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A Comparison Analysis of Twitter based Support Vector Machine and Bayes Comment Classification Algorithms

Usman Bukar Usman[1]Muhammad Abubakar[2]

Usman Bala[3]Aminu tukur[3]Anass Aliyu Usman[4]and Abubakar Usman Abubakar[5]

[1] Department of Computer Science, Mai Idris Alooma Polytechnic, Geidam Yobe state, Nigeria,

ubu1700016.msc@buk.edu.ng

[2,3,4] Faculty of Computer Science and Information Technology Bayero University Kano, Nigeria.

[3] Department of Computer Science, Yobe State University, Yobe, Nigeria.

[5]Department of Social Development, Mai Idris Alooma Polytechnic, Geidam Yobe state, Nigeria.

Abstract

Classification is the process of classifying which set of categories a new observation belongs, Classification algorithms are used in identifying which of a set of groups a new observation goes. A classifier usually uses some training data provided to it, so that it will know how a given input variable to the classification algorithm is correlated to a specific class already defined by the by the classification system. In our work we had done comparative analysis between support vector machine algorithm and Bayes algorithm with respect to comment classification. The result and discussion of the system is presented. In the normal twitter data Support vector machine has the highest precision of 0.97. In the hate-speech data Bayes algorithm has the highest precision of 0.85. In the macro average data Bayes algorithm has the highest precision of 0.90. In the Weighted average data Support vector machine has the highest precision of 0.96. In the normal twitter data support vector machine and Bayes has the same recall of 0.99. In the hate-speech data support vector machine has the highest recall of 0.61. In the macro average data support vector machine has the highest recall of 0.80. In the Weighted average data, all the two algorithms have recall of 0.96. In the normal twitter data, all the algorithms have the F1-Score of 0.98. In the hate-speech data support vector machine has highest F1-Score of 0.67. In the macro average data SVM has F1-Score of 0.82. In the Weighted average data Support vector machine has highest F1-Score of 0.96. In the future work we recommend integrating more algorithms to our comparison among various comment classification algorithms

Keywords: Support vector machine, Bayes algorithm, Classifier, Machine learning

1. Introduction

ACORS

Many Machine Learning (ML) have been used for distinct purposes. However, Machine learning can broadly speaking classify into two extensive categories which include: supervised machine learning and unsupervised machine learning. Unsupervised machine learning is used to conclude datasets consisting of input information without labeled responses [59]. Supervised machine learning techniques attempt to locate out the relationship between enter attributes (independent variables) and a goal attribute (dependent variable) [60]. Supervised studying is further divided into two which are Regression and Classification.

Classification is the technique of determining which set of categories belongs to a new commentary [43]. Simply refer to computer gaining information of classifiers as 'classifiers.' A classifier many times makes use of some education information to know how a given entered variable is associated with a unique category. Once a classifier is virtually trained it can be used to determine the type of an object correctly. Classification belongs to the supervised learning group, where the statistics is also provided to the class. There are pretty a few one-of-a-kind sorts of computing machine evaluation that belong to the class of unsupervised. So the computing computing device getting to know algorithm is now now not identified in unsupervised. There need to be strategies for interconnecting objects and mapping them into an appropriate category. There are moreover one of a kind classification necessities in the domains, such as loan acceptance, clinical diagnosis, risk identification, and so on. Every day, laptop scientists and researchers come up with progressive strategies of the utilization of these strategies for Machine learning. Wikipedia describes textual content fabric classification as a procedure of computing-sorting and categorizing opinions expressed in a piece of text, exhibiting writers a positive, negative, or independent attitude nearer to a exceptional problem, product, and so on. [41]. Perceptron, Naive Bayes, Decision Tree, Logistic Regression, K-Nearest Neighbor, Artificial Neural Networks / Deep Learning, and Support Vector Machine are amongst the most customary algorithms used for teaching classifiers [35] [36] [37] [42] [45] [46]. That of these algorithms has its very own experts and cons and there is no top-notch algorithm amongst them for that application-case, this raises the query of which algorithm is the large best wonderful for the particle problem that one is making an attempt to deal with [31] [32] [33]. This work is a try to find out which Machine Learning classifier or algorithms work fine for sentiment contrast amongst guide vector computing gadget and Bayes announcement classification. Literature investigation had verified the effort of researchers on Twitter sentiment analysis for instance,[54] made a comparative discover out about Twitter sentiment evaluation strategies for continue to the motive the use of python and created an net organisation to integrate it with marketer pro. [55] labored on computing gadget studying based in reality sentiment contrast for Twitter account made an evaluation of techniques of sentiment analysis in the evaluation of political views by using the usage of way of making use of supervised –machine –learning algorithms such as Naïve Bayes and information vector machine. To the extraordinary of our know-how, no researcher had carried out comparative comparison between assist vector computing device algorithm and Bayes algorithm with understand to remark classification. The goal of this study is to figure out the most first-rate Machine Learning algorithm for classifying

