

# Analysis Social CRM against Customer Retention Using Naive Bayes Classifier (Case Study: Xyz.Ltd)

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## ABSTRACT

XYZ.Ltd is one of companies in Indonesia, which is oriented in the area of retail franchising. In the implementation of SCRM by XYZ.Ltd, Customer Retention is the main case to be considered. By keeping and maintaining good relationship on every customer, it is expected that Customer Retention can be created. The analysis of Customer Retention in this study using a Naive Bayes Classifier method to find out the accuracy of data from customer comment according to 300 datasets and 2 attributes of Customer Retention decision making that is 1) Classification of customer satisfaction level; 2) Company response. In this study tools that is used is rapidminer studio 6.4.0 to quantify the accuracy of data, and the percentage of accuracy that is obtained around 99,29%. From the result of class precision negative prediction is 100% and class precision positive prediction is 98,00%.

Keywords: *Social CRM, Customer Retention, Naive Bayes Classifier.*

## 1. INTRODUCTION

Customer Relationship Management (CRM) is an enterprise to identify the best customer of a business thereafter maximizing all the percentage of the consumers by satisfying and maintaining them. There are three main process in applying CRM, such as: 1) Acquiring new customer (acquire); 2) Enhancing the relationships with customers (enhance); and 3) Maintaining customer (Customer Retention). From these three process of CRM, the third process of customer retention is a stage that needs special attention from the company, where the company is required to apply the right strategy to retain customers.

Recently CRM has evolved into application systems or software, and also leverages the social media called CRM Social (Social CRM / SCRM) [2]. The enormous use of online social media such as Twitter, Facebook,

Instagram, Youtube and other online social media, it becomes an opportunity for companies to improve communication with customers. Companies that have implemented social CRM or SCRM must also be able to process, analyze, create new strategies and innovations to fulfill customer's needs in order to achieve customer retention. One of the companies that have implemented SCRM is XYZ.Ltd.

XYZ.Ltd is a franchise retailer network in Indonesia and has been approved by the government through an award given to XYZ.Ltd as the "Leading Franchise Company". The number of outlets until 2015 reaches 11,400 outlets and lead to the beginning of 2016, the number of outlets reaches 12,800 stores. XYZ.Ltd is easy to find in residential areas, office buildings and public facilities.

Responding to the development of technology and information, XYZ.Ltd has been very active in implementing SCRM in supporting its business. It has been proven within the online social media activities that have been done among others: the use of Twitter as an online social media reached out the followers around 413,853 people with 67,365 posts activities, Facebook with the number of followers reaches out 1,822,046 people, Instagram with the number of followers reaches out 241,344 people, Youtube with the number of viewers around 573 people, web applications and some other android mobile applications. As the emerge of SCRM implemented by XYZ.Ltd, it is important to do surveillance in a form of observation towards SCRM activity that aims to find out how much influence of online social media in order to achieve customer retention. The observation of XYZ.Ltd SCRM activity will use an observation method process, afterwards data that has been observed in the form of customer comments will be processed and analyzed using naive bayes classifier (NBC).

In this study naive bayes method is used. The method aims to measure the level of accuracy of customer data, whether satisfy or not the customers with products and services offered by the company XYZ.Ltd, also by



classifying the level of customer satisfaction based on the use of words from customer comments data that impact on customer retention. NBC has a high and promptitude degree of accuracy when applied to large amounts of data [3].

This study will focus on the analysis of XYZ.Ltd SCRM to achieve customer retention. The main objectives and targets of the study are to find out how high the accuracy of data from customer comments to customer retention using naive bayes classifier method.

## 2. RELATED RESEARCH

The study entitled "Using Social CRM to Influence Customer Service and Loyalty: A Perspective In The Airline Industry". This study combines qualitative and quantitative methods by conducting interviews and online observation. Interview conducted for JetBlue. The Netnography method is used for qualitative research. Data collected based on Netnographic analysis reaches out 502 Tweets, and 26 online survey responses. The result of this study is the integration of social media to CRM affect customer service and customer loyalty. The main effect of Social CRM implementation is the increasing opportunity to collect customer feedback [4].

