An Approach for Detection of Spam SMS using SVM & Navie Bayes Algorithm

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Abstract **-** The use of SMS has increased in market day by day due to its low cost and ease of access, short message service is one of the most widely used services which has to lead it to spam attacks on mobile devices. Many people do not like to receive them since they are annoying. In this paper, an approach for detection and filtering of spam SMS has been presented using the naive Bayes and SVM algorithm. Navie Bayes is considered as the most effective algorithm for classification and data mining. We have considered multiple features for classification of spam and ham messages. In this, the system has achieved 96.95% test accuracy and 100% test precision for Navie Bayes algorithm and 98.31% test accuracy and 100% test precision for SVM.

Index Terms**: spam, ham SMS, machine learning, navie bayes, SVM(Support vector machine),detection,filtering**

I. INTRODUCTION

SMS is the most useful way of communication in today's world.SMS is a very powerful technique used for message transmission over message-sending protocol. But it's also facing the serious problem of SMS spamming, Spamming[5] is nothing but the use of SMS service for the purpose of advertisements and to harm securities of the customer. Generally, these unauthorized activities are done through e-mails but from last decay, it has shown its effect through SMS too. Spam SMS contains[2] details regarding market details, advertisement, request for asking personal detail, etc. Spam SMS is also used for phishing and identity theft, The spam SMS causes annoyance to customers and customers are also charged for receiving those SMS thus this SMS should be removed before they are received at the mobile end by customers.

In this schema our proposed system identifies the spam SMS based on the features extracted from spam and ham messages, In this paper the spam detection classifier with the highest accuracy is introduced, it depends on the fact of the problem of data classification[8], Simplicity of proposed system is important because it uses less amount of time and implementation step to achieve the best result for spam detection, here we have used the Naive Bayes algorithm[6] as spam classifier for spam detection, In which we have found that SVM gives result with high accuracy than NB

II. SYSTEM DESIGN

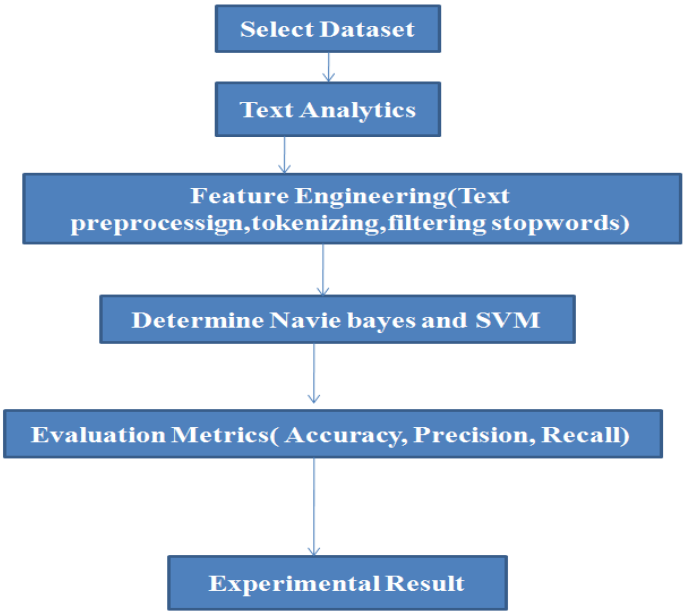

Fig.1: Modules of Proposed System

Following are the modules of a system

A. Load Dataset

In this paper, Data from the UCI Machine Learning repository will be used. This dataset contains 5574 text messages classified as ham and spam where total spam SMS are 747 and total ham SMS are 4827.

