



Sentiment Analysis on Mobile Banking Application Using Naive Bayes Classifier and Association Methods

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Abstract

The internet has grown rapidly and become the needs of the community in doing activity in various fields. One of them is the financial sector or bank. Banks as one of the areas that are close to the community must be able to provide customer satisfaction in providing quality services. The implementation of electronic banking services (e-banking)-quality is one of the keys to the banks to gather customers' funds. One of the e-banking services is the mobile banking is used exclusively in the cell phones to the efficiency of the customer in doing transaction. In order to view the customer response to the performance of the mobile banking facility, review to the client according to the application for six months was investigated. The Data reviews was taken from the Google Play. The review was analyzed using Sentiment analysis which is the process for classifying opinions into the category of positive or negative signals. This classification is then analyzed by using text mining with the Association of the words. The result are an important and useful information for the company. The method used in this classification is Naïve Bayes Classifier (NBC). The level of accuracy using the NBC is 89.41%. The accuracy showed that the classification by the system has been good.

Keywords: Internet Banking, Mobile Banking, Sentiment Analysis, Google play, Naïve Bayes Classifier.

1. Introduction

Information Technology is rapidly developing with the internet. The Internet makes the information can be accessed anywhere with fast and without borders. Based on a survey conducted by the Association of Indonesian Internet Service Provider (APJII), it is known that the number of internet users in Indonesia throughout 2017 is 143.26 million people. The Internet has become the needs of the community in doing various activities in many areas. One of them is the financial sector or banks. The implementation of electronic banking services (e-banking)-quality is one of the keys to the banks to raise customer funds (Suharini, 2008:168). According to Tampubolon (2009) electronic banking consists of ATM, Internet banking, phone banking and sms or mobile banking. Telematics Sharing Vision on May 2014, known the number of users of internet banking around 7.8 million people and the number of users of mobile banking around 21.8 million people. The user of mobile banking bigger more than internet banking because mobile banking practically to use. Today, almost all banks have been using the mobile banking in performing banking transactions such as bank Mandiri, Bank BCA, Bank BRI, BNI, Bank Permata, Bank BTN, and others. Based on the Top Brand E-Channel Mobile Banking in the year of 2014 and 2015 the first position of utilized facility is mobile banking or M-BCA with the number of transactions of 49.4% and 54.2%, with increasing value of 4.8%. While on the third position is BRI Mobile, with the number of transactions of 21.5% and 12.3%, with increasing value of 9.2%. Therefore, M-BCA should evaluate M-BCA application both in terms of the features and services provided in the application. To know how M-BCA user's response can use comments given for M-BCA application, it can

be done using sentiment analysis Naïve Bayes Classifier method. Reviews were performed by using comments (reviews) of M-BCA users in Google Play.

2. Experimental Details

2.1. Mobile Banking

Mobile banking is the banking services that can be accessed directly to mobile phone network or Global mobile phones for Mobile Communication (GSM) or CDMA networks using data that has been provided by the mobile phone operator. The cellular phones are like Telkomsel, Indosat, XL, etc. This service uses SMS messages in the form of a written message submitted and accepted into a user phone cellular. This transaction is easy to do anywhere because there is already provide by cooperation between banks, mobile operators and customers (Vyctoria, 2013).

2.2. Data Mining

The definition of data mining is simply a term used to describe the discovery in database. Where the data mining is using the technique of statistics, mathematics, artificial intelligence and machine learning to extract and identify an information that have the benefits and knowledge that linked from various large of database (Turban, dkk. 2005).

2.3. Text Mining

Text mining is a process for finding new and unknown information using a computer, by extracting information



automatically derived from a variety of different and unstructured text sources. The core of this process is to combine the information from various sources that have been successfully extracted (Tan, 1999). Text mining is also called Knowledge Discovery in Text (Text Data Mining) is a technique that is used to deal with issues such as information extraction, clustering, classification, and information retrieval (Berry & Kogan, 2010). There are two stages in the text mining such as text preprocessing that usually consists of the normalization stage, case folding, tokenizing, and filtering. The second stage is feature selection in the form of word weighting using TF-IDF.

