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1. Problem Statement

The proliferation of misinformation and disinformation, especially on social media platforms, poses a serious threat to public discourse, democracy, and societal trust. Traditional methods of manual fact-checking are insufficient to cope with the sheer volume of information being generated. This project addresses the need for an intelligent, automated solution that can detect fake news based on its textual content using state-of-the-art techniques in Natural Language Processing (NLP). The goal is to build a reliable system that can identify and classify fake news in real-time, enabling proactive mitigation of its spread.

2. Objectives of the Project

- Develop a machine learning-based model to classify news articles as fake or real using NLP.
- Analyze linguistic patterns, semantics, and metadata to differentiate between true and false claims.
- Provide interpretable insights into the model's predictions using explainable AI techniques.
- Create a simple user interface to allow real-time testing of the model on new inputs (optional).

3. Scope of the Project

Features to be Implemented:

- Data preprocessing and cleaning pipeline
- Feature extraction using TF-IDF and Transformer-based embeddings (e.g., BERT)
- Model training using classical ML models and deep learning models

- Visualization of model performance and data patterns
- Optional deployment as a web app (Streamlit or Flask)

Limitations:

- Focused on English language news only
- Fake news detection limited to textual content, not multimedia
- Deployment limited to small-scale demo purposes

Constraints:

- Use of only open-source libraries and publicly available datasets

4. Data Sources

1. LIAR Dataset

- **Source:** https://www.cs.ucsb.edu/~william/data/liar_dataset.zip
- **Description:** Contains 12,836 labeled short political statements from PolitiFact.com with speaker metadata and credibility labels.
- **Type:** Public, Static

2. FakeNewsNet Dataset

- **Source:** <https://github.com/KaiDMML/FakeNewsNet>
- **Description:** A comprehensive dataset with both textual content and social context information, derived from PolitiFact and GossipCop.
- **Type:** Public, Static

5. High-Level Methodology

Data Collection:

- Download the LIAR dataset and FakeNewsNet dataset from their respective sources.

Data Cleaning:

- Normalize text (lowercasing, removing punctuation, stopwords)
- Remove null or duplicate entries
- Handle class imbalance if necessary

Exploratory Data Analysis (EDA):

- Visualize class distribution
- Word frequency and n-gram analysis
- Sentiment analysis and speaker credibility trends

Feature Engineering:

- TF-IDF vectorization
- Word embeddings using BERT or RoBERTa
- Use speaker metadata and context features for enhanced prediction

Model Building:

- Baseline models: Logistic Regression, Naive Bayes
- Deep learning models: LSTM, BERT
- Ensemble approaches: Voting and Stacking Classifiers

Model Evaluation:

- Use metrics: Accuracy, Precision, Recall, F1-Score, ROC-AUC
- Employ cross-validation and confusion matrix for analysis

Visualization & Interpretation:

- Use matplotlib/seaborn for graphs
- Explain model predictions using SHAP and LIME

Deployment:

- Build a prototype web interface using Streamlit or Flask (optional)

6. Tools and Technologies

- **Programming Language:** Python
- **Notebook/IDE:** Google Colab, Jupyter Notebook
- **Libraries:**
 - Data Processing: pandas, numpy
 - NLP: nltk, spaCy, sklearn, transformers
 - Modeling: scikit-learn, TensorFlow, PyTorch

- Visualization: matplotlib, seaborn, plotly
- Explainability: SHAP, LIME
- **Optional Deployment Tools:** Streamlit, Flask

7. Team Members and Roles

Name	Role	Responsibilities
Aathi S	Project Lead & NLP Engineer	Model design, feature extraction, training, and evaluation
Keerthivasan V	Data Analyst	EDA, visualization, and insights generation
Vimalraj R	Frontend Developer	Streamlit/Flask interface, UX design, and integration
Rithik	Documentation Specialist	Project write-up, methodology, results interpretation

