Sentiment Analysis of *E-Commerc Brand* Review Using *Multinomial Text Naïve Bayes*

Nur Khotimah[1], Rochdi Wasono[2]
nurkhotimah111@gmail.com[1], rochdi@unimus.ac.id[2]

Universitas Muhammadiyah Semarang

Abstract. Technological developments has impact on buying and selling transactions online or e-commerce. Bukalapak is the most popular e-commerce content which used for buying and selling and has a mobile phone and website application, which gives users access to provide sentiment analysis reviews can be used to monitor consumer reviews of their products. Naive Bayes classifier is the one of classification method. Naïve Bayes classifier can be divided into two, namely multivariate Bernouli and Naïve Bayes multinomial text. Multinomial text Naïve Bayes able to reduce errors in document classification. The results obtained by the review given by Bukalapak users on Google Play using the Multinomial Naïve Bayes show that 89% of the reviews rated positively with the prediction accuracy of Naïve Bayes by 91.95%. As much as 80.71% of reviews give a rating of 5. However, there are some negative reviews that are mostly written, namely "Lambat", "Ribet", "Mengecewakan", "Susah", and "Perbaiki" it can be used to reference material for Bukalapak in improving the services.

Keywords: E-commerce, Multinomial Naïve Bayes, Text Mining, Sentiment Analysis

1 Introduction

The development of information and communication technology causes that developed and developing countries have changed strategies in the economy and business. Based on a survey of the Indonesian Internet Service Providers Association (APJII), the number of internet users in Indonesia has increased each year until the end of 2018 reaching 171.17 million people and 41.2% had made online transactions. The term used in buying and selling online is e-commerce[1]. Indonesia has become the largest e-commerce market in Southeast Asia. In 2014 Indonesia's online sales reached US $ 1.1 billion, higher than Thailand and Singapore. Survey of commercial internet content that was often used to buy goods or services online was Bukalapak. Bukalapak has a mobile phone application and website, which gives users access to reviews. User reviews are often used as an effective and efficient tool in finding information about a product or service [2], that recent research found nearly 50% of internet users rely on word-of-mouth recommendations before using a product. For this reason, we need a special method or technique that is able to categorize these reviews automatically, whether positive or negative.

Sentiment analysis is a way to identify and classify the polarity of a given text at the level of documents, sentences and phrases [3]. This technique is used in many fields such as e-commerce, health care, entertainment and politics, to name a few. For example, Sentiment Analysis is useful for companies to monitor consumer opinion about their products, and for consumers to choose the best product based on public opinion. The main challenge of

sentiment analysis is that comments are generally written in informal language, short messages showing limited cues about sentiments as well as widely used acronyms and abbreviations. In general, basic classification techniques such as Naïve Bayes (Multinomial and Bernoulli), Logistic Regression, SGD (Stochastic Gradient Descent), Linear SVM (Support Vector Machine) and Random Forest [4].

Sentiment analysis based on public comments on online stores such as Zalora and Berry Benka on Facebook social media. The Naive Bayes, K-NN and Decision Tree classification methods are used to compare the best classification prediction results[5]. The results of the test analysis show Naive Bayes, has a stable accuracy after being tested with several Frequent Itemset values. The other research also classify sentiments for film reviews using a variety of machine learning techniques. Machine learning techniques used are Naïve Bayes and Support Vector Machines (SVM) and get the results of Naive Bayes has the highest accuracy[6].

The Naive Bayes classifier can be used as a classification function, although several other algorithms have worked in the development of spam filters. Naïve Bayes is widely used in developing spam filters, because it is simple and easy to implement[7]. In general, Naïve Bayes classifier can be divided into two, namely multivariate Bernoulli and multinomial text Naïve Bayes [8]. In research conducted by the McCallum Naïve Bayes classifier used is the multinomial text Naïve Bayes. Multinomial text Naïve Bayes is able to reduce errors in the classification of documents with an average value of 27%, even reaching 50% of trials using multivariate Bernoulli [9].

So this research will analyze the sentiments of e-commerce brand review by using multinomial naïve bayes and word extraction to get an in-depth review of useful information later for various parties in need.

2 Method

Data

The data used in this study is a database from the Google Play Store website, which is all user review data of the Bukalapak application on 6-12 July 2019 which was retrieved through scraping techniques using Java Script and XAMPP. The data obtained amounted to 1640 data. There are three attributes used in this study are date, comment and Rating

Table 1. Attribute Information

No	Indicator	Data Type	Description
1	Date	Date	Attributes
2	Comment	String	Attributes
3	Rating	Numeric	Attributes

Analysis Method

In this study, researchers used R StudioR 3.4.4 and WEKA software. The data analysis methods used in this study are:

