

Text Classification for News Articles

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Abstract—Text classification is an important process in NLP that includes classifying or labeling text data according to predefined categories. However, there is a lot of text information available about text classification [2] which is becoming a tool for a lot of applications, including sentiment analysis, recommendation systems, and information retrieval. In our research we are focusing on a text classification for news articles using NLP. The objective of our research is to use different feature extraction and ML algorithm to enhance the correction rate and effectiveness of text classification for news articles. We will compare the results of ML algorithms such as the TF-IDF and the vectorize method. We used Random forest, logistic regression and Naive bayes algorithms. We will analyse the result we get from the algorithm and try to find the best performance among the different feature extraction methods. For further research we will use the dataset of containing various type of article. We will work on the dataset that contains the news of various genres so that we will be able to judge the efficiency. Text data is pre-processed, features are extracted using various methods, and classification models are trained using different ml algorithms. After attaining the result and accuracy we will analyze the result of the models. The results of this study will be applied to enhance the accuracy [3] of the word categorization for news articles with other text-based applications. The results can be applied to develop reliable text classification algorithms that will improve data efficiency and accuracy.

I. INTRODUCTION

Text classification is an important process in natural language processing that involves categorising or labelling text inputs according to predetermined categories. Text classification is becoming a crucial tool for many applications, including sentiment analysis, recommendation systems, and information retrieval, because to the vast amount of textual data that is available on the internet. We concentrate on text classification for news items using NLP approaches in this research work. The major goal of this research is to use various feature extraction and ML algorithm to increase precision and effectiveness of text classification for news articles. We want to calculate the performances of different ML such as random forest, naive bayes, and logistic regression, tf-idf and investigate the efficacy of various feature extraction methods. A dataset of news items are labelled with predetermined categories are gathered for research. Text data is preprocessed, features are extracted using a variety of methods, and classification models are trained using a variety of machine learning algorithms. We will analyze the performances of the models using different results with recall, accuracy and F1-score. The results of this

study can be applied to increase the text classification accuracy and effectiveness for news articles and other text-based applications. The results can be applied to create trustworthy text categorization algorithms that will improve the efficiency and standard of information retrieval in the digital era.

II. LITERATURE REVIEW

Some online papers are chosen for this evaluation of the literature centre on the subject of text classification using various NLP methods. We find various relatable works on this topic in different sectors. The first study by Barbera et al. (2020), provides a thorough overview of feature extraction of ML methods for text classification in news items.

Barbera et al.'s study from 2020 offers a useful manual for automatic text classification of news stories. The study focuses on the application of different features, extraction techniques and machine learning algorithms that improve text classification's precision and effectiveness. The study focuses on employing feature extraction and machine learning methods, including decision trees to categorise news items. According to the study, deep neural networks with pre-trained word embeddings produced the classification of news articles with the highest accuracy, 94%. The study's findings can be used to increase the text classification's effectiveness and efficiency for news articles and other text-based applications. Researchers looking to advance text categorization methods for news stories and other text-based applications can learn a lot from this study.

Rini Wongso's paper classes Indonesian news articles. Pre-processing, feature selection, and classification were used to classify. Pre-processing cleaned text data by removing stop words, stemming, and tokenizing. TF-IDF was used for feature selection and SVM and NB for classification. SVM with TF-IDF fared best in the experiment with 92.63% accuracy. TF-IDF was also shown to capture Indonesian language's distinctive traits. This research demonstrates the potential of the machine learning for Indonesian text classification. It shows how pre-processing and feature selection can improve text classification accuracy. It is useful for natural language processing researchers and practitioners who classify Indonesian texts.

We can see the use of the machine learning and NLP methods here. Using a set of pre-processing techniques, various extraction methods, and ML algorithms, Hui Li and Zeming

L provide a methodology [1] for text classification. Their work contributed huge knowledge in the sector of text classification according to the performances of a different machine learning algorithms [5] and feature extraction techniques. In comparison, the Naive Bayes method's 90% accuracy, the SVM method achieved a 92.5% success rate. With an accuracy of 92.5%, the TF-IDF method outperformed BoW(bag-of-words). Their investigation into and application of the numerous machine learning algorithms and word extraction strategies have some very useful insights. There are many possible applications for the proposed method beyond sentiment analysis and spam detection. These findings may be helpful for researchers and practitioners developing text categorization methods. Further research is needed to determine the efficacy of deep learning algorithms for text classification.

In this paper, it shows probability to use KNN problems along with processes for text classifications. The framework can check the similarity of different words.. Finally, the use of both KNN algorithm [6] and TF-IDF [6] method has been discussed as a good choice with minor modifications in their implementation [6].

Another paper showed that Naive Bayes method used for text classification using conditions to a class. After feature selection in text classification, Naive Bayes Classifier divides the text subspace composed of all documents and then again the auxiliary feature method proposed here partition the text subspace again, so that it can show better results than the normal or traditional way. Which indicates that the proposed method indeed improves the performance of Naive Bayes Classifier.

The Naive Bayes classifier is a method of machine learning that is used for text categorization. This work suggests an auxiliary feature strategy that may be utilised in conjunction with the Naive Bayes classifier. It indicates that using this method will help us to get more accurate result.