remarks between the useful resource vector laptop algorithm and the Bayes algorithm.

COMMENT CLASSIFICATION ALGORITHMS

We have four classes of classification algorithms classes encompass tree-based, probability-based (e.g., Naive Bayes), rule-based, and association-based [21] [22] [49]. Such four classes can be commonly divided into two quintessential classification problem forms, the classification subject being binary classification and multi-class classification. The Email unsolicited mail detection desktop is a real instance of binary classification. An available way to do this is to map junk mail emails to 1 whilst non-spam emails are mapped to 0, whilst a clear example of multi-class classification is handwritten persona focus the area classes go from zero to 9 [19] [20]. Below in determine 1 is the classification of commentary classification algorithms.
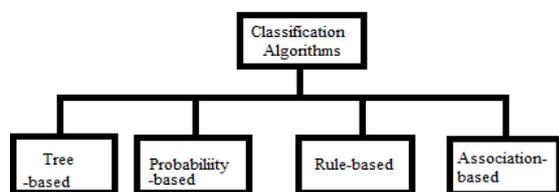

Figure. 1 Classification Algorithms

TDecision tree classifiers: A want tree is the simple constructing block of all wish tree-based classifiers. A decision tree in computing systems getting to recognize is set strategies that bring together sturdy inexperienced humans from inclined learners. In action, the choice tree normally has some complexities and is a very suited method for classification. A literature investigation had verified that Both random wooded area and boosted bushes can furnish noble penalties besides feature engineering [8] [23] [24] [25] [50]. 1. Probabilistic classifier: This is a classifier that can predict furnished the wondering

of an input, a distribution of possibility over a set of groups or classes, relative to the most probably crew to belong to the opinion. Probabilistic classifications have really helpful classifications on their very own or in special when combining classifications into ensembles [9][11][14][29][51][47][48].

2. Rule-based classifier: It is a classifier that makes use of hints for classification management. We have two kinds of rule-based classifiers that are guidelines that are at the equal time exclusive, and exhaustive. Classifier guidelines are together distinct and encompass at the same time wonderful laws. The policies are different, although [10] [13] [52] Exhaustive insurance policies classifiers have positive tips as they compensate for any feasible mixture of values of attributes. the record is governed with the aid of the usage of the capability of at least one law, it would not choose being tough to regulate. However, guidelines that are so imperative can now no longer be regarded as together one-of-a-kind [17] [18] [19].

3. An associative classifier: This is a form of a supervised mannequin of studying which uses pointers of affiliation to assign reason value. Wherever the ensuing category label mannequin corresponds to is created through way of an as-association classifier, each time the record meets positive necessities and is labeled as a result via the use of the classification on the right-hand facet of the rule [15][53]. Below in Table 1.1 is the desk of related literature.

Related literature is summarized in desk 1 below.

