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Conducting Sentiment Analysis of Tweets Using Machine Learning

M.Prasanna Kumar[1]*, Shaik Rahima[2], Koritala Harika[3], Mudra Bhavya Sri[4],Kuchika Jhansi Rani[5]

1*Assistant Professor: Vignan's Nirula Institute of Technology and Science for Women.

2,3,4,5 B.Tech Scholar: Vignan's Nirula Institute of Technology and Science for Women.

Abstract

The widespread use of the World Wide Web has given rise to a new means for people to communicate their feelings. Additionally, it is a very information-rich medium where users may see other users' opinions, which are divided into several sentiment classes and are becoming more and more important when making decisions. In order to assess the information in the form of the number of tweets where opinions are extremely unstructured and are either favorable or negative, or somewhere in between, this study contributes to the sentiment analysis for customers' review classification. To do this, we pre-processed the dataset first. Then, we extracted the adjectives with meaning from the dataset—a process known as feature vector extraction. then chose the feature vector list and used the Semantic Orientation-based WordNet, which extracts synonyms and similarities for the content feature, in conjunction with machine learning-based classification techniques, such as Naïve Bayes, Maximum Entropy, and SVM. Ultimately, we assessed the classifier's performance in terms of accuracy, precision, and recall.

1. Introduction

The analysis of the contents on the Web, covering many different areas, is the subject of the current research paper. The number and volume of these sites are growing exponentially [1], as are their dedicated product sites, many of which specialize in gathering user reviews from multiple websites, including Amazon, among others. Opinions are expressed in tweets on Twitter as well [2-10] , but it can take a lot of effort to get a general comprehension of this unstructured data. Users see these unstructured data (opinions)[11] on a certain website, which helps them form an opinion about the goods or services and ultimately comes to a conclusion. After that, these viewpoints are generalized in order to collect feedback for various objectives and produce insightful viewpoints where sentiment analysis is applied.

Sentiment analysis is a procedure when the dataset comprises attitudes, emotions, or evaluations that consider [12-18] human thought processes. It's really challenging to try to understand both the positive and the bad aspects of a sentence. The It's really challenging to try to understand both the positive and the bad aspects of a sentence. To encapsulate the review, each attribute that is utilized to categorize the sentences should have a strong adjective. It is challenging to categorize these materials since they are written in a variety of ways that make it tough for consumers or businesses to understand. Before purchasing a product, consumers are influenced by [19-25] sentiment analysis to determine whether or not the information provided about it is satisfactory. Businesses and marketers utilize this analysis to comprehend their [26] goods or services in a way that allows them to be provided in accordance with the demands of the user.

For sentiment analysis, two different kinds of machine learning approaches are typically employed: supervised and unsupervised. Clustering is the result of unsupervised learning, which has a category and does not offer any accurate targets. Because supervised learning uses labelled datasets, the model receives the labels while it is being trained. This research article is based on supervised machine learning [27-31] to assist us better comprehend sentiment analysis.

2. Literaturesurvey

The paper [1] (Kaur, 2015) describe regarding geographic area flood information set collected from twitter and realize the opinion of individuals. They used Naive Bayes formula for the classification of information and result they got 67% accuracy. They need collected several resolution from the individuals that are useful for each government and non-government organization to handle such scenario in an exceedingly higher manner. These strategies simpler than lexicon-based formula.

The paper [2] (Paul, 2017) describe regarding the ultimate match of Indian premier league sport event 2015. Objective of this paper to research standardity {the recognition} of IPL match and that player are popular and that team is dominate. They need used Hadoop and Map cut back artificial language. They got result like MS Dhoni is most talked regarding player [32-35] and metropolis Indians team fairly dominated. This technique gave higher result.

The paper [3] (Mittal, 2016) describe the requirement and impact of the sentiment analysis on on-line platform. They need additionally bestowed a listing of sentiments of emotions, interjections and comments that are extracted from posts and standing updates. They need got result [35-38] to knowing whether or not {the on-line the web the net} reviews and posts are being useful to client or not and that on-line websites being most popular by the purchasers.

