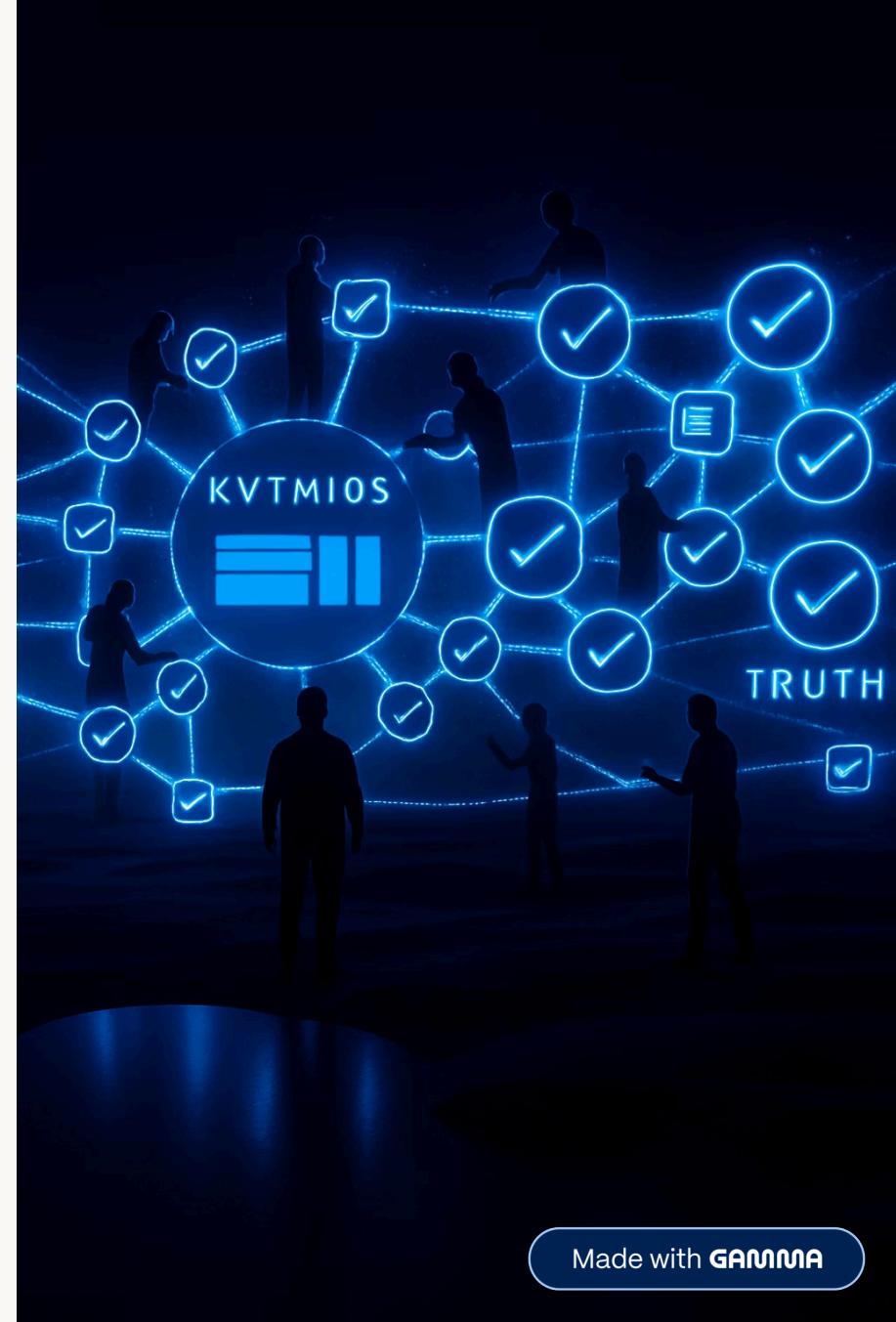


Improved Multi-Agent Knowledge Sharing System for News Bias Detection

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 3 Contributors



Introduction

- Misinformation and media bias threaten public trust and political discourse.
- Social media accelerates the spread of false narratives faster than fact-checkers can respond.
- Knowledge Graphs (KGs) structure real-world facts to support reasoning.
- Multi-Agent Systems (MAS) enable distributed, specialized analysis tasks.
- **Our proposed system** combines MAS and a dynamic KG to detect bias and verify facts in real-time news evaluation.