[12] Performed an experimental sentiment study about on the Lithuanian Internet statement datasets. Traditional computing device gaining knowledge of was once used, as well as deep learning. The Naïve Bayes Multinational

technique used to be the first-class end result obtained. Even the researchers used emotions removed, diacritics restored, and lemma uni-grams. While in the look up CNN has undervalued help for vector computer and Naïve Bayes, the distinction inaccuracy is negligible. Traditional techniques to computing machine mastering perform greater as compared to deep getting to know methods; even when utilized on small datasets, even deep gaining knowledge has tested precise results. They failed to restrict the distinction between usual and deep-rooted getting to comprehend methods at some point in this study. [56] Found that most lexicons may also moreover no longer discover a time period to be profitable in expressing unique feelings in a quantity of fields of predication, introducing mistakes in sentiment inference. A mannequin used to be proposed based totally on a context-graph that can be used to bring together one of a form sentiment lexicons through do-main the usage of the nearby context of the term. It was once observed that the model carried out higher effects than the primary lexicon. The newly developed tablet networks which have excessive normal overall performance enhancements have been investigated in their paper [7]. There's a lot of publicity on it, due to the fact of that. For paragraph, greater than CNN's [6] Find that the Unigram baseline is outperformed thru the tree kernel and function-based models. For the feature-based approach, attribute evaluation indicates that the most fundamental points are these which combine the prior polarity of words with the tags of their components of the expression. Using the in the past proposed cutting-edge unigram model as the groundwork for two classification tasks, a established fulfillment of over 4% used to be once achieved. 54] Worked on comparative study about of

Twitter sentiment assessment strategies for python-based stay features and developed a internet carrier to combine them with [8] Worked on neural community models for natural language processing, and used to be capable to test neural community fashions from the point of view of herbal language processing science in an effort to deliver natural language evaluation to tempo with neural techniques. [49] Developed an advice framework for a appropriate algorithm and its top of the line parameters for a given dataset, and an extra model was once built to predict the perfect parameter for a precise algorithm primarily based on archives won from historic datasets. [55] Worked on computer studying based sentiment contrast for Twitter account made a distinction of sentiment analysis techniques in the find out about of political views through making use of supervised – machine-learning algorithms such as Naïve Bayes and assisting vector machines. [2] Completed a sentiment evaluation of Twitter data science techniques. The researchers are investigating on Twitter on voice opinions about day by day issues. [58] worked on finding out about Twitter sentiment evaluation the usage of laptop studying algorithms on python. The researchers consider some papers involving search for in sentiment comparison on Twitter, describing the methodologies adopted and models utilized alongside describing a generalized python-based totally approach. Numerous researchers like [12], [27], and [56] had proposed a quantity of methods of shepherding sentiment evaluation and moreover had proposed a number of algorithms to conduct sentiment analysis. But appreciation the classification to which remark belongs will aid us to apprehend greater phrases of the commenter. In this research, we will try to find

out the satisfactory algorithm to be used in classifying remarks gotten from Twitter.

COMPARISON

Vector Machine algorithm used to be applied in the late 1990s and efficiently applied to applications related with engineering [59]. Support vector machines are supervised gaining knowledge of fashions with related analyzing algorithms that use a linear classifier to classify facts into two groups. [60]. Based on a set of training examples, each marked as belonging to one of the distinction of two categories, an aid vector computing device education algorithm generates a mannequin that assigns new examples to one or the other category, making it a non-probabilistic binary linear classifier (although there are techniques such as Platt scaling for the usage of vector resource computer in probabilistic classification setting) [44] [3]. in addition to performing linear classification, aid vector machines can effectually characteristic a non-linear classification the usage of what is referred to as the kernel trick, implicitly mapping their inputs into high-dimensional feature spaces [44]. Let $k(x.x)=x.x$ be a kernel, the soft-margin dual can be re-written as:be a kernel, the soft-margin dual can be written as follow

