CLASSIFICATION OF CUSTOMER COMPLAINTS ON INSTAGRAM COMMENTS USING NAÏVE BAYES ALGORITHM WITH N-GRAM FEATURE EXTENSION

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Abstract—Customer complaints about the company can be used as a form of self-evaluation and performance that has been carried out by the company, based on customer complaints the company can find out the weaknesses that exist in the company and fix them. The forms of submitting customer complaints are very diverse, currently not only by telephone, but customers also submit suggestions or complaints, customers can submit suggestions or complaints via electronic mail or e-mail or forums in cyberspace that are indeed created by product-producing companies to accommodate various complaints, suggestions, and direct criticism from consumers, especially social media that are free to express opinions on the delivery services used. Instagram is a social media that is more inclined towards images and on the other hand, has captions and comments text, a study is needed for the problem of customer complaints from shipping service users on an Instagram account of a delivery service company. Based on this background, a solution is needed in solving problems for text mining classification using Naïve Bayes with SMOTE techniques and N-Gram feature extraction with the usual process for text mining so that it can produce Naïve Bayes and SMOTE accuracy with an accuracy of 88.54%, before implementation. N-Gram and the accuracy rate increased by 1.44% after the N-Gram Term was applied to 89.98% by using a dataset of 776 Instagram comment text records that had to preprocess text.

Keywords: Classification, Comments Instagram, Complaints, Naïve Bayes, SMOTE Technique, N-Gram

INTRODUCTION

Indonesia has a variety of social media users, both men and women ranging from children, adolescents, adults, and the elderly. APJII takes a picture of the number of internet users in Indonesia, the result is that internet users in Indonesia have increased by 10.12% in 2018 compared to the previous year. The total number of internet users reached 171.17 million out of a population of 264.16 million (APJII, 2019). Meanwhile, around 75.47% of companies use...
Customer satisfaction is one of the things that a company expects when the resulting product has been marketed, either in the form of goods or services. Coupled with tough competition (Mayasari & Indriyani, 2016) between companies that produce similar products make companies compete to produce products according to consumer desires. However, it is not always the product that reaches the customer that it is completely free from problems (Putri, 2016), With the development of buying and selling online through various media, both purchasing via ecommerce sites or through social media is very easy, according to (Widagdo, 2016) the development of e-commerce is very interesting to discuss because over time, the telecommunications industry will develop both in terms of service coverage and internet connection speed. Payment system support that becomes easy, then electronic transactions or e-commerce activities will grow.

An increasing number of complaints given by customers require extra attention for every company that receives complaints to improve in manufacturing (Susi Indriyani, 2014) products or services (S. Indriyani & Mardiana, 2016). Often customers find problems in the use of products, either due to production errors or misuse of ways other than the delivery of goods, which are relatively more frequent problems experienced by customers, so that customer trust in goods delivery services is also very influential because the products purchased by consumers are expected quickly reach the customer.

Customer complaints can be submitted in various ways, for example through customer service, the use of technology allows increased effectiveness in service recovery, social media has been widely used by companies like customer service (Setiawan & Setyohadi, 2017). Customers can submit suggestions or complaints via electronic mail, e-mail, or forums on the internet created by product selling companies to accommodate various complaints, suggestions, and criticism directly from customers, especially on social media that are free to express their opinions on their delivery services wear. After going through this step, the company represented by customer service collects and analyzes complaints from customers to take action on the next step, which is of course by customer requests (Dewi, 2018).

Several studies have been conducted on customer complaints using the following classification research conducted by Prieta Dellia and Aris Tjahyanto regarding the classification of tax complaints on Twitter in 2017 (Dellia & Tjahyanto, 2017). Other research on twitter classification text for complaints of Bandung city government (Laksana & Purwarianti, 2015). The next research is the classification of Instagram comments to identify customer complaints of goods delivery services using the SMOTE technique (Ruhyana & Rosiyadi, 2019). Based on previous research, this study aims to use text mining to classify customer complaints on Instagram social media by taking text comments on one of the Instagram accounts of goods delivery services using the Naive Bayes method, adding SMOTE techniques and N-Gram feature extraction to increase accuracy so that it can make comparisons between the accuracy using the N-Gram feature and not using the N-Gram feature.

