Implementation of Sentiment Analysis and classification of Tweets using Machine Learning

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ABSTRACT: Twitter has turned into a tiny source of dynamic data for blogging places. People post on a wide range of topics and constantly communicate their assumptions, discuss current concerns, and positively review what they use in their daily lives on Twitter wall. The main goal is to assess the emotions expressed in tweets using various machine learning algorithms that identify tweets as positive or negative. If the tweet contains both negative and positive elements, the most dominant component should be chosen as the final component. In tweets, emojis, usernames, and hashtags must be managed and translated into a standard structure. Bigrams and unigrams, for example, must be removed as well. In any case, just relying on a single model, which did not give high accuracy, is taken into account when selecting a model with high precision. To be honest, organizers for these items have begun to investigate these modest internet journals (blogs) in order to get a general sense of their item. They frequently monitor and reply to client comments on smaller websites. One issue is coming up with new ways to recognize and abbreviate a broad sentiment. Several persons, such as Facebook, Twitter, and Instagram, were brought into interpersonal connection stages as recently as last year. Most people use social media to convey their feelings, ideas, or assumptions about objects, places, or people. Strategies Twitter, a micro-blogging platform, is a massive repository of public opinion for a variety of people, offers, businesses, and products, among other things. The public analysis system evaluations are known as sentiment assessment. Combination of sentiment analysis on Twitter give valuable context to what's being said on Twitter. The wide availability of internet exams and social media postings the media provides critical criticism to organizations in order to improve expert options and steer their marketing tactics to leisure and user selections. As a result, social media plays a key role in influencing the public's perception of the services or products chosen. The numerous tactics utilized for product classification critiques are highlighted in this study (which may be in the form of tweets) Tweet complaints to see if mass behaviour is positive, negative, or neutral. Analysis of the Product Market. The information used here comes from our Twitter product reviews, which were used to categorize opinions as satisfying.

Keywords: Twitter, SVM, Machine Learning, Social Media

1. INTRODUCTION

The world's textual information can be divided into two basic categories: facts and views. Facts are statements concerning components, events, and their attributes that have a specific target [1]. Opinions are often subjective expressions that depict people's feelings, assessments, or emotions regarding various components, events, and their properties. Individuals' positive or negative feelings are communicated through this form of expression. A large portion of current textual information handling research has focused on the mining and recovery of genuine information, such as information recovery, Web search, text categorization, text clustering, and a variety of other text mining and dialect preparation tasks [2]. Until recently, little attention had been paid to the management of differing viewpoints. However, opinions are so vital that we need to hear other people's perspectives if we have to make a decision. This is true for both individuals and organizations.

Opinion mining, also known as sentiment analysis, is the study of how people's views, sentiments, assessments, evaluations, states of mind, and emotions are related to various factors such as products, services, associations, people, topics, events, themes, and their features [3]. It refers to a broad range of issues. Sentiment analysis, opinion mining, opinion extraction, sentiment mining, subjectivity analysis, affect analysis, emotion analysis, review mining, and so on are only a few of the many titles and tasks available. Whatever the case may be, they are all now classified as sentiment analysis or opinion mining. While sentiment analysis is more commonly used in industry, both sentiment analysis and opinion mining are used as frequently as feasible in the educated community. They fundamentally refer to the same subject.

Text mining [4] research began with a focus on extracting correct data from archives. Recently, the focus has shifted to opinion mining, often known as sentiment analysis. Accessibility of opinionated content such as reviews, blog entries, online networking remarks, and, more recently, tweets, is one of the driving forces behind this movement. User Generated Content is another term for these archives (UGC) [5].

