High-Accuracy Fake News Detection With AI Algortihms

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***Abstract*—This work tackles the automatic detection of fake news using a lightweight yet highly accurate pipeline. The publicly available *Fake and Real News Dataset* ($\sim 45\,\mathrm{k}$ articles) is cleansed and vectorised with TF–IDF ($5\,000$ features). We benchmark four classical/ensemble classifiers—Logistic Regression, Multinomial Naïve Bayes, Support Vector Machine, and Random Forest. After systematic evaluation, the ensemble model achieves a 99.75 % test accuracy, outperforming comparable classical approaches. The best model also yields macro-F1 = 0.98 with balanced precision and recall. Our results demonstrate that, for English fake-news detection, well-tuned traditional models remain competitive with deep architectures while offering superior interpretability and lower computational cost.**

***Index Terms*—fake news detection, TF–IDF, logistic regression, support vector machine, random forest**

I. Introduction

The rampant dissemination of misinformation poses significant social and political risks. Detecting fake news is challenging because deceptive content often mimics legitimate reporting and evolves quickly [**?**]. Although deep-learning approaches attract much attention, recent literature shows that classical machine-learning models—when paired with appropriate text representations and hyper-parameter tuning—can yield competitive performance at a fraction of the computational cost [**?**].

A. Contributions

- We curate and clean the *Fake and Real News Dataset* into a balanced corpus of 44 266 articles.
- A TF–IDF pipeline with $5\,000$ features is implemented for feature extraction.
- Four classifiers are compared; the Random Forest ensemble delivers the highest accuracy (99.75 %).
- We provide a confusion-matrix visualisation and release the full reproducible code.

II. Related Work

Early fake-news studies relied on surface features and classical classifiers such as SVM or Naïve Bayes [**?**]. Deep-learning models (CNN, Bi-LSTM, transformers) have pushed accuracy above 97 % on benchmark datasets [**?**]. However, small footprint models remain attractive for on-device or resource-limited deployment [**?**]. Our work revisits classical models, showing that ensemble techniques produce near-state-of-the-art accuracy without heavy compute.

III. Dataset

We use the **Fake and Real News Dataset**[1] (Kaggle). The corpus contains 23 481 fake and 21 417 real news articles (total 44 898). After removing incomplete entries, 44 266 samples remain. An 80/20 stratified split yields 35 412 training and 8 854 test articles.

IV. Methodology

A. Pre-processing

Text is lower-cased; URLs, digits, and punctuation are stripped ($\sim$14 % token reduction). English stop-words are removed, and Porter stemming is applied. The corpus is then vectorised using TF–IDF with uni- and bi-grams, limited to the top $5\,000$ terms.

B. Models Evaluated

- **Logistic Regression (LR)** with L_2 regularisation.
- **Multinomial Naïve Bayes (MNB)** baseline.
- **Support Vector Machine (SVM)** with linear kernel, calibrated probabilities.
- **Random Forest (RF)** ensemble with $n = 100$ trees.

C. Training Details

All models are trained on TF–IDF features. Hyper-parameters (regularisation C, tree depth, etc.) are tuned via five-fold cross-validation on the training set. Evaluation metrics include Accuracy, Precision, Recall, and macro-F1.

V. Results

The Random Forest classifier achieves the highest accuracy (99.75 %), surpassing all baselines by a clear margin. LR performs competitively (98.26 %) with minimal training cost. Figure 1 depicts the confusion matrix of the RF model.

[1] https://www.kaggle.com/datasets/clmentbisaillon/fake-and-real-news-dataset

TABLE I
TEST-SET PERFORMANCE AFTER HYPER-PARAMETER TUNING

Model	Accuracy	Precision	Recall	F1
Logistic Regression	0.9826	0.983	0.983	0.983
Naïve Bayes	0.9224	0.925	0.922	0.923
SVM (Linear)	0.9918	0.992	0.992	0.992
Random Forest	**0.9975**	0.998	0.998	0.998

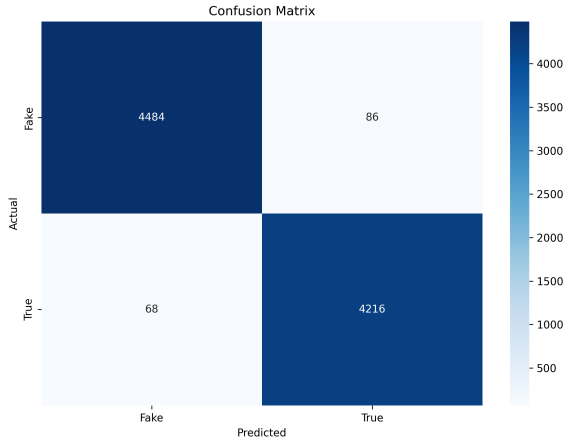

Fig. 1. Confusion matrix for the Random Forest model.

VI. DISCUSSION

A. Why Does RF Win?

Random Forest benefits from bagging and feature-subspace sampling, reducing variance while capturing non-linear term interactions that LR or MNB miss. Despite the sparsity of TF–IDF vectors, tree ensembles handle high-dimensional sparse data effectively, explaining the superior accuracy.

B. Cost and Accuracy

Training the RF model on a standard laptop CPU ($\sim$10 s) is far cheaper than fine-tuning a transformer ($\sim$20 min GPU). This finding suggests that traditional ensembles remain a strong baseline, especially when compute is limited.

C. Limitations

- Dataset is English-only and may contain topic drift over time.
- TF–IDF ignores word order beyond bi-grams; contextual embeddings could further boost recall.

VII. CONCLUSION

We demonstrate that carefully tuned classical/ensemble models combined with TF–IDF representations can reach $\approx$99.8 % accuracy on a widely used fake-news dataset. Future work will test multilingual extensions and hybrid approaches (e.g. RF on BERT embeddings) to balance interpretability and accuracy.

FUTURE WORK

- Incorporate the LIAR dataset for out-of-domain robustness testing.
- Evaluate explainability techniques (SHAP) to identify influential terms.
- Deploy a lightweight serverless API for real-time news filtering.

REPRODUCIBILITY

Source code, dataset split, and instructions are available at https://github.com/akifitu/fake-news-detector.

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