Problem Statement

- Manual fact-checking cannot match the speed and volume of online content.
- Bias detection requires nuanced understanding beyond simple text analysis.
- Large Language Models (LLMs) alone struggle with factual grounding and context.
- Automated systems enhanced with KGs can provide faster, more reliable news evaluation by grounding AI reasoning in real-world knowledge.

Research Objectives

Primary objectives

1. Assess the impact of shared KG-based memory in a multi-agent system on news bias detection and fact-checking accuracy.
2. Measure the performance difference between multi-agent systems with and without KG integration to show the effect a KG can have in addressing complex news evaluation tasks.

Research Questions

Specific Research Questions

1. What is the impact of knowledge graph integration into multi-agent system capabilities in bias detection, fact-checking, and overall system evaluation?

Approach



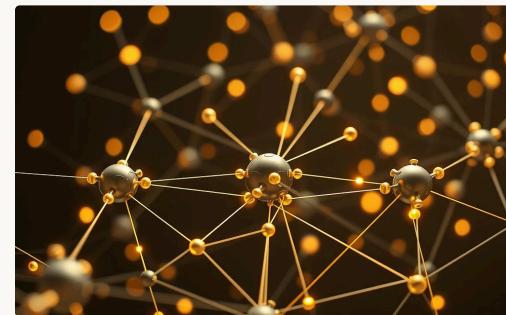
Fact-Checking

Agents focus on verifying content by performing context evaluation for accurate assessments.



Bias Detection

Agents compare new articles to ones available in knowledge to evaluate news.



Knowledge Graph Integration

Agents use the knowledge graph to enhance decision-making.



External Tools Integration

Leverage NewsAPI to build comprehensive news knowledge graph

System Architecture

Fact-Checker Agent



Verifies news claims by cross-referencing trusted sources and real-time Knowledge Graph data for factual accuracy.

Bias Detection Agent



Detects political bias through language cues and ideological framing using NLP models with Knowledge Graph context.

