A Study on Sarcasm Detection Algorithms

Lohita Sivaprakasam
SSN College of Engineering
Aarthe Jayaprakash
SSN College of Engineering

ABSTRACT

Sarcasm detection refers to the identification of the use of sarcasm- a humorous literary device in text. The use of sarcasm can be misleading and often hinders accurate comprehension of sentences. This paper aims at presenting the challenges in detection and ideas inculcated in existing literature to overcome these challenges. This study reveals that sarcasm detection is an entity of ongoing research and that more novel techniques are required to improve its efficiency.

INTRODUCTION

According to Cambridge's dictionary, the term "sarcasm" means - the use of remarks that clearly mean the opposite of what they say, made in order to hurt someone's feelings or to criticize someone/something in a humorous way. Sarcasm detection is the process of identifying whether a given piece of text is to be comprehended using its literal meaning, or as its opposite meaning. If a piece of text is to be comprehended opposite to its literal meaning, then it contains sarcasm.

CHALLENGES FACED

Natural Language Processing systems such as Online customer review summarization systems, dialogue systems or monitoring systems for brands face difficulty in identifying sarcasm. Typical Sentimental Analysis Systems do not support sarcasm detection. The results obtained from Sentimental analysis may provide a result opposite to what was intended. This adversely affects businesses employing this technology.

Datasets used to perform sarcasm detection are usually derived from online review sites, social media posts and comments and micro-blogging sites. The structure of these sentences isn't clearly defined, and they are short in nature, thus leading to ambiguity.

Apart from these issues, there exist certain specific challenges in sarcasm detection as follows.

• The datasets used for the detection process pose a problem due to the ambiguity and unnecessary plethora of details mentioned in the text. It is quite tough to extract useful information from the huge volumes of crude data.

• It is an easier task to detect whether a person is using sarcasm in speech. The use of sarcasm can be detected from the tone of speech, body language and facial expressions.

However, identifying sarcasm from a piece of text poses certain difficulties for many Natural Language Processing Systems..

• Sarcasm detection demands certain prerequisites such as being well informed regarding the current issues and trends. e.g. "Yet, another mind boggling performance by the Australian cricket team in England."

• Sarcasm detection, at times, requires the use of common sensical knowledge

• Sometimes sarcasm uses the hyperbole. Hyperbole is the use of exaggeration i.e. use of words belonging to superlative degree. Eg. "They ran like greased lightning."
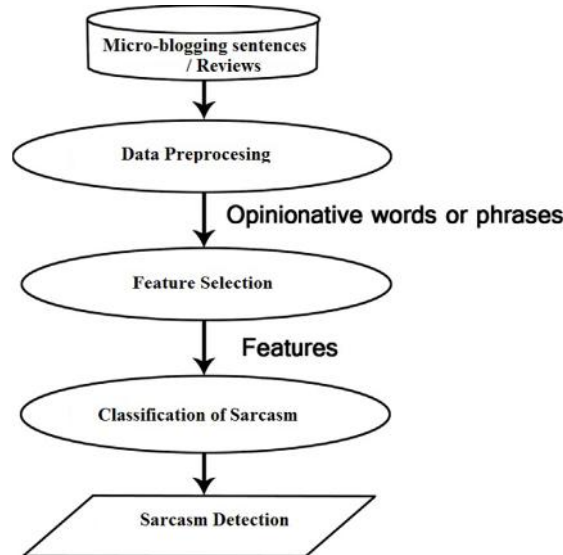
PHASES OF SARCASM DETECTION

Fig 1: Phases In The Sarcasm Detection Process

The entire process includes following steps:

1)Dataset Formation: Collecting dataset from various data sources.

  For example, from tweets on twitter or posts from facebook.

2) Data Pre-processing: It is the refinement of crude data into a crisp, shorter form such that it is suitable for performing sarcasm detection. This process involves elimination of irrelevant symbols and data such as URLs, hashtags and tags of the form @user.

3) Sarcasm Identification:

The techniques commonly used are:

• Lexical analyser can be used to extract useful information from popular phrases containing hashtags, tags using '@' and other short hand notations.

• Fuzzy techniques can be incorporated to predict the polarity of statements.

• Detection of sarcasm in tweets conveying the opposite of real-world facts using Fact Negation.

There are two sub-phases in Sarcasm Identification.They are
1.   Feature extraction phase
2.   Feature selection phase

1. Feature extraction: The process involves extracting the features listed below:

a. Term presence, Term Frequency, Inverse Document Frequency:

   The term presence determines whether a term is present in the document and the term frequency denotes the number of times a particular term has occurred in the document. Inverse document frequency determines the importance of the term under consideration. This is done by allocating weights for the desired terms.

b. Part of Speech (POS): POS defines the structural role that the term holds in the document ie. whether the term behaves as a noun, verb, adverb, etc.

c. Opinion expressions: The keywords and phrases that represent the opinions voiced in the text are termed as opinion expressions.

d. Negation: The meaning of the term is reversed by means of negation.