The paper [4] (Anto, 2016) describe the merchandise rating mistreatment sentiment analysis. In promoting of any product the producer can get the proper result from the client feedback. After got feedback they'll changes to his product in step with the feedback. Some [38-42] users continually fail to convey their feedbacks..

The paper [5] (Saragih, 2017) describe regarding the client engagement by analysis the comments on social mediain transport on-line. They used technique TF-IDF. The result shows that the class “Feedback system by driver” and “Feedback system by user” have the foremost comments for 3 means that of transports on-line, whereas class “service quality for driver “[42-48] has the littlest comments. This feedback of social media is accustomed evaluate the performance of this business transport on-line.

The paper [6] (Shahare, 2017) describe regarding the sentiment analysis of reports information of social media They need used technique naive Bayes and Levenshtein formula that confirm the feeling into totally different classes from social media news information. This technique provides {the higher the higher} performance for real time news information on social media and additionally provides better lead to term of accuracy. They got the result that the Levenshtein formula provides an awfully simple to text process on information. It works quick and supply most level of accuracy to process great deal of information.

This paper [7] (Mamgain, 2016) describe regarding the sentiment analysis of people’s opinions relating to high faculties in India. They need represented [48-50] comparison between the result obtained by the subsequent machine learning algorithms: Naive Bayes and SVM and Artificial Neural Network model: Multilayer Perception. Naive Bayes {Thomas Bayes mathematician} outperforms SVM for the aim of matter polarity classification that is fascinating as a result of the model utilized by Naive Bayes is easy (use of freelance probabilities) and therefore the likelihood estimates made by such a model are of caliber. Yet, the classification selections created by the Naive Bayes model portray a decent accuracy as a result of whenever a call with the upper likelihood is being created.

3. Proposed methodology

The three-stage model is the definition of the suggested hybrid model. This model's multi-aspect based filtration and impurity correction are applied during the initial preprocessing step. In order to normalize the input tweets, spell checking, stemming, acronym expansion, and stopword removal are defined at this step. The division of tag tokens into positive and negative elements from messages is also specified at this level. It also handles negative situations. The filtered text is processed in a second step to produce statistical features. This step involves transforming the input training and testing sets into the appropriate feature sets. In the last stage of this model, the hybrid classifier processes these features to predict sentiment. During the classification stage, KNN or SVM classifiers are chosen for each unique instance using a probabilistic predictive decision-making process.