Knowledge Graph

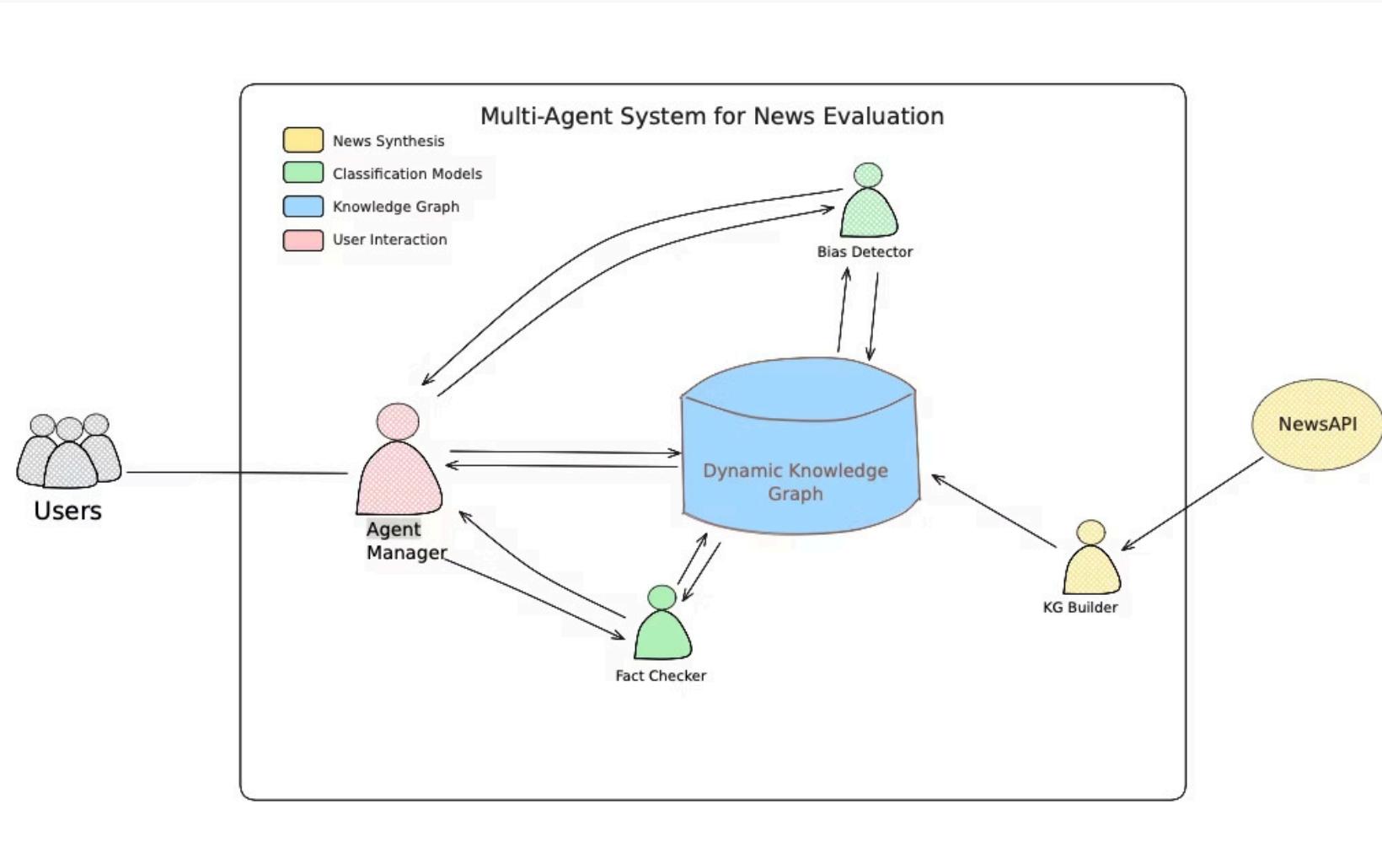


A Neo4j database aggregating facts, insights, and metadata for dynamic sharing and reasoning across agents.

Agent Manager



Coordinates tasks and communication for efficient collaboration among specialized agents in the system.



Datasets



News API

Free API to collect news articles for building knowledge graph.



AllSides Media

Used to annotate news articles with bias rating based on source.

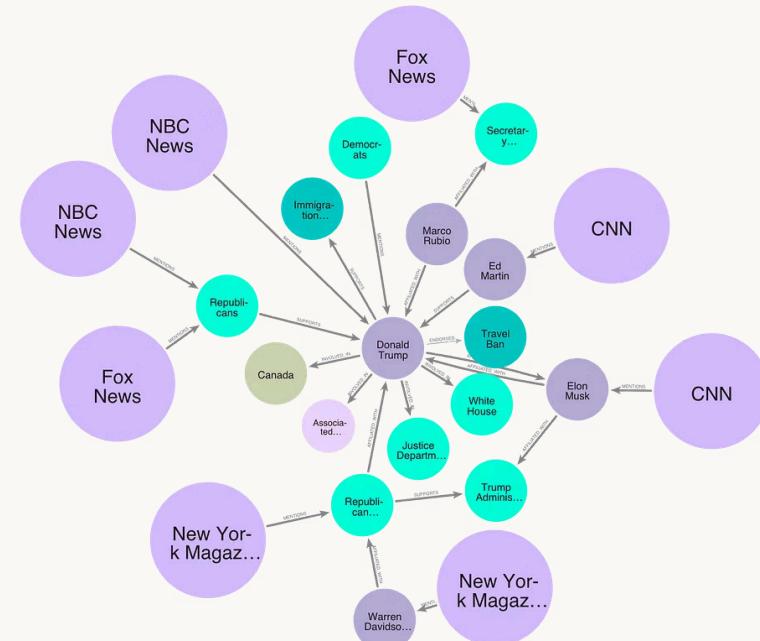


Media Bias Fact Check

Daily verified fact checks to build evaluation dataset.

