

Design of Intelligent Model for Text-Based Fake News Detection Using K-Nearest Neighbor Method

Hari Murti^{1*}, Sulastr², Dwi Budi Santoso³, Dwi Agus Diartono⁴, Kristiawan Nugroho⁵

Faculty of Information Technology and Industry, Universitas Stikubank, Indonesia

¹harimur¹@edu.unisbank.ac.id, ²sulastr²@edu.unisbank.ac.id, ³dwibudi³@edu.unisbank.ac.id,

⁴dwiagus⁴@edu.unisbank.ac.id, ⁵kristiawan⁵@edu.unisbank.ac.id

Submitted : Dec 7, 2024 | **Accepted** : Dec 30, 2024 | **Published** : Jan 8, 2025

Abstract: Text-based fake news detection is a crucial issue considering its negative impacts on society and individuals. One of the main impacts that has a significant and detrimental impact on society is disinformation, where false or misleading information can cause confusion and uncertainty in society. This can lead to misunderstandings and develop into riots in society which can lead to legal problems that are detrimental to society. In order to overcome this problem, a method is needed to detect fake news. This study aims to build a fake news detection method using machine learning, which is a technology widely used by researchers to detect and analyze past data. Various methods have been produced using machine learning, including the K-Nearest Neighbor (K-NN) method which is proposed as an effective solution to detect fake news. K-NN is a machine learning algorithm that works by classifying text based on its proximity to known data in feature space. This method is proposed because of its ability to handle non-linear data and its low complexity. The application of K-NN can increase the accuracy in detecting fake news by utilizing the characteristics of relevant text, thus helping in efforts to filter information and maintain the integrity of news circulating in the community. In a study conducted using the FakeNewsDetection dataset, the model evaluation results showed that KNN produced a Mean Absolute Error (MAE) of 0.011 and a Root Mean Squared Error (RMSE) of 0.077, better than the performance of other methods such as SVM and Neural Network.

Keywords: Fake News, Detection, Machine Learning, K-NN, Accuracy

INTRODUCTION

Computers play a vital role in the fight against hoaxes to this day. With their advanced data analysis capabilities, computers can process and analyze millions of pieces of information from multiple sources in a short time, helping to identify and verify facts. Artificial intelligence (AI) technology applied to computers enables the detection of patterns in the spread of false information (Egerton et al., 2020), while providing early warnings to the public and relevant authorities. In addition, social media platforms use computer algorithms to filter out invalid content and disseminate information that has been verified as true. The combination of speed, accuracy, and analytical capabilities of computers has made them an effective tool in reducing the negative impact of hoaxes on society.

Artificial intelligence (AI) uses a variety of sophisticated techniques to detect hoaxes, one of which is through text analysis. AI algorithms can analyze the content of news or statements suspected of being hoaxes by comparing them to a database of verified information. AI also uses machine learning (Alisya et al., 2024) to recognize language patterns that often appear in fake news, such as the use of sensational or emotional words. In addition, AI can check news sources to assess their credibility and cross-reference with other trusted sources. This process allows AI to provide an initial assessment of the authenticity of information, thereby helping to reduce the spread of hoaxes in society. Various machine learning methods have been used in detecting hoaxes, including supervised learning, unsupervised learning, and deep learning. In supervised learning, algorithms are trained using labeled datasets, such as hoax texts and real texts, to identify patterns and characteristics that differentiate the two. This method often uses techniques such as Support Vector Machines (SVM), Naive Bayes, K-Nearest Neighbor (KNN) and Random Forest. Unsupervised learning, on the other hand, is used to identify patterns in unlabeled data (Buslim & Iswara, 2019), helping to uncover newly emerging fake news with techniques such as clustering and anomaly

*name of corresponding author



This is an Creative Commons License This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

detection. Deep learning, which uses multi-layered artificial neural networks, is able to analyze large and complex data, such as images, videos, and text, to detect hoaxes with higher accuracy. The combination of these methods allows AI systems to continuously learn and adapt to new tactics used in hoax creation, thereby strengthening their ability to identify misinformation.

