A

Project Based Learning

On

Fake News Detection with Machine Learning: Performance comparison on the LIAR Dataset

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TECHNICAL TERMS

1. **Machine Learning (ML):** A field of AI that uses statistical techniques to give computer systems the ability to learn from data and improve from experience without being explicitly programmed.
2. **Natural Language Processing (NLP):** A subfield of AI focused on enabling computers to understand, interpret, and generate human language.
3. **Classification:** The process of predicting the category or class of given data points. In fake news detection, classification algorithms are used to determine if a news item is real or fake.
4. **TF-IDF (Term Frequency-Inverse Document Frequency):** A weighting scheme used in text mining to evaluate the importance of a word in a document relative to a collection or corpus of documents.
5. **BERT (Bidirectional Encoder Representations from Transformers):** A transformerbased model developed by Google that understands the context of a word in a sentence by looking at the words before and after it.
6. **Accuracy, Precision, Recall, F1-score:** Statistical measures used to evaluate the performance of classification models. These metrics help assess how well a model predicts the target labels.
7. **LIAR Dataset:** A benchmark dataset comprising 12.8K human-labeled short statements from various political contexts, with truthfulness ratings. It includes metadata such as the speaker, party, and subject for richer analysis.

ABSTRACT

The growing volume of fake news on digital platforms threatens public discourse and democratic decision-making. This project focuses on the automatic detection of fake news using machine learning and natural language processing. We employ multiple classification algorithm. Logistic Regression, Random Forest, and BERT on the LIAR dataset, which contains labeled political statements. The aim is to compare these models in terms of accuracy and contextual understanding. The results demonstrate the effectiveness of BERT in grasping the nuances of language, although traditional models still perform competitively with less computational cost.

INTRODUCTION

In the digital age, information is shared at an unprecedented speed, with social media platforms, blogs, and online news portals enabling instant communication and access to news content. While this has revolutionized the way people consume information, it has also made it easier for misinformation and fake news to proliferate.

Fake news not only misleads readers but also has the potential to influence elections, spread fear, damage reputations, and create social unrest. Manual fact-checking, while effective, cannot scale to meet the sheer volume of content generated every second. This has created an urgent need for automated systems that can reliably detect fake content.

Machine learning, particularly in combination with natural language processing (NLP), provides powerful tools to address this challenge. These technologies enable systems to analyze text for signs of deception, bias, or factual inconsistency. This project aims to explore these technologies by comparing traditional machine learning methods and deep learning models such as BERT.

By training models on the LIAR dataset, which contains thousands of labeled political statements, the project attempts to identify the most effective method for classifying news content as true or false. Our analysis also focuses on the trade-offs in terms of performance, accuracy, and computational requirements, ultimately guiding the development of scalable solutions for real-world deployment.