A. Descriptive Analysis, used to provide an overview of Bukalapak reviews on the Google Play site.

B. Sentiment Analysis based on lexicon dictionary, used to label data into positive and negative sentiment classes. The stages are as follows:

a). Preprocessing Data

At the preprocessing, data cleaning will be performed using the text mining method. Some of the stages that will be carried out include spelling normalization, case folding, tokenizing, and filtering

b). Labeling Sentiment Class

Weighting word by calculating the frequency of words appearing in a text document. The more often a word appears in a text document, the greater the weight of the word and the word is considered as a word that strongly represents the text document. The way to determine the class of sentiments is to count the number of positive words minus the score of the number of negative words in each review sentence (Susanti, 2016). Sentences that have a score> 0 will be classified into positive classes, sentences that have a score = 0 will be classified into neutral classes, while sentences that have a score of <0 are classified into negative classes.

c).Classification with *Multinomial Text Naive Bayes* is used to classify positive and negative reviews

Machine LearningClassificationwith Multinomial Text Naive Bayes

The classification process is done by dividing the data first, namely into training data and testing data. Training data is data that is used to make models and testing data is used to perform model testing. The data distribution used is 10 Cross Fold Validation. The Naïve Bayes Multinomial text step model is based on the Bayes theorem as shown below

$$P(C_i|d) = \frac{P(d|C_i)\,P(C_i)}{P(d)} \qquad (1)$$

Where d is the document object to be classified. C_i is label. $P(d|C_i)$ is a document probability in a label. $P(C_i)$ iss the probability of the label hypothesis *(prior probability)*.

By calculating the opportunity value terms in document d in class C_i can be calculated by the equation

$$P(C_i|d) = P(C_i) \prod_{k=1}^{nd} P(t_k|C_i) \qquad (2)$$

$P(t_k|C_i)$ is probability of term t_k on c and t_k is trem dokumen from d. Parameter $P(t_k|C_i)$ analyze by

$$P(t_k|C_i) = \frac{T_{ct}+1}{T_{ct}+\sum c} \qquad (3)$$

After the classification process the accuracy calculation is performed to see how accurately the multinomial naïve bayes are correct in predicting.

$$\text{Accuracy} = \frac{TP+TN}{TP+FN+FP+TN} \times 100\% \qquad (4)$$

3 Disscusion

Descriptive Analysis

Descriptive analysis in this study was used to see a general description of Bukalapak Application's based on user review data from the Google Play site, which is seen from several aspects including the number of reviews that come in according to the order oftime, the applications' rating given by users and the comparison of the reviews' number from users is

categorized into two categories, namely positive reviews and negative reviews. The following is a rating that illustrates the ratings given by Bukalapak ecommerce's users on the Google Play site.
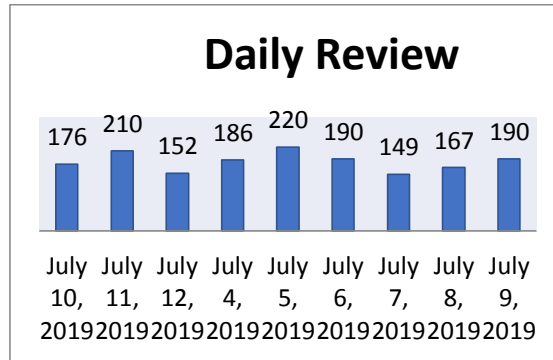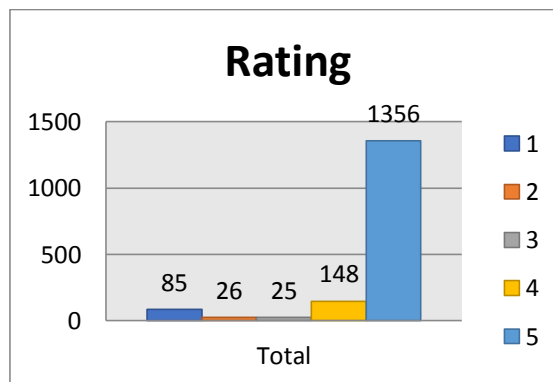

Figure. 1. Graph of Daily Review

Figure. 2. Graph of Rating

Sentimen Analysisand Machine Learning
The negative labeling results obtained the amount of data :

Table 2. Labeling Result of Sentiment

Labeling Result	Sum
Positive	1519
Negative	121

Based on the table above, the results of labeling negative classes show that the number of positive reviews has a higher frequency than the number of negative reviews. The number of positive reviews is 1,519, and negative reviews are 121 reviews. Negative reviews can be visualized as follows.
The negative class classification results obtained by the a
mount of data:

Table 2. Labeling Result of Classification

Labeling Result	Sum
Positive	1469
Negative	171

Result of classification*Multinomial text Naïve Bayes*.