Another study entitled "CRM Based On Naive-Bayesian Classification". The study is focused on building CRM applications to manage the data of customers. The built up of that applications using Naive Bayes classification to analyze and estimate customer patterns that generate ID cards as concessions from companies [5].

The study, entitled "Naive Bayes Classification Approach for Mining Life Insurance Databases for Effective Predictions of Customer Preferences over Life Insurance Products". The main focus in this study relating to the Naive Bayesian Classification algorithm that is how to classify and predict the customer based on the life insurance dataset. The results of the analysis shows that Naive Bayes has an effective potential in analyzing customer preference for life insurance products [6].

Another related study entitled "A Naive Bayesian Classifier for Educational Qualification". This study using classification methodology utilizing the Naive Bayesian classification algorithm for classifying people in 3 classes which are Low, Medium and High, based on 3 decision-making attributes that represent their educational qualifications. The results prove that the proposed method has been verified accuracy experimentally 90% with high Kappa value [7].

## 3. CRM, SOCIAL MEDIA, SCRM, CUSTOMER RETENTION AND NAIVE BAYES CLASSIFIER

### 3.1 CRM (Customer Relationship Management)

Definition of CRM according to experts [6]:

a) Kalakota and Robinson (2001), defines CRM as an integration of coordinated sales, marketing and service strategies.

b) Laudon and Travel (2002), is to store customer information and record all contacts that occur between customers and companies, and create customer profiles for company staff who needs the information about the customer.

c) Kotler (2003), CRM supports a company to provide customer service in real time and to connect with each customer through the use of customer information.

From those definitions about CRM, it can be concluded that CRM is essentially a business strategy that utilizes integrated information systems by positioning customers as a key aspect by collecting, storing and managing data, also analyzing and satisfying customer needs.

CRM has three main process: 1) getting a new customer (acquire). New customers are gained by providing easy access to information, new innovations and exciting services; 2) improve customer relationship (enhance). The company attempts to establish relationships with customers through the provision of good service to customers (customer service); 3) retain customer (customer retention). This stage is an effort to get customer loyalty by listening and trying to satisfy customer's desires [8].

CRM allows company to provide a better services for customers directly by developing the relationships with customers through the use of information or database (customer database) owned by the company [9].

### 3.2 Social Media

Social media can be defined as production, consumption and cross-platform information exchange for social interaction [10]. The term "social media" has been used in several contexts related to different technologies and what they can achieve. The latest innovations and technologies that depend on CRM are one of the factors that enable one to one initiative. As a result of Web 2.0 and social mediation, companies can develop their relationship to customize shopping experience, develop new products, or to build long-term profitable relationships [11].



### 3.3 SCRM (Social Customer Relationship Management)

SCRM combines the basics of CRM using digital channels, such as social networks. Thus, it does not replace traditional CRM but should be regarded as an enriching [11]. In other words, SCRM is not a separate part of CRM, SCRM is not a new product, but incorporates social media technology into existing CRM. The use of social media technology opens great opportunities for companies to interact directly with customers (collaborative conversations).

SCRM is defined as a business strategy supported by a technology platform in order to deliver value that is profitable for the company and its customers [12]. The other definition of SCRM is a philosophy as well as a business strategy supported by technology platforms, business rules and processes, and social characteristics, which is made to engage customers in a collaborative conversation to deliver mutually rewarding benefits within the scope.

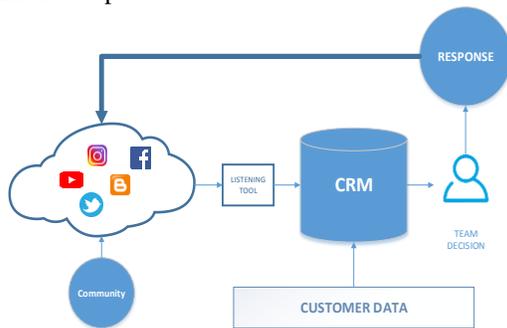


Fig 1. Figure 1 is a simple SCRM design overview in this study which is modified based on the SCRM design by Morgan and Chan [14].