Maximize

$$\sum_{i=1}^{m} \alpha_i - \frac{1}{2} \sum_{i=1}^{m} \times \sum_{j=1}^{m} \alpha_i \alpha_j \, y_i y_j \, {}_{K(x_i x_j)}$$

Subject to $0 \leq \alpha_i \leq C$, for any i=1,…,m,

$$\sum_{i=1}^{m} \alpha_i y_i = 0$$

Eqn. 1

In the equation above, C is called hyper parameter, while $k(x_i x_j)$ is called kernel function. These are provided by user. the variables α_i are Lagrange multipliers. This change made to the dual problem is called the kernel trick.

Bayes algorithm is a probabilistic primarily based classification algorithm. It is based totally definitely on Bayes theorem. Bayesian classification is based totally on Bayes theorem, for a teaching remark C, the classifier calculates for every category, the probability that the statement be categorized below Ci, the vicinity Ci is the ith category, making use of the legislation of the conditional probability. A Naive Bayes classifier is an easy probabilistic classifier notably primarily based on making use of Bayes theorem (from Bayesian statistics) with sturdy (naive) independence assumptions. An benefit of the naive Bayes classifier is that it completely requires a small extent of schooling records to estimate the parameters quintessential for classification [25]. Naïve Bayesian classifier, however, is a binary classifier for obtaining sure / no from the information and is a very simple technique of finding proper or false classification from a dataset [13]. Naive Bayes (NB) is one of the typically used classification algorithms. However, does its conditional presumption of freedom have an impact on its success to any degree [14]. Researchers have used Naïve Bayes to classify tremendous journals to make the desire of great journals less tricky for people. They mentioned in their getting to know that the Naïve Bayes Classifier algorithm has been able to end up aware of the content material cloth of the articles, even although the accuracy cost is no longer very good. They concluded by using the usage of announcing that for higher accuracy,

journals quartile classification the use of the Naive Bayes Classifier algorithm wants to be optimized with exclusive algorithms [25].

Function TRAIN NAÏVE BAYES (D, C) returns log p(c) and p(w|c)

  For each class c ϵ C   #Calculate P(c) terms

  N_{doc} =number of documents in D

  N_c = number of documents from D in class c

  Logprior[c] ←$\log\frac{Nc}{Ndoc}$

  V←vocabulary of D

Bigdoc[c] ←append (d) for d ϵ D with class c

For each word w in V   #Calculate p(w/c) terms

Count(w,c) ←# of occurrences of w is bigdoc[c]

Loglikelihood[w,c] ←$\log\frac{count(w,c)+1}{\sum w' in\ v(count(w',c)+)}$

  Return logprior, loglikelihood,V d

Below in table 2 are the advantages and the disadvantages of artificial neural network algorithm and support vector machine algorithm.

Table 2 Prons and Cons of the Algorithms

algorithms
SUPPORT VECTOR MACHINE **Advantages** • works well with even unstructured and semi structured data [44] . • the kernel trick is real power of support vector machine [44]. • scale relatively well to high dimension data [60]. • Have generations in practice **Disadvantages** • It is not easy to choose a good kernel function [59]. • Consumes long training time for large datasets [59]. • It is difficult to understand and interpret the final model [44]..
NAÏVE BAYES **Advantages** • When assumption of independent predictors holds true, a Naïve Bayes   classifier performs better as compared to other models [16]. • Naïve Bayes requires a small amount of training data to estimate the test data. So, the training period is less [16]. • Naïve Bayes is also easy to implement[16]. **Disadvantages** • Main imitation of Naïve Bayes is the assumption of independent predictors. Naïve Bayes implicitly assumes that all the attributes are manually independent [16]. • If categorical Variable has a category in test data set, which was not observed in training data set, then model will assign a zero probability and will be unable to make a prediction [16].

2. EXPERIMENTAL DESIGN

In our experimental we conducted empirical evaluation of both Bayes algorithm and support vector machine as used in comment classification.

