The Classification of Phishing Websites using Naive Bayes Classifier Algorithm

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Abstract
The background of this research is how to find out the selected websites which are classified through the naive Bayes classifier algorithm. With this algorithm, it can be seen how far the classification of Phishing is. The method used in this study is to use experimental methods or research on the data obtained, these tests will include new data that can be accounted for and can determine whether the data is suitable for use. The problem raised in this study is how to find out which principles have been clarified with the dizziness method using the naive Bayes classifier algorithm, with the algorithm, which websites can be classified properly. The purpose of this study is how to find out the data tested through training data will produce new data, especially well for items and produce from values Naive Bayes algorithm obtained an average accuracy value of 92.98% with a TP Rate of 0.930%, FP Rate of 0.076%, Precision of 0.930%, Recall of 0.930% and Fmeasure of 0.930%.

Keyword : *Phising, Website, Naive Bayes Classifier, Algorithm.*

I. INTRODUCTION

Making a website, many things must be prepared, especially from the content and appearance of the website and no less important is the security of a website because security is very important so that the data on a website can be safe and not misused by people who are not responsible for their existence. With this security, the website will be able to provide more detailed information so that it can be used by many people [1].The website also needs to be placed in a safe place with the concept of data mining and the concept of data so with this, storage becomes a very important thing because it will be a security system that is very concerned by people who want to be malicious to the website, therefore with the concept big data, the data on the website will feel safe and will be maintained as much as possible so that the data does not leak to unauthorized people [2].

The problem that the author wants to develop from this journal is a system or a way to improve the security of data security from phishing websites using the Naïve Bayes Classifier (NBC) algorithm. If the previous journal discussed cybercrime regulations and laws, especially in the form of phishing, then I as the author will develop writing to prevent phishing [3].The method I use is using the Naive Bayes Classifier Algorithm. The method used in this research is to conduct experiments on website data which will soon be tested using a good Naive Bayes Classifier Algorithm, so that the level of security of the website can be known [4].The final goal in this development is to apply the Naïve Bayes Classifier Algorithm to improve the security of the data we have from phishing websites which are expected to be useful in information technology forensics, especially in the field of cybercrime phishing websites [5].

II. LITERATURE REVIEW

One of the Indonesian IT forensic experts: Digital forensics or sometimes called computer forensics is the science that analyzes digital evidence so that it can be accounted for in court. The digital evidence includes mobile phones, notebooks, servers, any technological devices that have storage media and can be

analyzed. Computer security, a computer is said to be safe if it can be relied on and the software works as expected. Computer security is related to self-prevention and detection of unknown intruders in computer systems [6].In computer system security, what needs to be done is to make it difficult for other people to interfere with the system used, whether it is using a stand-alone computer, local network or global network. Must ensure the system can run well and conducive. Meanwhile, Barda Nawawi stated that Cyber Crime is one of the dark sides of technological progress that has a very broad negative impact on all areas of modern life today in his book Mayantara Crime Studies Development of Cyber Crime in Indonesia [7].Another theory is also expressed, the notion of cybercrime is all the activities of individuals or groups that use computer networks as a means to commit crimes, or make computers as targets of crime [8]. In the development of this paper, it has a variable, namely a dataset from UCI Machine Learning using a dataset that has a total of 30 attributes taken from the characteristics of phishing which are classified from four main groups features [9].

III. RESEARCH METHOD

Based on the results of the literature review above, the research method in this study uses experimental methods and data processing so that the effectiveness of the website you want to know can be known.With several steps that have been compiled based on the experimental method as described in the image below.