### 3.4 Customer Retention

Customer Retention is the marketing objective in order to protect customers from moving on the competition. The benefits of customer retention in terms of both short- and long-term economic value are as follows [15]:

- 1) Cheaper. The investment costs incurred to attract new customers outweigh the costs of maintaining existing customers. Some studies say that the cost of the company to attract new customers 5-fold more expensive.
- 2) Free promotion fee. Customers who perform have been satisfied and retention is usually voluntarily and glad to speak positively and recommend the products and services they buy
- 3) Premium cost. Satisfied customers willingly pay a higher price.

### 3.5 Naive Bayes Classifier (NBC)

The Naive Bayes Classifier is a probabilistic learning method based on Bayes's theorem. A key feature of NBC is the assumption of independence of each feature in the dataset [16].

In this method all attributes will contribute to decision making, with the same attribute weight being important and each attribute free from each other [17]. This algorithm predicts future probabilities based on previous experience [18].

The basis of NBC's theorem used in programming is the Bayes formula as follows [19]:

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

Where:

$P(H|X)$  = posterior probability H in X

$P(X|H)$  = posterior probability X in H

$P(H)$  = Prior probability of H

$P(X)$  = Prior probability of X

Bayes and HMAP (Hypothesis Maximum Appropri Probability) HMAP method is a simple form of bayes method called Naive Bayes. HMAP can be used as a method to derive hypotheses from a decision.

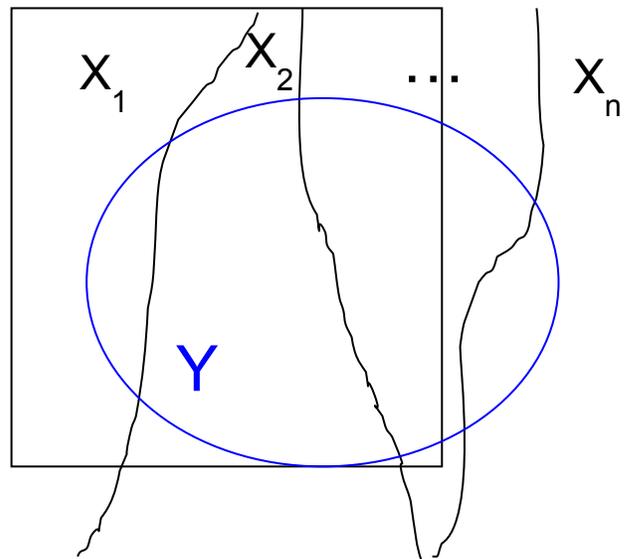


Fig 2. Possibility  $X_k$  in  $Y$

#### 4. RESEARCH METHODOLOGY

Processes in conducting the study are as follows:

**Entree** process, in the form of identification of an aim and make research study. Identification of aim is a process that refers to the background of the study. The study framework is designed as it has been listed in the systematic of writing scientific articles, namely: Introduction, literature review, Research Methodology, Results and Discussion, Conclusions and Bibliography. This research methodology will be conducted based on observation and data analysis using naive bayes classifier method.

**Data Collection** process, is the process of collecting data related to research that will be conducted with reference to the theory of research and case study research: XYZ.Ltd. Data Collection of online social media is focused on three online social media. The most relevant XYZ.Ltd is Facebook, Twitter and Instagram. The data which is collected from three online social media focuses on customer feedback in the form of customer complaints based on positive or negative word accuracy that will affect the achievement of customer retention.

**Analysis and Interpretation** process, in the form of data analysis of Facebook, Twitter and Instagram from XYZ.Ltd. The naive bayes classifier method is used to show customer feedback data classification analysis in the form of customer complaints classified based on the level of customer satisfaction to achieve customer retention, tools used to analyze and interpret data, researchers use rapidminer.

**Research Ethics** process, research ethics here means that as in the research conducted feedback data from customers and the name of withheld company (XYZ.Ltd) so that the results of this study does not harm any side.

#### 5. RESULT AND DISCUSSION

Based on the research process, so that the results and discussion are as follows:

##### 5.1 Entree process

Entree step results, in the form of the purpose of study which is conducted to analyze the accuracy of customer comments data in SCRM activities made by XYZ.Ltd to achieve customer retention. The study step is based on theories and case study studies.

