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ANALYSIS OF SENTIMENT ON USE OF MOBILE BANKING AT BANK SUMUT USING THE NAIVE BAYES METHOD

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Abstract

Mobile applications have several other limitations that other types of software do not have, such as mobile context, connections, small screens, different resolutions, limited power and capabilities and different data entry methods, so that in evaluating usability factors they cannot be equated with software on In general, this research aims to analyze the causal relationship used to explain the evaluation of the usefulness of using Bank Sumut's mobile banking by using sentiment analysis to determine customer satisfaction with Bank Sumut's mobile banking. Based on the results of testing the sentiment of the North Sumatra mobile application via sentiwordnet from 200 review data, it was found that the North Sumatra mobile application still has several problems such as complaints about the application being slow to respond. Complaints were also submitted for device connection processes that experienced errors. So it can be concluded that users want their needs to be heard and improvements are made based on user feedback to evaluate the usability factors of mobile applications. Based on the test results, the sentiment level needs to be considered for evaluating usability factors because with the sentiment level it is possible to identify the shortcomings of a mobile application based on certain usability factors. So it can be concluded that Bank Sumut can take advantage of the sentiment of North Sumatra mobile application users to increase response times in handling complaints or identify improvements needed by users, such as ease of non-cash payment transactions. Based on the test results, it can be concluded that when conducting sentiment analysis to get the best evaluation results, it is best to use a support vector machine with an accuracy value of up to 80% to get better usability evaluation results.

Keywords: ***North Sumatra mobile application, Usability Concept, Sentiment Analysis.***

1. INTRODUCTION

Customers can be defined as recipients, consumers, or purchasers of a company's products and services. After experiencing the services and products, customer opinions and feedback are very useful for managing business operations accurately to meet Customer Satisfaction. A lot of information and knowledge is available at our fingertips in the internet era and today's digital world. Banking is shifting to mobile banking as a result of technological advances. One example of how the Banking industry has evolved is the shift from paper to electronic payments. To remain relevant and survive in the Banking industry, every company must have the opportunity to increase revenue and operational efficiency. This migration is caused by high competition between banks. Currently, information and communication technology is developing very quickly. Additionally, these advances impact user engagement and interaction within online platforms, such as leaving reviews on apps. Reviews are very common in all fields, and many people use them to learn more about things they like, especially about things they want to buy or use. Technological progress in this world is running so fast after the industrial revolution 4.0. This era is an era where society will balance economic progress through a system that integrates virtual and physical space. This industry is an era where there will be a union between virtual space and the reality that we actually encounter in the real world. Now many people need services and want to access them easily and flexibly through applications. The success of this technology system can increase customer loyalty towards application use. According to the Financial Services Authority (OJK), Internet Banking is a banking facility that can be enjoyed by bank customers to carry out transactions via the internet network anytime and anywhere. According to a survey conducted by the Top Brand Award, m-BCA is the most popular mobile banking application in Indonesia in 2022. This assessment was made based on a survey of 8,500 respondents spread across 15 major cities in Indonesia. Respondents consisted

of 6,000 random samples, 1,700 booster samples, and 800 B2B booster samples. Samples were selected using multistage area random sampling and purposive sampling methods. The sample was then interviewed face to face using a structured questionnaire designed to measure three parameters, namely: Top of Mind, Last Usage and Future Intention. Bank Sumut seeks to increase financial inclusion and financial literacy so that the level of public knowledge and awareness in financial management/planning becomes better and continues to follow advances in digital finance. Bank Sumut's financial education and product information are also carried out in various strategies. starting from utilizing media such as company websites, social media, infosheets and other information materials, as well as carrying out activities in the form of socialization, workshops and mobile education.

