

Sentiment analysis on twitter about the death penalty using the support vector machine method

Sriani, Aidil Halim Lubis, Lia Putri Ashari Lubis*

* Computer Science, Faculty of Science and Technology, North Sumatra State Islamic University, Indonesia, 20353. Jln. 3, Glugur Darat I Village, East Medan District, Medan City, North Sumatra, Indonesia, 20236

*✉ lia.putriasharilubis@uinsu.ac.id

Submitted: 17/03/2024

Revised: 27/03/2024

Accepted: 07/04/2024

ABSTRACT

It is estimated that 175 million people in Indonesia utilize the Internet, according to the most recent we are social survey. 160 million of them are internet users who utilize social media, according to this data. It is estimated that 19.5 million Indonesians use Twitter. This is consistent with the numerous tweets that users have posted on Twitter about a variety of topics, including politics, music, health, and education. The death penalty is still one of the most popular subjects that is addressed on Twitter. When a judge rules that someone will be executed as retribution for a crime they have committed, this is referred to as the death penalty. As a result, sentiment analysis utilizing the support vector machine technique with linear kernel features and python programming was used to study public opinions on the death sentence. To improve the accuracy of the results obtained, data labeling on 848 data that were received through the scraping process was done manually in this study. Positive data is categorized as belonging to the class that supports the death sentence, while negative data is categorized as belonging to the class that opposes it. The study that was done shows an 8:2 difference between the training and test data. After preprocessing a dataset containing 758 data points, of which 606 will be utilized for training and 152 for testing, we obtain 91% accuracy, 91% precision, 100% recall, and 95% f1-score.

Keywords: Sentiment analysis; death penalty; support vector machine

1. INTRODUCTION

Indonesia was estimated to have 175 million internet users in 2020 according to the We Are Social survey. According to this research, 160 million of them utilize social media on the internet [1]

Social media refers to any website or platform that lets users engage in different ways with posts that other users have published. Users of social media typically can create commercial and personal profiles with a variety of content, including images, videos, and communications with friends and followers, tailored to their preferences and requirements. Social media has developed into a global platform for engagement and communication [2].

With 19.5 million members, Twitter is one of the many social media platforms that Indonesians use extensively (KOMINFO, Indonesia). This is consistent with the numerous tweets that users have posted on Twitter about a variety of topics, including politics, music, health, and education. The death penalty is one of the most popular subjects that is still discussed frequently on Twitter [3].

When a judge rules that someone will be executed as retribution for a crime they have committed, this is referred to as the death penalty. The death penalty, commonly referred to as execution, is a contentious practice that generates a lot of discussion worldwide.

Extremely serious crimes include planned murder, terrorism, state treason, armed robbery resulting in the death of victims, war crimes, and corruption are typically punishable by death. Every nation has its laws and protocols regarding the use of the death penalty [4].



A few nations have completely legalized the death sentence due to the belief that it infringes upon human rights, particularly the right to life. Some nations still uphold the death sentence as a method of justice for extremely serious crimes and include it in their legal systems [5].

Although there is legislation in Indonesia that calls for the death penalty for those who commit corruption, it has never been put into practice. Actually, since 1999, the UUPK has advocated for the legal threat of the death penalty, but in actuality, no one has been executed for bribery [6]. Consequently, political initiatives aimed at enhancing the quality of Indonesian law concerning criminal acts of corruption are grounded in diverse public views disseminated via Twitter [5].

One technique that can be applied in the classification process is the Support Vector Machine or SVM. SVM was first created for tasks involving classification and then modified for jobs involving regression [7].

SVM looks for the best hyperplane, or bounding plane, in the classification context to enable the separation of two classes of data [8]. This hyperplane is selected to maximize the shortest distance between the closest data points from both classes (referred to as support vectors) and the hyperplane. Stated differently, SVM looks for the hyperplane with the biggest margin between the two classes [9].

SVM's capacity to handle non-linear data by applying data transformation to a higher spatial form—also known as the kernel trick—is one of its primary advantages. SVM may convert linearly inseparable data into a higher dimensional space where linear separability is attainable by using the kernel approach [10].