A1 fx v1

	A	B
1	v1	v2
2	ham	Go until jurong point, crazy.. Available only in bugis n great world la e buffet... Cine there got amore wat...
3	ham	Ok lar... Joking wif u oni...
4	spam	Free entry in 2 a wkly comp to win FA Cup final tkts 21st May 2005. Text FA to 87121 to receive entry question(std txt rate)T
5	ham	U dun say so early hor... U c already then say...
6	ham	Nah I don't think he goes to usf, he lives around here though
7	spam	FreeMsg Hey there darling it's been 3 week's now and no word back! I'd like some fun you up for it still? Tb ok! XxX std chgs
8	ham	Even my brother is not like to speak with me. They treat me like aids patent.
9	ham	As per your request 'Melle Melle (Oru Minnaminunginte Nurungu Vettam)' has been set as your callertune for all Callers. Pre
10	spam	WINNER!! As a valued network customer you have been selected to receivea å£900 prize reward! To claim call 090617014
11	spam	Had your mobile 11 months or more? U R entitled to Update to the latest colour mobiles with camera for Free! Call The Mc
12	ham	I'm gonna be home soon and i don't want to talk about this stuff anymore tonight, k? I've cried enough today.
13	spam	SIX chances to win CASH! From 100 to 20,000 pounds txt> CSH11 and send to 87575. Cost 150p/day, 6days, 16+ TsandCs ap
14	spam	URGENT! You have won a 1 week FREE membership in our å£100,000 Prize Jackpot! Txt the word: CLAIM to No: 81010 T&C
15	ham	I've been searching for the right words to thank you for this breather. I promise i wont take your help for granted and will fu

Fig.2: Dataset

B. Text Analytics

Text analytics is the process of exploring and analyzing a large amount of unstructured data like a, an, the, of, for, that and other attributes in the data. It's also known as text analytics.

Here, The purpose behind the use of text analytics is to find the frequency of words in both spam and non-spam messages. The words we obtain from the dataset is a model feature. For this we have used function counter, this counter keeps the track of number how many time a word occurs in the database.

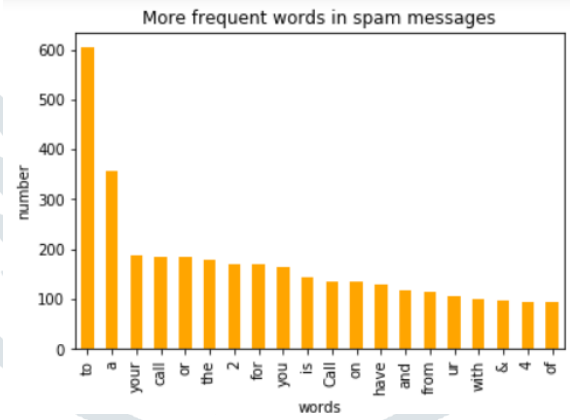

Fig.3: Frequent words in spam

We can see that the majority of words are 'to','a','your', call','or', the','2','for' etc. These words are known as stop words. These stop words are nothing but the words occurring the most of times in dataset.

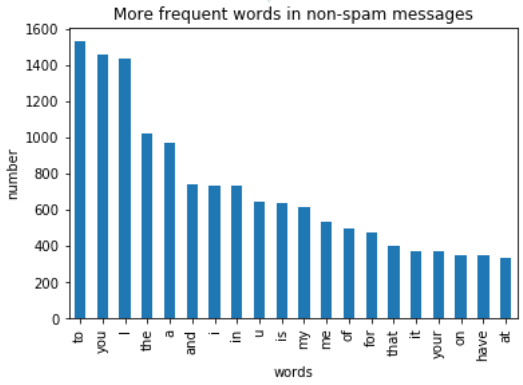

Fig.4: Frequent words in ham

C. Feature Engineering

Feature engineering is very important since it affects the performance of our classifier. Therefore the feature which will affect the process will be considered and others will not just to save space and improve performance time of classifier. Feature engineering has a performance component like Text preprocessing, tokenizing and filtering to build a dictionary of features and convert them into feature vectors.

The use of all features is time-consuming and thus can affect the performance of a classifier. In this research, we have used all these features for spam detection. The number of features we obtained is 8400 which will be used for classification.

D. Determine Machine learning algorithms

Navie Bayes: NB is the simplest probabilistic classification algorithm which is based on Bayes theorem due to its strong navie independence assumption. This assumption treated each word as single and independent. NB shows good performance under conditions where words are independent. With this condition, it handles real and discrete data because it's fast to train and fast to classify.

Support vector machine: SVM is a non-probabilistic classifier. Here each data in the dataset is viewed as a point in |v| dimensional space. It draws lines in space to separate black points and white points. New incoming data points will be put in the space. Based on the separating lines, we can classify the messages into spam and ham. It is simple and shows fast result but the problem is that they are hard to train.