This study tries to improve the accuracy of the classification of customer complaint data on Instagram comments by using the Naive Bayes algorithm using the SMOTE technique by adding the N-Gram feature to predict comments that contain complaints and not complaints. Then look at the level of accuracy of the method used before and after the application of the N-Gram term feature. The data from this research can be used for companies to reconsider their policies for decision making.

MATERIALS AND METHODS

The research methodology used in this study is the Cross-Standard Industry for Data Mining (CRISP-DM) method, the CRISP-DM research method consists of 6 steps (Sieber, 2008) Business Understanding, Data Understanding, Data Preparation, Modeling, Evaluation, Deployment.

Based on Figure 1, this research model discusses the classification of customer complaints about delivery services based on Instagram comments using the Naive Bayes algorithm with the SMOTE technique and the N-Gram feature. The data is taken from the Instagram comment of the @jne_id service account, the data used is 776 records with two attributes, namely text, and status, then labeling each comment with the complaint label is 554 records and 222, not complaint records.
The preprocessing stage carries out the text processing process starting from @annotation removal, transformation removes URL, tokenization, not negative transformation, Indonesian stemming, Indonesian stopword removal, and n-gram by term. The SMOTE technique is used to balance the unbalanced data between the complaint label and the not complaint label, followed by modeling using the naive Bayes algorithm and implementing the data using the rapid-miner application with the confusion matrix as a means of measuring the performance of the classification algorithm.

**RESULTS AND DISCUSSION**

Business understanding of what will be discussed in this study is to understand the processes that will be produced for both organizations and individuals. What will be discussed in this study as understanding the organization to improve organizational quality, at this stage the researcher makes a question what is the purpose of this text mining research? namely to improve services on freight forwarding services in response to customer complaints.

The classification model approach to Instagram comments that will be used by the Naïve Bayes algorithm adds SMOTE techniques and N-Gram feature extraction (Ruhyana & Rosiyadi, 2019) to improve the accuracy of the classification method used in the Instagram comment text dataset.

The second stage of CRISP-DM is that understanding data is needed to have an understanding of the data that will be used in the research process. The data used for this research experiment was collected through Instagram comment data from Instagram social media regarding customer complaints on one of the goods delivery service accounts using the Python API Instagram using the Python language on Github created by Levasha by only taking local text data. Instagram comments, then local data is labeled using the Crowdsourced labeling method is a data labeling method that involves the participation of the general public, of course for datasets that do not require special skills to label them or learn from participants in labeling. The results of selecting datasets are made in Microsoft Excel to be processed in data testing.

Data preparation is the data preparation stage for the text mining process, taking the data from the Instagram comment of the delivery service account, namely @jne_id from September 2018 to November 2018.
namely the account name and the comment text used in The limitation of this problem is only the comment text and adding a new field, namely the status, to be used as a class or label. The content of Instagram has a lot of information related to customer complaints of Instagram social media users, which is shown to the Instagram account @id_id delivery service. Before calculating using the proposed model, the data is cleaned so that the data is by the calculation method by eliminating noise and inconsistent data, the data preparation stages are as follows:

@Anotation removal is text parsed based on white space. In this process, all the annotations contained in Instagram comments will be removed, and turn all capital letters into lowercase letters. The results of text processing areas in table 2 below:

| Text before processing | Text after processing |
|------------------------|-----------------------|
| @ichal_firmansyah08     | complain kmm? Saya sdh dateng ke gudangnya langsung, saya coba email, dan balasannya barang sudah diterima oleh saya. Jelas2 sy tidak terima sama skali. | complain kmm? Saya sdh dateng ke gudangnya langsung, saya coba email, dan balasannya barang sudah diterima oleh saya. Jelas2 sy tidak terima sama skali. |
|                        | http://www.jne.co.id/i/d/tracking/trace |        |

