

Fake Headline Rewriter

By Team 24

Table of Contents

| | | |
|-------------------------------|------------------------------|------------------------------|
| 1 | 2 | 3 |
| Motivation | Methodology | Proposed solution |
| 4 | 5 | |
| Technical Approach | Expected Outcomes | |

Motivation

Why this project matters?

- The rise of misinformation and sensational headlines affects public opinion and trust.
- Manual fact-checking is time-consuming, inconsistent, and cannot scale.
- Rule-based systems alone fail to detect subtle linguistic patterns.
- Transformer models like DistilBERT understand deep context and improve fake-news detection accuracy.
- A hybrid system combining rule-based heuristics + neural models offers both speed and accuracy.

Problem Statement:

To develop a complete automated 5-stage pipeline that can:

1. Preprocess news text,
2. Detect fake/bias signals using heuristics and a neural transformer model (DistilBERT),
3. Verify factual elements using entity extraction and source credibility,
4. Rewrite sensational or unclear headlines into neutral ones,
5. Produce a final annotated output with confidence, warnings, and credibility labels.

Related Work:

- Fake News Detection Models: LIAR, FakeNewsNet, BuzzFeed datasets, BERT-based classifiers.
- Bias & Sentiment Studies: MediaBias/FactCheck, political text classification.
- Transformers: BERT, DistilBERT, RoBERTa widely used for text classification.
- Headline Generation: Research on summarization models (T5, BART).
- Our work extends this by using a hybrid approach (rule-based + DistilBERT) inside a full 5-stage pipeline.

Dataset used :

- **Input dataset** News Headlines datasets (Kaggle).
- Auto-detects text column and label column.
- Train-validation split performed without sklearn (custom splitter).
- Dataset used for:
 - DistilBERT fine-tuning
 - Heuristic scoring
 - Headline rewriting tasks

5-Stage Processing Pipeline:

Input → Detection → Verification → Rewriting → Output

Stage 1: Processing

- Remove URLs, HTML tags, punctuation.
- Lowercasing, stopword removal.
- Word reduction analysis.

Stage 2: Fake/Bias Detection

Rule-based heuristics:

- Sensational words
- ALL-CAPS ratio
- Exclamation marks
- Political bias terms

Neural model (DistilBERT fine-tuned):

- Fake vs real classification
- Transformer probability combined with heuristic scores.

Stage 3: Fact Verification

- Regex entity extraction (names, dates, numbers, URLs)
- Claim detection using linguistic indicators
- Knowledge-base lookup
- Source credibility scoring
- Verifiability score generation

Stage 4: Headline Rewriting

- Template-based generation.
- Entity + action-word insertion.
- Ranking using heuristics (neutrality, length, credibility terms).

Stage 5: Output Generation

- Credibility labels.
- Fake-risk classification.
- Bias annotation.
- Confidence score.
- Source references.
- Warning messages.
- Final rewritten headline.

Experiments:

How we evaluated your system:

- Fine-tuned DistilBERT using large dataset with CPU-optimized settings.
- **Evaluation metrics:**
 1. Accuracy
 2. F1-score
 3. Confusion matrix
- **Compared:**
 1. Transformer-only results
 2. Hybrid model performance
 3. Heuristic-only results
- Tested pipeline speed, scalability, preprocessing efficiency, and headline quality



Results:

- DistilBERT significantly improved fake-news classification accuracy.
- Hybrid model outperformed both standalone approaches.
 - **Headlines became:**
 1. More neutral
 2. Shorter
 3. Less sensational
 4. More credible
 - Quality tier distribution showed majority of articles classified as Good or Excellent.
 - Confidence scores increased due to transformer integration.

Analysis / Discussion:

- The neural model handled nuance that heuristics missed.
 - Source credibility + entity extraction increased verifiability reliability.
 - Template headline generator produced clear and consistent outputs.
-
- **Limitations:**
 1. DistilBERT training requires compute time
 2. Template headlines can sound repetitive
 3. Knowledge base is limited
-
- **Future improvements:**
 1. Expand knowledge base
 2. Multi-class bias detection
 3. Use BART/T5 for abstractive rewriting

Our Contributions:

What we've built:

- Designed and implemented a complete end-to-end NLP pipeline.
- Integrated both rule-based and neural transformer models.
- Implemented Windows-friendly training setup (no scipy/sklearn dependencies).
- Custom train/validation split and DistilBERT fine-tuning.
- Created automated headline rewriting + ranking mechanism.
- Generated annotated outputs with credibility, bias, confidence scoring.
- Delivered a modular, extensible architecture.

Proposed Timeline:

| Week | Task |
|------|-----------------------------------|
| 1 | Dataset collection & cleaning |
| 2 | Preprocessing, heuristics design |
| 3 | DistilBERT integration & training |
| 4 | Fact verification module |
| 5 | Headline rewriting |
| 6 | Output annotation system |
| 7 | Experiments & evaluation |
| 8 | Final report + PPT + demo |

Demo:

- Input text → processed output
- Heuristic fake score vs. DistilBERT score
- Combined hybrid score
- Fact verification details (entities, claims, sources)
- Rewritten headline
- Final annotation summary

Applications:

- News verification dashboards
- Journalism assistance tools
- Social media moderation
- Educational misinformation analysis tools
- Browser extensions for neutral headline rewriting

The End

THANK YOU FOR LISTENING

SE23UARI098- T.R.Sri Havishya

SE23UARI068-K.V.Subba Rao

SE23UARI036-E.Hrishikewara Reddy

SE23UARI024-C.Ramaraju