##### 5.2 Data Collection process

The result of data collection process, in the form of data from social media online, XYZ.Ltd is most relevant seen from the number of online activities such as Facebook, Twitter and Instagram. The collection of data from all three online social media will be discussed as follows:

**Focus Facebook Data:** Since 2010 XYZ.Ltd has been actively using Facebook to support the company's business processes. The data feedback or interaction can be seen as in Figure 3 as follows:



Fig 3. Customer's comment on Facebook

**Twitter Data Focus:** Just like Facebook, XYZ.Ltd has been utilizing Twitter's social media since 2010. Customer feedback data can be seen in Figure 4 as follows:



Fig 4. Customer's comment on Twitter

**Instagram Data Focus:** Instagram is one of the most popular online social media nowadays. With the rapid growth user of Instagram in Indonesia, XYZ.Ltd has used Instagram to support their business. The first post of XYZ.Ltd on March 01, 2015. Customer feedback data can be seen in figure 5 as follows:



Fig 5. Customer's comment on Instagram

Table 1. Dataset XYZ.Ltd

Customer	Social media	Comment
P8	Facebook	Semoga beruntung.. menunggu pengumuman sebulan.....
P16	Facebook	Tasnya bagus..terimakasih XYZ.....
P179	Instagram	Sistem blm aktif, eror sama sj PHP
P198	Twitter	Kelakuan buruk, total yg

hrs	dibayar	14.700
kasirnya	minta	15.000
ckckck		

1. Analysis and Interpretation process

a. Level of Customer Satisfaction

From dataset collected in table 1, then the next process is to determine the level of customer satisfaction manually. In the classification level of customer satisfaction there are 3 process to be done that is pre-processing, weighting and classification. There are several words that become attribute determinants of customer satisfaction levels that can be seen in Table 2.

Table 2. Classification of Customer Satisfaction Level

Word Choice	Satisfaction Level
Kecewa, Kedaluwarsa, Error, Mahal, Rugi	Tidak Puas
Mohon, Sabar, Syarat, Semoga	Puas
Murah, Jaya, hemat, Sukses, Alhamdulillah	Sangat Puas

1. Pre-Processing

Pre-processing step of data that is done include:

- Clearing process: Maintains consistent data quality so that can avoid an empty grade or noise and data inconsistency.

Table 3. Clearing

Comment Data	Clearing Result
Alhmdullillah....saya.kalo	Alhamdulillah Saya
..belanja..pelayananya	Belanja Pelayanan
baik mbk	Baik

- Case Folding: It is the uniformity process of letters form on a document by converting uppercase to lowercase or contrarily.

Table 4. Case Folding Process

Clearing Data	Case Folding Result
Alhamdulillah Saya	alhamdulillah saya
Belanja Pelayanan Baik	belanja pelayanan baik

- Tokenizing process: The process of cleansing and cutting words and picking up important parts of the word.

Table 5. Tokenizing Process

Case Folding Data	Tokenizing Result
alhamdulillah saya	alhamdulillah
belanja pelayanan baik	saya
	belanja
	pelayanan
	baik

- Normalization: The process of normalizing inappropriate words such as "muraaaaah" is changed to "murah".
- Filtering: is a process of taking important words tokenizing result.

Table 6. Filtering Process

Token Data	Filtering Result
alhamdulillah	alhamdulillah
saya	belanja
belanja	pelayanan
pelayanan	baik
baik	

- Steaming: The process of converting a mixed word into a basic word such as "tertipu" is changed to "tipu".

2. Word Warming

After the pre-processing step of the data, the next step is weighting. The weighting result is divided into 3 probabilities according to the level of customer satisfaction.

Table 7. Not satisfy probability customer

	Soci al Media	disappoin ted	err or	loss	Not satisfy probabilit y
P68	FB	0,412	0,00	0,00	0,412
P65	FB	0,000	0,24	0,00	0,245
P290	IG	0,000	0,00	0,00	0,000
P286	IG	0,000	0,00	0,00	0,000



P91	IG	0,000	0,000	0,000	0,000
P58	FB	0,000	0,000	0,272	0,272
P291	IG	0,000	0,000	0,000	0,000
P93	IG	0,000	0,000	0,000	0,000
P29	FB	0,000	0,000	0,000	0,000

