Fake News Classifier: Report and Documentation - by Akash Upadhyay

Overview

This document provides a comprehensive analysis of the Fake News Classifier developed using machine learning techniques. The classifier is designed to distinguish between real news and fake news based on the text content. The report includes an overview of the preprocessing steps, model performance, and outcomes.

Data Preparation and Preprocessing

Dataset

The dataset consists of training and testing files (`train.tsv` and `test.tsv`) with the following columns:

- `title`
- `text`
- `subject`
- `date`
- `label` (Target: `0` for fake news and `1` for real news)

Steps:

1. **Columns Dropped**: `title`, `subject`, `date`.
2. **Text Cleaning**:
    - Convert to lowercase.
    - Remove non-word characters and punctuation.
    - Remove numbers, square bracket content, HTML tags, and URLs.

Train-Test Split

- Training and validation split: 75% for training and 25% for validation.
- TF-IDF Vectorization: Applied to convert text into feature vectors for model input.

Models and Performance

Logistic Regression

- **Validation Accuracy**: 98%
- **Testing Accuracy**: 98%

Classification Report:

Metric	Precision	Recall	F1-Score
Class 0 (Fake)	0.98	0.98	0.98
Class 1 (Real)	0.97	0.98	0.98
Overall	0.98	0.98	0.98

Decision Tree Classifier

- **Validation Accuracy**: 94%
- **Testing Accuracy**: 94%

Classification Report:

Metric	Precision	Recall	F1-Score
Class 0 (Fake)	0.94	0.95	0.94
Class 1 (Real)	0.94	0.93	0.94
Overall	0.94	0.94	0.94

Gradient Boosting Classifier

- **Validation Accuracy**: 97%
- **Testing Accuracy**: 97%

Classification Report:

Metric	Precision	Recall	F1-Score
Class 0 (Fake)	0.98	0.96	0.97
Class 1 (Real)	0.96	0.97	0.97
Overall	0.97	0.97	0.97

Random Forest Classifier

- **Validation Accuracy**: 97%
- **Testing Accuracy**: 97%

Classification Report:

Metric	Precision	Recall	F1-Score
Class 0 (Fake)	0.97	0.97	0.97
Class 1 (Real)	0.97	0.97	0.97
Overall	0.97	0.97	0.97

XGBoost Classifier

- **Validation Accuracy**: 99%
- **Testing Accuracy**: 99%

Classification Report:

Metric	Precision	Recall	F1-Score
Class 0 (Fake)	0.99	0.99	0.99
Class 1 (Real)	0.99	0.99	0.99
Overall	0.99	0.99	0.99

Evaluation Metrics

AUC-ROC Curve

- **Training/Validation AUC-ROC**:
  - AUC: 0.99
- **Testing AUC-ROC**:
  - AUC: 0.99

Insights:

- The ROC curve demonstrates a strong ability of the model to distinguish between fake and real news, as shown by the high AUC score.
- The XGBoost model outperforms others in terms of both accuracy and AUC.

Implementation and Usage

Prediction Function

A prediction function (`testing(news)`) was implemented to classify news articles as fake or real:

1. Preprocess input text.
2. Transform the text using the trained TF-IDF vectorizer.
3. Use the XGBoost classifier for prediction.
4. Output label:
    - `Fake News` for class 0.
    - `Real News` for class 1.

Example Input and Output:

Input: "Nepal bombed Nagasaki in 1947."

Output:

```
Unset
XGB Prediction: Fake News
```

Batch Classification

The classifier supports batch classification through the `classify_and_save` function. It processes multiple text entries, predicts their labels, and saves the results to a JSON file.

Output Format (example):

```
Unset
{
  "results": [
    ["News text 1", "1"],
    ["News text 2", "0"]
  ]
}
```

Conclusion

Key Observations:

1. The XGBoost Classifier is the best-performing model with:
    - 99% validation and testing accuracy.
    - High precision, recall, and F1-scores.
    - Strong AUC-ROC performance.
2. The preprocessing pipeline effectively cleans the text, ensuring high-quality input for the models.

3. Batch classification capability and single-input prediction provide flexibility for real-world applications.

Future Improvements:

- Expand the dataset to include more diverse examples.
- Investigate the impact of additional features like metadata (e.g., `subject` and `date`).
- Explore deep learning models for further improvements in classification performance.