A. DATASET

•We evaluate our proposed recommendation algorithm on the twitter dataset Support Vector Machine Algorithm and Bayes Algorithm using Twitter dataset of 1MB size.

B. EXPERIMENTAL DESIGN

In our experimental design we intend to perform three different experiment. The experiments are as follows;

i. Comment classification algorithm based on Support Vector Machine Algorithm using Twitter dataset of 1MB size.

ii. Comment classification algorithm based on Bayes Algorithm using Twitter dataset of 1MB size.

iii. EVALUATION MATRICS

Precision, recall, and f-measure [34] [35] [36] are the most popular metrics used in evaluation [5]. Precision is a measure of accuracy or correctness and recall is a measure of absoluteness or completeness. The formulas are described in below.

$$Precision = \frac{True Positives}{True Positives + False Positittives} \quad Eqn.2$$

$$Recall = \frac{True Positive}{True Positive + False Negative} \quad Eqn.3$$

$$F1 = 2 \times \frac{PRECISION \times RECALL}{PRECISION + RECALL} \quad Eqn.4$$

iv. EVALUATION STRATEGY

To validate our approach, we have used 70% of dataset as training set and remaining 30% of dataset for testing purpose. we have conducted the experiment with twitter dataset. This process was repeated three times and, in each time,, we have selected a different test set from the divided parts.

3. RESULT AND DISCUSSION

In this section, we present the results of our comparison obtained from our experiment on twitter datasets.

A. EXPERIMENTAL RESULT

Experimental results are shown in Table 3 and table 4 graphical representation of the result in figure 2 below. The performance measured in terms of precision, recall, and F-Measure.

B. RESULT OBTAINED

In the normal twitter data Support vector machine has the highest precision of 0.97. In the hate-speech data Bayes algorithm has the highest precision of 0.85. In the macro average data Bayes algorithm has the highest precision of 0.90. In the Weighted average data Support vector machine has the highest precision of 0.96. In the normal twitter data support vector machine and Bayes has the same recall of 0.99. In the hate-speech data support vector machine has the highest recall of 0.61. In the macro average data support vector machine has the highest recall of 0.80. In the Weighted average data, all the two algorithms have recall of 0.96. In the normal twitter data, all the algorithms have the F1-Score of 0.98. In the hate-speech data support vector machine has highest F1-Score of 0.67. In the macro average data SVM has F1-Score of 0.82. In the Weighted average data Support vector machine has highest F1-Score of 0.96.

Evaluation result of the two algorithms: support vector machine and Bayes algorithm,

4. CONCLUSION AND FUTURE WORK

In the first section of the work, an introduction of the whole work was made, followed by literature review on machine learning, comment classification algorithms, and also the strength and weakness of the algorithms were discussed we made a comparison between support vector machine and Bayes algorithm as used in comment classification. The result and discussion of the system is presented. In the normal twitter data Support vector machine has the highest precision of 0.97. In the hate-speech data Bayes algorithm has the highest precision of 0.85. In the macro average data Bayes algorithm has the highest precision of 0.90. In the Weighted average data Support vector machine has the highest precision of 0.96. In the normal twitter data support vector machine and Bayes has the

same recall of 0.99. In the hate-speech data support vector machine has the highest recall of 0.61. In the macro average data support vector machine has the highest recall of 0.80. In the Weighted average data, all the two algorithms have recall of 0.96. In the normal twitter data, all the algorithms have the F1-Score of 0.98. In the hate-speech data support vector machine has

highest F1-Score of 0.67. In the macro average data SVM has F1-Score of 0.82. In the Weighted average data Support vector machine has highest F1-Score of 0.96. In the future we recommend incorporating more algorithms in our comparison among various comment classification algorithms.