Knowledge Graph

- A structured network representing news entities and their interconnections.
- Acts as a centralized shared memory accessible by all agents.
- Continuously updates with incoming articles and verified facts.
- Enables multi-hop reasoning to support fact-checking and bias detection.
- Improves accuracy and helps to minimize hallucinations common in large language models.



KG Builder Overview



Extract Triplets

Extract entities and their relationships from unstructured news articles.

Connect to Article

Link each extracted triplet to its respective Article node in the graph.

Merge into KG

Integrate new nodes and relationships seamlessly into the existing Knowledge Graph.



Example News Article

"Trump holds firm on tariffs as the White House looks to calm nervous allies."

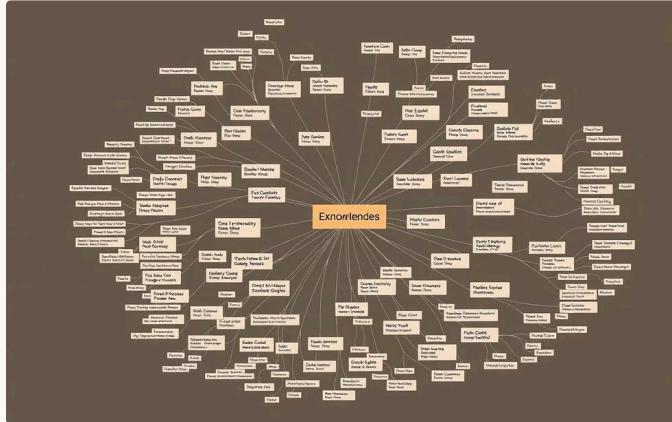
Extracted Triplets

- (Donald Trump) -[SUPPORTS]-> (Global Tariffs)
- (Donald Trump) -[INVOLVED_IN]-> (United States)
- (Republican Party) -[INVOLVED_IN]-> (Global Tariffs)
- (Jamie Dimon) -[AFFILIATED_WITH]-> (Jpmorgan Chase)
- (Dave Portnoy) -[AFFILIATED_WITH]-> (Barstool Sports)
- (Dave Portnoy) -[SUPPORTS]-> (Donald Trump)