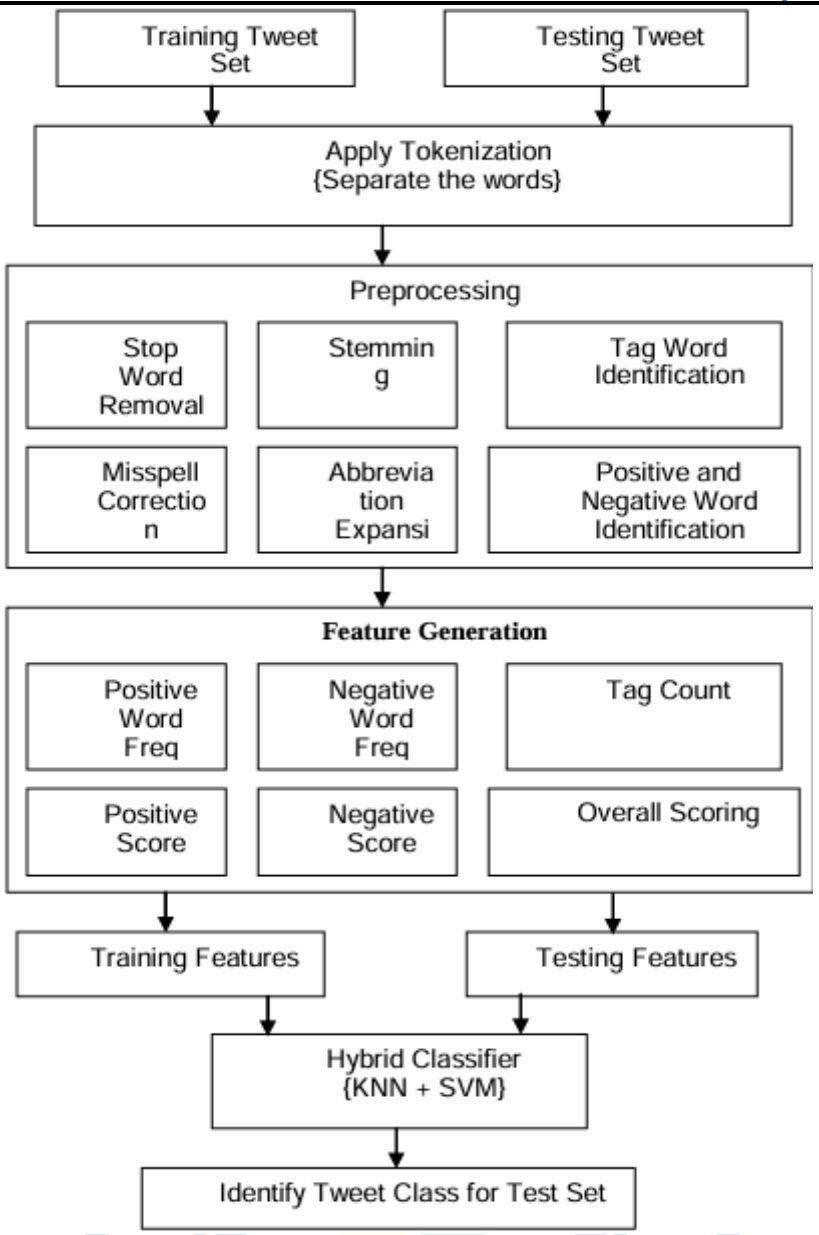

Fig 1: Flowchart of the proposed system

The classification is applied on the tweets acquired from the web. The description of dataset is given below in Table 1:

Features	Values
Dataset Name	Twitter-Sentiment-Analysis-FinalizedFull
Dataset Url	https://github.com/TharinduMunasinge/Twitter-Sentiment-Analysis
Number of Tweets	997
Classes	Positive Tweets , Negative Tweets and Neutral Tweets
File Type	CSV

3.1 Preprocessing:

Preprocessing involves a number of actions, including stemming, handling negation, handling stopword removal, abbreviation expansion, misspell correction, and creating positive and negative word lists for each tweet. For stemming, Porter's algorithm is employed.

Data

SrNo	Tweet	Filtered List	Tag Filtere...	Negative L...	Positive List	G	H
1	@united U...	[@unit, ua...	[ua5396, ...	[crap]	[get]		
2	I hate Tim...	[hate, time...	[hate, time...	[hate, porn]	[warner, li...		
3	Tom Shan...	[tom, shan...	[tom, shan...	[]	[]		
4	Found the ...	[found, sel...	[found, sel...	[]	[]		
5	@united a...	[@unit, arri...	[arriv, ye, fli...	[miss, slow]	[]		
6	Driverless ...	[driverless...	[driverless...	[]	[]		
7	how can y...	[not, love, ...	[not, love, ...	[joke]	[love]		
8	Safeway is...	[safewai, r...	[safewai, r...	[]	[rock]		
9	RT @jquer...	[rt, @jqueri...	[rt, ultim, jq...	[]	[]		
10	I saw Nigh...	[night, mu...	[night, mu...	[]	[]		
11	Missed thi...	[miss, , ge...	[miss, gen...	[miss]	[]		
12	is being fu...	[fuck, time,...	[fuck, time,...	[fuck, suck]	[warner]		
13	I hope the ...	[hope, girl,...	[hope, girl,...	[]	[hope]		
14	@aparajul...	[@aparaju...	[good, luck]	[]	[good, luck]		
15	needs so...	[explain, la...	[explain, la...	[]	[]		
16	@united T...	[@unit, tha...	[thank, ma...	[]	[thank, get]		
17	@ontheMA...	[@onthem...	[ditto!, not, ...	[]	[good]		
18	waiting in l...	[wait, line, ...	[wait, line, ...	[]	[]		
19	OMG, I wo...	[oh my go...	[oh my go...	[died, no]	[good]		
20	Theres a g...	[there, goo...	[there, goo...	[]	[]		
21	#MBA Adm...	[mba, adm...	[mba, adm...	[]	[]		
22	am loving ...	[morn, lov...	[morn, lov...	[outlier]	[love]		
23	Goodby, Si...	[goodbi, si...	[goodbi, si...	[]	[enjoi]		
24	12 Gift Ide...	[12, gift, id...	[12, gift, id...	[]	[lover]		
25	So the #C...	[coachella...	[coachella...	[]	[]		
26	New blog ...	[blog, post...	[blog, post...	[]	[]		
27	whoever is...	[whoever, r...	[whoever, r...	[rape, out]	[warner, u...		
28	@Donnie...	[@donnie...	[tell, spoke...	[]	[right, hop...		
29	Three Chi...	[china, aer...	[china, aer...	[]	[invest]		
30	Ok, first as...	[ok, asses...	[ok, asses...	[fuck]	[ok]		
31	heyy loves!...	[heyi, love...	[heyi, love...	[kick]	[loves]		
32	@united w...	[@unit, we...	[well, john,...	[]	[well]		
33	I loved tod...	[love]	[love]	[]	[love]		
34	RT @Wate...	[rt, @water...	[rt, ca, mer...	[]	[profit, well]		