Figure 1.1 depicts the various approaches for sentiment classification as well as the most often used algorithms. Text categorization tactics based on machine learning can be divided into two categories: supervised and unsupervised learning techniques. Countless prepared records are used in the managed approaches. When it's difficult to find these designated preparation archives, unsupervised procedures are used. The lexicon-based methodology is based on the discovery of an opinion lexicon that is then used to analyze the text [20].
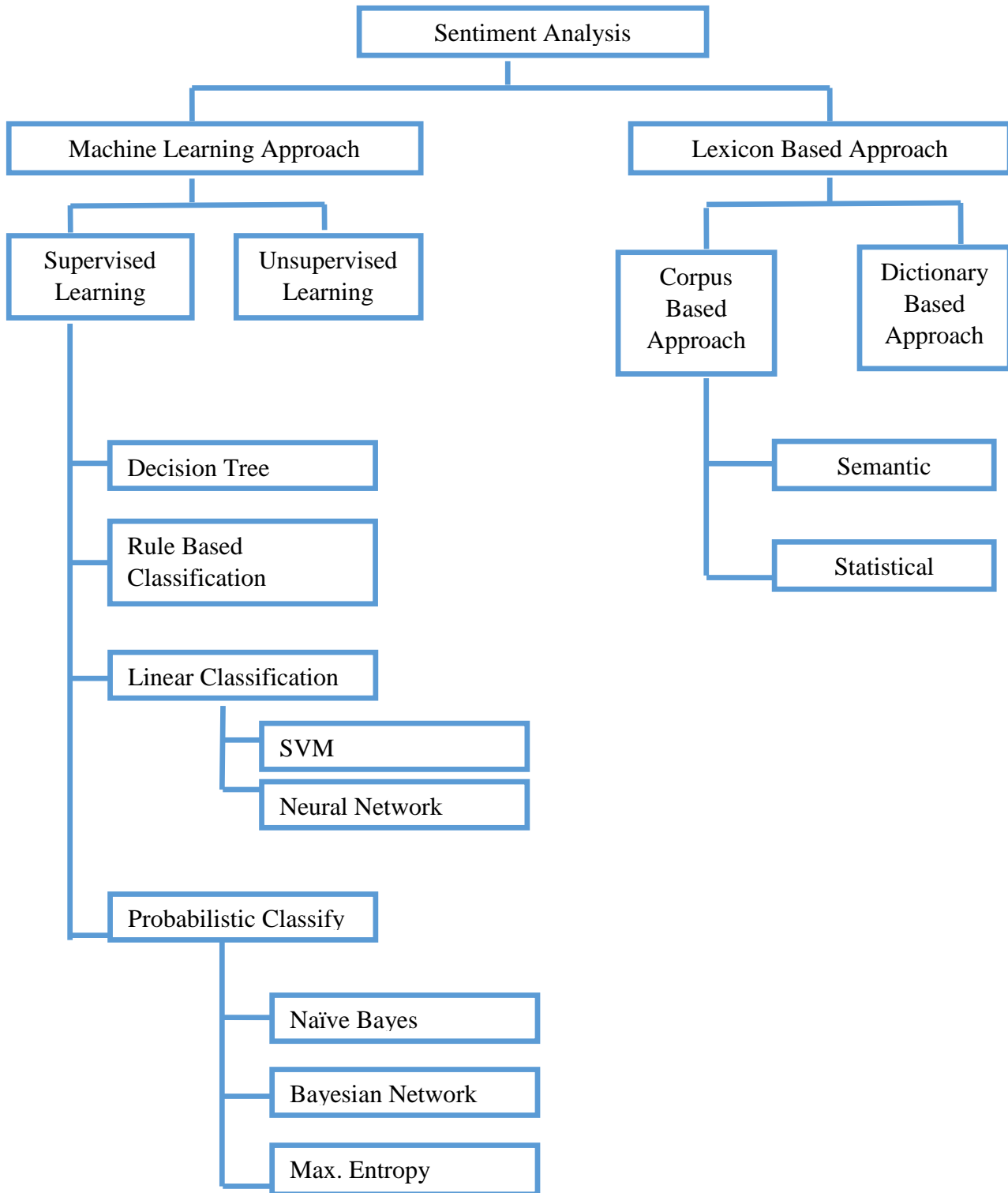
Sentiment Analysis

Machine Learning Approach

Lexicon Based Approach

Supervised Learning

Unsupervised Learning

Corpus Based Approach

Dictionary Based Approach

Decision Tree

Rule Based Classification

Linear Classification

SVM

Neural Network

Probabilistic Classify

Naïve Bayes

Bayesian Network

Max. Entropy

Semantic

Statistical

Figure 1.1 Sentiment Classification Techniques

2. LITERATURE REVIEW

(A. Raao and A. Shitole, 2020[1]) Twitter, a blog micro operator, is a giant store of public views voiced towards various individuals, offers, corporations, items, etc. Feeling assessment is the analysis system of public assessments. The sensitivity analysis in combination with Twitter provides positive insights into what Twitter says. The wide range of online assessments and postings in social media delivers vital input to groups to choose better to inform user passports and alternatives about their marketing technologies. Therefore, a sentiment evaluation is necessary to determine the opinion of the general public on the services or products picked. This article highlights various techniques for the classification of product (which could be tweets) critical of whether or not the mass behavior is positive, negative or neutral and for using that analysis to assess the product market. This article examines the various techniques used in tweeting. This article Data from this review of our product reviews acquired from Twitter and utilized to classify feelings as satisfying.

