

A Survey on Sentiment Analysis with Different Classifiers Used For Classification

Kaushar Ansari ¹, Mr. Anshul Sarawagi ²

Research Scholar (CSE Department) ¹, IES College of Technology, Bhopal
 Assistant Professor (CSE Department) ², IES College of Technology, Bhopal
 kausharansari23@gmail.com¹, ANSHULSARAWAGI301@gmail.com²

ABSTRACT - In the natural language processing world, sentiment analysis is considered to be one of the most important analyses. Most the businesses which are having online or offline platform are receiving the sentiments in the form of reviews. The reviews are very much important for the growth of the business because on the basis of reviews we can easily analyze that whether the business will grow or not. The reviews can be related to anything like movie, food service, political parties, online products, etc. But nowadays large amount of data is collected in the form of review itself, so it's become very difficult to analyze these sentiments by the humans alone. To overcome from this problem machine learning algorithms came into existence which are enough capable to analyze the reviews. In this paper we will discuss the some of the machine learning algorithms which are used for the classification of the sentiments. The work will represent the parameters on the basis of which performance of the machine learning algorithms are evaluated.

Keywords: - Naïve Bayes, K- Nearest Neighbor, SVM, TF-IDF, n-grams.

I. INTRODUCTION

Sentiment Analysis is a progressing field of research in data mining field. It is the computational treatment of assessments, suppositions and subjectivity of content [1]. Number of machine learning algorithms are already been developed in the area of sentiment analysis and different Sentiment based applications are examined and exhibited quickly in this survey. These articles are classified by their commitments in the different Sentiment analysis methods. Fields related to machine learning (transfer learning, emotion detection, and building assets) has pulled the researcher in this area. The fundamental objective of this overview is to give almost full picture of Sentiment analysis systems and the related fields with brief analysis. The primary commitments of this paper incorporate the complex orders of an enormous number of ongoing articles and the outline of the ongoing pattern of research in the opinion examination and its related regions. Sentiment analysis is one of the new difficulties showed up in automatic language processing with the advent of social networks.

Exploiting the measure of data is presently accessible, research and industry have looked for approaches to naturally break down Nowadays, social networks have changed the manner in which individuals express their feelings and purposes of view. This facility is given through literary distributions, online discourse locales, item assessment sites and so on. Individuals depend vigorously on this user produced content. Social networks provide extensive measure of substance produced by the client, it is significant substance for investigation and offer more administrations adjusted to the necessities of users. In the recent years there is lot of improvements in the field of data and opinion exchange has launched the research for the sentiments collected through social network. The analyses of sentiments utilizes, in addition to other things, the recognition of assessments on interpersonal organizations, explaining customer conduct, prescribing items and clarifying the result of the decisions. It comprises of scanning for evaluative messages on the Internet, for example, reactions, proposals and examining the sentiments communicated in that in a programmed or manual way, so as to comprehend open opinion.

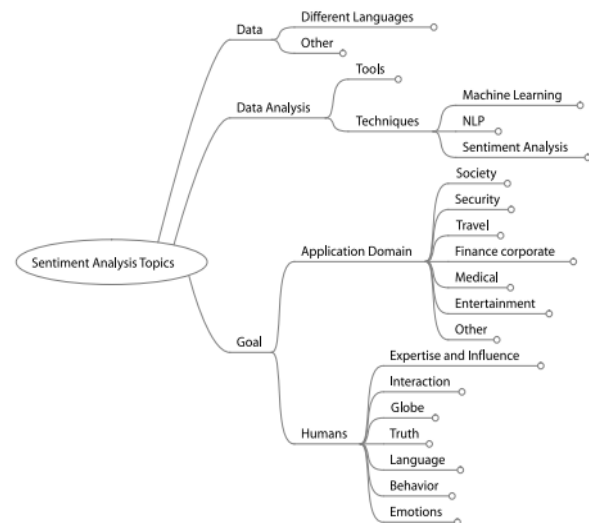


Fig. 1: Various phases in sentiment analysis

A large number of individuals are utilizing Twitter and this has made the most visited websites with an average of 58 million tweets for each day. Although social networks like Facebook, Twitter and Google+ are increasingly associated with many social phenomena such as hate speech, harassment, intimidation, depression or even suicide. That is it is very essential that we must detect this type of potential victims as fast as we can so that we can reinforce the prevention of this type of phenomena using social networks. Sentiment Analysis can be viewed as a classification process, mainly there are three are three classification level in sentiment analysis i.e.: document-level, sentence-level, and aspect-level. In document level classification document is classified on the basis of sentiments that means a whole document that contains information related to any topic are classified. In case of sentence level as the name suggest classification is perform on the single sentence related to any single topic. Last one is related aspect level in which sentiments are classified on the basis of various aspects of entities. Considering the sentence level classification in which first we determine whether the sentence is subjective or objective on the basis of this later on subjective sentences are expressed as positives.