This SVM approach has been used in the context of classification in several earlier research. Sentiment Analysis of 2018 Rice Imports on Twitter Using the Support Vector Machine Method and Weighting the Number of Retweets was the subject of one study [11], 318 data points with an accuracy rating of 48.95% were used by the researcher. In addition, studies on "Sentiment Analysis on Twitter with the hashtag #BPJSRASARENTENIR Using the Support Vector Machine Method" have been conducted [1], Using 300 data, the researcher applied the SVM algorithm with a 94% accuracy rate. The Kernel Trick feature, which is used in the SVM approach, is applied in the same way in both experiments. A relatively straightforward technique for delivering low-dimensional non-linear data mapping and subsequently transforming it to higher dimensions is the Kernel Trick feature. This attempts to make the process of classifying data easier by locating boundary lines that can linearly divide the data [12].

The two earlier studies mentioned above used similar attributes and a similar amount of data, but their accuracy findings differed greatly. This study attempts to ascertain whether the tweet has a favorable or negative sentiment and to guarantee and optimize the accuracy value that comes from applying the SVM algorithm with a bigger amount of data in comparison to previous studies.

2. METHOD

To minimize errors in the research process and optimize the research's outcomes, a sequential approach is used to conduct this study. The Figure 1 research stages that are used are as follows:

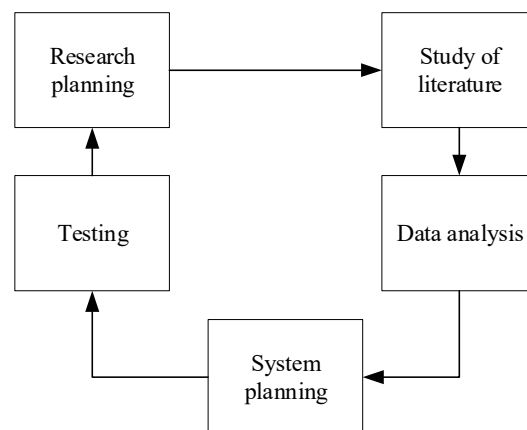


Figure 1. Research framework



Research planning is the first step that is put into practice. The Support Vector Machine was used to analyze sentiment on Twitter, a social media platform that discusses death sentences, particularly for those who commit crimes including corruption. The analysis produced data in the form of both positive and negative attitudes.

Examination of literature, the following step involves applying literature research by reading and comprehending multiple prior studies, whether they were published in journals, essays, theses, or related theses. 'Analysis of Twitter User Sentiment Towards Online Loan Applications Using the Support Vector Machine Method' is one of the studies that served as a guide for this research. In this study, the SVM kernel RBF algorithm with a penalty of $C=1.5$ can be used to carry out predicted tweets of opinion information related to the topic of online progress, with F1 score execution reaching 84%. Furthermore, a majority of the tweets expressed disapproval towards the availability of online credit and the requirement for government action to resolve the issue [13].

Experts will analyze opinion data about Indonesia's choices for the death sentence in this study. Information gathering is the primary phase of the examination. The process of gathering popular assessment data on the death penalty is done through virtual twitter entertainment using the Node Js data scraping module, which is a python library. More than 800 data pieces were collected by this scraping, and these were split between 80% training data and 20% testing data. This indicates that the remaining data are testing data, and the remaining 800+ data are training data groups. Since optimal grouping results depend on preparing information—assuming that preparatory information can cover the majority of the information needed for testing—this is anticipated to yield the highest precision value.

The process of identifying the facts and procedures required to develop a system is known as system design. This attempts to guarantee that the requirements for utilizing the system are satisfied accurately and succinctly with a comprehensive design. The first step in the system design process is creating a flowchart, like the one in Figure 2, that is appropriate for this research method.