(Pooja Kumari, Shikha Singh, Dakshata Talpade, 2015[2]) Microblogging websites, like Twitter, became an uncompromising, broad information source. A new paradigm in the burgeoning field of computer social science is using socially-generated Big Data to access information on the collective status of minds in human civilizations. Predicting the social reaction to a new product in the sense of popularity and adoption is one of the natural uses of this. In our study, we focus on Twitter for sentimental testing, the most popular microblogging medium. By means of the corpus we construct a classification of feelings which can determine a document's positive, negative and neutral feelings.

(A. Kowcika, Karthik Sondhi, Aditi Gupta, Raunak Kumar, [3] and Nishit Shivhre (2008)). It allows you to acquire valuable information and rapidly analyze tweets about the smartphone war from the Twitter website. The system employs an effective mechanism to determine the age of the user. A well-trained Naïve Bayes Classification can predict users' gender. Classifier Sentiment Model tweets a feeling. This allows to analyze data thoroughly on the basis of several customer criteria, such location, sex, age group.

(Ali Hasan, Sana Moin, Shahaboddin Shamshirband, Ahmad Karim, 2018[4]) Growth has been quick in the field of opinion mining and sentiment analysis and seeks to study the views or texts on various social media platforms through machine-learning approaches with sense analysis, subjective analysis or polarity calculations. In spite of the employment of numerous machine learning algorithms and sentiment analysis tools during elections, a state-of-the-art strategy is absolutely necessary. To address these issues, a hybrid strategy involving an analyser of sentiments, that integrates machine education, is part of the contribution of this paper. In addition, this article compares sentiment analytics techniques in the analysis of political points of view by using supervised machine learning algorithms such as Naïve Bayes and vector support machines (SVM).

(Payal Punde, Rasika Wagh, 2018 [5]) Social networking services like twitter offer their opinions as tweets every day. As tweet, the brief, fundamental style of expressing is characteristic. So we concentrated on feeling analysis of Twitter data in this review paper. The Sentiment Analysis considers the field of text and NLP data mining. The study of Twitter data sentiment analysis can be conducted in various respects. This study shows types and techniques of feeling analysis used to remove feelings from tweets. In this study we studied several strategies and ways of feeling analysis using Twitter as a data comparison.

(Hong Sound Goo 2017 and Adyan Marendra Ramadhani [6]) There is huge popularity among all of today's social media services. For many aims, such as prediction or sentiment analysis, data from the SNS (Social Network Service) may be employed. Twitter is an SNS which has a vast data with user posting, has the potential for study on text mining, and is subject to sentiment analysis. With this considerable amount of data. Yet it is a challenging task to handle so many unstructured data, machine learning is necessary to handle such a large number of data. The deep learning approach is that used in the neural network of several secret layers with the results of the experiment around 75 percent by the deep feed-forwards neural network.

(Rania Hodhod, Mohammed H. Abd El-Jawad, Yasser M. K. Omar, 2018[7]) As a result of the introduction of Web 2.0, the internet has a great amount of textual content, including news stories and historical records, and the growth of social media, such as Twitter, is markedly increasing. More people begin to share their views and opinions across the Internet and through other social media. This led to an increase of the quantity of sentiment information sentences supplied by users. It is inevitable to explore new approaches for learning how individuals feel and respond to diverse situations. In addition to the new hybrid approach that employs text mining and neural networks for the classification of feelings, the research compares the performance of other machine learning and profound learning techniques. More than 1 million tweets are collected in five domains in the datasets used in this work. The system was trained on 75% of the dataset and the remaining 25% were tested. The results reveal a maximum precision rate of 83.7%, showing the efficiency of the system's hybrid method in relation to typical monitored approaches.

3. Proposed Methodology

The Sentiment Analysis is a natural language problem, when the positive tweets are classified using machine-learning methods to classify, explore, analyze text, analyze data and visualize data.

The Natural Language Processing (NLP) is a hotbed of data-science study today and a Sentiment Analysis is one of the most common applications of the NLP. This domain has fundamentally reworked the way organizations function from opinion surveys to the creation of whole marketing campaigns, thus every data scientist must know this.

Thousands of texts (including named entities, topics, topics etc) may be analysed for sentiment in seconds as contrasted with the hours required for the same task by a team of people.

This work is aimed towards identifying hate talk in tweets. For simplicity, we state that a tweet comprises hate speech if it involves a racist or sexist feeling. The aim is therefore to classify racial or gender tweets from other tweets.