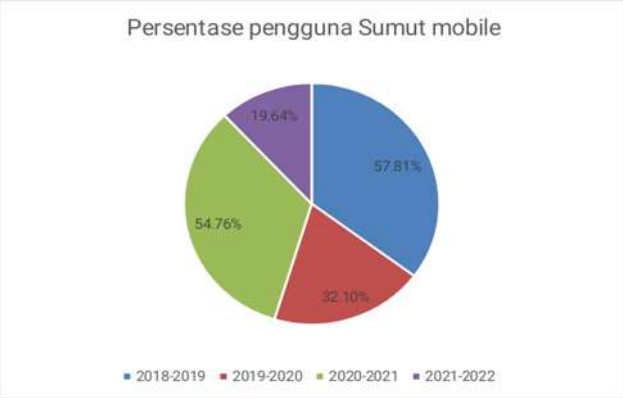


Figure 1.1 Percentage of North Sumatra Mobile Users

Every year, the number of North Sumatra Bank customers who use the North Sumatra mobile digital banking feature continues to increase. In 2022, the number of North Sumatra mobile customers will be recorded at 327,167 customers, an increase of 53,700 customers or 19.64% from 2021 of 273,467 customers. As the number of customers increases, the number of transactions in North Sumatra Bank's digital financial services increases significantly. In 2022, the number of North Sumatra mobile transactions will be 41,952,013 times, an increase of 13,062,926 times or 45.22% from 2021 which was 28,889,087 times. The total amount made through this application also grew 48.96% to IDR 7.768 trillion from 2021 of IDR. 5.215 Trillion. The increasing number of Bank Sumut customers who use increasingly complete mobile banking features has influenced the growth in the number of ATM cards and awareness of the use of mobile banking technology. In this research, the sentiment classification process uses the Naïve Bayes Classifier method. This method approach provides a digital-based survey and comparative analysis of existing techniques for opinion mining such as machine learning and lexicon-based approaches. The results obtained from research based on data mining surveys show five main complaints that are the main focus of banking service companies, namely network, comfort, ease of access and service. Considering the importance of technology-based channel integration for the banking sector in relation to customer satisfaction and experience, it is necessary to analyze the sentiment of using Bank Sumut's mobile banking on customer satisfaction.

2. RESEARCH METHODS

2.1 of literature

Literature study is the first and basic step of research. Literature studies are carried out to obtain and explore information about research and analyze methodological developments related to the research to be conducted. This stage begins with conducting studies related to the topic and scope of the research. Some of the references and literature used in this research come from journals, books, and conferences related to usability evaluation, software quality measurement, and sentiment analysis. Based on the literature study that has been carried out, the following information was obtained.

1. Mobile applications have several other limitations that other types of software do not have, such as mobile context, connections, small screens, different resolutions, limited power and

capabilities as well as different data entry methods, so that in evaluating usability factors they cannot be equated with software on generally.

2. In previous research, the software usability evaluation carried out did not take into account the level of user opinion sentiment.

This research aims to analyze the causal relationship used to explain the evaluation of the usefulness of using Bank Sumut's mobile banking by using sentiment analysis to determine customer satisfaction with Bank Sumut's mobile banking.

2.2 Research Stages

1. Data Collection and Analysis
2. System Design

3. RESULTS AND DISCUSSION

3.1 Data Collection

At the stage of collecting data, an understanding of the research object is carried out. Understanding of the research object is carried out by exploring information through user reviews of online learning applications provided via Google Playstore. At this stage, incoming user review data will be grouped based on the contents of each category.

At this stage, understanding is also carried out to find a method with the best categorization model approach so that it can help during the data processing process which will be carried out by comparing the results of data processing with the sentiwordnet algorithm. The sentiwordnet algorithm used is the Naive Bayes algorithm to determine the accuracy of the categorization method used.

3.2 Data Analysis

The process carried out in this stage is to understand the data that will be used as a research object so that it can be continued to the preprocessing stage. At this stage, the process of collecting raw data is carried out according to the required attributes from customer reviews of the North Sumatra Mobile application which are taken based on the most relevant reviews regarding the use of North Sumatra Bank mobile banking by paying attention to ratings or stars. The following are several examples of positive and negative reviews given by users of the Sumut Mobile application.