Other than these three levels classification sentiment analysis has to face challenges during analysis like semantic analysis that is evaluated and implement anew semantic similarity to recognize the real aspect of a work that is in different directions. The purpose of this paper is to give detail about the sentiment analysis with different machine learning classification algorithm. The paper is organized as follows: In section 2 there will be literature survey, the section 3 will cover the classification algorithm with the parameters represented during sentiment analysis and the last section will cover the conclusion and future work.

II. Literature Review

Sentiment analysis is treated as an errand of regular language handling at a few degrees of granularity. There has been a lot of research on feeling investigation, rule-based approaches, from bag of-words to machine learning algorithms. From a document level in Turney [2] sentence level classification in Hu and Liu [3] and recent sentence level in Wilson et. al. [4]. One of the famous social networking websites is Twitter, through which clients distribute tweets on current scenario and sentiments on any theme. The mining approach can be done at the document level or at the sentence level.

Tsytarau and Palpanas [5] have stated that Opinion retrieval has built up itself as a significant part of web indexes. Ratings, sentiment patterns and agent

feelings advance the hunt understanding of clients when joined with conventional archive recovery, by uncovering more bits of knowledge about a subject. Supposition accumulation over item surveys can be extremely valuable for item showcasing and situating, uncovering the clients' frame of mind towards an item and its highlights along various measurements, for example, time, geological area, what's more, understanding. Following how assessments or exchanges develop after some time can support us distinguish fascinating patterns and examples and better comprehend the manners in which that data is spread in the Internet.

Yu et al. has [6] shown the presence and intensity of emotion words as features to classify the sentiment of stock market news articles. In order to recognize such words and their power, a logical entropy model is created to grow a lot of seed words produced from a small corpus of securities that exchange stories with a sense of explanation. The relevant entropy model estimates the proximity of two words by looking at their logical conveyances using an entropy measure, taking into account the disclosure of words such as seed words. Exploratory findings show that the proposed plan will consider increasingly helpful terms of feeling and their power to compare, thereby enhancing the execution of the arrangement. Execution was further enhanced by the pooling of power and the proposed strategy beats the already proposed Point-Wise Mutual Information (PMI)-based development strategies.

Tao et al. has presented a technique that adopts a classification strategy depends on a novel semantic direction portrayal model called S-HAL (Sentiment Hyperspace Analog to Language). S-HAL fundamentally creates a lot of weighted features dependent on encompassing words, and describes the semantic direction data of words by means of a particular component space. Since the technique fuses the thought basic HAL and the speculation checked by the strategy for semantic direction derivation from pointwise shared data (SO-PMI), it can rapidly and precisely distinguish the semantic direction of terms without the utilization of an Internet web index. The aftereffects of an experimental assessment show that our technique beats other known strategies.

Masks and Vossen [7] has developed a vocabulary model for the portrayal of verbs, nouns and adjective words which is to be utilized in applications like opinion feeling and sentiment mining. The model means to depict the point by point subjectivity relations that exist between the entertainers in a sentence communicating separate frames of mind for every on-screen character. Subjectivity relations that exist between the various entertainers are marked with data concerning both the character of the frame of mind holder and the direction (positive versus negative) of the frame of mind. The model incorporates a

classification into semantic classes applicable to feeling mining and opinion investigation and gives intends to the distinguishing proof of the mentality holder and the extremity of the frame of mind and for the depiction of the feelings and assumptions of the various entertainers engaged with the content. Unique consideration is paid to the job of the speaker/essayist of the content whose point of view is communicated and whose perspectives on what's going on are passed on in the content. At long last, approval is given by a comment study that shows that these unobtrusive subjectivity relations are dependably recognizable by human annotators.

