Sentiment Analysis: An Insightful Literature Review

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Abstract—Understanding the consumer is becoming crucial in today's customer-focused company culture. Sentiment analysis is one of many methods that can be used to evaluate the public's sentiment toward a specific entity in order to generate actionable knowledge. In the commercial sector, sentiment analysis is critical in enabling businesses to establish strategy and obtain insight into user feedback on their products. Unfortunately, there are still many companies that do not hear customer feedback and run the business as usual, even though there is an analysis of sentiment that can reflect services and products of companies. The problem can be overcome by implementing sentiment analysis. When a company implements sentiment analysis, they can more easily discover what the consumers want, what they disapprove of, and what measures can be taken to sustain, which will help companies improve their products and services' performance. The purpose of this paper is to find out the uses of sentiment analysis in a company and the methodology that companies use to implement sentiment analysis. The research used in this paper was done by reviewing 22 papers that discuss sentiment analysis. This paper aims to learn more about the methodology and uses of sentiment analysis in a company.

Keywords—*Sentiment analysis; sentiment analysis approach; text mining*

I. INTRODUCTION

Sentiment analysis is one of study of people's opinions, feelings, emotions, and perspective about things such as item, activities, problem, occurrences, themes, and their attributes. As an outcome, sentiment analysis can be used to evaluate the public's sentiment toward a specific entity in order to generate meaningful information. Sociological trends [1]. In the commercial sector, sentiment analysis is critical in enabling businesses to establish strategy and obtain insight into user feedback on their products. Understanding the consumer is becoming crucial in today's customer-focused company culture [2]. Even though advanced sentiment analysis methods can effectively capture customer opinions and feedback about the products and services provided by businesses, many companies still choose to overlook these valuable insights. They continue operating in the same old ways, failing to adapt to the changing needs and expectations of their customer.

From various papers that were used, many businesses are having problems with their marketing campaigns. An issue can sometimes have an impact on a company's brand, causing marketing ineffectiveness and having little correlation with customer thoughts. With the steep increase of discussion platforms, consumer review sites, e-commerce, and social networking sites, there is a steady flow of ideas and opinions. This expansion makes it harder for businesses to acquire a more comprehensive understanding of their customers' aggregate thoughts and feelings toward products. The explosion of internet-generated information, along with tools such as sentiment analysis, helps businesses to look deeply into their customers' views toward their products [3]. In order to better serve customers and increase sales, marketers can identify sentiments from product reviews and use them to get in touch with those who require particular attention [4].

Other issues like the intense competition among businesses, cause every business to rush and enhance its invention and performance. Utilizing sentiment analysis as input for evaluation and assessment can be beneficial. The data analysis results in a better decision to enhance their offerings, discover the desires of their consumers, and enhance their overall experience during using their services [5].

The objective of this paper is to find out more about the reason why company should implement sentiment analysis, the approach that used, and the task and level of sentiment analysis. This paper can help researcher or a company while they are considering implementing sentiment analysis in their decision-making process. This paper consists of an introduction, a literature review, a research method, a result and discussion, and a conclusion.

The motivation of this study is to learn more about sentiment analysis in a company, especially the purpose, approach, and problems. The method used to achieve this motivation is to use the system literature review (SLR) method. This method is used by taking the results and summarizing the research from the previous study.

This contribution of this paper is to further explain the uses of sentiment analysis in the business. The purpose of this study is to identify which approach and task most companies use for sentiment analysis. So, when there are companies that consider sentiment analysis, they can decide which approach and task they will use and what the considerations of sentiment analysis are.

II. LITERATURE REVIEW

A. Text Mining

Text mining refers to extracting information from text-based documents [6], [7]. Data sources are obtained from documents or texts, such as Word documents, PDFs, text excerpts, or so on. Text mining has the aim of finding words and get useful information where the information can represent the content of related documents so that it can be analyzed related to each document [7].

B. Sentiment Analysis

Data sources are obtained from documents or texts, such as Word documents, PDFs, text excerpts, or so on. Text mining has the aim of finding words and get useful information where the information can represent the content of related documents so that it can be analyzed related to each document [7].

C. Sentiment Task

Sentiment analysis also defined as sentiment categorization. One of the modules of sentiment classification is polarity analysis, which is sometimes referred to as "opinion analysis" when discussing sentiment analysis. It is a small task intended to ascertain the tone of each text. Traditionally, polarity is either positive or negative [8].