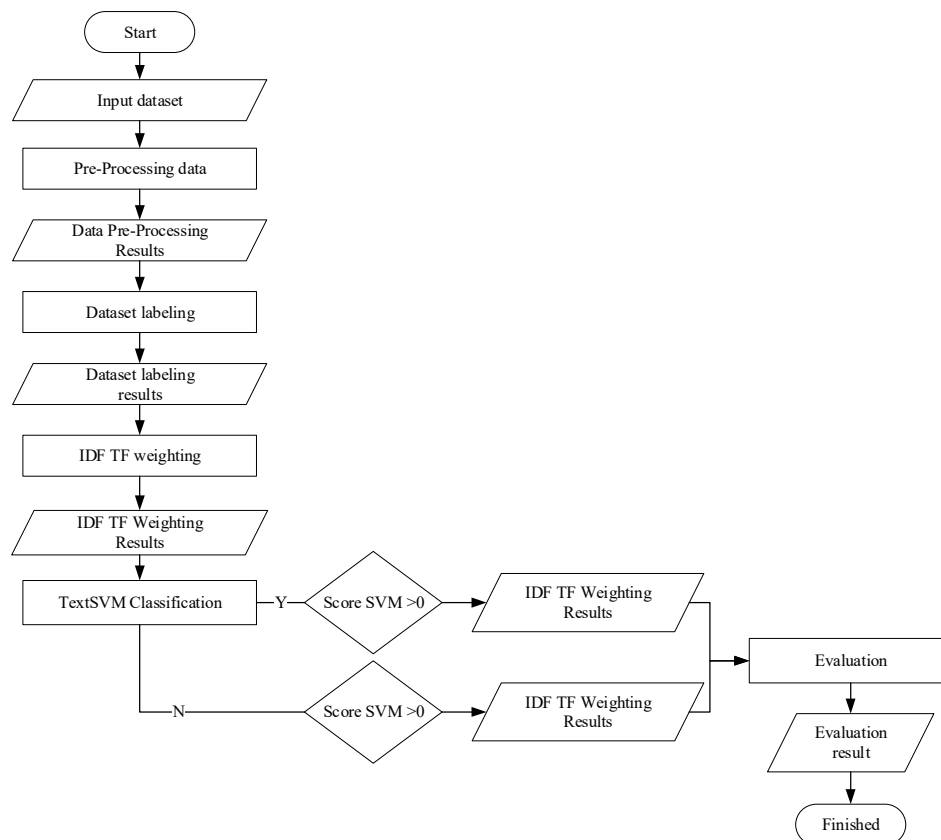


Figure 2. Classification system flowchart



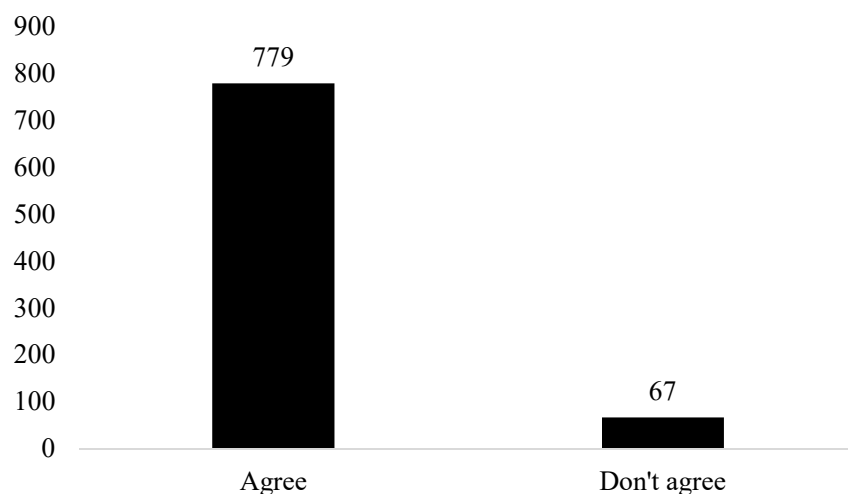
The following step involves testing the successfully gathered data using the flowchart that is attached to [Figure 2](#) as a guide for this testing process.

3. RESULTS AND DISCUSSION

Data analysis

#deathpunishment and #deathpenalty were the two keywords used in the scraping step to look for emotion. Tweets from August 17, 2022, to August 17, 2023, make up the data set. After being gathered, the data is downloaded into Microsoft Excel in the ".xlsx" format and transformed into the ".csv" extension.

820 data points all were successfully gathered, and to learn from the dataset to proceed to the next step, a label (value) comprising positive and negative labels will be manually assigned to each tweet. The distribution of the sentiment data that was collected is shown below, including in [Figure 3](#).



[Figure 3](#). Distribution of sentiment data

Data preprocessing

Data from scraping must go through a preprocessing stage before it can be analyzed. The preprocessing stage aims to change a dataset that is initially unstructured and has a lot of noise into clean data that is ready to be processed.

