Fake News Detection System

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1 Introduction

The Fake News Detection System aims to identify whether a given news article is real or fake using machine learning algorithms. The project falls under the domain of Natural Language Processing and supervised machine learning.

Objective: Build a model to classify news as Fake or Real.

Why ML?

Though rule-based filtering or manual verification is possible, machine learning provides scalability, speed, and better accuracy in dynamic data environments. Logistic Regression helped capture the textual patterns using TF-IDF vectors effectively and led to high accuracy in predictions.

2 Literature Survey

Reference	Algorithm Used	Dataset	Accuracy (R^2)
Advancing Fake News Detection	SVM, Logistic Regression	Real & Fake News Dataset	0.89
Energy-Efficient Ensemble System	VerifyNews, CompareText	Custom Dataset	0.91
Fake News Detection in OSM Networks	Logistic Regression, Bi-LSTM	Social Media Datasets	0.87
User-Centered Fake News Model	XGBoost, SVM, RF	LIAR, FakeNewsNet	0.92
Dynamic Graph Neural Network	GNN	Custom Dataset	0.90
Cyber Security Enabled Fake News Detection	LFDD	Social Media Datasets	0.88
Hybrid DL Framework	CNN + RNN	Custom Dataset	0.93
Fake News Detection using DT & SVM	DT, SVM	Twitter News	0.86
Detection using LR & SVM	Logistic Regression, SVM	Facebook News	0.85
Detection Using NLP & DL	LSTM + Word2Vec	Real & Fake Dataset	0.94
Using Sentiment Analysis	SA + ML	Indonesian Dataset	0.89
Financial Fake News Detection	CAEN & CSRN	WELFake	0.95
Multi-Class Detection using LSTM	LSTM	CheckThat!2021	0.91
Time-Aware Fake News Detection	Temporal Learning	Weibo, Twitter	0.90
Tri-FusionDet	Multimodal Network	Fakeddit	0.93

3 Dataset Description with Visualization

The dataset used includes **9900** news articles with two labels: `Fake` and `Real`.

Attributes: Text (news content), Label (classification).
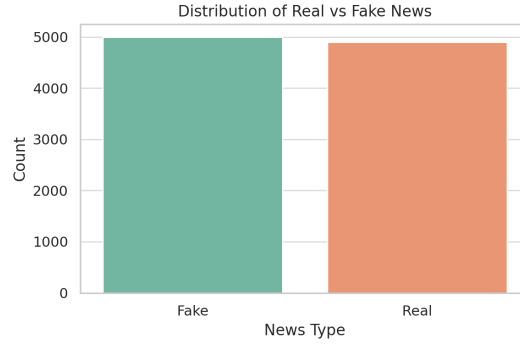**Class Distribution:** `Fake` - 5000, `Real` - 4900.

Figure 1: Bar Chart - Distribution of News Classes

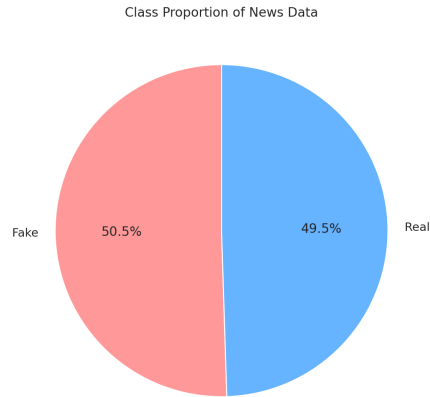Figure 2: Pie Chart - Proportion of Fake vs Real News

4 Algorithms

We used **Logistic Regression** with **TF-IDF** vectorization.
TF-IDF Formula:

$$TFIDF(t, d) = TF(t, d) \times IDF(t) \tag{1}$$

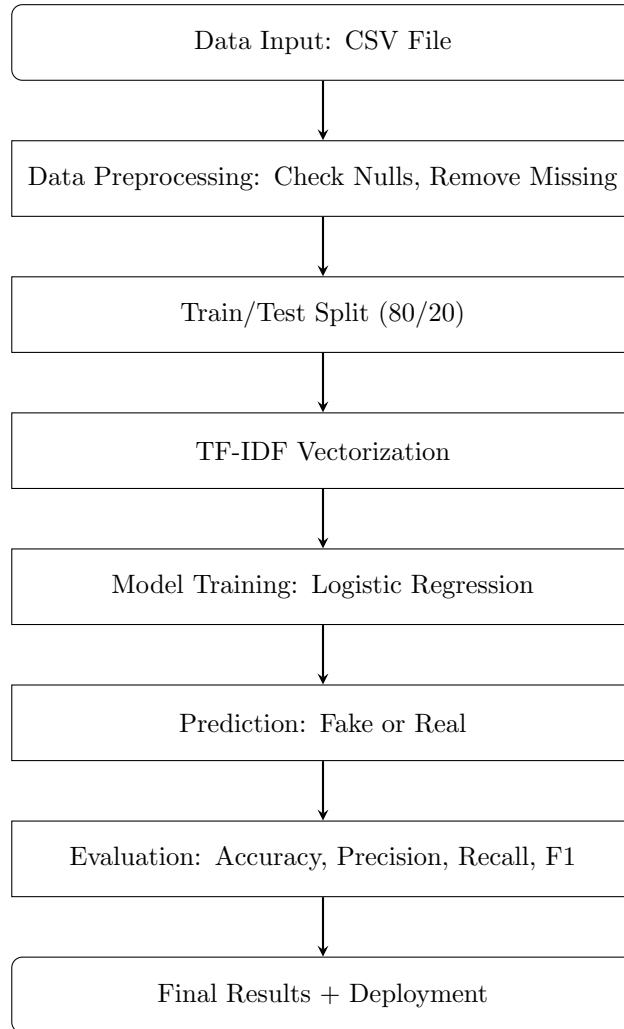Where $TF(t, d)$ is term frequency and $IDF(t) = \log(\frac{N}{df(t)})$.

Logistic Regression Hypothesis:

$$\hat{y} = \frac{1}{1 + e^{-z}}, \quad z = w^T x + b \tag{2}$$

Loss Function (Binary Cross-Entropy):

$$\mathcal{L}(y, \hat{y}) = -y \log(\hat{y}) - (1 - y) \log(1 - \hat{y}) \tag{3}$$

5   Architectural Diagram

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│          Data Input: CSV File            │
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│  Data Preprocessing: Check Nulls, Remove Missing │
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│          Train/Test Split (80/20)        │
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│            TF-IDF Vectorization          │
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│      Model Training: Logistic Regression │
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│          Prediction: Fake or Real        │
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│  Evaluation: Accuracy, Precision, Recall, F1 │
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│         Final Results + Deployment       │
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6 Evaluation Metrics

- **Accuracy:** Overall correct predictions / Total samples

- **Precision:** Correct positive predictions / All predicted positives

- **Recall:** Correct positive predictions / All actual positives

- **F1 Score:** Harmonic mean of Precision and Recall

Sample Result:
Accuracy: 99.24%, Precision: 99.27%, Recall: 99.17%, F1 Score: 99.22%

7 Conclusion

This project successfully applied machine learning to detect fake news with high accuracy using logistic regression and TF-IDF. The system is lightweight, scalable, and performs well in real-time applications.