D. Lexicon-Based Approach

Sentiment classification is a well-known research task in sentiment analysis, which is also referred to as sentiment categorization. One of the modules of sentiment classification is polarity analysis, which is sometimes referred to as "opinion analysis" when discussing sentiment analysis. It is a small task intended to ascertain the tone of each text. Traditionally, polarity is either positive or negative [9].

1) Dictionary based: The dictionary-based technique uses a manually compiled list of words with predetermined sets of opinions. This method's main presumption is that antonyms have the opposite polarity from that of the source word, whereas synonyms have the same polarity as it. In order to add antonyms and synonyms to a group or seed list that was previously created, large corpora like thesaurus or wordnet are scanned. The initial collection of words is manually collected in the first stage along with their orientation. Afterward, the list is extended by examining the lexical resources' antonyms and synonyms. The list is then increased after the words have been added iteratively [10].

2) Corpus based: To validate the emotion of sentences, this method makes usage of patterns in language structure (syntax) and word meaning (semantics). Starting with a predetermined list of sentiment words and their orientations, this method explores a very large corpus for sentiment tokens and their orientations by looking for syntactic or other related patterns. The corpus-based use in specific method situation. Training it, required a lot of labeled data. It does assist in addressing the issue of opinion words with context-dependent orientation, through study [10].

E. Machine Learning-Based Approach

Sentiment classification may be accomplished using machine learning algorithms. The machine learning method utilizes either syntactic or linguistic or both of them to figure out the problem of sentiment classification based on the standard text classification. Categorization model will match one the class label with the underlying record feature. The class label for a specific data of an unknown class or called test data is then predicted using the model [10].

1) Decision tree: Linked data structures resembling Bayesian networks are used to represent decision tree classifiers. Using multiple criteria taken from information theory, such as entropy and information gain, the population is separated into various sections in this classification process [11].

2) Naive bayes: Technique for organizing data into pre-existing categories [12]. The method of this approach is Bayesian classification which is based on Bayes' theorem. NB which is a type of probabilistic classification, uses to predict the probabilities of the dataset of features as part of a label. By calculating how the conditional probability of A's event might be occurred, will lead to the individual probabilities of A and B and the conditional probability of event B occurring [10].

3) Support Vector Machine: SVM is one of supervised machine learning algorithms. Supervised machine learning is a technique for making predictions of the data would be classified and categorized. SVM models looks for the best the best hyperlane attempts which will serve as separator of found by measuring the margin of the hyperlane and finding its maximum point [13].

4) Random forest: Random Forest is an adaptive learning method that incorporates the concepts of random subspaces and "bagging". The random forest algorithm belongs to a group of methods that utilize decision tree as an independent predictor. The random forest algorithm is one of the greatest classification algorithms, able to precisely classify enormous amounts of data. It is a versatile regression and classification assembly learning method that constructs multiple decision trees during training and delivers the class that is the mode of the classes output by individual trees [14].

III. RESEARCH METHOD

This paper is studied using the literature study technique. The purpose of using the literature study technique is to learn and comprehend the approach that used to conduct sentiment analysis. This technique involves gathering journals or papers related to sentiment analysis. After collecting all of the papers, it will be analyzed and summarized properly, and all of the important parts will be discussed and used in this work. All of the important discussion topics from this paper will be accomplished using that strategy, including determining the best approach for sentiment analysis.

A. Collecting Paper

The process of collecting the paper begins after deciding the topic to be discussed. Google and Google Scholar were used for the paper search. The papers collected are published by the Institute of Electrical and Electronics Engineers (IEEE), Elsevier, International Journal of Engineering and Advanced Technology (IJEAT), Springer, and other publishers. Key words used during the paper collection are:

- "Text Mining" AND "Twitter" AND "Sentiment Analysis"

- "Sentiment Analysis" AND ("Machine Learning" OR "Supervised" OR "Unsupervised")

- "Sentiment Analysis Approach"

- "Sentiment Analysis"

B. Sorting Paper

The papers collected are published by the Institute of Electrical After collecting the papers, all of the papers or journals must be evaluated again, and there are currently 33 papers or journals left. The papers or journals that will be used will highlight why company should implement sentiment analysis and what they obtain as a result of doing so. As the core principle, this work also used various the papers or journals.

C. Data Extraction

In Table I, all papers or journals will be analyzed and summarized using the necessary data, such as what purpose of sentiment analysis, how accurate the model of sentiment analysis, and what approach they used to implement sentiment analysis.

