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Comparative Analysis and Design of Different Approaches for Twitter Sentiment Analysis and classification using SVM

[1]Manish Bhargav, [2]Dr. Himanshu Arora
[1]M. Tech. Scholar, Department of Computer Science & Engineering, AIET, Jaipur
[2]Professor, Department of Computer Science & Engineering, AIET, Jaipur

Abstract: Companies and organizations have always found that the views and feedback of the community are their most important and valuable resource. With everyone using social media more and more, it makes it possible to analyze and evaluate things in ways that have never been done before. Before, organizations had to use methods that were unusual, time-consuming, and prone to mistakes. This way of analyzing fits right into the field of "sentiment analysis." Sentiment analysis is a broad field that deals with putting user-generated text into well-defined groups. There are a number of tools and algorithms that can be used to detect and analyze sentiment. For example, supervised machine learning algorithms can be trained with training data and then used to classify the target corpus. Lexical techniques, which use a dictionary-based annotated corpus to do classification, and hybrid tools, which are a mix of machine learning and lexicon-based algorithms, are also used. In this paper, we used Weka's Support Vector Machine (SVM) to analyze how people feel about something. SVM is a popular supervised machine learning algorithm used to find the polarity of text. The main objective is to analyze the emotions expressed in tweets using various simulations of artificial intelligence that classify tweets as positive or negative. If a tweet has both positive and negative components, the more prevalent component should be chosen as the closing statement. Emojis, usernames, and hashtags in tweets should be controlled and transformed into a standard development. Sincerely, these events' planners have started looking into these inconspicuous web blogs (online diaries) to acquire a feel for their niche. On other discreet sites, they routinely monitor and respond to customer feedback. Better means of seeing and combining a broad assessment are one challenge. A few people, including Facebook, Twitter, and Instagram, were really introduced to social affiliation stages a year ago. The vast majority of individuals utilize internet entertainment to express their thoughts about objects, places, or people. Systems Twitter, a less common platform for publishing material to blogs, is a huge repository of well-known reviews for various persons, services, associations, and products, among other things. Assessment examinations are reviews of the public assessment structures. What is said on Twitter has a substantial context thanks to a mixture of opinions. The widespread accessibility of online tests and virtual entertainment posts in the media provides connection with crucial examination to undermine expert judgments and direct their boosting strategies to relaxing and client conclusions. In this way, virtual distraction anticipates playing a significant role in influencing the general exposure of the companies or objects selected. This study highlights the many approaches used for item depiction analyses. Check topics on Twitter to see if the general public is acting in a favorable, negative, or neutral manner.

***Keywords:** Twitter, SVM, Machine Learning, Social Media*

1. INTRODUCTION

As a rule, three methodologies for feeling characterization ought to be conceivable: AI (ML), dictionary based technique, and cross breed procedure. The ML approach utilizes notable ML calculations as well as language factors. A feeling dictionary, or an assortment of known and precompiled opinion terms, is utilized in the Vocabulary based Approach. Vocabulary is a basic evaluator of feelings alluded to as assessment words. It is partitioned into dictionary based strategy and corpus-based approach, the two of which utilize verifiable or semantic methodology to decide opinion limit and enthusiastic love of words, in view of probabilistic loaded with feeling evaluations extricated from enormous corpora. The crossover approach joins the two procedures and is genuinely straightforward, with feeling dictionaries assuming a critical part in most of strategies.

Text order strategies in light of AI can be isolated into two classes: administered and unaided learning procedures. Endless arranged records are utilized in the oversaw approaches. At the point when it's challenging to track down these assigned planning files, solo systems are utilized. The vocabulary put together philosophy is based with respect to the disclosure of an assessment dictionary that is then used to break down the text.