Fig 2: Showing tweets after preprocessing

For stopwords, abbreviation expansion1 and misspell correction2 database is created.

Filtered list:-contains tweets after tokenization and applying the above written filters

Tag Filtered list:-contains the filtered list with @ tags removed. The @ tags are used in feature generation as tag count in each tweet.

Negative List:-contains negative adjectives in each tweet.

Positive List:-contains positive adjectives in each tweet.

3.2 Features Generation:

A list of adjectives3 is used for features generation. This list contains positive score, negative score, overall rating of an adjective among other attributes.

Attributes	Description
Id	Numeric Unique id to all adjectives
Adjective	Stores the textual information to represent the actual adjective
Pscore	Positive score, to represent the positive acceptability of an adjective Lies between 0 & 1
Fscore	Negative score, Lies between 0 & 1
Score	Overall score of adjective lies between -1 & 1 +ve values for +ve adjective -ve value for –ve adjective

Table 2: Describing various attributes of an adjective

The following features are utilized to train the classifiers:
Word count: The sum of all words in every tweet following filtering
Total number of @ tags used in every tweet
Negative word count: The total amount of negativity in every tweet
Total number of positive words in every tweet:
Positive score: The sum of the positive ratings for each positive adjective yields the overall positive score.
Negative score: The sum of the negative ratings for each negative adjective is the total negative score.
For every tweet, there is a positive and a negative score.
Class message 0: for unfavorable tweets

1: for neutral tweets

2: for positive tweets

3.3 Classification:

Following the creation of features, classification is carried out using our hybrid approach, which uses the prediction probabilities of both classifiers, as illustrated by the procedure below:

Algorithm:

Classification(TrainingSet,TestingSet) /*TrainingSet is the Training Tweet Set and TestingSet is the Testing Tweet Set on which features are generated */

{

1. TrainFeaturesSet=FeatureGeneration(TrainingSet)
   /*Generate Features for Training Set*/
2. TestFeaturesSet=FeatureGeneration(TestSet)

   /*Generate Features for Testing Set*/

3. SWeight=GenerateWeight(TrainFeaturesSet,SVM)

/*Process the Classifier, train with the Training Feature set and Generate Feature weights for SVM*, KNN is trained directly during testing/

4. For i=1 to TestFeatureSet.Length

   /*Process the Testing Instances*/

{

5. K1=Predict(TestFeatureSet(i),TrainFeaturesSet)

   /*Apply Prediction on Test Instance respective to KNN Classifier Weight*/

6.S1=Predict(TestFeatureSet(i),SWeight)