2.4. Sentiment Analysis

Sentiment analysis is a Natural Language Processing (NLP) and extraction information to know the author’s feelings in the form of positive or negative comments. This is done by analyzing the documents in large quantities (Mukherjee, 2012). Sentiment analysis, also known as opinion mining, is a branch of research in domain of text mining

2.5. Naïve Bayes Classifier

Naïve Bayes Classifier (NBC) is one of the simple algorithms in machine learning methods. Although the NBC algorithm is simple but has the high ability and accuracy (Rish, 2001). The existing algorithm on NBC is part of the bayes in learning algorithm. Bayes learning algorithm is done by calculating explicit probability value to describe the hypothesis sought. The Data used for NBC is represented by a conjunction of attribute values and a target function $f(x)$. These values can have any value from the set of domain V (Dumais, 2002).

$$P(F_1, \dots, F_n|C) = \frac{P(C)}{Z} \prod_{i=1}^n P(F_i|C)$$

In the equation above is a model of *Naïve Bayes theorem* which then will be used in the classification of reviews

2.6. Evaluation of Classification System

The process of classification system evaluation can use confusion matrix like table above. Confusion matrix has accuracy to determine the good classification. That’s for see the performa of classification system (Gorunescu, 2011)

Table 1: Confusion Matrix

	The detection by System	
	Positive	Negative
Positive	True Positive (TP)	False Negative (FN)
Negative	False Positive (FP)	True Negative (NP)

2.7. Method

The Data used in this research is data reviews on mobile banking application BCA in google play store. The data used are data for six months from October 2017 to March 2018. The variables used in this research are rating variable, date and review. The analysis method is used naïve bayes classifier, descriptive analysis, barplot, wordcloud, and words association. This research uses the help of R 3.5.0 and Microsoft Excel software. The following stages of research conducted

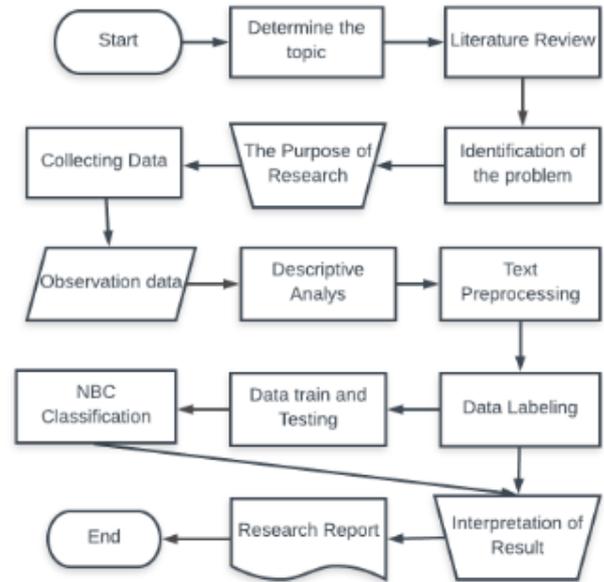


Fig.1: Research Flowchart

3. Results and Discussion

3.1. Descriptive Analysis

Characteristics of the data is a description of the data presented becomes easier to get important information.

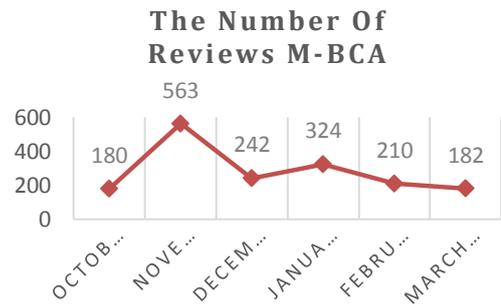


Fig. 2: The number of reviews M-BCA

The graph above shows the number of incoming reviews on the Google Play Store site fluctuates. However, in November 2017 the highest number of reviews was 563 reviews compare to the other month.