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This system utilizes two methods. The corpus-based system starts with a seed rundown of assessment terms and afterward scans a broad corpus for extra assessment words to support the revelation of assessment words with setting explicit presentations. Factual or semantic strategies ought to have the option to achieve this. The word reference put together cycle depends with respect to finding assessment seed words and afterward searching for equivalents and antonyms in the word reference. The new client driven Web has a lot of information made by different clients. Rather than being inactive clients, clients are currently co-makers of advanced content. Web-based entertainment is as of now a critical part of the Web. As per the discoveries, four out of each and every five Web clients utilize some type of online entertainment. Client responsibilities to virtual entertainment incorporate blog entries, tweets, surveys, and photograph/video moves, in addition to other things. Large numbers of the information on media as surveys or postings structure a significant and interesting reach that ought to be researched and taken advantage of. With the development in receptiveness of assessment resources, for example, film surveys, thing audits, blog audits, and virtual entertainment tweets, the new difficult assignment is to mine gigantic volumes of compositions and make appropriate calculations to get a handle on others' perspectives. This information has tremendous incentive for organizations that need to understand individuals' opinion on their items or administrations. This data helps them in going with informed choices. Notwithstanding the way that the surveys and conclusions gathered from them are valuable to organizations and it is likewise helpful to clients.

2. LITERATURE REVIEW

(Shitole Ayit Kumar and Devare Manoj, 2018) This research presents the construction of an IoT framework which not only captures information from the sensors in real time but also provides a fruitful viewing recognition of the human face in the field of physical situations. Live sensor data are aligned to the class label of the detected person to accomplish Multi-Classifying. This research is used with the use of supervised machine learning algorithms to optimize human prediction through cloud sensor data analysis, as well as local datasets. Decision Tree and Random Forest models provide better outcomes as a performance measure in imbalanced class data set with a larger average f1-score and approximate calculation times necessary to run models utilizing 5 fold cross validation on very big data sets. The experiment demonstrates that light-dependent resistance is the most informative sensor to predict person successfully using Decision Tree, followed by gas, temperature, and moisture sensor.

(Prafulla Surve, Lalindra De Silva, Nathan Gilbert, and Ruihong Huang, 2013). A popular form of Twitter sarcasm is a happy feeling that contrasts with a terrible situation. For example, a good feeling like "love" or "enjoy" followed by a phrase described by a bad activity or condition is found in many sarcastic tweets (e.g. "examining" or "being ignored"). In order to identify this form of tweet sarcasm, we designed a sarcasm recognizer. We have a new bootstrapping algorithm which automatically learns from sarcastic tweets lists of happy feelings and negative scenario phrases. We show that the recognition of sarcasms improved by recognizing opposing contexts using the sentences learned through bootstrapping.

(Rohit Joshi and Tekchandani of Rajkumar, 2016) Online microblogging on social networks was utilized to communicate opinions in very brief messages regarding certain entities. There are various popular microblogs such as Twitter, Facebook, etc in which Twitter gets greatest attention in the area of product research, film reviews, bursaries, etc. We have extracted Twitter data i.e. movie reviews for feel prediction utilizing techniques for machine learning. For classifying data using the unique graph, the bigram and the hybride, that is the unicram + bigram, we have used supervided machine learning methods such as support vector machines (SVM), maximum entropy and Naïve Bayes. The results suggest that 84 percent for movie review SVM exceeded other classifications with exceptional accuracy.

3. Methodology

The dynamic execution of functions via online social media, notably Twitter, is the focus of this system. Several steps need to be finished in order to obtain the best test results for assessing Twitter tweet emotions. The steps that must be completed are Sentiment, Pre-Processing, and Data Extraction.

Data extraction is the initial stage of the development process. The six attributes in the dataset—goal and text, which are used to gauge sentiment—are the most significant.

Pre-processing is the stage that comes following data extraction. The data is turned into analysis-ready data at this level. This pre-processing includes cleaning, emoticon transformation, case folding, tokenization, stopword filtering, and lemmatization.

1. Cleaning: During the cleaning step, extraneous letters and punctuation are removed from the text. It lowers the findings' cost of noise. Among the characters that are eliminated are URLs, tags (#), commas, dots, and other punctuation marks. Enter "#GoodDay Today's weather is very nice." as an

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illustration of a phrase for data cleansing. "GoodDay Today's weather is so nice," appears next in the output.