As a sample of manual calculations in this research, below are 5 training data and 2 testing data attached, as attached in [Table 1](#) and [Table 2](#).

In [Table 1](#) are 5 training data that will be used in manual calculations in this research, where the data comes from a dataset that has been previously collected.

[Table 1](#). Sample training data

| Training data |
|--|
| @alisyarief Anyone with a name called corruption must be eradicated. If necessary, the death penalty. |
| @sepedakujelek @M45Broo If this presidential candidate wins, he dares to put the corruptors to death, which means the people will like him the most. |
| @VIVAcoid There's no promise of the death penalty for corruptors, right? |
| What's the law, Mr Ustad, for laughing at someone afraid because the lights are out in their house? |
| @ author_sajak When will the death penalty for perpetrators of criminal acts of corruption be implemented in Indonesia? |

Meanwhile, in [Table 2](#), 2 testing data that will also be used in the manual calculation process in this research, where these 2 data are also obtained from the results of the dataset that was previously collected.



Table 2. Sample testing data

| Data testing |
|--|
| @VIVAcoid I would rather be a presidential candidate who promises that if corruptors will be punished with death if anyone dares to make a promise like that, they will automatically vote for the presidential candidate. |
| @VIVAcoid Punish corruptors to death so that no one else in society suffers. |

The first step in text mining is preprocessing, which transforms the data into the necessary format. This procedure is used to find, handle, and arrange data before analyzing textual relationships using both organized and unstructured data [14].

The process of organizing text into information that will be handled later is known as preprocessing. Hunter computations cannot be used directly on a text. Consequently, it is anticipated that text preprocessing will transform the text into mathematical information.

Following the preprocessing phase, the data samples associated with Tables 1 and 2 will be ready for use in the subsequent classification phase. The preprocessing stage's outcomes are listed below and are included in Table 3.

Table 3.. Preprocessing results

| Initial sentiment | Preprocessing result sentiment |
|--|--|
| Training data | |
| @alisyarief Anyone with a name called corruption must be eradicated. If necessary, the death penalty. | ['name', 'corruption', 'eradicate'] |
| @sepedakujelek @M45Broo If this presidential candidate dares to sentence corruptors to death, it means that the people will like him the most | ['presidential candidate', 'brave', 'corruptor', 'like', 'people'] |
| @VIVAcoid There's no promise of the death penalty for corruptors, right? | ['promise', 'corruptor'] |
| What's the law, Mr Ustad, for laughing at someone afraid because the lights are out in their house? | ['law', 'cleric', 'laughing', 'people', 'fear', 'house', 'lights'] |
| @ author_sajak when will the death penalty for perpetrators of criminal acts of corruption be implemented in Indonesia | ['sajak', 'laku', 'action', 'criminal', 'corruption', 'laku', 'indonesia'] |
| Data testing | |
| @VIVAcoid I would rather be a presidential candidate who promises that if corruptors are punished by death if anyone dares to make a promise like that, they will automatically vote for the presidential candidate. | ['more', 'better', 'presidential candidate', 'promise', 'corruptor', 'brave', 'promise', 'auto', 'vote', 'presidential candidate'] |
| @VIVAcoid Punish corruptors to death so that no one else in society suffers. | ['law', 'corruptor', 'let', 'society', 'suffering'] |

3.3 TF-IDF weighting

Word-by-word weight calculations are made using the TF-IDF approach, which is frequently employed in data recovery and is perhaps the most accurate method available. The Term Frequency (TF) and Inverse Document Frequency (IDF) values in each token in the file in the corpus are meant to be considered by this method [15].

The N-Gram Technique is the method used in the TF-IDF process. One method for cutting n-characters from strings is the N-Gram approach. Typically, this N-Gram method is used to bolster a character. N-Gram must be used to simplify estimation and reduce errors in TF-IDF extraction. Aside from that, using N-Gram pays off because the outcomes are accurate and productive [14].