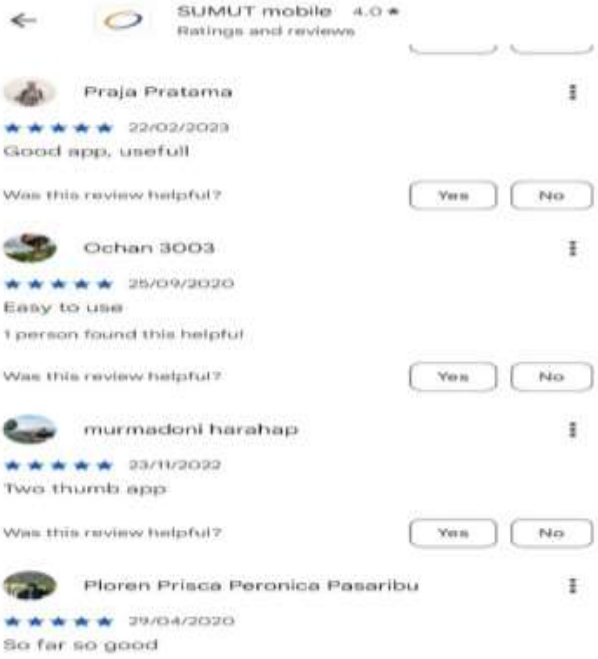


Figure 3.1 Example of a Positive Review of the North Sumatra Mobile Application

Figure 3.1 is several examples of positive reviews with a 5 star rating given by application users. Usually these reviews contain positive comments given by users for the Sumut Mobile application or in the form of emoticons that express the user's feelings towards the Sumut Mobile application service.

Figure 3.2 Example of a Negative Review of the North Sumatra Mobile Application

Figure 4.2 shows several negative reviews given by users of the Sumut Mobile application. Negative reviews given are marked with a one star rating and generally these negative reviews contain negative comments or emoticons that express feelings or complaints from users of the North Sumatra Mobile application. Data obtained from the crawling process from Google Playstore on the Sumut Mobile application based on the most relevant reviews amounted to 200 data.

```
len(df_busu.index) #count the number of data we got

200
```

Figure 3.3 Crawling data results with Google Scraper Python

3.3 Data Preparation

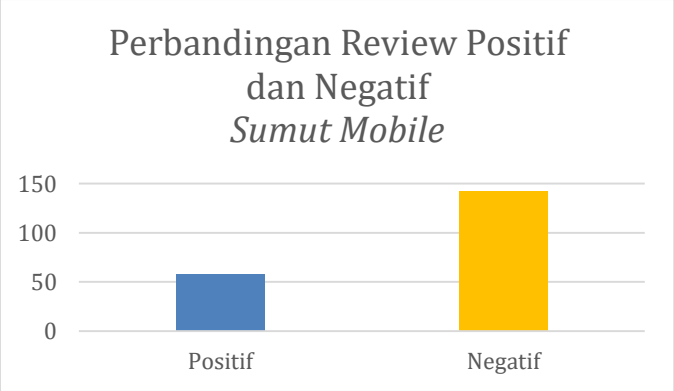
This stage is the stage of the data preparation process which aims to obtain data that is clean and ready to be used in research. From the initial data obtained, a cleansing process is then carried out to remove duplicate words and eliminate data that is irrelevant and unrelated to each application. The data obtained is then made into a dataset with dataset attributes in the form of text and labels. The text contains application user comments provided via the Google Play Store and the label contains the categories of these comments in the form of positive and negative. The review data from each application was then grouped into one and saved in Microsoft Excel in .xlxs format to form two datasets, namely the North Sumatra Mobile dataset.