This paper discusses the variety of Machine Learning and Deep Learning algorithms used in text classification with their advantages and shortcomings. Moreover, it includes the benefits and limitations of feature extraction, feature selection method and supervised and unsupervised machine and deep learning models used for a text classification task. Despite being expensive, this paper shows the hope to find the future that these deep neural networks will be applied efficiently in the automatic monitoring of web based text data and classifying unseen data into automated labels with an advancements of deep neural networks.

This paper gives an overview of the varieties of text features in different sectors by using different methods and algorithms accurately in the real world. The text classification algorithms use some manners and these metrics help to evaluate the algorithm. Finally, with these techniques, various algorithm for text classification is discussed here.

III. DATASET

Since our project focuses on the newspaper article and hence we need a dataset that contains news of various topic. One of

the dataset we are using is The BBC News Archive dataset, which is comprising a total of 2,225 news pieces, spanning a period from 2004 to 2005. Each article in the collection includes crucial information such as the headline, category, date, and the full text of the news piece. The dataset comprises many different sorts of news stories, making it useful for testing and researching various text categorization systems.

Category	1623
File	1535
Title	1517
content	1698

TABLE I
DATASET OF BBC NEWS ARCHIVE

Business, entertainment, politics, sports, and technology are only few of the news genres represented in the dataset. The names of the source files that included the news pieces that are relevant to this topic are provided in the filename. In the title section there is a title of the collected contents and the news article is present under the content section.

We also used AG's News Topic Classification Dataset. This file contains 1,20,000 different examples of training for writing three-column news stories. The column containing the Class ID comes first, then the column containing the title, and finally the column containing the description.

IV. METHODOLOGY

In this research, we collected some dataset in a CSV format of news articles from different online sources. We pre-processed the data to get accurate results using different methods of NLP. The tokenization was done properly and removed the corresponding similar words and stop words.

Method Selection:

TF-IDF : Term frequency or TF calculate the occurrence of the texts. It will be determined by the occurrences of the word in the documents. By doing so, we can find the word which is the important word and that will be used to fetch the article. The inverse document frequency (IDF) evaluate how much unique the term or the word is in the document collection.

Multinomial Naive bayes: This algorithm learns from a labelled training dataset we will try to apply this to automatically categorize articles into different topics or classes [1]. The topic or the keyword will be from different genres. In contrast to our research, Naive Bayes have the capacity to deal with extensive vocabularies and high-dimensional feature spaces when working with a large number of words taken from a range of publications.

Logistic Regression is efficient for computing purposes and also can handle large dataset as we are also working with the large dataset. It is also efficient in imbalance datasets. It does this by modifying the decision threshold or by employing class weights to compensate for the imbalance in class representation that exists.

Random Forest's randomization helps prevent overfitting, and it also makes the model more tolerant of erroneous information in text input. Together, these two features make

the model more robust. It enhances the algorithm's capacity to generalise to new types of content that it has not previously encountered.

The above classifiers will be tested on our dataset to determine different rates such as F1 score.

V. RESULT AND DISCUSSION

Precision means predicted positive cases. Basically precision compares the number of positive cases which are compared with other cases, if they are correctly predicted or not. Recall means how many positive predictions are correct. It calculates the ratio of accuracy. The F-1 score is a numerical average which calculates the precision and recall and the higher value will show better performance.

	Model	Test Accuracy	Precision	Recall	F1	process
0	Random Forest	25.48	0.25	0.25	0.25	tfidf
1	Random Forest	97.86	0.98	0.98	0.98	vectorize
2	Logistic Regression	20.95	0.21	0.21	0.21	tfidf
3	Logistic Regression	97.86	0.98	0.98	0.98	vectorize
4	Multinomial Naive Bayes	19.76	0.20	0.20	0.20	tfidf
5	Multinomial Naive Bayes	96.43	0.96	0.96	0.96	vectorize

Performances

Here, from the result table we can see that when we apply the tf-idf and the vectorize process for both methods. The Random forest gives the highest value is 97.86%, F-1, recall and precision score is 0.98 for both methods. Another highest result is 96.43% which we get after applying Naive Bayes. F-1, recall and precision scores are 0.96 for the method.

The results are very low in the tf-idf process. The test accuracy for Random forest is 25.48%. The test accuracy for LR is 20.95% and for multinomial naive bayes is 19.76%.

After applying all the methods, we can say that naive bayes and random forest methods give us the highest accuracy in the Vectorize process. So it will fare if we use Random Forest and Logistic regression in the Vectorize method for further researches.

VI. CONCLUSION

The proposed research paper, titled "Text Classification for News Article using NLP Techniques," will expand upon the NLP to text classifications. In this situation, we got varying conclusions by using several datasets with various methods. We started by reading through some online copies of previous research works. We compared the methods Multinomial Naive Bayes, Logistic Regression and Random forest with two processes; Vectorize and the TF-IDF. The results were not helpful from the TF-IDF process as they gave very low results for all the methods.

The information can be used for text searches in news articles. The text of news articles should be classified so that readers can find the relevant information they are looking for. We have researched on subject text classification, but further research work will elaborate this sector more.

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