By applying the calculation to each word, the weight (term) of each word is calculated and each word is then multiplied by the IDF. The following is a sample calculation of TF values and DF values from 5 training data and 2 testing data. To find the TF-IDF weight value, the equation used is equation (1) below:

$$W = TF \times IDF \quad (1)$$



Where:

W : weight of the d-th document with the t-th word

TF : the number of words contained in the document being searched

IDF : Inverse Document Frequency

The results of applying this equation to 5 training data are shown in Table 4 below:

Table 4. TF-IDF weighting

| Term | TF | | | | | DF |
|------------------------|----|----|----|----|----|----|
| | D1 | D2 | D3 | D4 | D5 | |
| name | 1 | 0 | 0 | 0 | 0 | 1 |
| corruption | 1 | 0 | 0 | 0 | 1 | 2 |
| eradicate | 1 | 0 | 0 | 0 | 0 | 1 |
| presidential candidate | 0 | 1 | 0 | 0 | 0 | 1 |
| brave | 0 | 1 | 0 | 0 | 0 | 1 |
| corrupt | 0 | 1 | 1 | 0 | 0 | 2 |
| like | 0 | 1 | 0 | 0 | 0 | 1 |
| people | 0 | 1 | 0 | 0 | 0 | 1 |
| promise | 0 | 0 | 1 | 0 | 0 | 1 |
| ustad | 0 | 0 | 0 | 1 | 0 | 1 |
| laugh | 0 | 0 | 0 | 1 | 0 | 1 |
| person | 0 | 0 | 0 | 1 | 0 | 1 |
| afraid | 0 | 0 | 0 | 1 | 0 | 1 |
| house | 0 | 0 | 0 | 1 | 0 | 1 |
| light | 0 | 0 | 0 | 1 | 0 | 1 |
| rhyme | 0 | 0 | 0 | 0 | 1 | 1 |
| follow | 0 | 0 | 0 | 0 | 1 | 1 |
| criminal | 0 | 0 | 0 | 0 | 1 | 1 |
| in demand | 0 | 0 | 0 | 0 | 2 | 1 |
| indonesia | 0 | 0 | 0 | 0 | 1 | 1 |

After the TF (term frequency) value is obtained, the next step is to find the value of the IDF. Equation (2) is a formula for determining the IDF value of each word, which is as follows:

$$IDF = \log\left(\frac{D+1}{df+1}\right) + 1 \quad (2)$$

When,

IDF : Inverse Document Frequency

D : word frequency in D

df : many documents contain search terms

The following is an example of applying this formula to the first data:

$$IDF = \log\left(\frac{D+1}{df+1}\right) + 1 = \log\left(\frac{5+1}{1+1}\right) + 1 = \log(3) + 1 = 2.099$$

The results of calculations using the equation above are shown in Table 5.

Table 5. TF-IDF value from training data

| Term | TF-IDF | | | | |
|------------------------|--------|-------|-------|----|-------|
| | D1 | D2 | D3 | D4 | D5 |
| name | 2.099 | 0 | 0 | 0 | 0 |
| corruption | 1.693 | 0 | 0 | 0 | 1.693 |
| eradicate | 2.099 | 0 | 0 | 0 | 0 |
| presidential candidate | 0 | 2.099 | 0 | 0 | 0 |
| brave | 0 | 2.099 | 0 | 0 | 0 |
| corrupt | 0 | 1.693 | 1.693 | 0 | 0 |
| like | 0 | 2.099 | 0 | 0 | 0 |
| people | 0 | 2.099 | 0 | 0 | 0 |
| promise | 0 | 0 | 2.099 | 0 | 0 |



| <i>Term</i> | TF-IDF | | | | |
|-------------|--------|----|----|-------|-------|
| | D1 | D2 | D3 | D4 | D5 |
| ustad | 0 | 0 | 0 | 2.099 | 0 |
| laugh | 0 | 0 | 0 | 2.099 | 0 |
| person | 0 | 0 | 0 | 2.099 | 0 |
| afraid | 0 | 0 | 0 | 2.099 | 0 |
| house | 0 | 0 | 0 | 2.099 | 0 |
| light | 0 | 0 | 0 | 2.099 | 0 |
| rhyme | 0 | 0 | 0 | 0 | 2.099 |
| follow | 0 | 0 | 0 | 0 | 2.099 |
| criminal | 0 | 0 | 0 | 0 | 2.099 |
| in demand | 0 | 0 | 0 | 0 | 4.198 |
| indonesia | 0 | 0 | 0 | 0 | 2.099 |