Various studies on fake news detection using various Machine Learning methods have also been carried out, including using the Naïve Bayes method in a study conducted by Senhadji (Senhadji & Ahmed, 2022) on fake news detection with a model accuracy of 90%, in addition Nurhasanah (Nurhasanah et al., 2022) also used the Naïve Bayes algorithm to detect fake news with an accuracy rate of 89%. In other studies, researchers also used other methods such as Support Vector Machine (SVM) such as in a study conducted by Shafira (Shafira, 2023) who used SVM to detect hoaxes in news about Covid 19, this study managed to achieve the highest accuracy rate of 83.17%. Using SVM Saraswati (Wayan Sumartini Saraswati et al., 2023) also managed to produce a fake news detection model with an accuracy rate of 98.9%. In addition, researchers also used the Decision Tree (DT) method to detect fake news such as in a study conducted by Abdullah (Abdullah et al., 2024) which produced a fake news detection model with an accuracy of 96.36%. In further research, the Random Forest method was also used to detect hoax news as in the research conducted by Tambunan (Tambunan et al., 2023) with an accuracy of around 98%, this research used the hoax dataset from Kominfo. The Random Forest method was also used in several other studies, including those conducted by Ramadhan (Ramadhan et al., 2022) who used 6256 rows of news dataset with a model accuracy level of 84%. Furthermore, with Random Forest, Yonathan (Yonathan et al., 2022) also succeeded in building a model to detect hoax news with an accuracy level of 82.21%..

This study uses the K-Nearest Neighbor (KNN) method which has several advantages over other machine learning methods, especially in terms of its simplicity and effectiveness in various applications. KNN is an algorithm that does not require special training, because it works based on the principle of instance-based learning where the classification of a data is determined by the majority of its K nearest neighbors. This makes KNN very easy to implement and adapt to various types of data without requiring complicated parameter adjustments. In addition, KNN tends to be more robust to non-linear data and can handle data with non-uniform distributions. Other advantages are its flexibility in handling multiclass data and its ability to work well on small to medium datasets. Although KNN can be slow for very large datasets due to the high computational requirements in calculating distances, its advantages in simplicity, flexibility, and accuracy in many cases make it a popular choice among machine learning practitioners.

LITERATURE REVIEW

Research in the field of text-based sentiment detection is one of the interesting research topics in machine learning. Various studies have been conducted using various algorithms. Machine Learning (ML) has the ability to analyze and process large amounts of data quickly and accurately and produce better predictions based on patterns detected from the data. ML enables more efficient automation of decision-making processes, reduces human error, and increases productivity. Research in hoax detection using machine learning has shown significant progress in recent years. This technology utilizes machine learning algorithms, such as text classification, sentiment analysis, and natural language processing (NLP), to identify and verify the truth of information circulating on social media, websites, and news platforms. Researchers use various methods, including research using the Decision Tree algorithm conducted by Irena & Erwin Budi Setiawan, (2020) which detects fake news on the Twitter social media platform, resulting in the best accuracy performance of 72.91%. In another study (Haq et al., 2024) using Naïve Bayes in detecting fake news on social media, using the TF-IDF (Term Frequency-Inverse Document Frequency) technique, this study produced an accuracy of 88%. Other machine learning algorithms such as K-Nearest Neighbor (KNN) were also used by (Indra et al., 2024) in a study on detecting hoax news about the Indonesian presidential election, this approach produced an accuracy performance of 79.54%. In another study (Nurohanisah et al., 2024) using the random Forest method in detecting hoax news, this approach produced increasingly better accuracy performance with an accuracy level of 87%.

METHOD

This study uses a machine learning approach to produce the best-performing model. Research regarding fake news detection was carried out in several stages which can be seen in Figure 1 as follows :

*name of corresponding author



This is an Creative Commons License This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

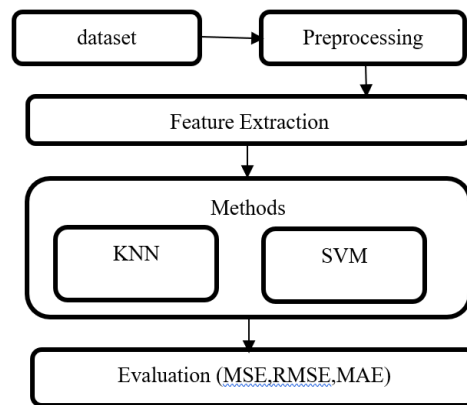


Fig 1. Research Stages

The stages in machine learning begin with data collection, which is a fundamental step in obtaining information that will be used in model training. The research dataset on fake news detection was obtained from:

<https://www.kaggle.com/datasets/emineyettm/fake-news-detection-datasets>

This dataset contains 6 features, namely ID, subject, data, title, text containing , text containing 30,100 data with classes consisting of 0 (fake) and 1 (real). The dataset structure can be seen in Figure 2 as follows :

Columns (Double click to edit)				
	Name	Type	Role	Values
1	ID	datetime	target	0, 1
2	subject	categorical	feature	News, politics, politicsNews, worldnews
3	date	datetime	feature	
4	title	text	meta	
5	text	text	meta	

Fig 2. Dataset fake-news-detection

After the data is collected, the next stage is preprocessing. Preprocessing aims to clean and prepare the data so that it can be processed further. This step includes filling in missing data, normalizing or standardizing data, and removing outliers that can interfere with model performance. Preprocessing also includes converting data into an appropriate form, for example converting categorical data to numeric through techniques such as one-hot encoding. After preprocessing, feature extraction is performed. At this stage, relevant features are identified and extracted from the data to help machine learning algorithms understand existing patterns. Feature extraction aims to reduce data complexity and improve model accuracy(Ahmed Medjahed, 2015) by highlighting the most influential attributes. Furthermore, the extracted features are used in the model training stage through an algorithm that in this study uses the K-Nearest Neighbor (KNN) & Support Vector Machine (SVM) methods.

Machine learning models need to be evaluated using the Mean Absolute Error (MAE) and Root Mean Squared Error (RMSE) metrics to provide a more complete picture of their predictive performance. MAE measures the average absolute difference between predicted and actual values, which provides information about how much error occurs on average without considering the direction of the error. On the other hand, RMSE provides a more sensitive picture to large errors, because it squares the difference between predicted and actual values, thus emphasizing significant errors. At the evaluation stage, the RMSE and MAE approaches are used to measure the performance of the resulting model in machine learning. RMSE and MAE are calculated using the following formulas:

$$MAE = (1/n) * \sum_{i=1}^n |y_i - \hat{y}_i| \quad 1)$$

*name of corresponding author



This is anCreative Commons License This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

where :

- n is the number of samples in the data
- y_i is the actual value
- \hat{y}_i is the predicted value

$$RMSE = \sqrt{\frac{1}{n} \sum_{i=1}^n (y_i - \hat{y}_i)^2} \quad 2)$$

where :

- n is the number of samples in the data
- y_i is the actual value
- \hat{y}_i is the predicted value

RESULT

This study uses machine learning algorithms, namely SVM and KNN to detect fake news using the Orange application, which is one of the best applications in data mining to process text-type datasets, in this case in fake news detection research. Orange is an open source machine learning technology for data mining to explore and visualize data(Wiguna & Rifai, 2021). The visualization form of the Orange application can be seen in Figure 3 as follows:

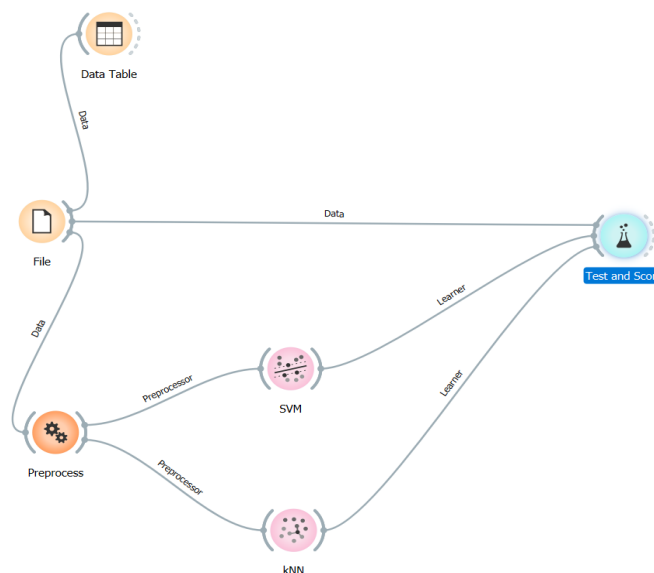


Fig 3. Orange App Model

The design of the orange application regarding text-based fake news detection as shown in Figure 3 shows that the dataset regarding fake news is entered into a file whose data can be viewed in the data table or further processed in the preprocess for the next data to be processed using 2 machine learning methods, namely SVM and KNN. The final results of the model's performance will be measured in Test and Score to determine the algorithm performance of each method. The results of performance measurements with a random sampling approach using 70% training data and 30% testing data when compared to several studies using similar datasets and methods can be seen in Table 1 as follows:

Table 1. Model measurement with random sampling

Methods	MAE	RMSE
BiLSTM(Afrianto et al., 2022)	0,094	0,306
LSTM(Khalis Sofi et al., 2021)	0.038	0.048
SVM(Ours)	0.512	0.542
KNN(Ours)	0.033	0.126

If the cross-validation approach is used with the 10 cross-validation technique, the measurement results are shown in Table 2 below.

*name of corresponding author



This is anCreative Commons License This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

Table 2 Model measurement with cross validation

Methods	MAE	RMSE
Support Vector Machine (SVM)	0.725	1.628
K-Nearest Neighbor (KNN)	0.011	0.077

Mean Absolute Error (MAE) and Root Mean Square Error (RMSE) are two evaluation metrics that are often used in prediction models to measure accuracy. The lower the MAE and RMSE values, the better the model's performance in predicting values that are close to the actual data. A low MAE value indicates that the model has a small absolute error rate in its average prediction, while a low RMSE indicates that the model makes fewer large errors because it gives a higher penalty for large deviations. In Tables 1 and 2 with different evaluation techniques, it can be seen that the KNN method has lower MAE and RMSE values compared to other methods such as SVM, LSTM and Bi-LSTM. This shows that the KNN method has better performance than other methods. If visualized in a graphical display, the results of performance measurements between methods are shown in Figure 4 as follows:

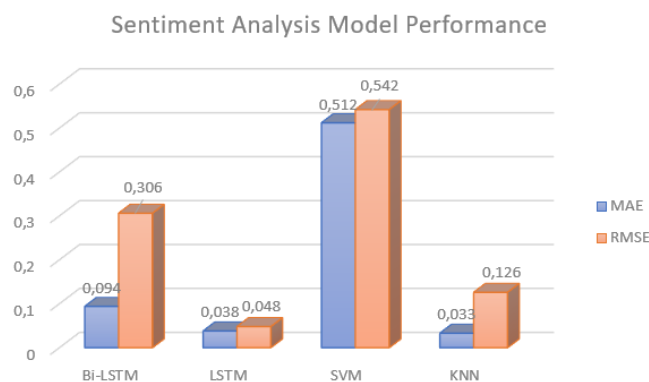


Fig 4. Model Performance Chart

In Figure 4, it can be seen that the KNN model has the smallest MAE value as well as the RMSE value. In addition, the LSTM method also has small MAE and RMSE values, which means that both methods have good performance in detecting fake news data on social media.

DISCUSSIONS

In the research that has been conducted, it is seen that the K-Nearest Neighbor (KNN) method produces a model that has better performance compared to the Support Vector Machine (SVM) in fake news detection research with low MAE and RMSE levels indicating that the resulting model has good performance in recognizing fake news. This is shown in the classification results as shown in the visualization shown in Figure 5 as follows.

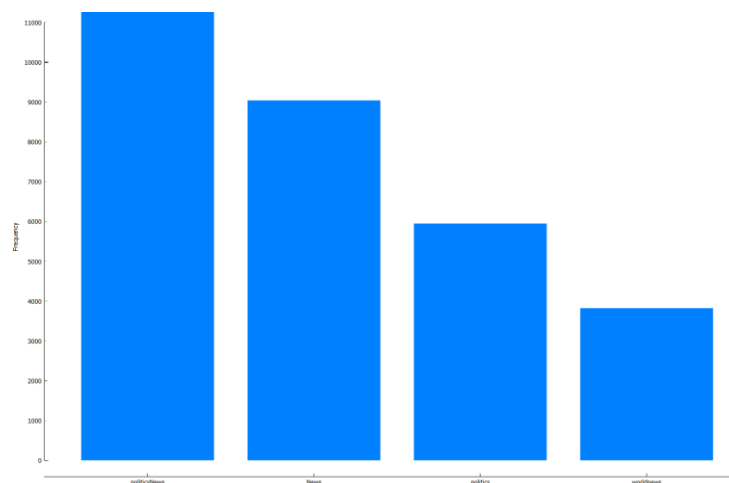


Fig 5. Fake News Detection Chart

*name of corresponding author



This is anCreative Commons License This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