In paper [8], authors has described the Multi-view Ensemble Approach to SemEval-2017 Task 4 on Sentiment Analysis on Twitter, specifically the Message Polarity Classification sub-task for English. The article is based on a voting group where each base classifier is trained in a different space. The first space is a bag-of- word model and has a linear SVM as the base classifier. The second and third spaces are two separate techniques to combine word embeddings to represent sentences and to use the Linear SVM and the Logistic Regressor as simple classifiers. The proposed system was ranked 18th out of 38 systems considering the F1 score and 20th in considering recall.

In paper [9], authors considered the Twitter dataset (total 1000 comments) and used a combination of machine learning and ensemble method (majority voting) to identify the comments. They used twitter-specific features as a classifier input for classification.

Desai and Radhi states that [10] has stated that sentiment refers to the feelings or opinion of person towards some particular domain. Study of sentiment (opinion) and its polarity-based classification is a difficult task. Other challenges are the sheer amount of knowledge on one subject, all of which have different representations. Classification and clustering are two key methods used to perform twitter data sentiment analysis. They used Possibilistic Fuzzy C-Means with SVM to boost the accuracy of movie tweets and worked on up to 3-grams.

III. Approaches used in Sentiment Analysis

Today machine learning and deep learning has made an impact in the world of analysis. Through these two approaches one can perform analysis on the different types of datasets related to various fields. In the same way sentiment analysis is also done through machine learning approaches though which can perform analysis on the sentiments. In the below given below figure it is shown that how sentiment data set go through different steps during analysis. The steps involve different text preprocessing techniques, dimensionality reduction approaches, classification algorithms and different computing parameters.

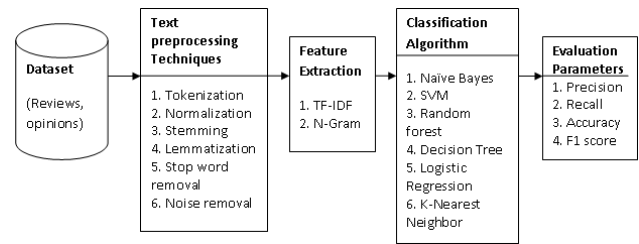


Fig. 2: Steps during classification of sentiments

Let us discuss these steps in details:

Dataset – It’s a collection of reviews or sentiments or opinions related to any product, movie, organization, political party and many more. These records are mainly stored to perform analysis. In today’s world most of the dataset comes under the category of big data [11].

Text preprocessing – The preprocessing of dataset is very much needed during analysis because this is the step which can perform removal of noise, removal of redundancy, handling of missing values etc. Some of the preprocessing techniques which applied during sentiment analysis are as follows:

- **Tokenization:** This step divides the large paragraphs into a list of tokens which are actually sentences. These sentences can further be broken into words. For example, suppose there is sentence like, “I am doing M. Tech. degree from Bhopal”, but after tokenization this sentence will form the tokens and split into individual words like {“I”, “am”, “doing”, “M.Tech.”, “degree”, “from”, “Bhopal”}.
- **Stemming:** Through this process one can change the tenses of the words to its base form and this can remove the redundancy as well as helps to remove the unnecessary computations . For example: likes, liked, likely, liking are replaced by like during stemming process.
- **Lemmatization** – It’s the process of merging of two or more words into single word, this process actually analyze the morphology of the word and later on eliminates the ending of the word like caught is replaced by catch, blunders are replaced by mistakes, etc.
- **Noise removal** – It is observed that almost all the datasets are in raw form, so it is very much needed that there should be some cleaning process along with the help of regular expression of NLP used to remove noises. Sometimes it happens that removal of noise process also remove eliminates a few numbers of rows of the dataset which leads to decreased accuracy.
- **Removing Stop words** – Stop words are considered as the common words in English

language that does not make any contribution during sentiment analysis like is, an, are, that, of, etc.

- Normalization – There are many ways through which normalization can be performed like converting a complete text either into lower case or upper case, removing punctuation and transforming the numbers to equivalent words. Through normalization uniformity of the text can be increased.