2. Convert Emoticons: Emoticons are symbols that represent emotion in a face expression using letters, punctuation, and numbers. Users frequently utilize emoticons to convey their moods. Emoticon conversion is one method for text-based emotion representation. Input: "There's a storm outside and I'm unable to play outside:(," Output: "There's a storm outside and I'm unable to play outside sad." This is an example of a sentence converter emoticon. Table 5.1 below provides some instances of emoticon to word translations:

Table 1. Emotions Representation

Emoticon	Word Conversion
:(:-(:-<	“Sad”
:) :-) :^)	“Smile”
:@	“Shocked”
=^.^=	“Cat”

3. Case folding: There may be both uppercase and lowercase letters in the tweet. By changing every letter to lowercase during this step, the letters are uniformed. This is an illustration of a phrase that folds the cases "With the output "BJP is the now the governing party in the government," the BJP is the current government.

4. Tokenization: This procedure involves segmenting or splitting phrases into words or parts. This deduction results in a token. In certain cases, removing superfluous punctuation brings the tokenization process to a close. Uni-gram, bi-gram, tri-gram, and n-gram are a few tokenization models that may be applied. Given the input "life is excellent," this is an example of a tokenization statement, with the desired outcome "It's a nice life.

5. Filtering: Filtering is the removal of words that are often used but are deemed useless (stopwords). The stopwords list consists of a group of words that are often used across several languages. Many text mining application programs exclude stop words because their usage is too broad, enabling users to focus on other terms that are far more important. This is an illustration of a stopwords sentence: "I'm going for a jog" input, "I'm going for a jog" output. Table 5.2 below displays several Stopwords terms:

6. Lemmatization: In this step, the words' ends are removed in order to discover their lemmas, or root forms, in a dictionary. Sentence stemming is demonstrated via the input "the boy's vehicles are various colors" and the result "the boy car be different color."

7. Weighing Word: In Word, weighing is the process of giving a word a score based on how frequently it appears in a text document. One typical technique for weighting words is the TF-IDF approach (Term Frequency-Inverse Document Frequency). The phrases "Term Frequency" and "Document Frequency" are both used in the weighting method known as Term Frequency-Inverse Document Frequency. Term

Frequency is a weighting notion that considers how frequently (frequency) a phrase appears in a text. The length of each document varies, thus a term may appear more frequently in a lengthy text than in a brief one. As a result, term frequency is frequently determined using the length of the text (the total words in the document). While the number of papers where a phrase appears is known as Document Frequency. As the frequency of occurrence diminishes, the weight value does as well. When calculating an expression's frequency, a lot of its terms are taken into consideration. Some words, however, aren't as important and shouldn't be taken into account. In order to boost the weight of other key words and lower the weight of these less significant terms, respectively. The primary requirement for stop-word stems from this. As a result, TFIDF must be calculated so that scores may be determined using Equation.

The suggested model's sentiment analysis is carried out using a variety of algorithms, with the greatest results coming from the most effective and precise ones.

1. Logistic Regression: This approach produces excellent results for binary classification, where the output variable can either be 0 or 1. (binary from). This is because it makes use of the sigmoid function. This mathematical function has the ability to convert any real value to a number between 0 and 1, which looks like the letter "S." There are only two viable classes since the goal or dependent variable is dichotomous in nature. Therefore, the expected value of y becomes 1 as the value of z approaches positive infinity; conversely, as the value of z approaches negative infinity, the predicted value of y becomes 0. The label is categorized as positive class 1 if the sigmoid function result is larger than 0.5, and as negative class or class 0 if it is less than 0.5. [13]

2. Decision Tree: Unlike other supervised learning algorithms, the decision tree approach may also be utilized to resolve regression and classification issues. Building a training program is the goal of employing a decision treemodel that learns fundamental decision principles from the data and uses them to infer the class or value of the target variable. There are two ways to separate a node in the decision tree. One is information gain, in which node purity

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is determined using entropy. Using Gini impurity is an additional technique. [15]

3. Random-Forest: A single tree could not produce particularly accurate results. The Random Forest algorithm is required because of this. An ensemble of decision trees, which are typically trained using the bagging method, are combined to form a forest. The fundamental tenet of the bagging approach is that mixing many learning models enhances the final result. [12]