The labeling and categorization process is carried out by considering that reviews with a value of 1 and 2 will be given a value of 0 (Zero) and categorized as a Negative label, reviews with a value of 3 will not be included in the research because a value of 3 has a neutral value, while reviews with a value of 4 and 5 will be given a value of 1 (one) and categorized as a positive label. So from the labeling process the data in the table is obtained as follows:

Table 3.1. Labeling results for the North Sumatra Mobile application review dataset

Label	Amount
Positive	58
Negative	142

If you look at graph 3.1, the reviews given by users of the North Sumatra mobile application after data management results are dominated by negative reviews, therefore further research is needed to find out the analysis of application users and the corrective steps that must be taken to make the North Sumatra mobile application able to compete with mobile banking. Other Banks.



Graph 3.1 Comparison of positive and negative reviews of North Sumatra Mobile

The initial stage that will be carried out in this research is the text preprocessing stage, researchers use Python Google Collab to carry out the text preprocessing stage. The following are the stages carried out in text preprocessing after data normalization is carried out. The data normalization process aims to convert comments provided by users into lowercase letters.

Table 3.2. Data Normalization Results for the North Sumatra Mobile application review dataset

Username	Mark	Date	Review	Label
Asrori range	5	4/27/2024 22:43	Fast and accurate, no problem at any time and time of transaction	1
Nellygoklas Simatupang	1	4/26/2024 2:14	I updated the application but it doesn't work. I have deleted four applications on my cellphone but I cannot update the M Bank Sumut application. Please make it easier	0
Iman Kurniawati Gulo	3	4/24/2024 14:36	Make transactions easier.	Neutral
Build Situmorang	1	4/23/2024 13:45	Little by little updates, instead of getting better, it's the opposite.	0
Juliana Manalu	4	4/23/2024 10:22	The better the features	1

3.3.1 Use of Stopwords

This stage filters comment data by referring to Indonesian stopwords. The stopword filter process in this research uses stopword words obtained from the Google search engine. The following are the results of the stopword filter process carried out:

Table 3.3. Comparison of comments before and after the stopword filter

Previous Data	After Data
Fast and accurate, no problem at any time and time of transaction	fast and accurate, no matter what time the transaction occurs, there are problems
I updated the application but it doesn't work. I have deleted four applications on my cellphone but I cannot update the M Bank Sumut application. Please make it easier	I can't update the application. four cellphone applications, delete the M Bank Sumut application, I updated it. made easier
Make transactions easier.	Make transactions easier
Little by little updates, instead of getting better, it's the opposite.	ittle by little updates, instead of getting better, it's the pposite.
The better the features	he better the features

Table 3.3 shows the results of data processing before and after the stopword filter was carried out on comment data provided by users regarding the application that was the object of research.

3.3.2 Stemming

Stemming is the process of forming words into basic words, in this research the stemming process was carried out using Indonesian stemming and aims to form basic words from opinions given by users of the North Sumatra Mobile application

Table 3.4 Differences in data before and after the stemming process

Previous data	Data after
Fast and accurate, no problem at any time and time of transaction	fast, accurate, what time the transaction occurs, there are problems
I updated the application but it doesn't work. I have deleted four applications on my cellphone but I cannot update the M Bank Sumut application. Please make it easier	How come I can't update the application, four cell phone applications, delete the M Bank North Sumatra application, updating is easy
Make transactions easier.	easy transaction
Little by little updates, instead of getting better, it's the opposite.	A little update doesn't make it better, it actually goes back
The better the features	the better the features

Table 3.4 shows the differences in data before and after the stemming process using Indonesian stemming. After the stemming process is carried out, the application review text provided by users turns into a collection of basic Indonesian words. The stemming process was carried out using Python Google Collab.