Table 3 Support Vector Machine

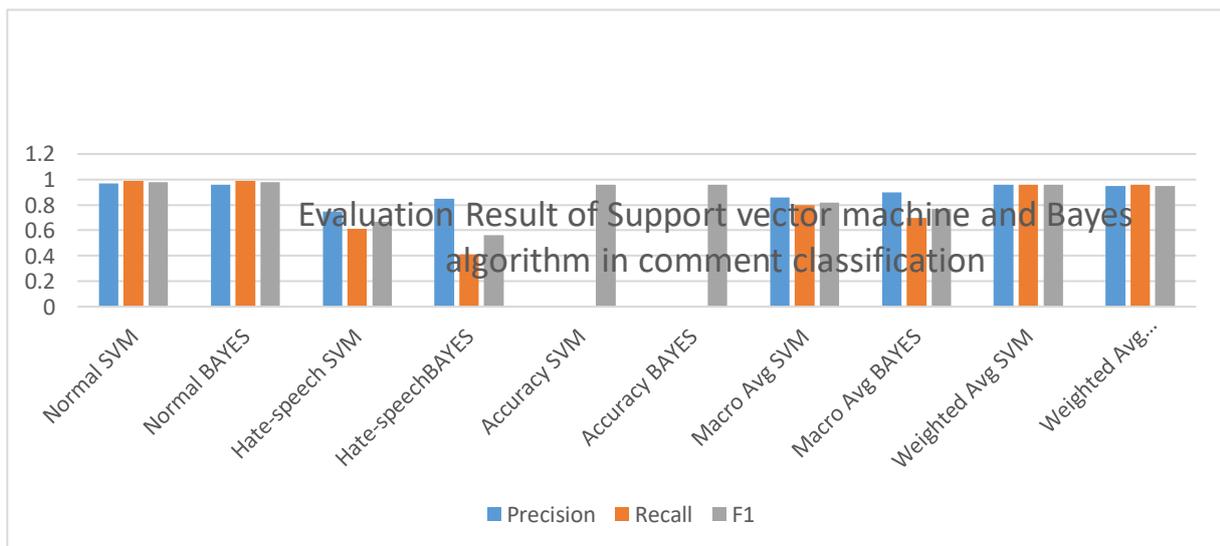| Algorithms	Precision	Recall	F1-score	Support
Normal	0.97	0.99	0.98	8940
Hate-Speech	0.75	0.61	0.67	649
Accuracy			0.96	9589
Macro avg	0.86	0.80	0.82	9589
Weighted avg	0.96	0.96	0.96	9589
Normal	0.96	0.99	0.98	8940
Hate-Speech	0.85	0.41	0.56	649
Macro avg	0.90	0.70	0.77	9589
Weighted avg	0.95	0.96	0.95	9589

Figure. 2: Comparison result of support vector machine and artificial neural network in comment classification

Table 1 RELATED WORK

SN	TITLE	REFERENCES	METHODOLOGY	WEEKNESS	STRENGTH
1	A sentiment analysis experiments on the Lithuanian Internet comment dataset using traditional machine learning and deep learning.	[12]	Long-short term memory	LSTM method underperformed the baseline.	the best result was demonstrated by the Naïve Bayes Multinomial method with the accuracy.
3	Building dynamic lexicons for sentiment analysis	[56]	context-graph	Recognized that most of these lexicons do now not think about that a word can express exclusive sentiments in extraordinary predication domains, introducing mistakes in the sentiment inference.	Building domain-specific sentiment lexicons the use of the word's neighborhood context.
4	Machine health monitoring using local feature-based gated recurrent unit networks	[57]	comparing the BiGRU RNN network with other neural networks such as CNN, LSTM, and Hybrid CNN+LSTM.	Other classiers are not explored	the BiGRULA accomplished higher accuracy over the take a look at dataset than the other three community models.
5	A comparative study of twitter sentiment analysis methods for live applications using python	[54]	created a web service to integrate it with marketpro.	Low accuracy	Its web based so it accessed by multiple individuals.

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