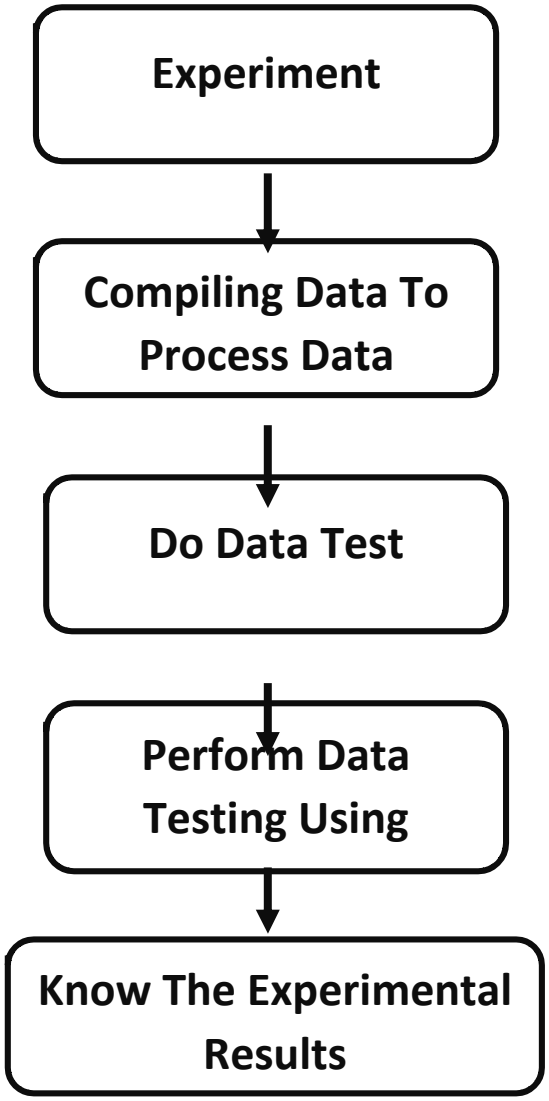

Fig 1. Experimental Method

IV. RESULT AND DISCUSSION

The development that I did was to apply the nave Bayes classifier algorithm to improve data security from phishing websites. Naive Bayes classifier (NBC) is a machine learning method that utilizes probability and statistical calculations proposed by British scientist Thomas Bayes, which predicts future probabilities based on past experience. The theory of Naïve Bayes Classifier works very well compared to other classifier models.

The nave Bayes classifier method will look for several possibilities whether the website we are accessing is safe or not. That way we can maintain the security of our data by not accessing the web that has been detected as a phishing web. This nave Bayes method was chosen because it was considered the most appropriate to solve the problem of detecting phishing websites. This method is able to select data by classifying a set of data by utilizing probability and statistics. Where the probability used is by using predictions of future probabilities on the basis of the past.

$$P(H|X) = \frac{P(X|H).P(H)}{P(X)} \quad \ldots\ldots\ldots\ldots\ldots (1)$$

Where :

X : Data with unknown class

H : Hypothesis data is a specific class

P(H|X) : Probability of hypothesis H based on condition X(posteriori probability)

P(H) : Hypothesis probability H(prior probability)

P(X|H) : Probability of X based on the conditions on the hypothesis H

P(X) : Probability X

The explanation it can be interpreted that the nave bayes method can be interpreted as a process of classifying based on the number of instructions given based on the results of the sample to be tested, while the nave bayes method can be seen below.

$$P(C|F1\ldots Fn) = \frac{P(C)P(F1\ldots.Fn|C)}{P(F1\ldots.Fn)} \quad \ldots\ldots\ldots(2)$$

Where the variable is still influenced or describes the class of the F1 variable so that the C variable before entering the data and processing it can produce possibilities that can change in the variable so that it gets accurate evidence. Therefore, the number of formulas in the sample must be followed by a lot of formulas.

$$\text{Posterior} = \frac{\text{Prior x likelihood}}{\text{Evidence}} \quad \ldots\ldots\ldots\ldots..(3)$$

Based on formula 3 above, it can be seen that the posterior produces a prior multiplied by like-like divided by the existing evidence. Therefore, by using the application called, the contents of the website classification can be known.

