved 0.89, 0.81 and 0.84 precision, recall and f score ,respectively in tweets with sarcastic hashtag and 0.64, 0.75 and 0.69 precision, recall and f score respectively in tweets without sarcastic hashtag.
Liu et al	Streaming API, Behavioral	Sarcasm Detection	SCUBA (n-gram, behavioral	Using SCUBA, social media

	Modeling, Approaches- - Contrast - Hybrid		modeling Augmented Framework)	teams can better detect sarcasm and deliver appropriate responses to sarcastic tweets.
Rosso et Al	Machine Learning	Differentiation between Irony and Sarcasm Tweets	N-grams, TwitIE uses Penn Treebank Project tagset.	Such Linguistic Analysis of not involving automatic techniques is a crucial step in works that deals with distinguishing between irony and sarcasm.
Lunando et al	Machine Learning	Indonesian Sarcasm and sentiment analysis	SentiWordNet(Unigram Feature extraction Component)	By using the sentiment score, the accuracy of the general sentiment analysis is improved for about 4%.And then, the result shown that the negativity feature for detecting sarcasm are quite effective since it increased the accuracy by 6%.
Bouazizi et al	Machine Learning	Effect of Sarcastic tweets on sentiment analysis	Key Performance Indicator(KPI)	The accuracy of negative tweets increases after adding Sarcasm Related feature.
Tayal et al	Supervised Learning	Detection of polarity of sarcastic Political Tweets	Supervised Learning	By Using a supervised approach we can determine the polarity and predict results.

V. CONCLUSION AND FUTURE WORK

In this paper we did a detailed study of sarcasm detection from various Research papers, we found that the data set selected by them varies in each research. Giving the possibility to focus more on a different data set and gives a great opportunity in data mining field. Secondly, we have discussed various techniques to carry out sarcasm analysis on Twitter data including Naïve Bayes, Maximum Entropy, and Support Vector Machine, PBLGA (Parsing Based Lexicon Generation Algorithm), SCUBA, Trend Micros WRS, manual inspection etc. It has been found that various techniques applied for sarcasm analysis are domain and language specific.

Taking a finite data set and perform sarcasm detection analysis is one of the limitation found, and work on dynamic data should be focused in future also we found that the sarcasm detection does not limit till text mining but other areas can also be focused on such as Audio mining, video mining and recognition etc. and work in this field can be focused further.

REFERENCES

[1] Chao chen, et al," A Performance Evaluation of Machine Learning Bsed Streaming SpamTweets Detection" IEEE Transactions on Computational Social Systems Vol. 2, no. 3 pp: 65 – 76, 2015.

[2] Santosh Kumar Bharti; Korra Sathya Babu; Sanjay Kumar Jena,"Parsing- based sarcasm sentiment recognition in Twitter data" IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM) pp: 1373 – 1380; 2015

[3] Mondher Bouazizi; Tomoaki Ohtsuki, "Opinion mining in Twitter: How to make use of sarcasm to enhance sentiment analysis"in 2015 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM) pp. 1594 – 1597, 2015

[4] Ashwin Rajadesingan, Reza Zafarani, Huan Liu,"Sarcasm Detection on Twitter: A Behavioral Modelling Approach", Proceedings of the Eighth ACM International Conference on Web Search and Data Mining, pp. 97-106, ACM,2015

[5]Edwin Lunando; Ayu Purwarianti," Indonesian soci al media sentiment analysis with sarcasm detection", I nternational Conference on Advanced Computer Science and Information Systems (ICACSIS),pp: 195 – 198 IEEE, 2013.

[6] Maria Khokhlova; Viviana Patti; Paolo Rosso," Disti nguishing between irony and sarcasm in social media texts: Linguistic observations"In 2016 International FRUCT Conference on Intelligence, Social Media and Web (ISMW FRUCT)pp. 1 – 6, IEEE publications, 2016

[7] D. K. Tayal; Sumit Yadav; Komal Gupta; Bhawna Rajput; Kiran Kumari," Polarity detection of sarcastic political tweets" International Conference on Computing for Sustainabl Global Development (INDIACom),pp: 625 – 628, 2014 ,IEEE

[8] DanaAl-Ghadhban; Eman Alnkhilan; LammaTatwany; Muna Alrazgan," Arabic sarcasm detection in Twitter", 2017 International Conference on Engineering & MIS (ICEMIS), pp.1-7, 2017, IEEE

[9] Anand kumar D. Dave; Nikita P. Desai," A comprehensive study of classification techniques for sarcasmdetection on textual data", 2016 International Conference on Electrical, Electronics, and Optimization Techniques (ICEEOT),pp, 1985 – 1991, 2016,IEEE

[10] Aishwary N. Reganti; Tushar Maheshwari; Upendra Kumar; Amitava Das; Rajiv Bajpai," Modeling Satire in English Text for Automatic Detection". 2016 IEEE 16th International Conference on Data Mining Workshops (ICDMW),pp.970 – 977,2016,IEEE

[11] Mohd Suhairi Md Suhaimin; Mohd Hanafi Ahmad Hijazi; Rayner Alfred; Frans Coenen," Natural language processing based features for sarcasm detection: An investigation using bilingual social media texts", 2017 8th International Conference on Information Technology (ICIT),pp. 703-709 IEEE.

[12] Mondher Bouazizi; Tomoaki Otsuki Ohtsuki," A Pattern-Based Approach for Sarcasm Detection on Twitter", IEEE Access, , Vol: 4, pp. 5477 - 5488 ,IEEE Journals & Magazines, 2016

[13] Satoshi Hiai; Kazutaka Shimada," A Sarcasm Extraction Method Based on Patterns of EvaluationExpressions", 2016 5th IIAI International Congress on Advanced Applied Informatics (IIAI-AAI), pp. 31 – 36,2016

[14] Anukarsh,G.Prasad; S.Sanjana; Skanda, M. Bhat; B.S.Harish," Sentiment analysis for sarcasm detection on streaming short text data", 2017 2nd International Conference on Knowledge Engineering and Applications (ICKEA), pp.1-5, IEEE publications, 2017

[15] Abhinav Mathur; Vikas Saxena; Sandeep K Singh," Und erstanding sarcasm in speech using mel-frequency cepstral coefficent" 2017 7th International Conference on Cloud Computing, Data Science & Engineering-Confluence, pp 728-732,IEEE Publications, 2017

[16] http://www.macmillandictionary.com/.

[17] http://www.thefreedictionary.com/.

[18] http://www.collinsdictionary.com/.

[19] http://www.merriam-webster.com/.