Figure 5 shows that fake news is mostly detected from political news and from several other news. The K-Nearest Neighbors (KNN) method can be better than Support Vector Machine (SVM) in detecting fake news or hoaxes because KNN has simpler and more flexible properties, and can work well even though the data has a non-linear distribution. Another advantage of KNN when compared to deep learning methods such as Long Short-Term Memory (LSTM) in detecting fake news lies in its simplicity, efficiency, and ease of implementation. KNN does not require complicated model training or parameters that must be optimized like in LSTM, which requires a lot of data and time for training, and requires higher computing. KNN works based on the principle of proximity, which makes it faster to implement and more efficient in detecting fake news on smaller or limited datasets. In addition, KNN is more transparent and easy to understand, making it easier to analyze results and detect patterns more directly. Meanwhile, LSTM, although very effective in handling sequential data and more complex contexts, can be at risk of overfitting on small datasets and requires a lot of computing resources.

CONCLUSION

In this era of increasingly rapid development of information technology, fake news is a common phenomenon. The spread of fake news is becoming increasingly massive through social media. This has a negative impact on society which can cause chaos that often ends in court. The development of machine learning and its algorithms helps humans in various areas of life, especially in text-based sentiment detection. This study uses the KNN method which has been proven to contribute to producing a fake news detection model with very good performance. Producing an MAE level of 0.033 and an RMSE of 0.126 indicates that the model has good performance in detecting fake news better than SVM which has a model performance with a lower performance level. In further research, a fake news detection model will be developed with the Deep Learning algorithm using various dataset sources on various social media.

ACKNOWLEDGMENT

The authors would like to thank the Direktorat Penelitian, Pengabdian Masyarakat dan Publikasi (DPPMP) for the Internal Research of Lecturers at Stikubank University Semarang for funding this research.

REFERENCES

- Abdullah, N. A. S., Rusli, N. I. A., & Yuslee, N. S. (2024). Development of a machine learning algorithm for fake news detection. *Indonesian Journal of Electrical Engineering and Computer Science*, 35(3), 1732–1743. <https://doi.org/10.11591/ijeecs.v35.i3.pp1732-1743>
- Afrianto, N., Fudholi, D. H., & Rani, S. (2022). Prediksi Harga Saham Menggunakan BiLSTM dengan Faktor Sentimen Publik. *Jurnal RESTI (Rekayasa Sistem Dan Teknologi Informasi)*, 6(1), 41–46. <https://doi.org/10.29207/resti.v6i1.3676>
- Ahmed Medjahed, S. (2015). A Comparative Study of Feature Extraction Methods in Images Classification. *International Journal of Image, Graphics and Signal Processing*, 7(3), 16–23. <https://doi.org/10.5815/ijigsp.2015.03.03>
- Alisya, S. N., Harahap, B., & Wayahdi, M. R. (2024). Design of a Website-Based Battuta University Employee Payroll System. 1(4), 16–21.
- Buslim, N., & Iswara, R. P. (2019). Pengembangan Algoritma Unsupervised Learning Technique Pada Big Data Analysis di Media Sosial sebagai media promosi Online Bagi Masyarakat. *Jurnal Teknik Informatika*, 12(1), 79–96. <https://doi.org/10.15408/jti.v12i1.11342>
- Egerton, T. O., Sochima, E. P., & Palimote, J. (2020). Application of Supervised Machine Learning Algorithms to Detect Online Fake News. *International Journal of Computer Science and Mathematical Theory*, 6(1).
- Haq, M. Z., Octiva, C. S., Ayuliana, A., Nuryanto, U. W., & Suryadi, D. (2024). Algoritma Naïve Bayes untuk Mengidentifikasi Hoaks di Media Sosial. *Jurnal Minfo Polgan*, 13(1), 1079–1084. <https://doi.org/10.33395/jmp.v13i1.13937>
- Indra, Agus Umar Hamdani, Suci Setiawati, Zena Dwi Mentari, & Mauridhy Hery Purnomo. (2024). Comparison of K-NN, SVM, and Random Forest Algorithm for Detecting Hoax on Indonesian Election 2024. *Jurnal Nasional Pendidikan Teknik Informatika (JANAPATI)*, 13(1), 166–179. <https://doi.org/10.23887/janapati.v13i1.76079>
- Irena, B., & Erwin Budi Setiawan. (2020). Fake News (Hoax) Identification on Social Media Twitter using Decision Tree C4.5 Method. *Jurnal RESTI (Rekayasa Sistem Dan Teknologi Informasi)*, 4(4), 711–716. <https://doi.org/10.29207/resti.v4i4.2125>
- Khalis Sofi, Aswan Supriyadi Sunge, Sasmitoh Rahmad Riady, & Antika Zahrotul Kamalia. (2021). Perbandingan Algoritma Linear Regression, Lstm, Dan Gru Dalam Memprediksi Harga Saham Dengan Model Time Series. *Seminastika*, 3(1), 39–46. <https://doi.org/10.47002/seminastika.v3i1.275>
- Nurhasanah, N., Sumarly, D. E., Pratama, J., Heng, I. T. K., & Irwansyah, E. (2022). Comparing SVM and Naïve Bayes Classifier for Fake News Detection. *Engineering, MAThematics and Computer Science (EMACS)*