$$\begin{aligned} &P(C|F1, \ldots Fn = P(C)P(F1\ldots.Fn|C) \\ &= P(C)P(F1|C)P(F2,\ldots Fn|C,F1) \\ &= P(C)P(F1|C)P(F2|C,F1)P(F3,\ldots Fn|C,F1,F2) \\ &=(C)P(F1|C)P(F2|C,F1)P(F3|C,F1,F2)P(F4,\ldots \\ &Fn|C,F1,F2,F3) \\ &= \\ &P(C)P(F1|C)P(F2|C,F1)P(F3|C,F1,F2)\ldots P(Fn| \\ &C,F1,F2,F3\ldots Fn\text{-}1) \quad \ldots\ldots.(4) \end{aligned}$$

This is where the assumption of very high (naive) independence is used, that each clue (F1, F2..Fn) is independent of each other. With these assumptions, one similarity applies as follows for nave Bayes calculations:

$$P(F_i|F_j) = \frac{P(F_i \cap F_j)}{P(F_j)} = \frac{P(F_i)P(F_j)}{P(F_j)} = P(F_i) \quad (5)$$

Untuk i≠j , sehingga

$$P(F_i|C,F_j) = P(F_i|C) \quad (6)$$

based on formulas 5 and 6 above, it is known that the Nave Bayes theorem is used in the classification process to get the next data and uses a Gaussian Density identification formula.

$$P(X_i = x_i|Y = y_j) = \frac{1}{\sqrt{2\pi\sigma_{ij}}} e^{-\frac{(x_i-\mu_{ij})^2}{2\sigma^2 ij}} \quad (7)$$

Where :

Q	: Opportunity
Xi	: Attribute to I
xi	: attribute value to i
Y	: the class you are looking for
yi	: Sub class Y you are looking for
u	: mean, states the average of all attributes
q	: Standard deviation, represents the variance of all attributes

After testing and finding 80% of the training data evidence and 20% of the data results, cross-validation techniques are used on the model. With a sample issue, the Multiplus Cross-validation data will be used once as data validation.

Fig 2. Total Data Set

K fold cross validation begins by dividing the desired n-fold number of data. In the process of cross validation, the data will be divided into n partitions with the same size D1, D2, D3.. And then the test and training process is carried out n times. In iteration i partition. Will be test data and the rest will be training data.The test scenario is the stage of determining the tests to be carried out. The test is carried out using the kcross validation method with a k value of 10 fold, this test aims to determine the accuracy of the nave Bayes classifier method applied to the analysis and tested with different training and testing data. The use of 10

folds is recommended because it is the best number of folds for validity testing as shown in the following table:

Table 1. Data Set Training

Fold	Data	*Subset*
Fold 1	Training Testing	$S_2, S_3, S_4, S_5, S_6, S_7 S_8, S_9, S_{10}$ S_1
Fold 2	Training Testing	$S_1, S_3, S_4, S_5, S_6, S_7 S_8, S_9, S_{10}$ S_2
Fold 3	Training Testing	$S_1, S_2, S_4, S_5, S_6, S_7 S_8, S_9, S_{10}$ S_3
Fold 4	Training Testing	$S_1, S_2, S_3, S_5, S_6, S_7 S_8, S_9, S_{10}$ S_4
Fold 5	Training Testing	$S_1, S_2, S_3, S_4, S_6, S_7 S_8, S_9, S_{10}$ S_5
Fold 6	Training Testing	$S_1, S_2, S_3, S_4, S_5, S_7, S_8, S_9, S_{10}$ S_6
Fold 7	Training Testing	$S_1, S_2, S_3, S_4, S_5, S_6, S_8, S_9, S_{10}$ S_7
Fold 8	Training Testing	$S_1, S_2, S_3, S_4, S_5, S_6, S_7, S_9, S_{10}$ S_8
Fold 9	Training Testing	$S_1, S_2, S_3, S_4, S_5, S_6, S_7, S_{10}$ S_9
Fold 10	Training Testing	$S_1, S_2, S_3, S_4, S_5, S_6, S_7 S_8, S_9$ S_{10}

