

RoostAI: A University-Centered Chatbot



Name: Vansh Nagpal

Major: CS/Math

Minor: DS

Role: ML Engineer

Name: Nitin Gupta

Major: CS

Minor: Math/DS

Role: ML Engineer



UNIVERSITY OF
South Carolina

The Problem

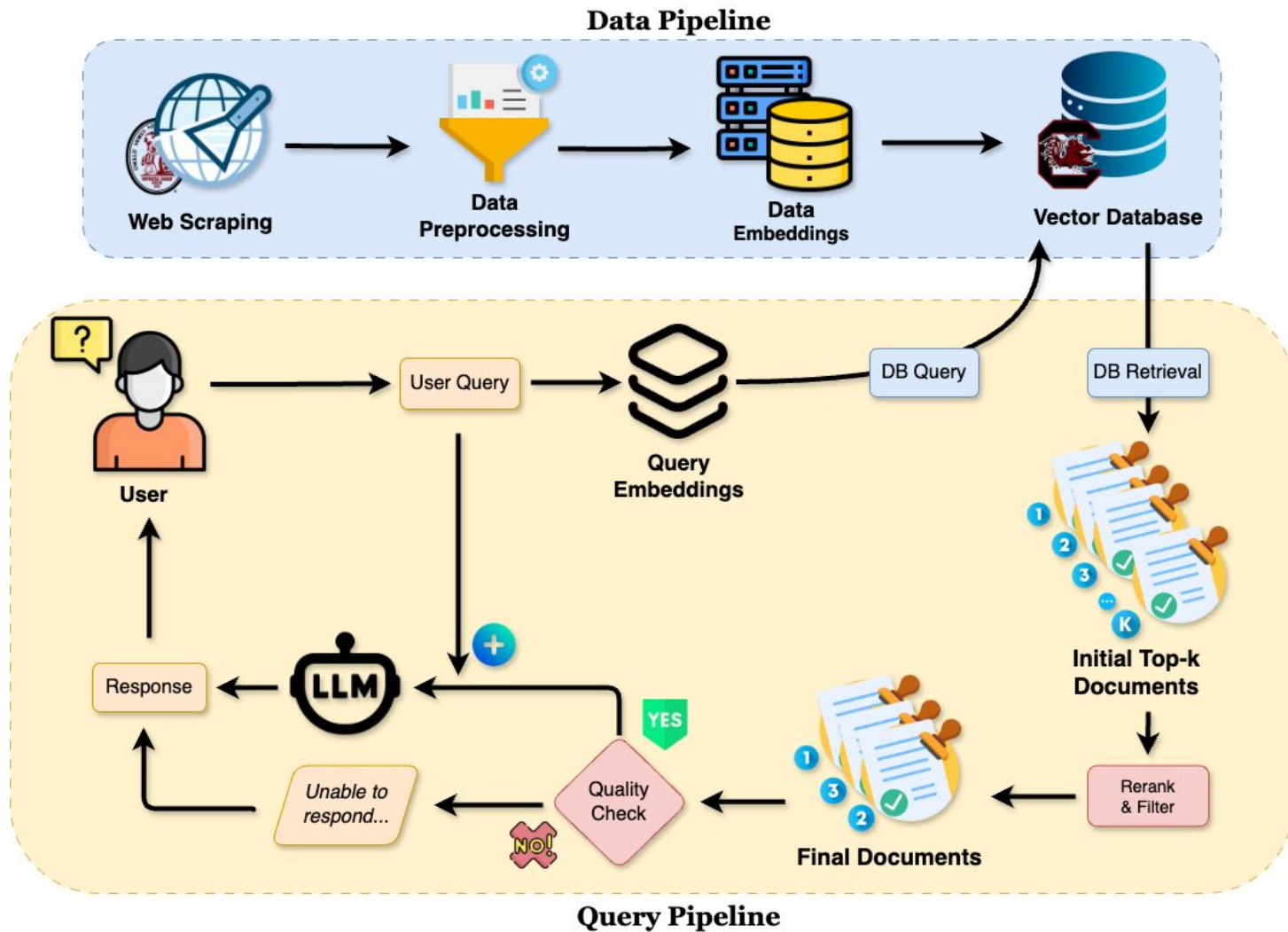
USC lacks a **comprehensive, easy-to-use** resource that informs them of campus related information **quickly**.