Officially, with a tweet and label training sample, which indicates that the tweet '1' is racist/sexistent and that the tweet label '0' signifies that it is not racist/sexist, your aim is to predict the label on that test dataset. The measurement of this F1-Score is the evaluation method.
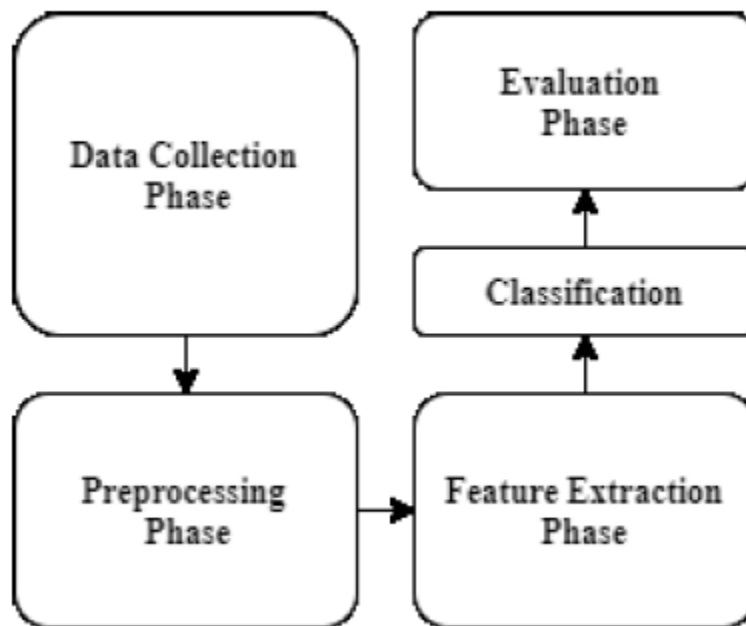

Figure 2 Process Flow Overview of System

Figure 2 depicts the methods used for ordering tweets from the input data set, including pre-processing phases in extraction and classification through the evaluation phase (results from various classification systems will be analyzed in this stage). The Flow of Proposed System is illustrated in Figure 3. By collecting the tweet, the dataset is produced and divided into data sets for testing and training. The training data are used for model training and test data are required to calculate the model's performance metric. This allows the model to dial into positive or negative categories the freshly generated tweets collect from the Twitter API.

This Proposed System will perform the following things:

A. Data Collection: The data utilized is a huge number of tweets taken from the Kaggle repository and Twitter. Collection of data. Twitter API is used to construct a Twitter application and to receive permission in order to gather tweets from Twitter. Both positive and negative tweets are used to collect the information. The trainings dataset are the positive and the negative tweets.