*name of corresponding author



This is anCreative Commons License This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

- Journal*, 4(3), 103–107. <https://doi.org/10.21512/emacsjournal.v4i3.8670>
- Nurohanisah, S., Astuti, R., & Muhammad Basysyar, F. (2024). Deteksi Berita Palsu Menggunakan Algoritma Random Forest. *JATI (Jurnal Mahasiswa Teknik Informatika)*, 8(1), 422–428. <https://doi.org/10.36040/jati.v8i1.8418>
- Ramadhan, N. G., Adhinata, F. D., Segara, A. J. T., & Rakhmadani, D. P. (2022). Deteksi Berita Palsu Menggunakan Metode Random Forest dan Logistic Regression. *JURIKOM (Jurnal Riset Komputer)*, 9(2), 251. <https://doi.org/10.30865/jurikom.v9i2.3979>
- Senhadji, S., & Ahmed, R. A. S. (2022). Fake news detection using naïve Bayes and long short term memory algorithms. *IAES International Journal of Artificial Intelligence*, 11(2), 746–752. <https://doi.org/10.11591/ijai.v11.i2.pp746-752>
- Shafira, A. (2023). Hoax COVID-19 News Detection Based on Sentiment Analysis in Indonesian using Support Vector Machine (SVM) Method. *International Journal on Information and Communication Technology (IJOICT)*, 8(2), 66–77. <https://doi.org/10.21108/ijoict.v8i2.682>
- Tambunan, T., Yohanna, M., & Silalahi, A. P. (2023). Penerapan Metode Random Forest Dalam Mendeteksi Berita Hoax. *METHOMIKA Jurnal Manajemen Informatika Dan Komputerisasi Akuntansi*, 7(2), 301–306. <https://doi.org/10.46880/jmika.vol7no2.pp301-306>
- Wayan Sumartini Saraswati, N., Putu Krisna Suarendra Putra, I., Dewa Made Krishna Muku, I., & Dana Pramitha, G. (2023). *Support Vector Machine For Hoax Detection*. 6(2), 107–117. <https://doi.org/10.31598>
- Wiguna, R. A. raffaidy, & Rifai, A. I. (2021). Analisis Text Clustering Masyarakat Di Twitter Mengenai Omnibus Law Menggunakan Orange Data Mining. *Journal of Information Systems and Informatics*, 3(1), 1–12. <https://doi.org/10.33557/journalisi.v3i1.78>
- Yonathan, A., Sujaini, H., & Pratama, E. E. (2022). Perbandingan Algoritma Klasifikasi dalam Pendeteksian Hoax pada Media Sosial. *Jurnal Aplikasi Dan Riset Informatika (JUARA)*, 1(1), 44–49. <https://doi.org/10.26418/juara.v1i1.53126>