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Sarcasm can play different roles when used in text.

These roles mainly being:

a) Wit: when sarcasm is used as wit, it is done so with the intention of being humorous; the writer uses special speech forms, exaggerates, or employs a different tone from what he usually uses. In the case of social networks, tones used in speech are converted into writing using special techniques to emphasize and deemphasize. This degree of emphasis can be attributed by the use of exclamation marks and question

Marks, enclosure in quotes, use of capital letters as well as the use of emoticons.

b) Whimper: when sarcasm is used as a whimper, it is incorporated to portray how angry or irritated the writer is.

By use exaggeration or hyperbole, or by employing very positive expressions to describe a negative situation, the writer's emotion is revealed.

c) Avoidance: when sarcasm is used as an avoidance, it refers to a scenario when the the writer wants to be discreet and deceptive, avoiding revealing sensitive information. Such a writer can make use of sarcasm. The writer can use complex sentences and unusual words and expressions.

2. Feature Selection:

 Feature selection plays an important role in text categorization.

 The feature selection methods are:

a.   Lexicon method- This method involves computing the sentiment based on the semantics of the term in consideration.

b.   Statistical method- This method can be enforced by using various techniques, one being Point wise mutual information. The probability of events t and c occurring together and the probabilities of t and c occurring independently are compared. If there is a correlation between t and c, then the joint probability $P(t,c)$ of events t and c will be much larger than the product of their individual probabilities i.e. $P(t) P(c)$.

 In the context of reviews, sarcastic sentences are greater in number in negative reviews than positive reviews. This fact denotes that the detection of sarcastic sentences lead to the improvement of sentiment analysis, namely positive-negative identification, because conventional PN identification methods without sarcastic detection can not recognize the polarity of the reviews correctly. This result shows a significance of sarcasm extraction even if the number of sarcastic sentences in reviews is small.

ANALYSIS OF DETECTION ALGORITHMS

Sarcasm can be used in 2 forms in tweets. One form being, the contradiction of a negative sentiment in a positive scenario and the other being, the contradiction of a positive sentiment in a negative scenario.

Lexicon based approach: A parsing based lexical generation algorithm is used to perform sarcasm identification from tweets on Twitter [1]. Lexicon-based Approach relies on a sentiment lexicon, a collection of known and precompiled sentiment terms. The lexicon-based approach depends on finding the opinion lexicon which is used to analyze the text.

An interjection is one of the eight major parts of speech, along with verbs, nouns, pronouns, adjectives, adverbs, prepositions and conjunctions.It is a word solely designed to convey emotion. It simply conveys to the reader the way the author is feeling. An Interjection Word Start algorithm identifies the use of sarcasm in tweets containing interjections, such as- hurray, oh, boo, yay, yuck, etc.

Mondher Bouazizi at.al [2] devised an approach to identify the degree of sarcasm found in tweets. Four sets of patterns, namely sentiment-related features, punctuation related features, syntactic features and pattern features are extracted using Part of Speech tags. It is followed by the computation of Key Performance Indicators (KPIs) namely, accuracy, precision and recall. It is observed that the precision factor is remarkably high for sentiment-related features.

Support Vector Machine: Roberto González et al [3], Ellen Riloff et al. [5] and Ashwin Rajadesingan et al. [6] have performed sarcasm detection by means of the SVM technique. In order to differentiate between the

classes, the data points undergo a linear separation in the search space. This type of linear classifiers is termed as Support Vector Machine(SVM). SVM classifier is an efficient tool for textual form of data due to its sparse nature.

SVM has been used in collaboration with sequential minimal optimization, balanced winnow classifier, and Weighted nearest neighbour classification for the detection of sarcastic comments by the authors of [4],[5] and [6].

Dictionary based approach: Ashwin Rajadesingan et al. [6] performed sarcasm detection by making use of the Dictionary based approach. It is a lexicon based approach in which the list of opinion words generally used to express sarcasm are collected from common knowledge. This set can further be extended by addition of synonyms from repositories such as the Word Net. They have used the dataset provided by Warriner et.al.[35] for computing the word affect score and Sentiment Strength[36] is used for computing word sentiment score.

Corpus based approach: The dictionary based approach falls short of the need to detect sarcastic comments which are dependent on the context used in the particular environment. Ellen Riloff et. al.[7] made use of a corpus based approach to make the classifier learn about positive words and the context in which they appear negative in order to detect the sarcastic sentences. Davidov et al.[6] created datasets of Amazon reviews and Tweets required to train their classifier for sarcasm detection.

Supervised and semi-supervised methods: Davidov et.al.[8] used a supervised type of classifier for sentiment analysis on Twitter data. They used four main types of features for the purpose of classification, namely single word features, n-gram features, pattern features and punctuation features. Davidov et.al.[9] proposed a semi-supervised methodology for identification of sarcastic sentences. The methodology involved a gold sample which consists of tags corresponding to each sentence tagged by three annotators.