B. Pre-Processing: Raw twitter tweets mostly lead to a noisy dataset. This is due to the easy idea of the use of social media by people. For example, retweets, emoticons or clients have some unusual properties that need to be appropriately segregated from each other. Tweets have certain unusual qualities. Therefore, an ion raw Twitter computer should be standardized to produce a set of data, which can be learnt successfully from various classifiers. The data set has been standardized by numbers of pre-processing steps.
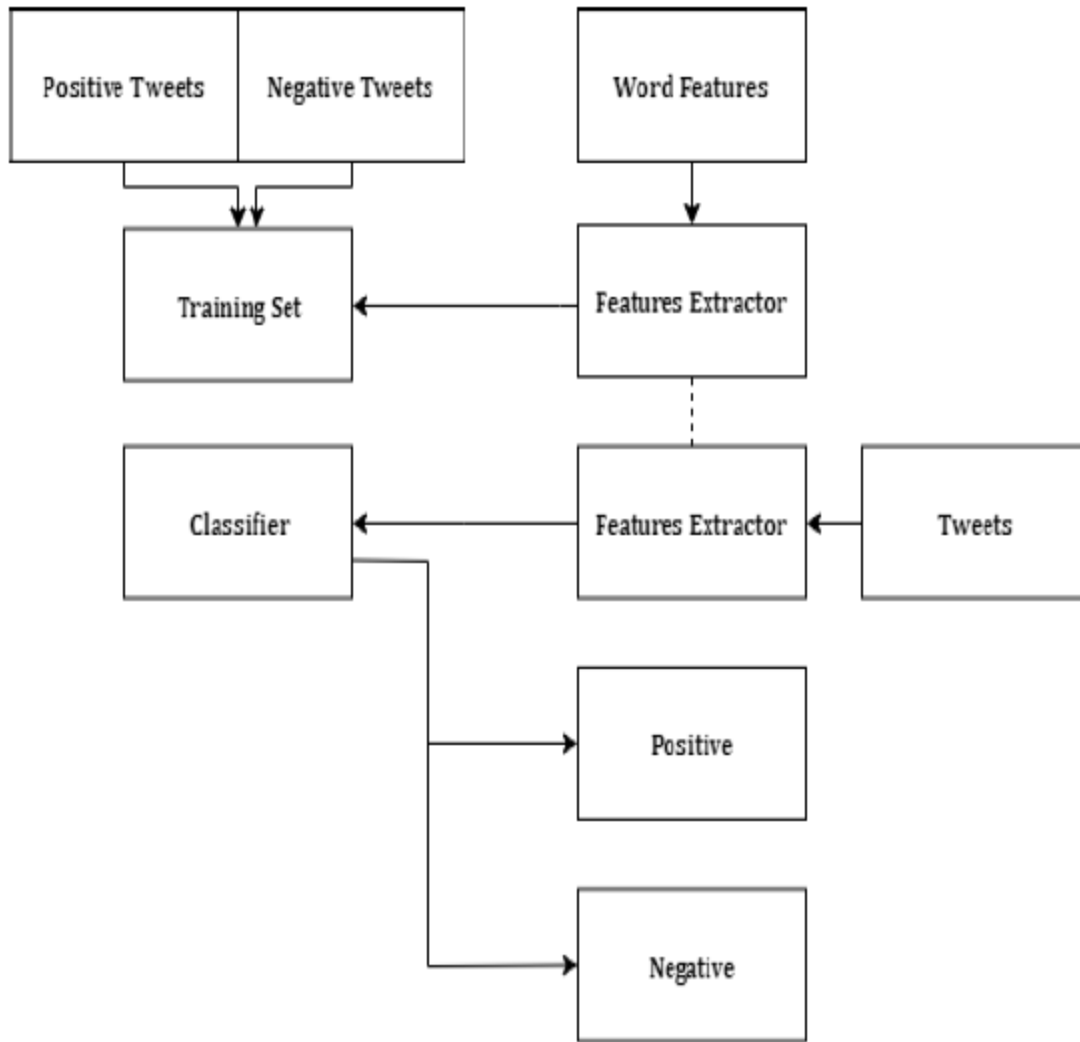
Figure 3 Step by Step Process Flow for Sentiment Analysis

Initially, there is wide-ranging pre-processing of the following tweets:

- Convert the tweet to the lowercase.
- Replace two or more dots with the spaces.
- Strip spaces and quotes from the ends of tweet.
- Replace two or more spaces with a single space.

Special twitter features are as follows:

The following are special twitter features:

1) URL: Customers share regular hyperlinks in their tweets to different pages. For content grouping, a precise URL is not significant because the highlights would be scarce. Supplant all URLs with the word URL in tweets along these lines. The usual URL term (www\.[\S]+)|(https?://[\S]+)).

2) User Note: A handle is attached to every Twitter user. In their @handle tweets, people often mention other users. The phrase USER MENTION substitutes all user references. The user mention is regularly expressed @[\S]+.

3) Emoticons: Clients use different emojis to spread different feelings routinely in their tweets. All the emojis used through web-based networking media are hard to coordinate fully, given the constant growth of the quantity. Coordinate some fundamental emojis as frequently as possible, in any situation. EMO POS or EMO NEG are replaced by the coordinated emojis which rely on whether the sentiment is positive or negative.

4) Retweet: Retweets are tweets which another person recently sent and which are shared by different customers. Retweets begin with RT letters. We eliminate RT from tweets because it is anything but an important aspect for arranging content. The usual articulate ion for retweet co-ordination is \brt\b. Following the application of tweets, individual tweets are prepared for and managed as follows: Strip any ["?!,():,' from word. Strip any punctuation. Convert 2 or more letters to 2 letters of repeated ions. Some people send tweets like me, including characters, sooooo happpppy to emphasize specific words. This is done to handle tweets like this, and I'm really pleased about them. Remove - and remove - and remove. This is done to address words like T-shirt and theirs by transforming them into the wider t-shirt of their structure. Check whether the term is valid and recognize it only if it is valid. It marks a legitimate word as a word that begins with a letter set with progressive characters, names, or points (.) and emphasis ( ).

C. Function Extraction: To be specific unigrams, extract two types of highlights from a dataset. Make the unigrams and bigrams in the data set recurrent and select N unigrams and bigrams for our analysis. for more information. • Unigrams: The nearness of single words or tokens in the content is probably the less complex and the most commonly used highlighting for the content organization. Remove single words from the training dataset and make these words circulate repeatedly (frequency distribution).