This development is an experimental research where the research is carried out by applying k-fold cross-validation to the phishing website dataset. The data set is taken from the UCI Machine Learning repository. Furthermore, from the feature reduction results, the dataset is applied to a popular machine learning algorithm, namely nave Bayes to measure the level of accuracy. The software used in this research is WEKA, with the research flow modeling as below:

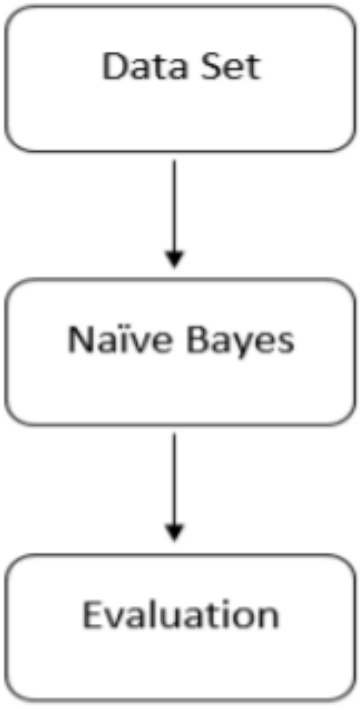

Fig 3. Training Testing

After that, the writer collects some data that will be processed with the data source from UCI Machine Learning. By using the nave Bayes algorithm, the data will be processed to find results with the best level of accuracy. This Naïve Bayes Classifier algorithm will later identify a website address that is suspected of being a phishing website address. That way from the side of the internet network users will know that the website address is safe or not. By using a dataset that has a total of 30 attributes taken from the characteristics of phishing which are classified from four main groups, namely, Address Bar based Feature, Abnormal based Feature, HTML and Javascript based Features and Domain based Feature. For testing Naïve Bayes using the k-fold cross-validation method to determine the performance of the algorithm. The categorical table of attributes can be seen in the table below:

Table 2. Value and Attribute

Value	Attribute
1 = Valid 0 = Suspicious -1 = phising	having_IP_Address, URL_Length, Shortining_Service, having_At_Symbol, double_slash_redirecting, Prefix_Suffix, having_Sub_Domain, SSLfinal_State, Domain_registeration_length, Favicon, port, HTTPS_token, Request_URL, URL_of_Anchor, Links_in_tags, SFH, Submitting_to_email, Abnormal_URL Redirect, on_mouseover, RightClick, popUpWidnow, Iframe, age_of_domain, DNSRecord, web_traffic, Page_Rank, Google_Index, Links_pointing_to_page, Statistical_report, Result (Label)

The use of k-fold cross-validation will later use 10 folds of the total existing dataset. The dataset used here is about 11055 attribute data, which means it will be divided into about 1100 data in each fold. From these calculations will produce detailed accuracy taken up to the F-Measure which is described by the results in the table below.

Table 3. Flods Cross Validation

Hasil 10 Folds Cross Validation							
	1	**2**	**3**	**4**	**5**	**6**	**7**
Weight average	0.93 0	0.07 6	0.93 0	0.93 0	0.93 0	92.9 8	7.01

Table Description:
The above results are in percent %
1. TP Rate
2. FP Rate
3. Precision
4. Recall
5. F-Measure
6. Accuracy
7. Error

From the detailed calculation of the accuracy, you will find the results of cross validation with an accuracy level that can be said to be very accurate because it will get a value of 92.98% and a small error tolerance value of 7.01%.

V. CONCLUSION

The Naïve Bayes algorithm is very precise to calculate the classification of phishing websites. From the dataset that has been inferred with the following results, the results of testing the Naive Bayes algorithm obtained an average accuracy value of 92.98% with a TP Rate of 0.930%, FP Rate of 0.076%, Precision of 0.930%, Recall of 0.930% and Fmeasure of 0.930%. Thus the results of the application of the naive bayes algorithm to protect data from phishing websites are said to be very good, and the use of the algorithm is appropriate if it is used to prevent data theft from a phishing website threat.

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