TABLE I.   NUMBER OF PAPER IN SOURCE THAT HAVE BEEN SELECTED

No.	Number Of Paper in Source That Have Been Selected			
	Source	Journals Found	Candidate Studies	Selected Studies
1	IEEE	32	10	10
2	Elsevier	29	11	4
3	IJEAT	8	3	1
4	Other Publishers	893	18	10
	Total	962	42	25

IV.   RESULT AND DISCUSSION

A. Purposes of Paper

Based on the 22 journals that have been collected and reviewed there are 8 journals that discuss the purposes of using sentiment analysis, especially comparison between different classification and six about analyzing social issues through social media. Analyzing social issue can be a result to track trend to the competitor or using it in marketing.

TABLE II.   PURPOSE OF USING SENTIMENT ANALYSIS

No.	Purpose Of Using Sentiment Analysis		
	Purposes	References	Total Papers / Journals
1	Analyzing customer satisfaction through social media.	[5], [13]	2
2	Analyzing social issues through social media.	[17], [32], [33], [15]	4
3	Analyzing social issue through social media & comparing classification	[21], [26], [27], [28], [30], [31]	6
4	Comparison between different classification	[14], [16], [19], [20], [22], [23], [25], [29]	8
5	Comparison with different algorithm	[18], [24]	2

By categorizing the objectives of each paper, especially in the classification comparison found in numbers 3 and 4 with a total of 14 papers on Table II, we can find out which classification has the best performance. Based on 14 papers, the best classification performance can be found by taking the maximum accuracy value for each classification.

B. The Sentiment Analysis Implementation Approach

There is something that must be improved in the marketing process and competitor analysis to analyze customer trends. Sentiment analysis in the text mining process must be carried out. Some companies take advantage of public opinion in Twitter media to detect customer needs. Then, the company analyzes the suitable algorithm for the data type and amount of training data. From there, they can decide which approach they will use.

From Table III, it showed that Support Vector Machine is the common approaches in a high dimensional. The Support Vector Machine approach is used by 8 journals. The second common approach is Naive Bayes approach and Decision Tree approach.

Although Random Forest exhibits the highest accuracy, it is less accurate than Naive Bayes and Support Vector Machine due to the influence of the amount of data it processes (Table IV).

TABLE III.   THE SENTIMENT ANALYSIS IMPLEMENTATION APPROACH

No.	The Sentiment Analysis Implementation Approach		
	Purposes	References	Total Papers / Journals
1	Support Vector Machine	[13], [14], [15], [17], [18], [20], [22], [30], [33]	8
2	Naive Bayes	[5], [16], [19], [21], [22], [25], [29], [33]	8
3	Decision Tree	[16], [21], [22], [29]	4
4	Random Forest	[14], [21], [24],	3
5	Logistic Regression	[22], [26], [32]	3
6	Lexicon-based	[15], [25]	2
7	Language Processing (NLP)	[30], [31]	2
8	K-Nearest Neighbors (KNN)	[16], [20]	2
9	CNN-SVM	[23]	1
10	Convolutional Neural Network (CNN)	[27]	1
11	Long short term memory network (LSTM)	[27]	1
12	Logistic Regression and Lexicon	[28]	1

TABLE IV.   THE COMPARISON OF ACCURACY BETWEEN TOP 3 APPROACH

No.	The Comparison of Accuracy between Top 3 Approach			
	Approach	Accuracy	Data	References
1	Random Forest	94.54%	400,000 data	[24]
2	Support Vector Machine	91.50%	236,867 data	[22]
3	Naive Bayes	83.43%	3,744 data	[21]

Among these methods (Table IV), the languages utilized vary. The Random Forest method [24] is employed in English, while the SVM method [22] is used in Vietnamese, and Naive Bayes [21] is applied in Indonesian.

Additionally, there are distinct preprocessing stages associated with each method. In order to mitigate the occurrence of false statements, [21] data is manually labeled. The study in [22] replaces abbreviations, acronyms, and misspellings with their original words to ensure thorough analysis during subsequent stages. On the other hand, [24] follows standard preprocessing steps without implementing any specific modifications. However, it is important to note that these factors may have a minimal impact on the results, primarily due to the differences in the raw data utilized.
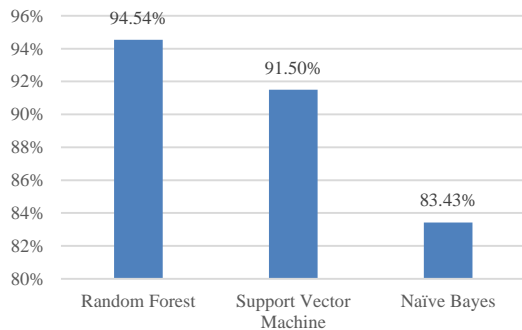

Fig. 1.   Top 3 approach used in implementation sentiment analysis.