3.3.3 Tokenize

This stage aims to find and form terms from comment data provided by application users. The following are some of the terms that were successfully formed:

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Table 3.5. Terms formed from the basic word formation process

Text	*Term*
Fast and accurate, no problem at any time and time of transaction	Fast[],accurate[]when[] hours[], how much[] transactions[] There is[] Problem[]
pay for water pump lae nciho..transaction was successful..even though I couldn't even check	Pay[] water[] pam[] lae[] nciho[] result[] even though[], just check[] ngk[] Can[]
The better the features	better[] feature[] his[]

3.4 TF-IDF

In this process, weighting is carried out on the terms that have been formed. The following are the weight values of several terms from one of the research objects:

Table 4.6 TF-IDF weighting

Term	T.F	IDF
Fast[] accurate[] when[] hour[] how many[] transactions[] are there[] problems[]	0.23 0.48 0.145 0.2130.396 0.436 0.581	48 436 396 145 992 23 581
Pay[] water[] pam[] lae[] nciho[] results[] whereas[] just check[][] ngk[] Can[]	0.992 1.31 1.33 1,125 1,170 0.349 1,500 1,651 1,659	125 31 717 500 651 349 706 659 33 664 170

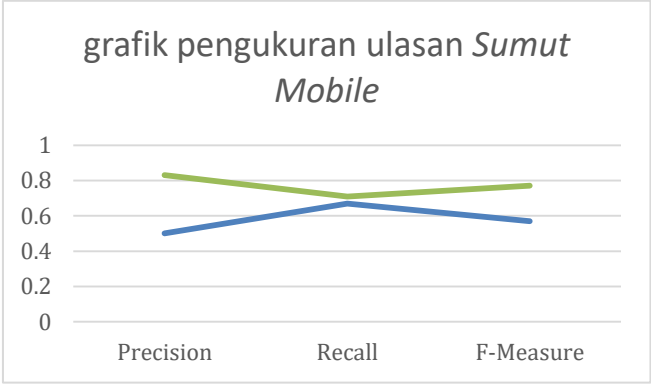
3.5 Sentiment Analysis

In this sentiment analysis process, the data from the evaluation of usability factors which already have usability factors, orientation and sentiment level are then analyzed again and the precision, recall, f-measure and accuracy values are measured. In this sentiment analysis, the sentiment orientation of the data will be matched with the rating in the opinion of the user concerned. Table 3.7 below shows the results of measuring precision, recall and f-measure values on mobile applications that have been tested.

Table 3.7. Precision, Recall and F-Measure Measurement Results on Sentiment.

Mobile Application	*Sentiment*	*Precision*	*Recall*	*F-Measure*
North Sumatra Mobile	Positive	0.50	0.56	0.57
	Negative	0.83	0.71	0.77

Based on the precision, recall and f-measure measurement results shown in Table 3.7, it can be concluded that the resulting precision, recall and f-measure values are greater than negative sentiment values of 83%, 71% and 77%. The average measurement value obtained is quite low because there are no opinions that produce neutral sentiment values when tested, so a value of 0 for neutral sentiment greatly influences the average value of sentiment measurements in this study. This shows that the Sumut Mobile application needs feature improvements to help facilitate customer transactions. When compared with research by Sari, Willa (2023) used a sample of the BCA Mobile application by conducting sentiment analysis of BCA Mobile user reviews using text mining with the Naive Bayes algorithm method in Python. The type of data used is qualitative text data by collecting user reviews of mobile banking applications on Google Playstore. The results of the research show that BCA Mobile has a positive sentiment of 44% with an accuracy of 82%, while the results from the confusion matrix for the sentiment class are positive at 87% and for the negative class it is 79%. This assessment is reviewed from several aspects of the reviews given by users, such as the verification process, ease of use, security and the features presented.



Graph 4.2 Measurement of North Sumatra Mobile Reviews

3. 6 Evaluation

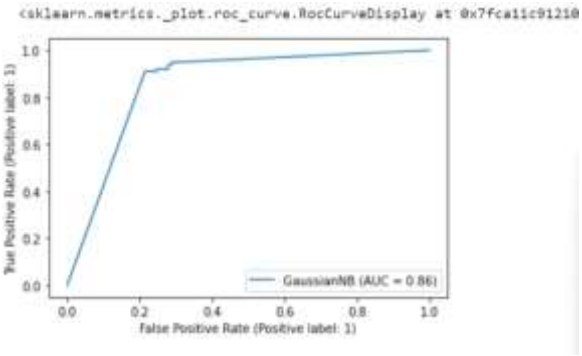
The evaluation results of the dataset containing comments from users of the North Sumatra Mobile application which were processed using the Naive Bayes algorithm and cross validation showed an accuracy value of 77.50%. The confusion matrix formed from the results of classification using the Naive Bayes algorithm and cross validation is as follows:

Table 3.8. Sentiment Matrix Confusion Results

Mobile Application	*Sentiment*	*Precision*	*Recall*	*F-Measure*
North Sumatra Mobile	Positive	0.50	0.56	0.53
	Negative	0.87	0.84	0.85

Table 3.8 shows the confusion matrix formed in processing a dataset containing comments from users of the North Sumatra Mobile application using the Naive Bayes algorithm and cross validation. The confusion matrix shows the correct and incorrect classification results. Apart from using cross validation, this research also applies data processing of comments from users of the North Sumatra Mobile online learning application using the Naive Bayes algorithm and partitioning validation. The way this validation method works is by dividing the dataset into training data and testing data. From the evaluation results

using partitioning validation, an accuracy value of 77.50% was obtained. with the following confusion matrix:



Graph 3.3 North Sumatra Mobile ROC Curve

Figure 3.2 shows the ROC curve formed from processing a dataset containing comments from users of the Sumut Mobile application. From this curve it can be seen that the AUC value obtained is 0.86.

4.7 Evaluation result

After the feature extraction steps, the next process is to train and evaluate the selected classifier model using the Sklearn machine learning tool. In the process, the researcher compared 3 classification methods to verify the analytical methods used as comparison material to carry out further research in the future either by the researcher or future researchers. Based on the results of the analysis of the three methods, the following data was obtained:

Table 3.9 Classification report results of the Sentiment analysis method

Classification Report	***Random Forest***	***Naive Bayes***	***Support Vector Machine***
Accuracy	75%	70%	80%
Recall	16.67%	50%	50%
Precision	100%	50%	75%
F1- Score	28.57%	50%	60%
ROC Auc	0.58	0.64	0.71

The results shown in Table 3.9 show that SVM has the best overall performance compared to other stand-alone classifiers with accuracy, precision, recall and F1-score values of 80%, 50%, 75% and 60% respectively compared to the method other analysis of the North Sumatra Bank mobile banking application. However, researchers use the Naïve Bayes method in managing sentiment data because it is an analysis that is often used in analyzing the usability of an application. Thus, performance depends on the classifiers that compose it. Then, by using only the 3 best classifiers, the possibility of ensemble methods to achieve greater performance may be increased. Between hard voting and soft voting, hard Voting has lower performance compared to soft voting because they rely on individually predicted labels from each Classifier, low performance of one of the classifiers could affect the results more.

Soft voting, on the other hand, performs better because it uses a more powerful technique to estimate labels formulated by the average probability value of all classifiers, which reduces overfitting and creates a better model. For the results of the sentiment distribution analysis, image processing is then carried out. From each positive and negative review of the Sumut Mobile application to increase the success rate of profile images, it is concluded that interpolation techniques to improve low image resolution and image filtering and segmentation techniques to improve image quality. In this research, the sentiment classification process uses the Naïve Bayes Classifier method. This method approach provides a digital-based survey and comparative analysis of existing techniques for opinion mining such as

machine learning and lexicon-based approaches. The results obtained from research based on data mining surveys show five main complaints that are the main focus of banking service companies, namely network, comfort, ease of access and service. Considering the importance of technology-based channel integration for the Banking sector in relation to customer satisfaction and experience This sentiment will be analyzed further using a Word Cloud to see the most frequently occurring words in tweets, which are represented by size and color hue. The blue word cloud represents positive sentiment, and the red word cloud represents negative sentiment. The results show that the majority of tweets contain comments related to digital bank applications and their features, user experience, bank policies, and running promotions as shown in the image below:

Figure 3.4 North Sumatra Mobile User Sentiment Sentiwords

The most positive sentiment mostly came from users who appreciated Bank Sumut's policies regarding low admin fees and high interest rates compared to other banks. Meanwhile, negative sentiment mostly stems from complaints about applications that are slow to respond. Complaints are also filed regarding device connection processes that experience errors. According to ANSI (American National Standards Institute), software reliability is defined as the probability of failure of software operation for a specified period of time in a specified environment. Although software reliability is defined as a probabilistic function, supplemented by the notion of time, we should note that software reliability is different from hardware reliability. Software reliability is not directly related to time. While mechanical components may age over time, software will not rust during its life cycle. The Software will not change over time unless intentionally modified or upgraded.

One of the benchmarks for software quality is ISO 9126, which was created by the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). ISO 9126 defines software product quality, models, quality characteristics, and related metrics used to evaluate and establish the quality of a software product. One of the quality factors according to ISO 9126 is Reliability, namely the ability of the software to maintain a certain level of performance, when used under certain conditions, such as the ability of the software to avoid failure as a result of errors in the software. The ability of software to maintain its performance if a software error occurs. And the ability of the software to rebuild performance levels when system failures occur, including data and network connections. Based on this, Bank Sumut must pay more attention to user sentiment and voices on social media, and ensure that their needs are heard and improvements made are based on user feedback. They can leverage automated sentiment analysis in their customer service tools to improve response times in complaint handling or identify the most requested improvements from user feedback or target specific demographic groups for promotions.

4. CONCLUSION

Conclusions that can be drawn from this research include the following.

1. Based on the results of testing the sentiment of the North Sumatra mobile application via sentiwordnet from 200 review data, it was found that the North Sumatra mobile application still has several problems such as complaints about the application being slow to respond. Complaints were also submitted for device connection processes that experienced errors. So it can be concluded that users want their needs to be heard and improvements are made based on user feedback to evaluate the usability factors of mobile applications.
2. Based on the test results, the sentiment level needs to be considered for evaluating usability factors because with the sentiment level it is possible to identify the shortcomings of a mobile application based on certain usability factors. So it can be concluded that Bank Sumut can take advantage of the sentiment of North Sumatra mobile application users to increase response times in handling complaints or identify improvements that users need, such as ease of non-cash payment transactions.
3. Based on the test results, it can be concluded that when conducting sentiment analysis to get the best evaluation results, it is best to use a support vector machine with an accuracy value of up to 80% to get better usability evaluation results.

REFERENCES

Adrian, Bramanthyo dkk.2022. Sentiment Analysis on Customer Satisfaction of Digital Banking Indonesia. International Journal of Advanced Computer Science Applications. Fakultas Ilmu Komputer. Universitas Indonesia. Vol 13. No.3. Pp 466-473

Ahdiat, Adi. 2024. Penetrasi user Internet di Indonesia Capai 79% pada 2024. https://Penetrasi Internet di Indonesia Capai 79% pada 2024 (katadata.co.id). Diakses pada 5 Januari 2024

Annur, Cindy Mutia. 2022. Aplikasi mobile banking terpopuler di Indonesia siapa Juaranya. https://databoks.katadata.co.id/datapublish/2022/06/22/aplikasi-mobile-Banking-terpopuler-di-Indonesia-siapa-juaranyar. Diakses pada 20 september 2023

Alshehri, F., & Freeman, M. (2012). Methods of usability evaluations of mobile devices.Australasian Conference on Information Systems, (2007), 1–10.

Alya,Nadira. 2023. Analisis Sentimen Pada Ulasan Aplikasi Mobile Banking Menggunakan Metode Naive Bayes Dengan Kamus Inset. Informatic and Computational Intelligent Journal. Fakultas Ilmu Komputer. Universitas Brawijaya. Vol.5.No.1. Pp. 35-47

Atoum, I., & Otoom, A. (2016). Mining Software Quality from Software Reviews : Research Trends and Open Issues. International Journal of Computer Trends and Technology (IJCTT), 31(2), 74–83. https://doi.org/10.14445/22312803/IJCTT-V31P114

Baccianella, S., Esuli, A., & Sebastiani, F. (2008). S ENTI W ORD N ET 3 . 0 : An Enhanced Lexical Resource for Sentiment Analysis and Opinion Mining, 0, 2200–2204.