D.K.Tayal et.al [10] proposed a five step procedure in order to determine the polarity of the sarcasm found in tweets. The procedure is described below.

1: Split the document with tweets for a particular candidate into sentences.

2: Extract the opinions from each sentence by recognizing the opinion adjectives, emoticons, opinion verb in conjunction with punctuation marks and hash tags.

3: Determine the polarity of each opinion verb and adjectives regarding the political issue using polarity defined in the opinion dictionary.

4: Calculate the overall polarity of each sentence.

5: Calculate the polarity of each document.

COMPARISON OF TECHNIQUES:

The following figure presents the percentage of three major algorithms used for sarcasm detection, namely lexicon-based, machine learning and hybrid approaches. It can be observed that the lexicon-based approach is employed more in sarcasm detection dude to its simplicity even in the case of complex cases. Tsytsarau and Palpanas et. al. [11] have found that majority of the work they devised was using machine learning approach. It can be inferred that there has been an interest shown in recent years towards the machine learning approach. Also, the hybrid methodology is not of frequent use due to its complex nature of computations.
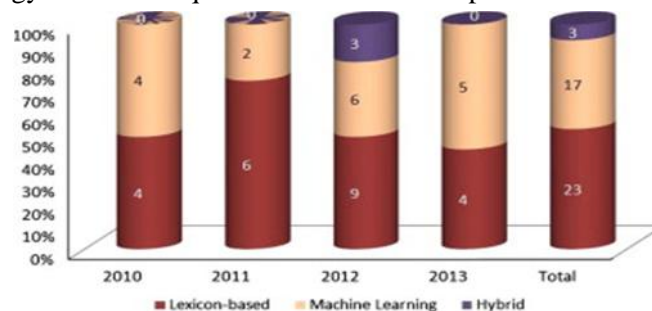

Fig 2: Comparison of Sarcasm Detection Algorithm Types Over the Years

CONCLUSION:

This paper presented the concept of sarcasm detection in sentiment analysis of textual content. It put forward the various challenges pertaining to sarcasm which makes it difficult to detect when compared to other sentiments. It provided a review of the research works published in papers that have proposed techniques to identify sarcasm. In doing so, the aspects achieved so far are elucidated and the shortcomings of certain aspects have also been mentioned. It can be concluded that there is scope for further research and enhancements in the sarcasm detection of textual content.

REFERENCES:

[1] S. K. Bharti, K. S. Babu ve S. K. Jena, "Parsing-based Sarcasm Sentiment Recognition in Twitter Data," in Proceedings of the 2015 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining , Paris, 2015.

[2] Mondher Bouazizi, Tomoaki Ohtsuki, "Sarcasm Detection in Twitter" in Global Communications Conference (GLOBECOM), 2015 IEEE.

[3] González-Ibánez, Roberto, Smaranda Muresan, and Nina Wacholder."Identifying sarcasm in Twitter: a closer look." Proceedings of the 49th Annual Meeting of the Association for Computational Linguistics: Human Language Technologies: short papers-Volume 2. Association for Computational Linguistics, 2011.

[4] Davidov, Dmitry, Oren Tsur, and Ari Rappoport. "Semi-supervised recognition of sarcastic sentences in twitter and amazon." Proceedings of 1990 the Fourteenth Conference on Computational Natural Language Learning. Association for Computational Linguistics, 2010.

[5] Riloff, Ellen, et al. "Sarcasm as Contrast between a Positive Sentiment and Negative Situation." EMNLP. 2013.

[6] Rajadesingan, Ashwin, Reza Zafarani, and Huan Liu. "Sarcasm detection on Twitter: A behavioral modeling approach." Proceedings of the Eighth ACM International Conference on Web Search and Data Mining. ACM, 2015.

[7] Bamman, David, and Noah A. Smith. "Contextualized Sarcasm Detection on Twitter." Ninth International AAAI Conference on Web and Social Media. 2015

[8]. D. Davidov, Dmitry, O. Tsur, A. Rappoport, "Enhanced Sentiment Learning Using Twitter Hashtags and Smileys," in Proc. "23rd International Conf. on Computational Linguistics:Posters", pp. 241–249, 2010.

[9]. D. Davidov, Dmitry, O. Tsur, A. Rappoport, "Semisupervised Recognition of Sarcastic sentences in Twitter and Amazon," in Proc. "14th Conf. on Computational Natural Language Learning", pp. 107116, 2010.

[10] D. K. Tayal, Sumit Yadav, Komal Gupta, Bhawna Rajput, Kiran Kumari, "Polarity Detection of Sarcastic Political Tweets" in 2014 International Conference on Computing for Sustainable Global Development.

[11] Mikalai Tsytsarau, Themis Palpanas, Survey on mining subjective data on the web Data Min Knowl Discov, 24 (2012), pp. 478-514