Table 8. Satisfy Probability customer

Customer	Social Media	patient requirement	hopefully	Satisfy probability
P68	FB	0,000	0,000	0,000
P65	FB	0,000	0,000	0,000
P290	IG	0,210	0,000	0,210
P286	IG	0,000	0,440	0,440
P91	IG	0,000	0,315	0,315
P58	FB	0,000	0,000	0,000
P291	IG	0,000	0,000	0,000
P93	IG	0,000	0,000	0,000
P29	FB	0,000	0,000	0,000

Table 9. Very Satisfy probability customer

customer	Social Media	cheap	victorious	thrift	Very satisfy probability
P68	FB	0,000	0,000	0,000	0,000
P65	FB	0,000	0,000	0,000	0,000
P290	IG	0,000	0,000	0,000	0,000

		0			
P286	IG	0,000	0,000	0,000	0,000
P91	IG	0,000	0,000	0,000	0,000
P58	FB	0,000	0,000	0,000	0,000
P291	IG	0,580	0,000	0,000	0,580
P93	IG	0,000	0,000	0,796	0,796
P29	FB	0,000	0,619	0,000	0,619

In Table 7-9, it can be seen that each table represents the level of customer satisfaction based on the TF-IDF feature. In the calculation of customer level satisfaction if the probability of not satisfied on one customer is greater than the other probability can be seen in table 7, so that the customer level satisfaction is not satisfied. In table 8, if the probability of satisfying is greater than the probability of not being satisfied or very satisfied, then the satisfaction level is satisfied, contrarily for table 9.

3. Customer Classification

From the weighting stages of the word, then the results of customer classification can be seen in table 10:

Table 10. Customer result classification

Customer	Social Media	Not satisfied probability	Satisfy probability	Very satisfied probability	classification
P68	FB	0,412	0,000	0,000	Not satisfy
P65	FB	0,245	0,000	0,000	Not satisfy
P290	IG	0,000	0,210	0,000	satisfy
P286	IG	0,000	0,440	0,000	satisfy
P91	IG	0,000	0,315	0,000	satisfy
P58	FB	0,272	0,000	0,000	Not satisfy
P291	IG	0,000	0,000	0,580	Very satisfy
P93	IG	0,000	0,000	0,796	Very satisfy



P29	FB	0,000	0,000	0,619	Very satisfy
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**b. Corporate Response**

According to the observations is conducted, researcher see some comments that are often used by companies in responding the customers on the three social media XYZ.Ltd is the word Sobat as an usual greeting with the percentage is 24%, said halo with 14% percent as well as the word thank you often used at the end of the comment. Company behavior in communicating with customers can be seen in Figure 6.

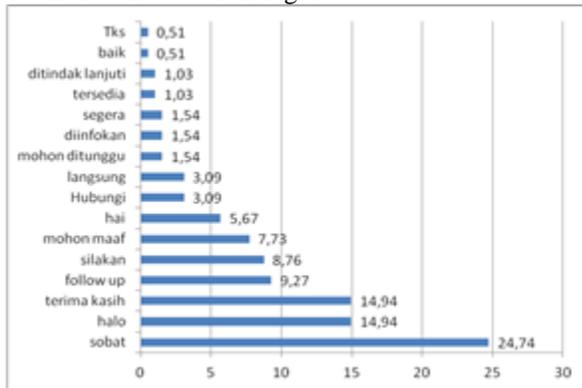


Fig 6. Company Behavior

In the application of SCRM company's response or corporate response especially to customer complaints is very important. Implementation of NBC method based on the observation that is conducted to produce attribute of company response, which influence to customer retention can be seen in Table 11 as follows:

Table 11. Corporate Response

Customer	Social Media	Company's respond
P8	Facebook	No
P16	Facebook	Yes
P179	Instagram	Yes
P198	Twitter	No

Based on table 11, the Corporate Response attribute generates two categories: "Yes" for the company's decision to respond to customer complaints and the "No" category explains that the company does not respond to complaints from customers. It can be explained from table 11 that P8 (P8 explains: customer with number 8) after observation, the customer does not get a response response from the company. While P16 or customer 16

get response or reply to comments from XYZ.Ltd company.