Bank Indonesia. 2022. Diakses pada 20 September 2023 https://Indonesiapaymentsistemandfinancialmarketinfrastructrue/Bankindonesia.go.id/

Ben, W., & Karaa, A. (2013). A NEW STEMMER TO I MPROVE INFORMATION RETRIEVAL, 5(4), 143–154.

Cambria, E., Schuller, B., Liu, B., Wang, H., & Havasi, C. (2013). Knowledge Based Approaches to Concept- Level Sentiment Analysis. IEEE Intelligent Systems, 1541–1672. https://doi.org/10.1109/MIS.2013.45

Chakraborty, G., Liu, J., & Sarkar, M. K. (2013). SAS Global Forum 2013 Poster and Video Presentations Feature-based Sentiment Analysis on Android App Reviews Using SAS ® Text Miner and SAS ® Sentiment Analysis Studio

Jiawen Liu , Mantosh Kumar Sarkar and Goutam Chakraborty , Oklahoma State SAS Global Fo, 1–7.

El-Halees, A. M. (2014). Software usability evaluation using opinion mining. Journal of Software, 9(2), 343–349. https://doi.org/10.4304/jsw.9.2.343-349

Federaç~ao Brasileira de Bancos (Febraban) (Brazilian Federation of Banks) (2018), "Pesquis Febraban de tecnologia bancaria 2018", available at:https://cmsportal.febraban.org.br/Arquivos/documentos/PDF/febraban_2018_Final.pdf / (accessed 6 September 2018).

Hamouda, A. (n.d.). Reviews Classification Using SentiWordNet Lexicon, (2), 120–123.

Harrison, R., Flood, D., & Duce, D. (2013). Usability of mobile applications : literature review and rationale for a new usability model, 1–16.

Kaur, A., & Gumber, N. (2014). Sentimental Analysis on Application Reviews on Educational Apps, (11), 16–19.

Khan, A. (2011). Sentiment classification by sentence level semantic orientation using sentiwordnet from online reviews and Blogs. International Journal of Computer Science & Emerging Technologies, (4), 539–552. Retrieved fromhttps://economysea.withgoogle.com/report

Omotoso, Babatunde. 2020. Mobile Banking Applications in Nigeria : An Analysis of User Sentiments.Journal of Banking. The Chartered Institute of Bankers of Nigeria. Vol 10. No.1

Rahman, Abd Nurazzah dkk. 2022. Classification of Customer Feedbacks Using Sentiment Analysis Toward Mobile Banking Applications. International Journal of Artificial Intellegent. Faculty of computer and mathematical scienses. Universiti Teknologi MARA. Vol 11. No.4. Pp 1579-1587

Reydet, S. and Carsana, L. (2017), "The effect of digital design in retail Banking on customers' commitment and loyalty: the mediating role of positive affect", Journal of Retailing and Consumer Services, Vol. 37, pp. 132-138.

Shen, X.L., Li, Y.J., Sun, Y. and Wang, N. (2018), "Channel integration quality, perceived fluency and omnichannel service usage: the moderating roles of internal and external usage experience", Decision Support Systems, Vol. 109, pp. 61-73.

Straker, K. and Wrigley, C. (2016), "Translating emotional insights into digital channel designs opportunities to enhance the airport experience", Journal of Hospitality and Tourism Technology, Vol. 7 No. 2, pp. 135-157.

Willa,Fatika Sari. 2023. Analisis Sentiment Review Pengguna BCA Mobile Menggunakan Teks Mining. Fakultas Ekonomi dan Bisnis. Universitas Andalas. Vol.6. No.2. Pp 981-987