D. Bigrams: Bigrams are word combinations in the dataset that occur in corpus progression. The highlights/features are a good way to indicate annulment of the word in everyday language - that's not good.

SVM is a non-probabilistic linear binary classifier, often known as vector support machines. For categorizing content, if the feature space is huge, this approach is best supported. To obtain the largest margin for a training set of points (x i, y i) where x is the vector of the function and y is the group,

$y_i = 1$ and $y_i = -1$

The equation of the hyperplane is as follow:

$$w \cdot x - b = 0 \qquad (1)$$

Where, w is a vector normal to the hyperplane and b is an ffset. After that, to maximize the margin (Distance of losest examples from hyperplane), denoted by γ, as ollows:

$$\max_{\omega,\gamma} \gamma, s.t. \forall_i \gamma \leq y_i(\omega.x_i + b) \qquad (2)$$

The word "C" is 0.1. C term is the Error Term's penalty parameter. In other words, the misclassification of the objective function is affected. Both Unigram and Unigram+Bigram can be used to run SVM. Settings can also be executed with frequency and presence. To acquire a correct tweet analysis of feelings, different classifiers can be created.

4. RESULT ANALYSIS

4.1 Sentiment Analysis Process

The process of overall evaluation and simulation of sentiment analysis can be expressed as follows-

Data Visualization:

It express dataset details target: the polarity of the tweet (0 = negative, 4 = positive)

date : the date of the tweet (Sat May 16 23:58:44 PDT 2009)

polarity : the polarity of the tweet (0 = negative 4 = positive)

user : the user that tweeted (TerraScene)

text : the text of the tweet (i'm 10x cooler than all of you)

	polarity	id	date	query	user	text
720002	0	2260768735	Sat Jun 20 19:44:38 PDT 2009	NO_QUERY	tarheelprincess	@MOCAShop Wow, normally a Ferrell fan. This ma...
262514	0	1986214420	Sun May 31 18:30:11 PDT 2009	NO_QUERY	bebfoo	@netbender I got that enough from punk shows t...
812355	4	1548349187	Fri Apr 17 20:42:31 PDT 2009	NO_QUERY	valentineskid	@ramblelite i got everyone noaw yo. simm's got...
385860	0	2053684945	Sat Jun 06 05:23:05 PDT 2009	NO_QUERY	auilix	@Rayuen yeah a couple (like randall munroe of ...
321526	0	2003809917	Tue Jun 02 07:11:07 PDT 2009	NO_QUERY	jozigirl	I feel for the families of the plane crash dis...
438569	0	2066210181	Sun Jun 07 10:05:32 PDT 2009	NO_QUERY	bluegirlboo	i dont feel well today
29364	0	1563462317	Sun Apr 19 22:55:59 PDT 2009	NO_QUERY	mariee_	@LishaKatherine so true! Im miss talking to you
577052	0	2212239259	Wed Jun 17 13:50:59 PDT 2009	NO_QUERY	james51050	CANT READ
14386	0	1553674273	Sat Apr 18 14:54:25 PDT 2009	NO_QUERY	krissenbee	UGH. don't wanna edit anymoreeee So lost.
254577	0	1984285786	Sun May 31 14:48:27 PDT 2009	NO_QUERY	CallumBaker	just got up and I have a toothache

Figure 4 Overview of Analysis of Polarity from the Tweets

The overall database has been analyzed for positive and negative tweets. Such as the Total length of the data is: 200000. Number of positive tagged sentences is: 47741 Number of negative tagged sentences is: 152259
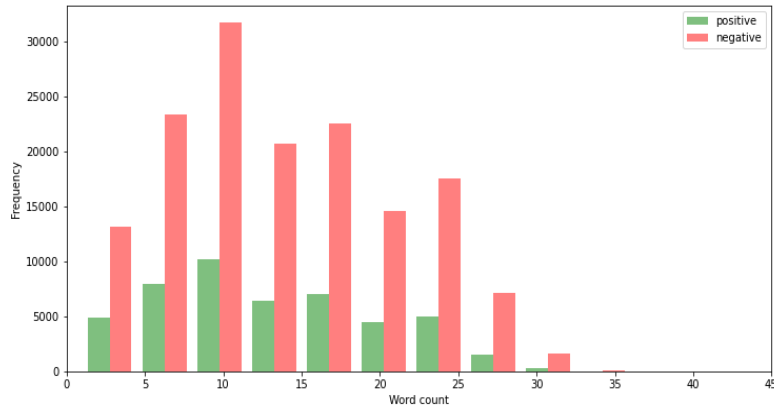