4. Linear SVC: For classification and regression, the Support Vector Machine (SVM) is a simple supervised machine learning algorithm. SVM identifies a hyper-plane that divides the various data types. In two-dimensional space, this hyper-plane is nothing more than a line. N is the number of features or characteristics in the dataset, and each data object is plotted in an N-dimensional space using SVM. Next, choose the ideal hyperplane for data separation. You must have understood that SVM can only conduct binary classification by default as a consequence (i.e., choose between two classes). However, there are a number of approaches to use for multi-class situations. [20]

5. Multinomial Naive Bayes: Naive Bayes is based on the Bayes theorem, which stipulates that characteristics in a dataset are independent of one another. The chance of one feature's occurrence has no effect on the likelihood of the other. For limited sample sizes, Naive Bayes will perform better than the most effective alternatives. [5] Multinomial Nave Bayes is a variant of Nave Bayes that takes into account a feature vector in which a particular term reflects the frequency, or number of times it appears. [10] [14]

6. Bernoulli Naive Bayes: This method uses discrete data and operates on the Bernoulli distribution. The primary feature of Bernoulli Naive Bayes is that it only accepts binary values for attributes like true or false, yes or no, performance or failure, 0 or 1, and so on. The multinomial model and the Bernoulli model are equally time difficult. [10] [14]

The suggested machine learning model has been applied to analyze user-provided Twitter sentiment on any topic. The gadget simultaneously communicates the user's study findings while simultaneously gathering pertinent data from Twitter in real-time, calculating emotions, and doing so. The incoming data will be kept in a TXT file alongside it since it will be utilized to predict results.A system for real-time sentiment analysis is depicted in Figure 4. The following is a discussion of how the system functions. The collection of data is the system's initial task. For this, information is received from Twitter using the Twitter API. Access to the Twitter API requires the creation of a Twitter application. The supplied access tokens are used to verify every API queries made by the application during app building. These tokens are made up of Access Secret, Access Key, Consumer Secret, and Consumer Secret. The user-supplied keyword is used to filter and gather the tweets. More information than simply tweets may be found in the Twitter dataset. The dataset must thus be pre-processed, which includes all of the pre-processing techniques. After preprocessing, data is fully suitable for sentiment analysis.

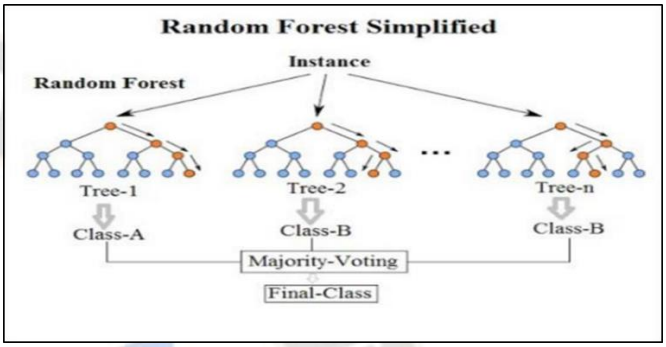

Figure 1 Random Forest Method

For real-time data insights, it is then directed to the sentiment model created in earlier stages. Each tweet is given a favorable or negative evaluation by the model, and the user is presented with the findings in accordance. The Tweet and its polarity are stored in separate columns in a TXT file that is simultaneously recorded with the data. As soon as all of the tagged findings have been gathered, it is utilized to display the prediction graph.

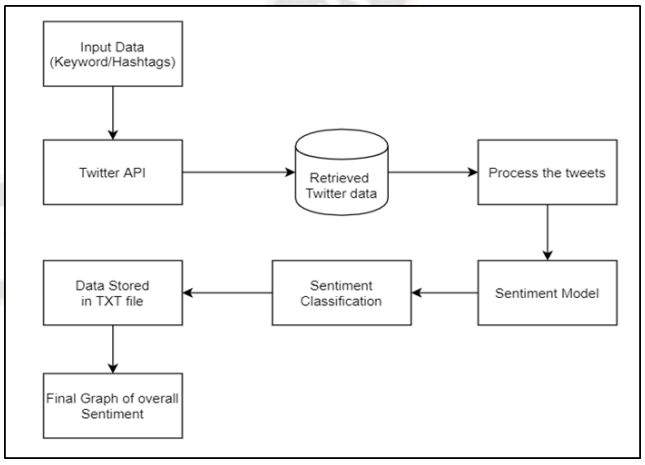

Figure 2 Proposed Methodology

4. RESULT ANALYSIS

The general data set has been broke down for positive and negative tweets. For example, the All out length of the information is: 200000. Number of positive labeled sentences is: 47741 Number of negative labeled sentences is: 152259.