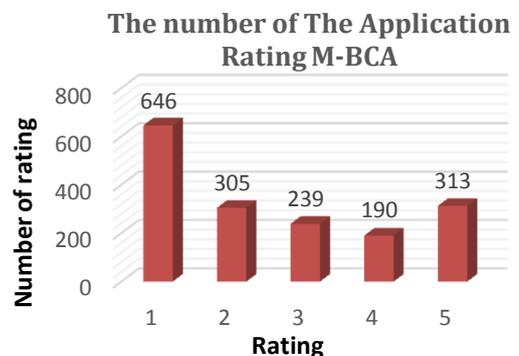


Fig. 3: The number of Rating M-BCA

The graph above is the number of the ratings given by the user of M-BCA for the application. Thus, the rating needs to be noticed by BCA. According to research of MGHWord (2013) revealed

that 95% customers affected by the *online review*. This rating has a scale of 1-5 which generally has the category of "very bad" for scale one, "bad" for scale two, "average" for scale three, "very good" for scale four, and "Excellent" for scale five.

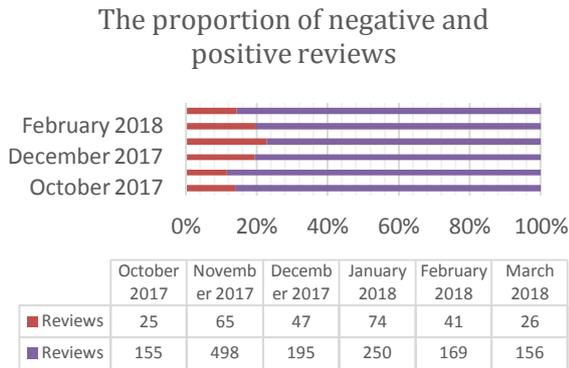


Figure 4: The proportion of positive and negative reviews

The graph above is the proportion of positive and negative reviews classification during the six months since October 2017 until March 2018. Based on the graph above shows that the proportion of negative reviews is more than the proportion of positive reviews. Visualization of positive classification that is often used by application users to describe M-BCA using *wordcloud*.

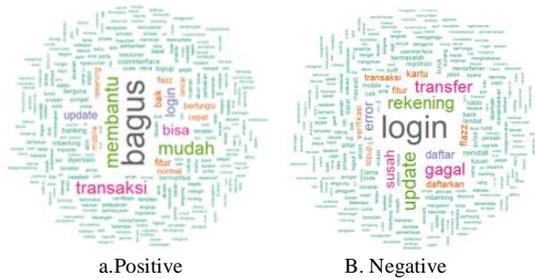


Fig 5: Word cloud from the positive and negative class

Wordcloud is one of the methods used to visualize data. This graphic can be easily understood and is often used in *text mining*. *Wordcloud* makes the frequency of the words displayed more interesting but still informative. The function of *wordcloud* displays the more often one word appears then the word will get bigger.

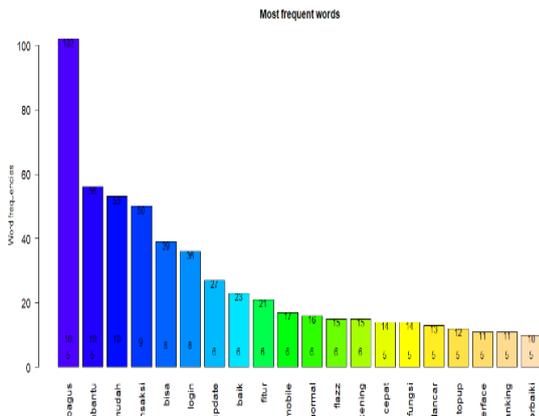


Fig. 6: Barplot from positive class

Barplot is used to display the words that have many frequencies. The above barplot for the positive class where the most common word is the word good of 102, the word helps as much as 56, and others.