Figure 5 Analysis of Word Count for Positive and Negative Tweet Sentiments

Figure 4 and Figure 5 explains the analysis of data for positive and negative sentiment. This is the first step for the design of sentiment analysis which involves the analysis of positive and negative tweet with respect to frequencies and word counts. Data analysis helps in understanding the utility of data as well as it helps in designing proper pre-processing system for the design of optimal classifier and prediction system.
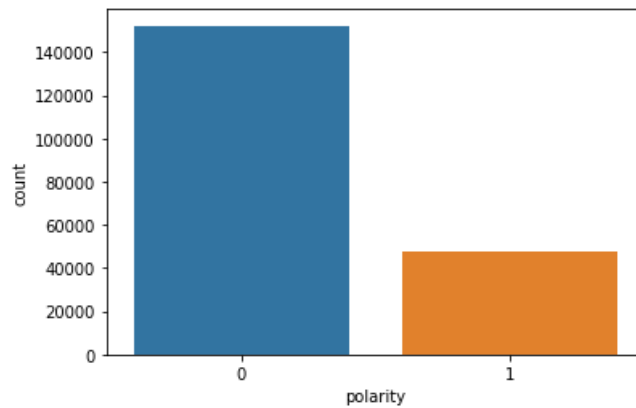

Figure 6 Comparative Assessment of Data for Positive and Negative Tweets

Figure 6 explains the comparative analysis of data for positive and negative sentiment. The polarity of 0 and 1 has been assigned for both negative and positive tweets respectively.

Feature Extraction:

Feature extraction is another important step in the process of sentiment analysis which involves the processing of tweets and creation of word cloud based on sentiment of tweets. The process has been explained in figure 6, 7 and 8 respectively.

	polarity	text	processed_tweets
720002	0	@MOCAShop Wow, normally a Ferrell fan. This ma...	mocashop wow normally ferrell fan make sad wai...
262514	0	@netbender I got that enough from punk shows t...	netbender got enough punk show ringing never w...
812355	1	@ramblelite i got everyone noaw yo. simm's got...	ramblelite got everyone noaw yo simms got cat ...
385860	0	@Rayuen yeah a couple (like randall munroe of ...	rayuen yeah couple like randall munroe xkcd kn...
321526	0	I feel for the families of the plane crash dis...	feel family plane crash disaster one
438569	0	i dont feel well today	dont feel well today
29364	0	@LishaKatherine so true! Im miss talking to you	lishakatherine true im miss talking
577052	0	CANT READ	ant read
14386	0	UGH. don't wanna edit anymoreeee So lost.	gh dont wan na edit anymoreeee lost
254577	0	just got up and I have a toothache	ust got toothache

Figure 6 Pre Processing of Tweets to Generate Word Cloud
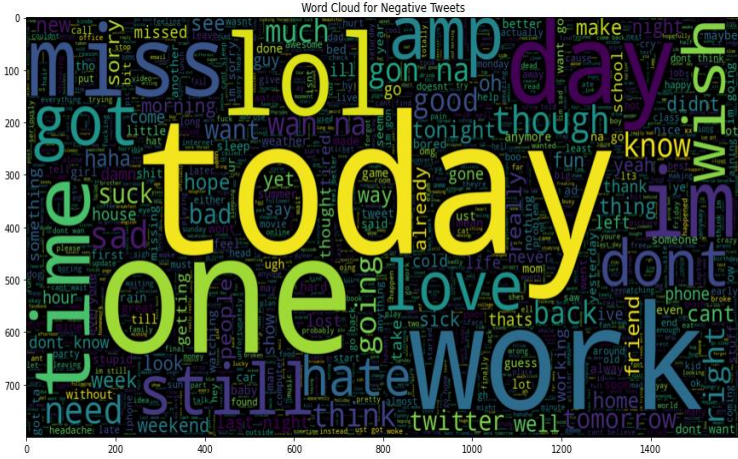
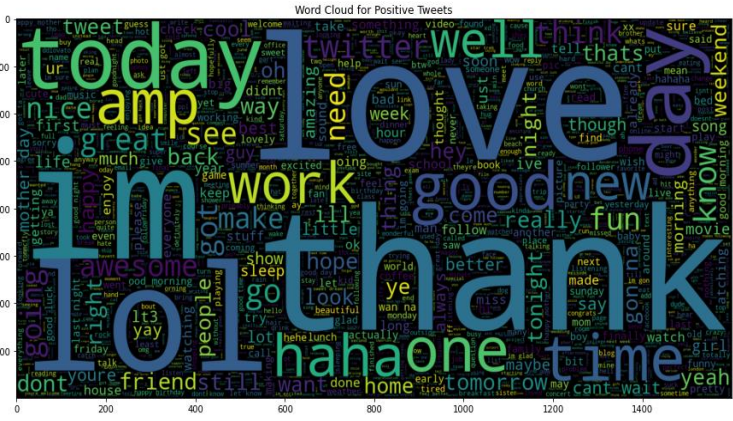Figure 7 Word Cloud Formation for Negative Tweets