   /*Apply Prediction on Test Instance respective to SVM Classifier Weight*/

7. If (K1>Th1 And S1>Th1)

   /*Apply Hybrid Classifier for Test Class Identification, Th1 is the threshold used for prediction probability, Th1=0.5 is used here*/

{

8. TestFeatureSet(i).Class=IdentifyClass(greater(K1,S1))

}

9.Else If (K1>Th1)

/*Apply KNN Classifier for Test Class Identification*/

{

10. TestFeatureSet(i).Class=IdentifyClass(K1)

}

11. Else

```
12. /*Apply SVM Classifier for Test Class Identification*/
 {
13. TestFeatureSet(i).Class=IdentifyClass(S1)
 }
}
Return TestFeatureSet.Class
}
```

4. Result

The hybrid classification model based on SVM and KNN is provided in this study to process twitter features and extract hidden sentiments from them. Weka (3.8) is incorporated into Netbeans 8.0 for implementation. Weka is a popular data mining provides results in terms of accuracy and precision and can be used for preprocessing, grouping, classification, etc. f-measure, recall, etc. The different datasets, such as lists of adjectives, acronyms, and training dataset, testing dataset, and misspell corrections. Weka is used directly to run the classifiers KNN and SVM alone; however, when used in combination, weka is incorporated into Netbeans and the confusion matrix, and the results are manually generated. A separate comparative study is presented with respect to KNN and SVM based algorithms.

K=15 is used to compare the hybrid technique with KNN.

Features	Values
Size of Training Set	699(267-positive,264-negative,168-neutral)
Size of Testing Set	298(114-positive,113-negative,71-neutral)
Tweet Classes	Positive, Negative, Neutral
Existing Methods	KNN & SVM
Proposed	Hybrid KNN+SVM

The description of processing training and testing set is shown in Table 3

The following confusion matrix for KNN and SVM is obtained from Weka by opening the TrainFeaturesSet and TestFeaturesSet directly:

Table 4: Confusion matrix for KNN

		Predicted		
	Class	Negative	Neutral	Positive
Actual	Negative	**77**	19	17
	Neutral	9	**46**	16
	Positive	21	14	**79**

Table 5: Confusion Matrix for SVM

		Predicted		
	Class	Negative	Neutral	Positive
Actual	Negative	**77**	14	22
	Neutral	11	**47**	13
	Positive	16	20	**78**

Analysis results shows True Positives(TP), False Positives(FP), True Negatives(TN) and False Negatives(FN) for each sentiment class. Thus confusion matrix is derived below:

Table 6: Confusion Matrix for KNN+SVM

		Predicted		
Actual	Class	Negative	Neutral	Positive
	Negative	**77**	12	24
	Neutral	0	**48**	23
	Positive	0	12	**102**

With the help of confusion matrices Accuracy, Precision, Recall and F-measure for positive, negative and neutral classes are calculated and is also compared for the 3 approaches used above.

