Fake News Detection using Machine Learning Algorithms

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1. Motivation and Problem Statement

With the rise in popularity of the Internet, social media platforms like Facebook and Twitter have become new sources of information for people. But these online media platforms are being manipulated by certain entities to promote biased opinions and spread distorted facts. This phenomenon is known as fake news [10]. Fake news can lead to serious problems in various domains such as politics, finance, science, etc. The most recent example is the spread of misinformation about vaccines during the COVID-19 pandemic that led to issues in maintaining public health [9]. Thus, it is important to distinguish between real and fake news to control the disastrous effects that fake news can have on our society in the long term.

In this project, we aim to use machine learning algorithms for automated classification of news articles as fake or real. We aim to explore various textual properties in natural language processing on the dataset, which we will use to train different ML models and ensemble methods and evaluate their performance to determine the best model for this learning task.

2. Dataset

We have used the dataset available on Kaggle [1], which has two files, train.csv (20387 training samples) and test.csv (5127 testing samples). The testing data has four attributes: id, title, author, text and the training data has the additional column of class label (0 for reliable news and 1 for unreliable news).

3. Pre-processing Techniques

The first step towards preprocessing is to remove the NaN values in the dataset, which can be done easily after converting the dataset to a Pandas dataframe. Now "stemming" and "lemmatization" are performed, which reduces the words in the dataset to their basic roots. In the penultimate step, we drop stop words and also normalise the data. Stop words are the words that do not carry any significant semantic in a sentence [2]. Lastly, we vectorise the document, as the ML models cannot interpret words directly, we have to convert them into numbers. This is achieved by word2vec, Count Vectorizer and TFIDF Vectorizer [11].

4. Machine Learning Techniques to Explore

On the basis of the related work on this topic, we decided to keep the **Naïve Bayes Classifier** as our baseline model.

The advanced models to be used for comparison of performance with the baseline model are **Logistic Regression, Support Vector Machine, Decision Tree, Passive-Aggressive Classifier & Neural Network (LSTM).** [8]

5. Model Selection and Tuning Hyperparameters

Model selection strategy: Stratified K-Fold Cross Validation. It is a cross-validator that splits the dataset into k test folds while maintaining the ratio of the classes in each test fold which makes the model training less biased [3].

Hyperparameters Tuning Strategy: Bayesian optimization. It chooses the hyperparameter to evaluate by taking into account past evaluations [4].

6. Training Approaches to Explore

Gradient descent, stochastic gradient descent and mini-batch gradient descent [5].

7. Ensemble Methods to Explore

1. Bagging (Random Forest)
2. Boosting (XGBoost) [7]

8. Evaluation Metrics and Error Analysis

The ML models will be evaluated and error analysis will be done using the following metrics: Accuracy, Precision, F1-score, Recall, AUC-ROC curve and confusion matrix, etc [6].

9. Work Distribution

Tasks	Team Members
Data Pre-preprocessing, Analysis	Akshat, Shruti
Implementing ML techniques (2 each)	Everyone
Hyperparameter tuning, model selection	Everyone
Training and Ensemble approaches	Tarini, Shruti
Evaluation metrics, error analysis	Akshat
Drawing final conclusions, report writing	Everyone

References

[1] Dataset Available Here (Click).

[2] Pre-processing in NLP (Click).

[3] Model Selection (Click).

[4] Hyperparamater Tuning (Click).

[5] Training Approach Selection (Click).

[6] Evaluation Metrics and Error Analysis (Click).

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