Fact-Checker Agent



Breaking down claims into structured components

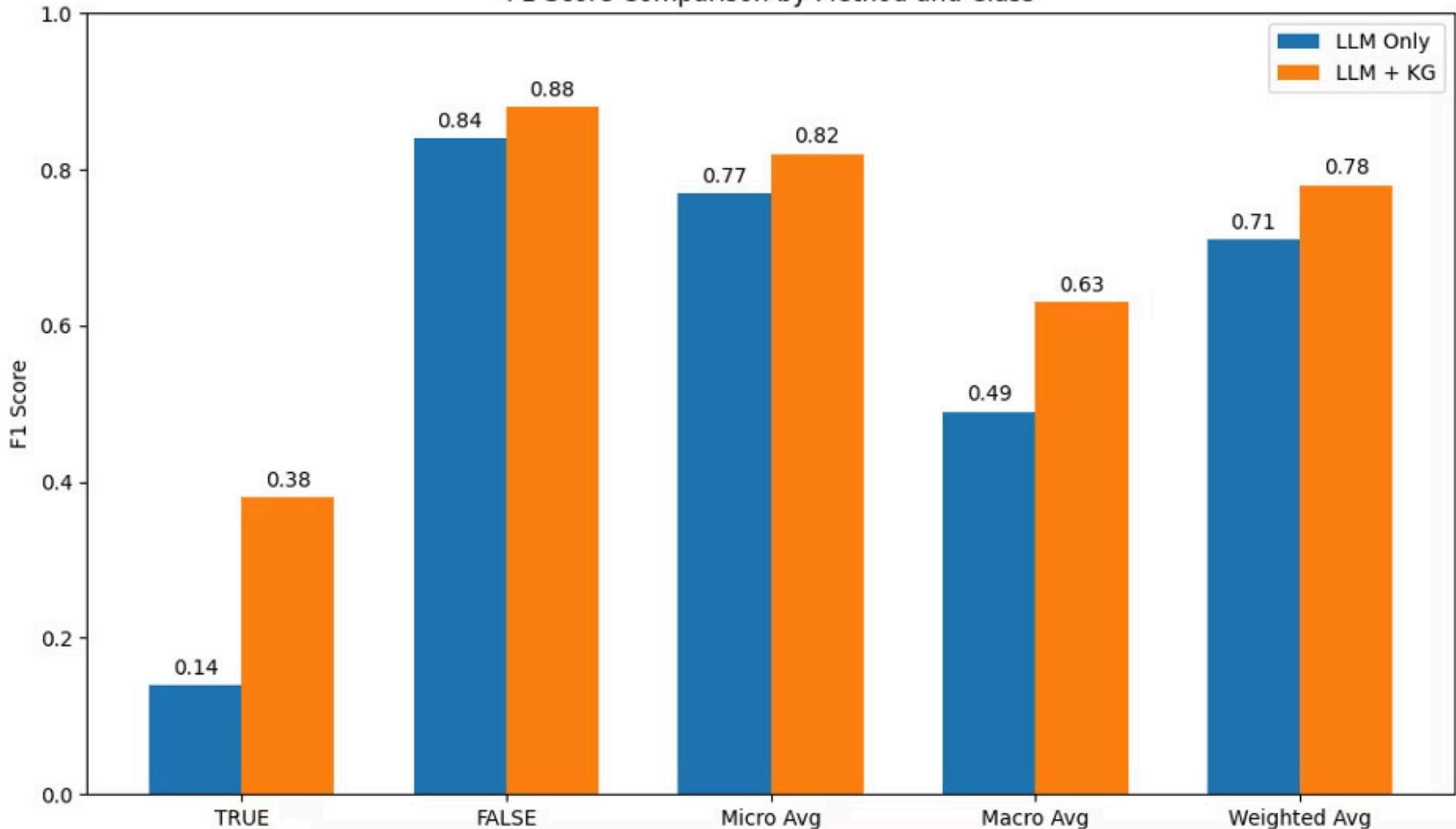


Querying the Knowledge Graph for evidence



Generating grounded LLM prompts and delivering verdicts

F1 Score Comparison by Method and Class

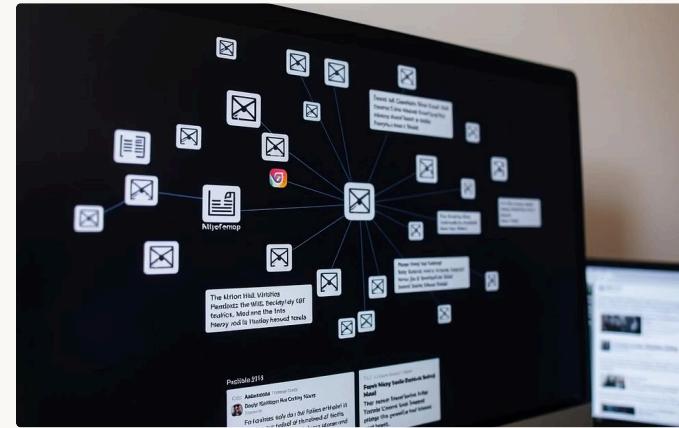


Bias Detection Agent



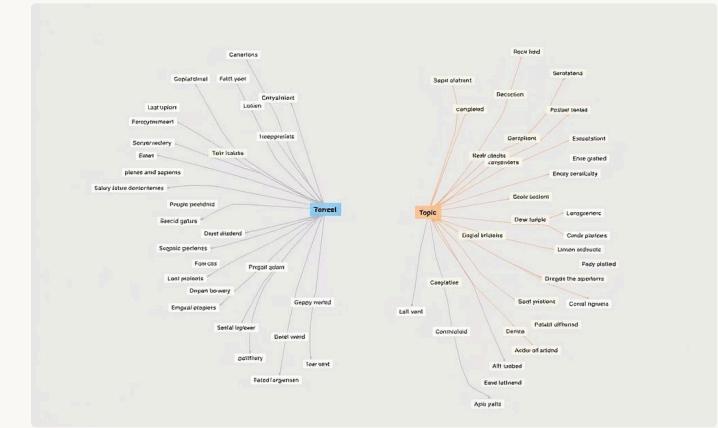
Article Parsing

Extracts key information from articles for detailed analysis



Retrieves Similar Articles

Uses the Knowledge Graph to find related articles for comparison



Structural Similarity

Enhances bias classification accuracy by examining article structures

	Bias Detection Performance Metric				
	Balanced Accuracy	Cohen Kappa	Macro F1	Matthews Correlation	Weighted F1
LLM-Only	0.735	0.488	0.615	0.574	0.705
LLM-KG	0.823	0.745	0.76	0.759	0.877

Table 4: Comparison of bias detection results between the LLM-only benchmark and the LLM+KG system.

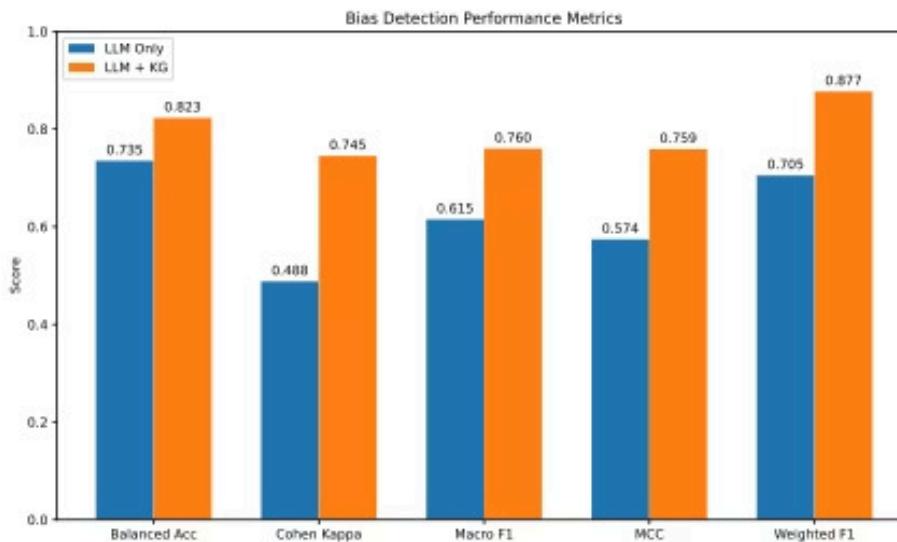


Figure 8: The results of bias detection with the LLM+KG against the benchmark of just the LLM.

Experimental Results

Fact-Checking Improvements

- True claims recall: +257%
- Macro F1: 0.49 → 0.63
- Micro F1: 0.77 → 0.82

Bias Detection Gains

- Balanced Accuracy: 0.735 → 0.823
- Cohen's Kappa: +53%
- Macro F1: 0.615 → 0.76

Conclusion

Summary of Key Contributions

- Developed a multi-agent system combining LLMs and Knowledge Graphs.
- Achieved significant improvements in bias detection and fact-checking accuracy.

Research Objectives and Results

- Validated that KG integration improves LLM system performance.
- Demonstrated measurable gains across key evaluation metrics.

Real-World Applications

- Real-world deployment in journalism for rapid bias and fact-checking.
- Supports media literacy education and critical news analysis.



Future Work

1

Architectural Enhancements:

Improve agent communication; allow agents to update the Knowledge Graph dynamically.

2

- Knowledge Graph Upgrades:**

Add vector embeddings (GraphRAG) and time-sensitive weighting.

3

- New Agent Types:**

Introduce rhetorical analysis, credibility checking, and narrative framing agents.

4

- Deployment Considerations:**

Focus on scalability, robust error handling, user-specific interfaces, and ethical guidelines.