Source: (Amsury et al., 2020)

Tokenization (Regexp), the result of Transformation Remove URL is continued by the Tokenization process (Regexp), where all the words in each document are collected and punctuated and removed if there are symbols, special characters, or anything that is not a letter. The results of text processing areas in table 4 below:

| Text before processing | Text after processing |
|------------------------|-----------------------|
| Tokenization regexp    | Tokenization regexp   |
| complain kmm? Saya sdh dateng ke gudangnya langsung, saya coba email, dan balasannya barang sudah diterima oleh saya. Jelas2 sy tidak terima sama skali. | complain kmm? Saya sdh dateng ke gudangnya langsung, saya coba email, dan balasannya barang sudah diterima oleh saya. Jelas2 sy tidak terima sama skali. |

Source: (Amsury et al., 2020)

Transformation Not Negative, From the results of the Indonesian Slang Normalization, the next is a not negative transformation process. In this process, words that have a negative value will be converted into non-negative sentences. The results of text processing are as in table 5 below:

| Text before processing | Text after processing |
|------------------------|-----------------------|
| Preprocessing Transformation not negative | Preprocessing Transformation not negative |
| complain kmm? Saya sdh dateng ke gudangnya langsung, saya coba email, dan balasannya barang sudah diterima oleh saya. Jelas2 sy tidak terima sama skali. | complain kmm? Saya sdh dateng ke gudangnya langsung, saya coba email, dan balasannya barang sudah diterima oleh saya. Jelas2 sy tidak terima sama skali. |

Source: (Amsury et al., 2020)

Indonesian Stemming, the result of the not negative transformation will be carried out by a stemming process, namely changing words that have affixes into basic words using Indonesian stemming for Instagram comments. The results of text processing are as in table 6 below:

| Text before processing | Text after processing |
|------------------------|-----------------------|
| Preprocessing Indonesia stemming | Preprocessing Indonesia stemming |
| complain kmm? Saya sdh dateng ke gudangnya langsung, saya coba email, dan balasannya barang sudah diterima oleh saya. Jelas2 sy tidak terima sama skali. | complain kmm? Saya sdh dateng ke gudang langsung, saya coba email, dan balasannya barang sudah diterima oleh saya. Jelas2 sy tidak terima sama skali. |

Source: (Amsury et al., 2020)
Indonesian Stopword Removal, the results of Indonesian stemming will be continued to the Indonesian stopword removal process, in this process irrelevant words will be deleted, such as words but, for, with, which have no separate meaning if separated by other words and not related to adjectives related to sentiment. The results of text processing areas in table 7 below:

| Text before processing stopword removal | Text after processing stopword removal |
|----------------------------------------|----------------------------------------|
| complain kmn Saya sdh dateng ke gudang langsung saya coba email dan balas barang sudah terima oleh saya Jelas sy tidak terima sama skali | complain kmn sdh dateng gudang langsung coba email balas barang sudah terima Jelas tidak terima sama skali |

Source: (Amsury et al., 2020)

Extraction of the N-Gram (Term) Feature, the results of the Indonesian stop-word removal will be continued in the last process, namely Generate n-Gram (Terms) is a set of words given in a paragraph and when calculating n-grams is usually done by moving one word forward, in this stage using the trigram. The results of text processing areas in table 8 below:

| Text before processing N-Gram | Text after processing N-Gram |
|------------------------------|------------------------------|
| complain kmn sdh dateng gudang langsung coba email balas barang sudah terima Jelas tidak terima sama skali | complain kmn sdh dateng gudang langsung coba email balas barang sudah terima Jelas tidak terima sama skali |

Source: (Amsury et al., 2020)

Based on Figure 2 is a confusion matrix model in a rapid-miner application using the Naive Bayes algorithm.

Source: (Amsury et al., 2020)
Based on Figure 3, it is a documented process carried out in the Rapid-miner application by adding n-gram by terms. The results of testing Indonesian Instagram comment data with 776 records using the Naïve Bayes + SMOTE and Naïve Bayes + SMOTE + N-Gram methods can be seen in the table.