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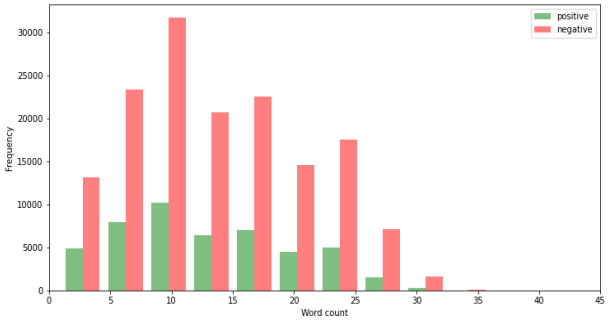

Figure 3 Word Count Analysis

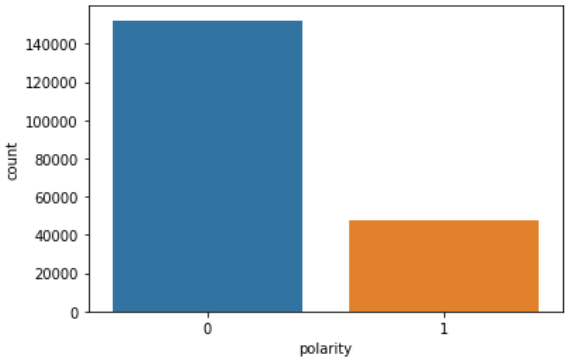

Figure 4 Negative and Positive Messages Classification

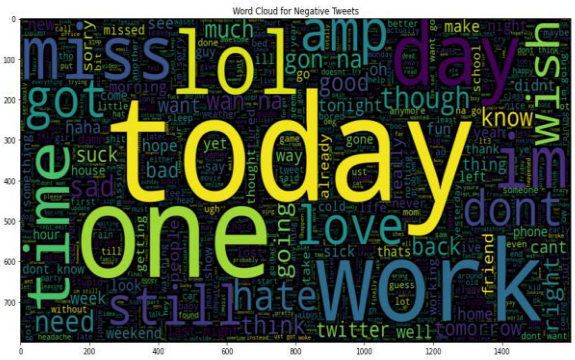

Figure 5 Word Cloud Formation

Support vector machine based classifier is utilized for appraisal of blueprint and suspicion for feeling from the assessment done on dataset.

The work done in this paper awards standing apart various classifiers from demand countless English tweets related with unequivocal things into great as well as horrendous feelings. Utilizing appraisal consolidates instead of standard text gathering gives high accuracy. This framework is utilized to rank wonderful classifiers for feelings and helps business relationship for making their future philosophies related with the thing.

Table 1

Analysis of Proposed Work

Factor	Random-Forest	Decision-Tree	Proposed Method
Analysis of Accuracy	74.22 %	77.1 %	**84 %**

5. CONCLUSION

The effectiveness of Support Vector Machine (SVM) for sentiment analysis has been examined in this research. We employed two pre-classified datasets of tweets for the performance study of SVM; the first dataset included tweets concerning self-driving cars, while the second dataset included tweets about Apple items. Performance comparison and analysis are done using the Weka tool. Results are assessed using the f-measure, recall, and accuracy metrics. The average accuracy, recall, and f-measure for the first dataset have increased respectively, according to the findings. The average Precision, Recall, and F-Measure for the second dataset have also shown better result respectively. Complete findings are displayed graphically and in tabular form. The outcomes unequivocally demonstrate how SVM performance is dependent on the input dataset. It is important to use vast and varied datasets to better investigate how SVM and other machine learning approaches are affected by performance. The findings of this study can serve as a baseline for comparative analysis. Additionally, it should be looked at whether machine learning algorithm performs better on which sort of dataset for classification purposes and what the potential causes could be. This may help academics find new, more effective machine learning techniques for categorization.

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