Table 3. Confusion Matrix

Label	Actual Positive	Actual Negative
Predicted Positive	1428	91
Predicted Negative	41	80

$$\text{Accuracy} = \frac{1428 + 80}{428 + 91 + 41 + 80} \times 100\% = 91.95\%$$

Based on the rating it can be seen that the majority of Bukalapak users have good judgment or perception of the e-commerce. While if seen from negative labeling the total of positive reviews is more than the negative reviews total. The number of positive reviews is 1,469 reviews or 89% while the rest are negative reviews. Based on the Multinomial Text Naive Bayes classification evaluation has an accuracy rate or is able to predict correctly at 91.95%.
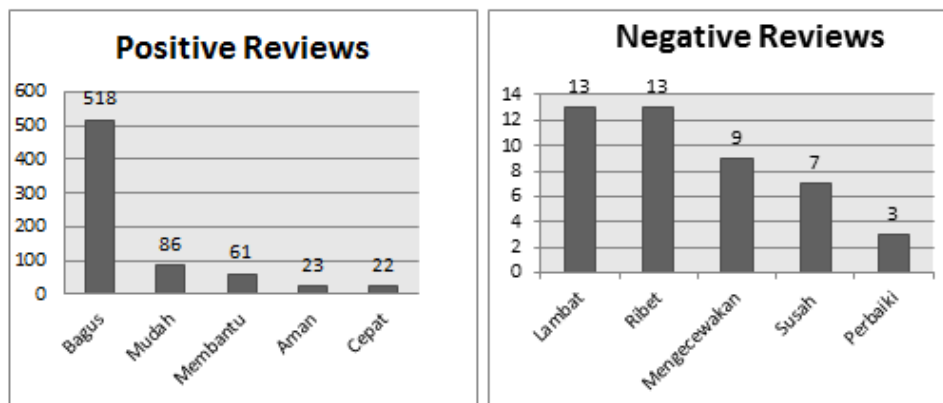

Figure. 3. Word of Positive and Negative Reviews

The results of the analysis of words that often appear on positive reviews there are 5 words that appear most namely "Bagus","Mudah","Membantu","Aman" and "Cepat"while for negative reviews are "Lambat","Ribet","Mengecewakan","Susah", and "Perbaiki". The number of words that often appear can be a number of points of consideration for improving the quality of e-commerce services.

4   Conclusions

The review given by Bukalapak users on Google Play using the Multinomial Naïve Bayes shows that 89% of the reviews rated positively with the accuracy of the prediction of Naïve Bayes by 91.95% it's mean that Multinomial naive bayes is recommended method for sentiment analysis, and as much as 80.71% of reviews give a rating of 5. However, there are some negative reviews that are mostly written are "Lambat", "Ribet", "Mengecewakan", "Susah", and "Perbaiki"this can be an evaluation material for Bukalapak in improving the services.

References

[1] APJII: Penetrasi & Profil Perilaku Pengguna Internet Indonesia. Apjii. Retrieved from www.apjii.or.id (2018).

[2] Fanani, F: Klasifikasi Review Software Pada Google Play Menggunakan Pendekatan Analisis Sentimen. Skripsi. Program Studi Teknologi Informasi Fakultas Teknik UGM Yogyakarta (2017).

[3] Kang, H., Yoo, S. J., & Han, D: Expert Systems with Applications Senti-lexicon and improved Naïve Bayes algorithms for sentiment analysis of restaurant reviews. Expert Systems With Applications, 39(5), 6000–6010. (2012). https://doi.org/10.1016/j.eswa.2011.11.107

[4] Mohaiminul, M., & Sultana, N: Comparative Study on Machine Learning Algorithms for Sentiment Classification. International Journal of Computer Applications, 182(21), 1–7 (2018). https://doi.org/10.5120/ijca2018917961

[5] Gusriani, S., Wardhani, K.D.K., & Zul, I.M: Analisis Sentimen Berdasarkan Komentar Publik Terhadap Toko Online Pada Media Sosial Facebook (Studi Kasus:Zalora dan BerryBenka). Jurnal Aksara Komputer Terapan Vol 5, No 2 (2016).

[6] McCue, Rita. A Comparison of the Accuracy of Support Vector Machine and Na¨ıve Bayes Algorithms In Spam Classification. University of California (2009).

[7] Metsis V, Androutsopoulos I, Paliouras G: Spam Filtering with Naive Bayes – Which Naive Bayes. CEAS 2006 - Third Conference on Email and AntiSpam. California (US): CEAS (2006).

[8] Manning C D, Raghavan P, Schütze: Introduction to Information Retrieval. Cambridge (GB): Cambridge University Press (2009).

[9] McCallum A, Nigam K: A Comparison of Event Models for Naive Bayes Text Classification. Didalam : AAAI-98 workshop on learning for text categorization. hlm 41-48 (1998).

[10] Susanti, A.R: Analisis Klasifikasi Sentimen Twitter Terhadap Kinerja Layanan Provider Telekomunikasi Menggunakan Varian Naive Bayes. Tesis. Institut Pertanian Bogor (2016).