**Table 9. Confusion Matrix Method Naïve Bayes + SMOTE**

|                | True Complaint | True NotComplaint | Class Precision |
|----------------|----------------|-------------------|-----------------|
| Pred. Complaint| 461            | 34                | 93.13%          |
| Pred. NotComplaint| 93             | 520               | 84.83%          |
| Class Recall   | 83.21%         | 93.86%            |                 |

Source: (Amsury et al., 2020)

Based on table 9, the accuracy results for the naïve Bayes method with the SMOTE technique are 88.54%, with the precision prediction complaint class of 93.13% and the precision prediction not complaint class of 84.83%. True complaint recall class was 83.21% and true not complaint recall class was 93.86%.

**Table 10. Confusion Matrix Metode Naïve Bayes + SMOTE + N-Gram**

|                | True Complaint | True NotComplaint | Class Precision |
|----------------|----------------|-------------------|-----------------|
| Pred. Complaint| 466            | 23                | 95.30%          |
| Pred. NotComplaint| 88             | 531               | 85.78%          |
| Class Recall   | 84.12%         | 95.86%            |                 |

Source: (Amsury et al., 2020)

Based on table 10, the accuracy results for the naïve Bayes method with the SMOTE technique and the N-Gram feature is 89.98%, with the precision prediction complaint class of 95.30% and the precision prediction not complaint class of 85.78%. True complaint recall class was 84.12% and true not complaint recall class was 95.86%.

**Table 11. Evaluation F-Measure**

| Method            | F-Measure |
|-------------------|-----------|
| NB + SMOTE        | 89.14%    |
| NB + SMOTE + N-Gram| 90.56%   |

Source: (Amsury Fachri, et al., 2020)

Based on table 11, the results of the F-Measure evaluation for the naïve Bayes algorithm with the SMOTE technique are 89.14% while the naïve Bayes algorithm with the SMOTE technique and the N-Gram feature is 90.56%, seen from the testing process of the Naïve Bayes algorithm model using the technique. SMOTE and Naïve Bayes using the SMOTE technique and the N-Gram feature, the highest model test results of all algorithm test results are SMOTE-based Naïve Bayes and the N-Gram feature. Therefore the weight to be used in application modeling is based on the test results of the Naïve Bayes algorithm based on the SMOTE technique and the N-Gram feature.

**CONCLUSION**

Based on the results of the research that has been carried out, a model has been successfully built to classify customer complaints on delivery services on Instagram accounts, it can be concluded that the naïve Bayes classification algorithm uses the SMOTE technique which processes Instagram comment data regarding 776 records of customer complaints of freight forwarding services, an accuracy rate of 88.54% while the results of the naïve Bayes classification using the SMOTE technique with the N-Gram feature found that an accuracy rate of 89.98% was proven by using the N-Gram feature to increase the accuracy rate by...
1.44\% compared to without using the N-Gram feature.

The suggestions that can be conveyed by data processing needs are to use different classification algorithms such as Decision Tree, Random Forest, k-NN so that different research can be carried out from the existing ones. Using other feature selection methods such as Chi-Square, Gini Index, Mutual Information Part of Speech (POS), etc. so that the results can be compared. Enrich the dataset used so that research can be more specific and accurate.

REFERENCE

Amsury, F., Ruhyana, N., Saputra, I., & Sulistyowati, D. N. (2020). Laporan Akhir Penelitian Mandiri: Klasifikasi Keluhan Pelanggan Pada Komentar Instagram Menggunakan Algoritma Naive Bayes Dengan Ekstarksi Fitur N-Gram. Jakarta.