**c. Customer Retention**

From the analysis of customer retention decision-making attributes, then at this stage of customer retention, is a decision label that will result in a customer can survive on products / services offered XYZ.Ltd in SCRM implementation. The training data table can be seen in Table 12 below:

Table 12. Data Training sample

Cust omer	Social Media	Classific ation	Compa ny respon d	Custo mer retenti on
P8	Faceboo k	Satisfy	Tidak	Tidak
P16	Faceboo k	Very satisfy	Yes	Yes
P179	Instagra m	Not satisfy	Yes	No
P198	Twitter	Not satisfy	No	No
P29	Faceboo k	Very satisfy	No	Yes
P66	Faceboo k	satisfy	Yes	Yes

Based on the sample training data in table 12, then the classification of NBC will be divided into 2 predictions of an event that the customer is said to be able to survive on products / services offered XYZ.Ltd are as follows:

- Hypothetical decision of customer retention = Yes:
    - H1 (Very Satisfied, Yes) = Yes
    - H2 (Very Satisfied, No) = Yes
    - H3 (Satisfied, Yes) = Yes
    - \* decision "Yes" is a decision that the customer can survive on products / services XYZ.Ltd
  - Hypothetical decision of customer retention = No:
    - H1 (Satisfied, No) = No
    - H2 (Not Satisfied, No) = No
    - H3 (Not Satisfied, Yes) = No
    - \* "No" decision is a decision that customer can not survive on product or service of XYZ.Ltd
- From hypothesis result of sample training data, hence need to do hypothesis test based on formula of theorem NBC, where assumption of customer retention sample data are:



Y = Customer Retention

X1 = Classification

X2 = Corporate Response

In fact from the results obtained, Decision P (Y = Yes) = 3/6 and Decision P (Y = No) = 3/6.

If the data is examined in NBC implementation, then if customer classification = SATISFY, but the customer does not get the response from the company (corporate response = NO), will there be Customer Retention ?.

Fact:

$$1. P(X1 = Satisfied | Y = Yes) = 1/3,$$

$$2. P(X1 = Satisfied | Y = No) = 1/3,$$

$$3. P(X2 = No | Y = Yes) = 1/3,$$

$$4. P(X2 = No | Y = No) = 2/3$$

HMAP (Hypothesis Maximum Appropriation Probability) of this state is:

$$P(X1 = Satisfied, X2 = No | Y = Yes) = \{P(X1 = Satisfied | Y = Yes). P(X2 = No | Y = Yes)\}.$$

$$P(Y = Yes) = \{(1/3). (1/3)\}. (3/6) = 0,057$$

$$P(X1 = Satisfied, X2 = No | Y = No) = \{P(X1 = Satisfied | Y = No). P(X2 = No | Y = No)\}$$

$$.P(Y = No) = \{(1/3). (2/3)\}. (3/6) = 0,112$$

From the result of HMAP calculation of probability value of decision of Customer Retention = No (0,112), bigger than decision of Customer Retention = Yes (0,057). So the results obtained are the decision Customer Retention = NO, which means that customers do not survive the product / service from XYZ.Ltd.

The results of testing the grade accuracy with rapidminer tools can be explained as follows:

### 1. Pre-Processing and Validation Process

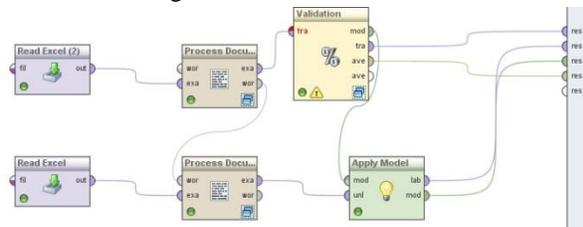


Fig 7. Pre-Processing and Validation Process

As mentioned before, in figure 7 are the process taken in this research which first is pre-processing data on training data or training data to be target data used. Validation stage is the data validation process and determine the classification model that is naive bayes, as in figure 8.

### 2. Naive Bayes classification process

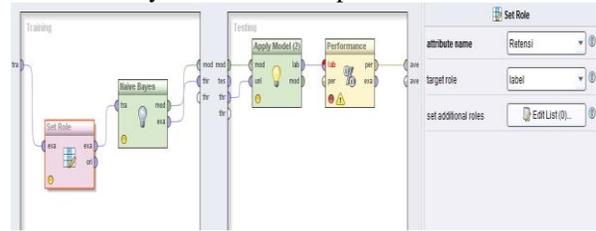


Fig 8. Naive Bayes Classification process

The determination of naive bayes design classification can be seen in figure 8. After determining the design classification in the training data, the next step is to test the data using the data testing or test data to produce the accuracy of NBC and the classification data pattern. The data test process can be seen in figure 7 above. From the data test results, the grade accuracy of Customer Retention prediction results produce the highest accuracy of 99.29%.