E. Evaluation Metrics

In our proposed system the classifier is evaluated using Accuracy, Precision, and Recall, However for classifying binary class evaluation reference the confusion matrix. In order to compute evaluation metrics, identifiers are defined which are a collection of true positive, true negative, false positive, false negative.

True positive is the message that are correctly classified as spam.

The true negative is the message that is classified as ham.

False positive is ham messages that are classified as spam.

False negative is spam messages that are classified as ham.

Following are the metrics using which our system is evaluated.

Accuracy: It's the percentage of the messages that are classified correctly.

Precision: Its number of spam messages that are classified

Recall: It defines the number of spam messages classified as spam.

Alpha: Its number added during the Navie calculation to avoid the Zero result

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III. EXPERIMENTAL RESULT

In our proposed approach, The Navie Bayes and SVM classifier are used with very fast and accurate result providing python library, In this, we have used Pycharm IDE and Jupiter notebook as our tool, In which firstly we have collected a large amount of SMS from UCI Machine learning repository. Next , we load the python libraries which contains libraries like numpy, pandas, matplotlib, collections, sklearn and Ipython.where numpy and pandas for read-write and other operations, matplotlib for the visual presentation of frequent words on graph, Collection to use the counter vector to generate the counter vector and finally sklearn for feature extraction, model selection, SVM and navie bayes algorithm, Here data is loaded and presented using matplotlib graphs, then we find the frequency of words in spam and ham and generate the model feature for that we have used function vector. In the end, we find that the most of the frequent words are stop words So to increase the performance time of our classifier and to reduce the size of data we removed those stop words which generally don't affect the whole operation of classification. For this purpose, we have performed Text preprocessing, tokenizing, and filtering of stop words to build the dictionary of features and transform the dictionary into a feature vector.

After that we have to transform spam/non-spam into a binary variable, then we split our dataset into train and test set using a sci-kit-Learn library and especially the train_test_split method. In this test size=0.33 indicates the size of the test set in percentage which is 33%, Now we apply the naive Bayes and SVM to train the different models, finally, we evaluate the accuracy, recall, and precision of the model with the test set. we check the top 10 models generate to see the model with most test precision and test accuracy

Following is the confusion matrix with naive Bayes classifier

	Predicted 0	Predicted 1
Actual 0	1587	0
Actual 1	56	196

Fig.5: Confusion metrics for NB

Following is the result we obtained after NB operation

```
best_index = models[models['Test Precision']==1]['Test Accuracy'].idxmax()
bayes = naive_bayes.MultinomialNB(alpha=list_alpha[best_index])
bayes.fit(X_train, y_train)
models.iloc[best_index, :]
```

```
alpha             15.730010
Train Accuracy     0.979641
Test Accuracy      0.969549
Test Recall        0.777778
Test Precision     1.000000
Name: 143, dtype: float64
```

Fig.6: Final Result with NB

As we can see in the figure we misclassify 56 spam messages as non-spam messages and we did not misclassify any non-spam messages which are our goal

The same way we also apply support vector machine in this system and we train different models with a change in regularization parameter C

Following is the confusion metrics with support vector machine classifier

	Predicted 0	Predicted 1
Actual 0	1587	0
Actual 1	31	221

Fig.7: Confusion metrics with SVM

Following is the result we obtained after SVM operation

```
best_index = models[models['Test Precision']==1]['Test Accuracy'].idxmax()
svc = svm.SVC(C=list_C[best_index])
svc.fit(X_train, y_train)
models.iloc[best_index, :]
```

```
C                 800.000000
Train Accuracy      0.997053
Test Accuracy       0.983143
Test Recall         0.876984
Test Precision      1.000000
Name: 3, dtype: float64
```

Fig.8: Final Result with SVM

As shown above, SVM misclassifies 31spam as non-spam messages which seem better than navie Bayes result.

Following shows the comparison of both classification algorithms.

Table 1: Performance Comparison

Name	Test Accuracy	Test Precision	Test Recall
NB	96.95%	100%	77.77%
SVM	98.31%	100%	87.69%

IV. CONCLUSION

This system classifies the SMS into spam and ham messages using Navie Bayes and SVM. In which we found that Navie Bayes has an accuracy of 96.95% and SVM has an accuracy of 98.31 %. Our main aim was to detect and classify spam messages which it's classifying correctly with high accuracy.

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