APJII. (2019). Buletin APJII Edisi-40 - Mei 2019: Survei APJII yang Ditunggu-tunggu, Penetrasi Internet Indonesia 2018. Retrieved from apjii.or.id website: https://apjii.or.id/content/read/104/418/BULETIN-APJII-EDISI-40---Mei-2019

Dellia, P., & Tjahyanto, A. (2017). Tax Complaints Classification on Twitter Using Text Mining. JIPTEK Journal of Science, 2(1), 11–15. https://doi.org/10.12962/j23378530.v2i1.a2 254

Dewi, R. N. (2018). Model Text Mining Untuk Identifikasi Keluhan Pelanggan Produk Perusahaan Perangkat Lunak (Universitas Islam Indonesia). Universitas Islam Indonesia. Retrieved from https://dspace.ui.ac.id/bitstream/handle/123456789/10239/Tesis Rona Neysa Dewi 12917229.pdf?sequence=2&isAllowed=y

Hartini, S. (2016). Efektifitas Endorsement pada Media Sosial Instagram pada Produk Skin Care. Bina Insani ICT Journal, 3(1), 43–50. Retrieved from http://www.ejournal-binainsani.ac.id/index.php/BIICT/article/view/794

Indriyani, S., & Mardiana, S. (2016). Pengaruh Penanganan Keluhan (Complaint Handling) Terhadap Kepercayaan Dan Komitmen Mahasiswa Pada Perguruan Tinggi Swasta Di Bandar Lampung. Jurnal Bisnis Darmajaya, 2(1), 1–13. Retrieved from https://journal.darmajaya.ac.id/index.php/jurnalBisnis/article/view/615

Indriyani, Susi. (2014). FAKTOR EMPATI DALAM PENANGANAN KELUHAN TERHADAP KEPERCAYAAN DAN KOMITMEN MAHASISWA DI STIE MITRA LAMPUANG. Seminar Bisnis & Teknologi 2014 IBI Darmajaya, 1–15. Bandar Lampung: Institut Informatika Dan Bisnis Darmajaya. Retrieved from https://jurnal.darmajaya.ac.id/index.php/sembistek/article/view/199

Laksana, J., & Purwarianti, A. (2015). Indonesian Twitter text authority classification for government in Bandung. Proceedings - 2014 International Conference on Advanced Informatics: Concept, Theory and Application, ICAICTA 2014, 129–134. https://doi.org/10.1109/ICAICTA.2014.7005928

Mayasari, I. Y., & Indriyani, R. (2016). Analisis Strategi Bersaing pada PT.Citra Surya Pacific. AGORA, 4(2), 188–196. Retrieved from http://publication.petra.ac.id/index.php/ma najemen-bisnis/article/view/4803

Putri, R. L. (2016). Peningkatan Kualitas Produk Melalui Penerapan Prosedur dan Sistem Produksi : Studi Pada UD Wijaya Kusuma Kota Blitar. Jurnal Wahana Riset Akuntansi, 4(2), 813–828. Retrieved from http://ejournal.unp.ac.id/index.php/wr/ article/view/7223/

Ruhyana, N., & Rosiyadi, D. (2019). Klasifikasi Komentar Instagram Untuk Identifikasi Keluhan Pelanggan Jasa Pengiriman Barang Dengan Teknik Smote. Faktor Exacta, 12(4), 280–290. https://doi.org/10.30998/faktorexacta.v12i4 .4981

Sabirin, & Setiawati, C. I. (2017). The driving factors of Instagram utilization for marketing efforts in promoting the student-owned online store. Proceedings - 2016 International Seminar on Application of Technology for Information and Communication, ISEMIANTIC 2016, 64–69. https://doi.org/10.1109/ISEMIANTIC.2016.7873811

Setiawan, R. A., & Setyo hardi, D. B. (2017). Analisis Komunikasi Sosial Media Twitter sebagai Saluran Layanan Pelanggan Provider Internet dan Seluler di Indonesia. Journal of...
Sieber, J. E. (2008). Data Mining: Knowledge Discovery for Human Research Ethics. *Journal of Empirical Research on Human Research Ethics, 3*(3), 1–2. https://doi.org/10.1525/jer.2008.3.3.1

Widagdo, P. B. (2016). *Perkembangan Electronic Commerce (E-Commerce) di Indonesia.* Yogjakarta.