The TF-IDF value is normalized to equalize the interval of each data. Data normalization is a stage to ensure that the records in the dataset remain stable. Equation (3) is used in the data normalization process, namely:

$$TF_{norm}(t, d) = \frac{TF(t, d)}{\sqrt{\sum_i (TF(t, d))^2}} \quad (3)$$

When,

d : d document

t : word ke-t

TF : number of words in the document

Examples of applying this formula include:

$$TF_{norm}(t, d) = \frac{TF(t, d)}{\sqrt{\sum_i (TF(t, d))^2}} = \frac{2.099}{\sqrt{(2.099)^2 + (1.693)^2 + \dots + (2.099)^2}} = \frac{2.099}{\sqrt{103.98}} = 0.209$$

The process of normalization is frequently used as an information-organizing element in artificial intelligence. Normalization aims to adjust a numerical segment's upper bound to capitalize on a typical scale in a set of data without altering value discrepancies or erasing any information. Certain algorithms also need normalization to accurately model the data [16]

Data transformation, or converting the original data into a format that enables simple and quick data processing, is necessary for the normalization process. Removing data redundancy (repetition) and normalizing information is the primary objective of data normalization, which enables more accurate data processing. The results of the normalizing calculations are shown in [Table 6](#).

Table 6. Data normalization

| No. | D1 | D2 | D3 | D4 | D5 |
|-----|-------|-------|-------|-------|-------|
| 1 | 0.206 | 0 | 0 | 0 | 0 |
| 2 | 0.166 | 0 | 0 | 0 | 0.166 |
| 3 | 0.206 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0.206 | 0 | 0 | 0 |
| 5 | 0 | 0.206 | 0 | 0 | 0 |
| 6 | 0 | 0.166 | 0.166 | 0 | 0 |
| 7 | 0 | 0.206 | 0 | 0 | 0 |
| 8 | 0 | 0.206 | 0 | 0 | 0 |
| 9 | 0 | 0 | 0.206 | 0 | 0 |
| 10 | 0 | 0 | 0 | 0.206 | 0 |
| 11 | 0 | 0 | 0 | 0.206 | 0 |
| 12 | 0 | 0 | 0 | 0.206 | 0 |
| 13 | 0 | 0 | 0 | 0.206 | 0 |
| 14 | 0 | 0 | 0 | 0.206 | 0 |
| 15 | 0 | 0 | 0 | 0.206 | 0 |
| 16 | 0 | 0 | 0 | 0 | 0.206 |



| No. | D1 | D2 | D3 | D4 | D5 |
|-----|----|----|----|----|-------|
| 17 | 0 | 0 | 0 | 0 | 0.206 |
| 18 | 0 | 0 | 0 | 0 | 0.206 |
| 19 | 0 | 0 | 0 | 0 | 0.412 |
| 20 | 0 | 0 | 0 | 0 | 0.206 |

The encouragement the vector machine is a learning framework that uses space speculation as a linear ability in space that highlights very large aspects. It also performs the acquisition of deviations resulting from measurable active learning hypotheses and makes use of preparation through the application of learning calculations to streamline hypotheses [15].

Support Vector Machine, or SVM, is a machine learning-based grouping technique that uses patterns or class predictions from learning outcomes. Finding a hyperplane or decision boundary that divides each class is the method utilized for grading. Additionally, this helps distinguish between tweets with positive sentiment (+1) and tweets with negative sentiment (-1) in this study [17].

Use the most recent α value to determine the support vector value for each page. Each class's biggest value is selected, as shown in Table 7 below:

Table 7. Determination of support vectors

| No. | D1 | D2 | D3 | D4 | D5 | α | Kelas |
|-----|-------|-------|-------|-------|-------|----------|-------|
| 1 | 0.206 | 0 | 0 | 0 | 0 | 0.257893 | 1 |
| 2 | 0.166 | 0 | 0 | 0 | 0.166 | 0.255541 | 1 |
| 3 | 0.206 | 0 | 0 | 0 | 0 | 0.257893 | 1 |
| 4 | 0 | 0.206 | 0 | 0 | 0 | 0.256946 | 1 |
| 5 | 0 | 0.206 | 0 | 0 | 0 | 0.256946 | 1 |
| 6 | 0 | 0.166 | 0.166 | 0 | 0 | 0.256688 | 1 |
| 7 | 0 | 0.206 | 0 | 0 | 0 | 0.256946 | 1 |
| 8 | 0 | 0.206 | 0 | 0 | 0 | 0.256946 | 1 |
| 9 | 0 | 0 | 0.206 | 0 | 0 | 0.258367 | 1 |
| 10 | 0 | 0 | 0 | 0.206 | 0 | 0.343225 | -1 |
| 11 | 0 | 0 | 0 | 0.206 | 0 | 0.259225 | 1 |
| 12 | 0 | 0 | 0 | 0.206 | 0 | 0.259225 | 1 |
| 13 | 0 | 0 | 0 | 0.206 | 0 | 0.259225 | 1 |
| 14 | 0 | 0 | 0 | 0.206 | 0 | 0.343225 | -1 |
| 15 | 0 | 0 | 0 | 0.206 | 0 | 0.343225 | -1 |
| 16 | 0 | 0 | 0 | 0 | 0.206 | 0.25599 | 1 |
| 17 | 0 | 0 | 0 | 0 | 0.206 | 0.25599 | 1 |
| 18 | 0 | 0 | 0 | 0 | 0.206 | 0.25599 | 1 |
| 19 | 0 | 0 | 0 | 0 | 0.412 | 0.252738 | 1 |
| 20 | 0 | 0 | 0 | 0 | 0.206 | 0.25599 | 1 |

The highest α value within each class is used in the calculation of the kernel function for that class. The highest α value from the positive class, 0.259225, is represented by the $K(x_i, x^+)$ value, whereas the highest α value from the negative class, 0.343225, is represented by the $K(x_i, x^-)$ value.

The outcomes will be acquired following the conclusion of the Support Vector Machine algorithm testing procedure. where the results under consideration are labels from test data that the model received during training. The accuracy, precision, recall, and f1-score values of the model employed on the dataset will be revealed once the test data classification results—sentiment classes—are separated from the real class data. These numbers are displayed in Table 8 below:

Table 8. Confusion matrix

| | | Prediction | |
|--------|-------------|------------|-------------|
| | | Agree | Don't agree |
| Actual | Agree | 140 | 0 |
| | Don't agree | 12 | 0 |

From Table 8, the values for accuracy, precision, recall, and f1-score can be calculated using the equation below:



$$Accuracy = \frac{140}{140+12+0+0} \times 100\% = 91\%$$

$$Precision = \frac{140}{140+12} \times 100\% = 91\%$$

$$Recall = \frac{140}{140} \times 100\% = 100\%$$

$$F1-Score = \frac{2 \times 91 \times 100}{91+100} \times 100\% = 95\%$$

To see the overall accuracy, precision, recall, and F1-score values, you can use the classification report. Figure 4 below is a classification report from the results of sentiment analysis applied using the Support Vector Machine method.

| | precision | recall | f1-score | support |
|--------------|-----------|--------|----------|---------|
| setuju | 0.91 | 1.00 | 0.95 | 144 |
| tidak | 1.00 | 0.00 | 0.00 | 14 |
| accuracy | | | 0.91 | 158 |
| macro avg | 0.96 | 0.50 | 0.48 | 158 |
| weighted avg | 0.92 | 0.91 | 0.87 | 158 |

Figure 4. Confusion matrix testing death penalty verdicts

Based on the acquired results, it can be inferred that an accuracy value of 91%, precision of 91%, recall of 100%, and f1-score of 95% were attained in death sentence/death penalty instances utilizing 606 training sentiments and 152 test sentiments.

4. CONCLUSION

The accuracy achieved in sentiment analysis with the use of Support Vector Machines can be categorized as very good. In this study, 848 tweets were scraped and the keywords #death penalty and #death penalty were applied to a dataset that was obtained. An accuracy of 91%, precision of 91%, recall of 100%, and f1-score of 95% were achieved using the dataset. In keeping with the findings of this study, it may be concluded that some people think that corruptors should be executed because their corrupt acts are thought to have hurt society as a whole. They view the death sentence as a kind of justice suited to the severity of the harm brought about by corrupt activities.