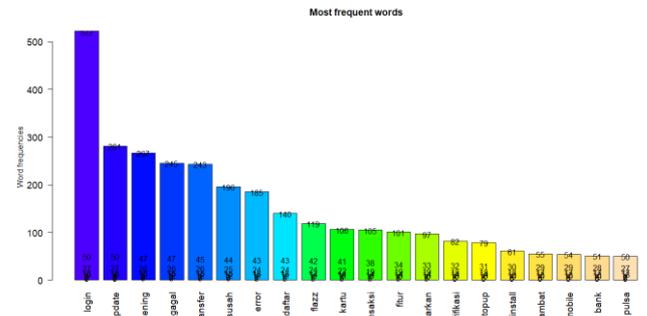


Fig. 7: The negative class Barplot

The above barplot for negative class where the most word is word login as much as 522, the word update is 281, and others.

Table 2: The association of positive words

Good	Help	
Userinterface	Business	0.12
Professional	The Work	0.12
The resolution	Customer	0.12
Easy	Features	
Customers	Flazz	0.62
Pay	Topup	0.58
Transfer	Complete	0.35
Affairs	Function	0.29

The table above is the association of the word for positive classification. The Association shows the greatness of the word relationship that belongs to a word with another word. For instance, the word good often accompanied or followed by the word "user interface".

Table 3: The association of negative words

Log In	Difficulty	
Long	Provider	0.14
Reinstall	Erer	
Update	Application	0.18
Update	Failed	
The complaint	Verify	0.21
Rekning	Rekning	0.14
Register	Truncated	0.12

The table above is an five word association for negative classification that shows the relationship of words that users often use to provide as assessment of m-BCA applications. For instance in a negative review, a word that indicates the condition of the application such as word login that often coincides with word long-time. This means that the application has a problem with the long-time of login process.

3.2. Classifier Naïve Bayes

Before doing the analysis with naïve classifier bayes data (data partition), data are divided into two namely data training and testing. The data partition was performed with the proportion of 80 percent for training data and 20 percent for testing data based on the class classification. The number of training data is larger compared to the testing data. This is because the more larger amount of training data then the model that will be obtained will be the better.

Table 4: Confusion Matrix

Prediction	Actual		Class Precision
	Positive	Negative	
Positive	25	7	78.13%
Negative	29	279	90.58%
Class Recall	46.30%	97.55%	
F-Measure	58.14%	93.90%	
Accuracy	89.41%		

Based on the above table using the Naïve bayes classifier method for application user reviews obtained predicted results that in positive class, from 56 positive reviews, there are 29 prediction error reviews, meaning that not all positive reviews can be correctly classified as positive reviews. Meanwhile, the number of positive reviews which classified correctly is 25 reviews so that the value of recall for positive class is 46.30%. While in the negative review, of the 286 reviews there are 279 reviews classified correctly as negative reviews and there were seven predictions errors that entered into positive reviews, resulting in a negative class recall score of 97.55%. In addition to the recall value, there is also the precision value that indicates the level of accuracy of information requested by the user with the answers provided by the system. Based on the table 4, it is known that the values of positive and negative precision sentences are 78.13% and 90.58%, respectively. The result of the classification by NBC method has an accuracy of 89.41%, meaning that from 340 data reviews that tested, there are 304 reviews that are correctly classified by NBC model. In addition, there is a f-measure value that is used as a measure of system performance in classifying. The f-measure value for positive reviews is 58.14 percent and the f-measure value for negative reviews is 93.90%.

4. Conclusions

Based on the results, the accuracy of sentiment analysis using Naïve Bayes Classifier method is 89.41%. The accuracy indicates that the classification is good. In addition, of 1701 reviews there are 278 positive reviews and 1432 negative reviews. As for further research, should use other methods to compare with the results that have been found in this research.

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