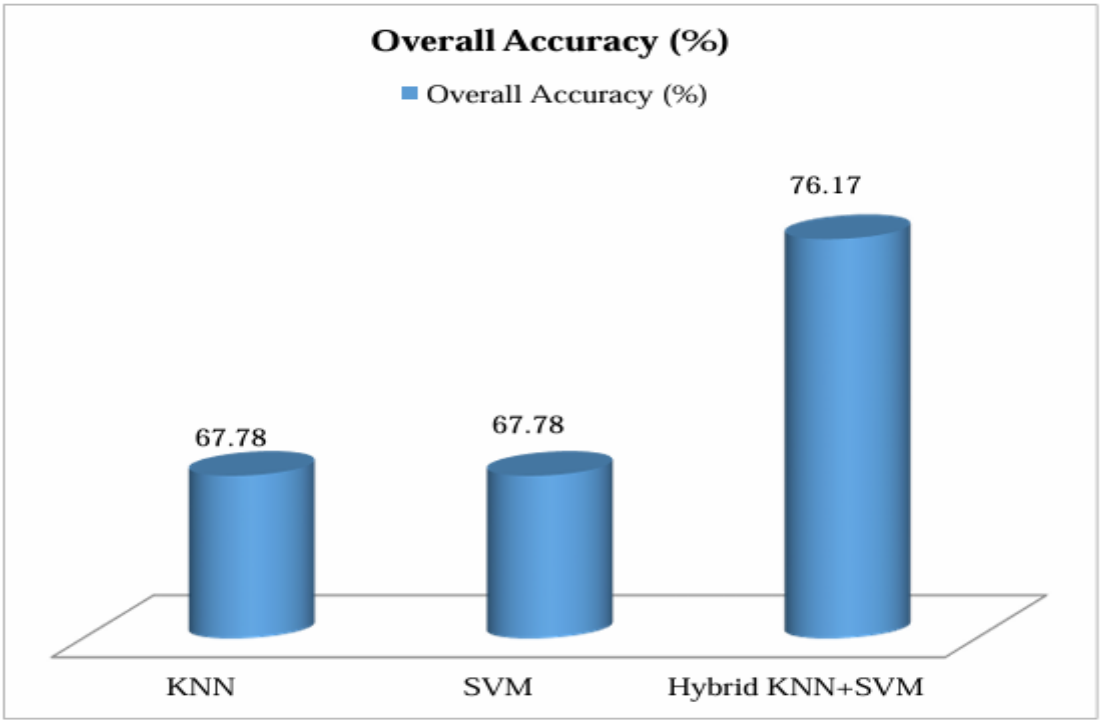

Fig 5: showing overall accuracy for 3 approaches

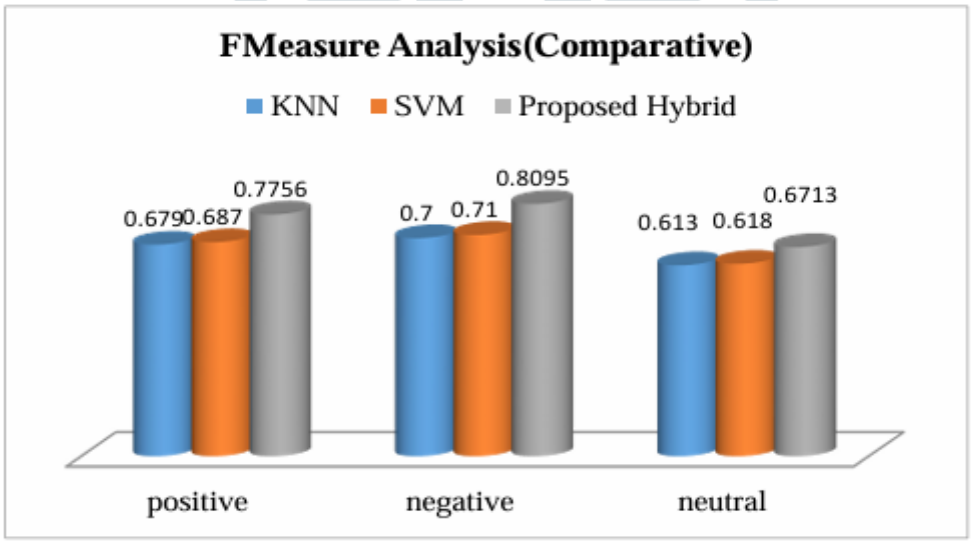

Fig 6: showing f-measure analysis

5. Conclusion

Opinion and text mining encompasses Twitter sentiment analysis as well. The main objective is to analyze the sentiments expressed in the tweets and utilize the collected data to train and test a machine learning model. Based on the model's

performance, we will be able to use it in the future. Data collection, text pre-processing, sentiment classification, sentiment detection, model training, and testing are among the steps involved. Over the previous ten years, the models utilized in this study have improved and now have efficiencies of between 85% and 90%. The dimension of data variety is still absent, though. Because of the language and acronyms used, it also has a lot of application issues. As the number of classes increases, many analyzers perform worse. Consequently, there has a very bright future for sentiment analysis research and development.

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