REFERENSI

- [1] G. Santoso Teguh, *Analisis Sentimen Pada Twitter dengan Tagar #BPJSRASARENTENIR Menggunakan Metode Support Vector Machine*. Pekanbaru: Universitas Islam Riau, 2021.
- [2] F. Alvianda, *Analisis Sentimen Konten Radikal di Media Sosial Twitter Menggunakan Metode Support Vector Machine*. Malang: Universitas Brawijaya, 2018.
- [3] A. Novantirani, M. Sabariah Kania, and V. Effendi, "Analisis Sentimen pada Twitter untuk Mengenai Penggunaan Transportasi Umum Darat Dalam Kota dengan Metode Support Vector Machine," *e-Proceeding of Engineering*, vol. 2, 2018.
- [4] B. A. Saebani, *Fiqih siyasah pengantar Ilmu Politik Islam*. Bandung: CV Pustaka Setia, 2008.
- [5] M. Taupan, *Demokrasi Pancasila Analisa Konsepsional Aplikatif*. NP Sinar, 1989.
- [6] D. Rosyida, *Pendidikan Kewargaan (Civic Education) Demokrasi, Hak Asasi Manusia & Masyarakat Madani*, Abdul Rozak, dkk., ed. Jakarta: ICCE UIN Syarif Hidayatullah Jakarta kerjasama The Asia Foundation & PERNADA MEDIA, 2003.



- [7] I. M. Parapat, M. T. Furqon, and Sutrisno, “Penerapan Metode Support Vector Machine (SVM) Pada Klasifikasi Penyimpangan Tumbuh Kembang Anak,” *Jurnal Pengembangan Teknologi Informasi dan Ilmu Komputer*, vol. 02, no. 10, Oktober 2018.
- [8] O. Al Farobey, *Implementasi Metode Support Vector Machine Untuk Mengetahui Respon Masyarakat Terhadap Pemberian Vaksin Sinovac*. Jakarta: UIN Syarif Hidayatullah, 2021.
- [9] R. Umar, Sunardi, and M. Ardiansyah Nur, “Penerapan Algoritma Support Vector Machine Pada Analisis Sentimen Hashtag Twitter,” *JURIKOM (Jurnal Riset Komputer)*, vol. 9, pp. 1607–1613, 2022.
- [10] R. R. Fiska, “Penerapan Teknik Data Mining dengan Metode Support Vector Machine (SVM) untuk Memprediksi Siswa yang Berpeluang Drop Out (Studi Kasus di SMKN 1 Sutera),” *SATIN – Sains dan Teknologi Informasi*, vol. 03, no. 01, 2018.
- [11] R. Nandini Afidianti, *Analisis Sentimen Impor Beras 2018 Pada Twitter Menggunakan Metode Support Vector Machine dan Pembobotan Jumlah Retweet*. Malang: Universitas Brawijaya, 2018.
- [12] R. Husna El, R. Wasono, and M. Al Haris, “Analisis Sentimen Pada Twitter Mengenai Netflix Diblokir Telkom Menggunakan Metode Support Vector Machine,” *Seminar Nasional Variansi*, pp. 214–222, 2020.
- [13] A. Putra and R. Latifah, “Analisis Sentimen Pengguna Twitter Terhadap Aplikasi Pinjaman Online Menggunakan Metode Support Vector Machine,” *Seminar Nasional Penelitian LPPM UMJ*, 2022.
- [14] E. R. Lidinillah, T. Rohana, and A. R. Juwita, “Analisis sentimen twitter terhadap steam menggunakan algoritma logistic regression dan support vector machine,” *tekno*, vol. 10, no. 2, pp. 154–164, Jul. 2023, doi: 10.37373/tekno.v10i2.440.
- [15] Friska Aditia Indriyani, Ahmad Fauzi, and Sutan Faisal, “Analisis sentimen aplikasi tiktok menggunakan algoritma naïve bayes dan support vector machine,” *tekno*, vol. 10, no. 2, pp. 176–184, Jul. 2023, doi: 10.37373/tekno.v10i2.419.
- [16] Sonia Wanda Mafriza and Armansyah, “Klasifikasi karir mahasiswa bidang web developer menggunakan algoritma naïve bayes,” *infotech*, vol. 4, no. 2, pp. 270–280, Dec. 2023, doi: 10.37373/infotech.v4i2.907.
- [17] A. Handayani and I. Zufria, “Analisis Sentimen Terhadap Bakal Capres RI 2024 di Twitter Menggunakan Algoritma SVM,” *josh*, vol. 5, no. 1, pp. 53–63, Oct. 2023, doi: 10.47065/josh.v5i1.4379.