In sentiment analysis, accuracy is determined by the percentage of correctly classified documents or text samples. In other words, it measures how well the sentiment analysis model is able to correctly predict the sentiment of a given text. To determine the accuracy of a sentiment analysis model, the model's predictions are compared to the actual sentiment labels of the text samples in the dataset. The accuracy is calculated as the ratio of the number of correctly classified text samples to the total number of text samples in the dataset.

Accuracy is a widely used metric to evaluate sentiment analysis model performance. However, it is important to note that accuracy alone may not provide a complete picture of the model's performance. Other metrics such as precision, recall, and F1 score should also be considered to assess the model's overall effectiveness.

C. The Implementation

Data Collection: Gather a dataset of labeled text samples. This dataset should include text samples along with their corresponding sentiment labels (e.g., positive, negative, neutral). Data available at https://drive.google.com/file/d/12QSJv-BiIBOs2cwHNcZwcZ1GcIXWCrS0/view?usp=sharing.c6y45x2/1; https://doi.org/10.17632/x8mc6y45x2.1

Data Preprocessing: Clean and preprocess the text data to remove any irrelevant information, such as special characters, numbers, or punctuation. Convert the text into a numerical representation that can be used by machine learning algorithms, such as word embeddings or bag-of-words representation.

Feature Extraction: Extract relevant features from the preprocessed text data. This step involves representing the text samples in a format that can be used by machine learning algorithms. Some common approaches include TF-IDF (Term Frequency-Inverse Document Frequency) and word embeddings like Word2Vec or GloVe.

Split the Data: Divide the dataset into training and testing sets. The training set will be used to train the sentiment analysis model, while the testing set will be used to evaluate its performance.

Model Training: Choose a machine learning algorithm, such as Decision Tree, Support Vector Machine (SVM), or Naive Bayes, to train the sentiment analysis model. Fit the model to the training data and optimize its parameters using techniques like cross-validation or grid search.

Model Evaluation: Evaluate the trained model using the testing set. Measure its performance metrics, such as accuracy, precision, recall, and F1 score, to assess how well it predicts the sentiment of the text samples.

Model Deployment: Once the model has been trained and evaluated, it can be deployed for sentiment analysis tasks. New, unlabeled text samples can be fed into the model, and it will predict their sentiment based on the learned patterns from the training data.

The author also conducted a study using a dataset from Google Play Store API that have 2976 data. This study was carried out to test and determine the accuracy of the model based on three algorithms that often appear. Through this study, the author got results as shown on Table V.

TABLE V.   THE COMPARISON OF ACCURACY BETWEEN TOP 3 APPROACH

No.	The Comparison of Accuracy between Top 3 Approach	
	Algorithms	Author's research accuracy
1	Support Vector Machine	83%
2	Logistic Regression	83%
3	Naive Bayes Classifier	74%

The results, as shown in Fig. 1, clearly show that the random forest model exceeds the other two models in terms of accuracy, confirming its place as the best method for the task at issue. The study also draws attention to a crucial finding: when working with diverse datasets with different features and preparation methods, the outcomes can vary greatly.

The data from the Google Play Store that random forest and SVM have comparable characteristics and capabilities. As a result, state with confidence that these two algorithms prove to be the best options for E-commerce case studies, demonstrating their adaptability and efficiency in handling a variety of scenarios and commercial applications. Taking into account the particulars and quirks of each dataset and use case.

V.   CONCLUSION

In conclusion, this study aimed to review various sentiment analysis approaches and analyze their performance. Based on the comprehensive analysis conducted, the random forest

approach emerged as a popular choice with superior performance compared to other approaches. This finding suggests that leveraging random forest algorithms can be highly beneficial in sentiment analysis tasks.

Furthermore, our investigation identified the optimal ratio between test and training data to be 80/20, indicating that allocating a larger portion of the dataset for training (80%) and a smaller portion for testing (20%) yields favorable results.

The insights gained from this research provide valuable guidance for future studies and research endeavors in sentiment analysis. Future researchers should explore text mining applications for business strategies. Additionally, there is a scope for further enhancing the accuracy of machine learning approaches in sentiment analysis tasks, which could yield even more reliable and precise sentiment predictions. By building upon the knowledge and findings obtained in this study, future research can contribute to advancing the field of sentiment analysis and its practical implications across various industries.

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