Figure 8 Word Cloud Formation for Positive Tweets

4.2 Analysis of Classification Accuracy

Support vector machine based classifier is used for analysis of classification and prediction of sentiment from the analysis done on dataset. The process has been expressed with the figure of merit such as confusion matrix which is shown in figure 5.7. The process has been done on python with help of Jupyter notebook platform.
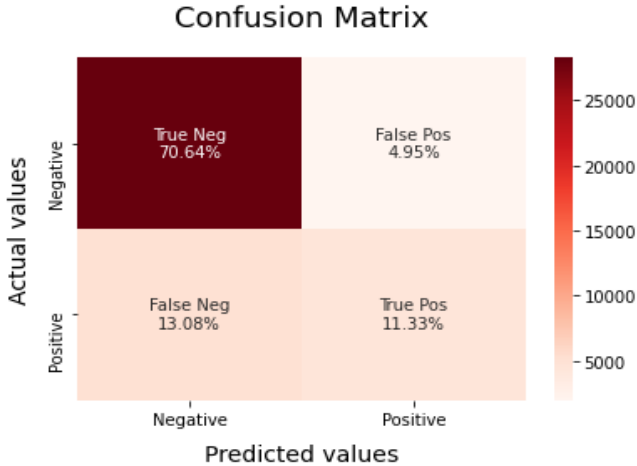

Figure 9 Analysis of Confusion Matrix by Support Vector Machine Classifier

The work done in this paper allows comparing different classifiers to classify a huge number of English tweets related to particular products into positive as well as negative sentiments. Using sentiment features rather than conventional text classification gives high accuracy. This system is used to rank satisfactory classifiers for sentiments and helps business organizations for making their future business plans related to the product.

Table 1

Analysis of Performance Parameters for the Sentiment Analysis

Parameters	Value
Accuracy of model on training data	**94.96 %**
Accuracy of model on testing data	**81.97 %**
Precision	**0.84 (Negative) and 0.70 (Positive)**
Recall	**0.93 (Negative) and 0.46 (Positive)**
Macro average Accuracy	**72 %**
Weighted Average Accuracy	**81 %**

Table 2

Comparative Analysis of Accuracy

Parameter	Random Forest Method	Decision Tree Method	Proposed Method
Accuracy of model on testing data	76 %	75.89 %	**81.97 %**

5. CONCLUSION AND FUTURE SCOPE

5.1 Conclusion

Twitter, a microblogging website, is a popular social media platform. A vast database of public sentiment about a variety of people, services, businesses, and products, etc. The system of analyzing one's public ratings is known as sentiment evaluation. When sentiment analysis is integrated with Twitter, it provides useful insights into what people are saying. The widespread availability of internet reviews and social media postings provides essential input for businesses to make more informed decisions when tailoring their marketing strategies to the interests and preferences of their customers. As a result, sentiment analysis is critical for assessing how the general public feels about certain services or products. This paper focuses on the various techniques for categorizing product criticisms (which can take the form of tweets) based on the criticisms expressed in tweets in order to determine whether the massive behavior is positive, negative, or neutral, and then using that information to evaluate the product market. The data for this look at our online product reviews was acquired from Twitter and utilized to rank the satisfactory sentiment classifier. The research presented enables a comparison of different classifiers for classifying a large number of English tweets about specific products into positive and negative feelings. When sentiment features are used instead of traditional text categorization, excellent accuracy is achieved. This approach is used to rank satisfactory sentiment classifiers and aids business groups in developing future business plans for the product.

5.2 Future Scope

Future study will focus on combining emotions and text for sentiment analysis, as well as using a hybrid classification technique to regional language tweets to see how effective it is .Sentiment analysis is used to determine if the sentiment in a piece of text is positive, negative, or neutral. Sentiment analysis is a form of natural language processing and is part of a subcategory of NLP techniques known as information extraction.

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