D. Dimensionality Reduction - In case of dimensionality reduction there are two main approaches one is feature selection [12] and the other one is feature extraction [13]. Through this feature selection and feature extraction, classification of the algorithms can also be improved [14]. In this paper the discussion will be on feature extraction methods one is Term Frequency – Inverse Document frequency (TF-IDF) and N-Gram.

- TF-IDF – This is a well recognized method to evaluate the importance of the word in the document. Term frequency of a specific word is calculated as the number of occurrence of that particular word in the document with the total number of words in the document. Inverse Document frequency is related with the importance of the particular word in the document. The words like “a”, “is”, “an”, “are” etc. occurs frequently in all documents but they don’t have any importance during sentiment analysis. IDF is calculated as $IDF(t) = \log(N/DF)$, where N represents the number of documents and DF is the number of document containing term t. The textual representation of information can be converted into a Vector Space Model (VSM) with the help of TF-IDF. Let’s assume a word ‘good’ appears in any document 15 times and the total number of words be 300 in that case term frequency will be $15/300=0.05$ and assume that there is total number of 60000 documents and 800 document contains the term happy, then IDF will be $60000/800=75$. Computing both these terms then TF-IDF (happy) will be $0.05*75= 3.75$.
- N-Gram – This term is defined as formation of features of text in case of supervised machine learning algorithms. There can be sequence of n tokens for the given text. The values of the n can be 1,2,3 and so on. Suppose we are having a sentence “Engineering is a better option for higher secondary students”, in this case when n=1 it is called as unigram, for n=2 called as bigram and n=3 will be trigram. So for the above sentence if we take n=2 then it will produce

“Engineering is”, “a better”, “option for”, “higher secondary”, “students”.

E. Classifiers used in Sentiment Analysis: Classifiers are used for classification of sentiments.

i. Naive Bayes - This is powerful algorithm for characterization utilized for arranging information on premise of probabilities. With a huge number of records additionally this algorithm works marvelously. It essentially chips away at Bayes hypothesis and utilizes different probabilities to order information. In Naive Bayes class with most extreme likelihood is viewed as the anticipated class. Naive Bayes is otherwise called Maximum a Posterior Naive Bayes has different focal points and inconveniences crosswise over various spaces. It is a quick and profoundly adaptable algorithm and It is utilized on both Multiclass and Binary Classification. It can likewise be utilized on little datasets and therefore gives great outcomes [15].

ii. K-Nearest Neighbor - This algorithm is basic and has applications primarily in design acknowledgment, interruption recognition and a lot more are likewise there. In this separation between information purpose of which we need to recognize class is determined utilizing Euclidean separation (different estimates like Manhattan separation and so on.) is determined with the current information focuses and the k closest neighbor (estimation of k is at first chosen can be 3, 4 and so forth.) will decide in favor of the class of new information point. Majority voting will choose the class [16].

iii. Support Vector Machine - This is an efficient regression algorithm as well as a classification function. It attracts a hyperplane in order to isolate classes. This algorithm works wonderfully well with relapse, the impact of SVM increases as we increase dimensional space. SVM also works well when the measurement number is greater than the example number. There is a drawback, because it doesn't perform well on huge datasets. SVM typically uses cross-validation to increase its computational efficiency [17].

iv. Random Forest -It is a collection of selected tree calculations that can be used for both classification and regression. In this algorithm, for the most part, more trees are compared to better execution and efficiency. In a specific set of preparation, delete an example set of focus information using a bootstrap strategy. After this, the tree of choice depends on the yield of the past step. Apply the last two stages and we're going to get a range of trees. Every tree constructed must decide for the information stage. [18].

v. Decision Tree - The algorithm can be considered for both classification and regression purpose. The key idea is to partition the dataset into smaller subsets, and at the same time the relevant tree is constantly being created. It can handle both categorical and numerical data. We can

use the Gini index for data gain parameter to choose which property will be used for further dataset division. If we use Gini index, the decision tree is called CART (Classification and Regression Tree) and if we use information gain, it is called ID3. This algorithm can be effectively used for sentiment analysis. [19].

V. CONCLUSION

This survey paper is related to information about the sentiment analysis, dimensionality reduction and the different types of classifier used during sentiment analysis. Paper has shown how the sentiment analysis is done and how it pass through various phases during classification. The paper also gives a brief idea about the classification algorithm. In the future we will work on the hate speech analysis in which we classify the hate sentiments through different classification algorithm.

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