PerformanceVector (Performance)				SimpleDistribution (Naive Bayes)			
Table View				Plot View			
accuracy: 99.29%							
	true tidak	true ya	class precision				
pred. tidak	90	0	100.00%				
pred. ya	1	49	98.00%				
class recall	98.90%	100.00%					

Fig 9. Accuracy Results

From the grade accuracy that is obtained based on the size evaluation of the NBC design classification in figure 9, it can be explained that the prediction of classification result is not for not decision = 90, the prediction is not for yes decision = 0, the prediction for not decision = 1, and the prediction yes for yes decision= 49. The result of Class precision which is obtained for customer retention prediction "No" = 100% and customer retention prediction "Yes" = 98.00%. While the success system rate to rediscover the information can be seen in the class recall decision "No" = 98.90% and class recall decision of "Yes" = 100%.

By using rapidminer studio 6.4.0 to know the level of accuracy in customer comments data that affect customer retention using this method of NBC generate two class simple distribution design that is retention class "Yes" 0,340 and retention class "No" 0,660. From the simple distribution obtained, the "No" class is larger than the "Yes" class with 1360 distributions, this means more customers can not survive the products / services of XYZ.Ltd The results of simple distribution design can be seen in figure 10

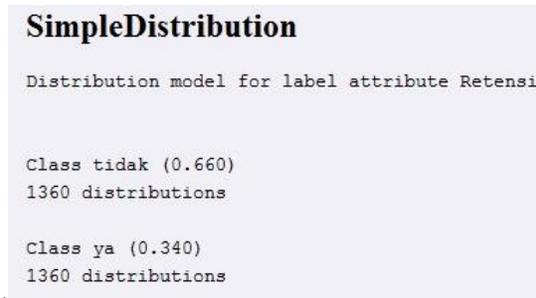


Fig 10. Simple Distribution Design

The graph result classification of NBC result method prediction with customer retention as label class produce charts in Figure 11.

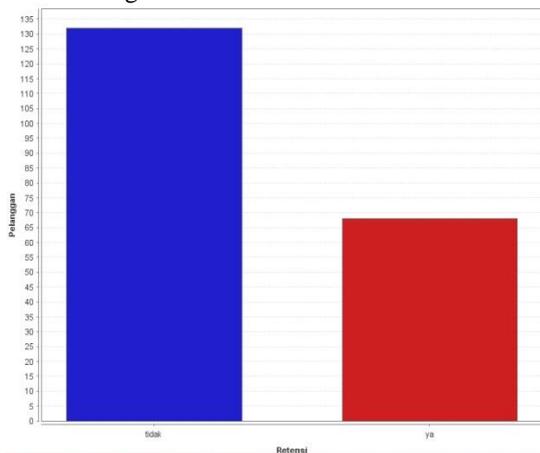


Fig 11. Charts Retention Attribute

Information :

Blue color: Chart Retention attributes of not  
Red color : Chart Retention attributes of yes

## 6. CONCLUSIONS

Based on research activity analysis of SCRM XYZ.Ltd to achieve customer retention using Naive Bayes Classifier method, so the conclusion that can be taken as follows:

1. SCRM is part of the data mining application where in this process, it is need for data mining step that must be done in the analysis phase (customer satisfaction level, corporate response and customer retention).
2. The accuracy result of using Naive Bayesian Classifier (NBC) method, yields 99.29% accuracy, with class precision obtained for customer retention class = No is 100%, while class precision for customer retention class = Yes is 98, 00%. This means that according to data analyzed by more customers, which is no longer stand on XYZ.Ltd

3. The high data accuracy using NBC in this study, indicates that the NBC method is feasible to be applied in classifying and analyzing the accuracy of customer data. This is proven by the results of high accuracy for 300 datasets analyzed in this study.

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