No AI chatbot exists to provide students with a reactive/interactive UI to quickly ask questions

Project type: Implementation within a specific domain



The RoostAI Framework



LLM Prompt

You are a chatbot specifically designed to provide information about the University of South Carolina (USC). Your knowledge encompasses USC's history, academics, campus life, athletics, notable alumni, and current events related to the university. When answering questions, always assume they are in the context of USC unless explicitly stated otherwise. Provide accurate and up-to-date information about USC, maintaining a friendly and enthusiastic tone that reflects the spirit of the community. If you're unsure about any USC-specific information, state that you don't have that particular detail rather than guessing. Your purpose is to assist students, faculty, alumni, and anyone interested in learning more about USC.

Context information:

- {document-1}
- {document-2}
- {document-3}
- {document-4}
- {document-5}

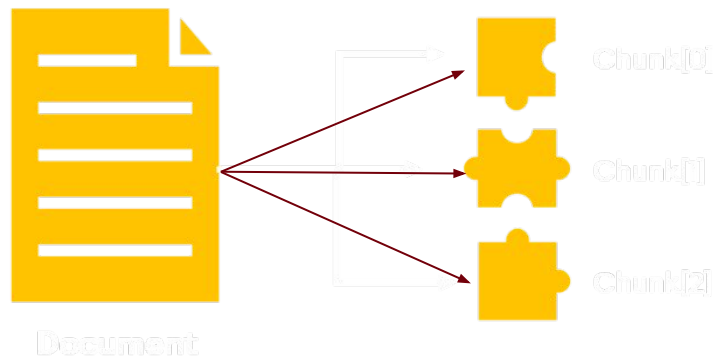
User question: {query}

Please provide a helpful response based on the context above. If the context doesn't contain relevant information to answer the question, please state that clearly. Additionally, make sure to enclose your response in `<response>` tags.

The 4 *RoostAI* Systems

We implemented 4 vectorized databases corresponding to different chunking strategies:

- Fixed-token Chunking
- Sentence-splitting Chunking
- Semantic Chunking with a 50% and 95% dissimilarity threshold



FAQ Evaluation

Goal: Evaluate the efficacy

Data: 108 USC FAQs as our ground truth responses

Evaluation:

- **NLP Metrics** to evaluate the generated answer
- **RAG Metrics** to evaluate the retrieval pipeline

Question ▲	Answer ▼
Can a program include more than one concentration?	Yes, programs may have multiple concentrations within the major.
Can I choose specific (prescribed) courses as part of the Carolina Core for my program?	Yes. Certain programs may require courses that are approved as Carolina Core foundational courses. It makes sense that those programs would “prescribe” those courses as required for the particular Carolina Core component that they fulfill.

Figure: Sample USC FAQs

NLP Evaluation

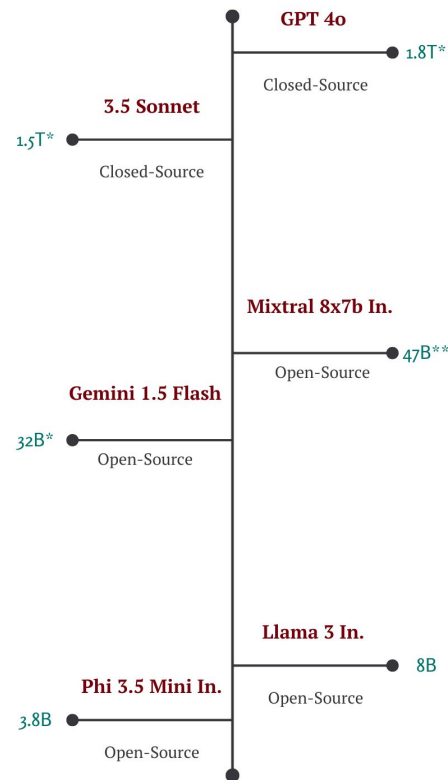
Data: USC FAQs (Question + Reference Answer)

6 Metrics: BLEU, ROUGE-L, Jaccard Similarity, BERT Score, Levenshtein Ratio, Jensen-Shannon Divergence

Independent Variables: 4 RoostAI Systems + 6 LLMs

LLMS
CONSIDERED

Ordered by Parameter Count

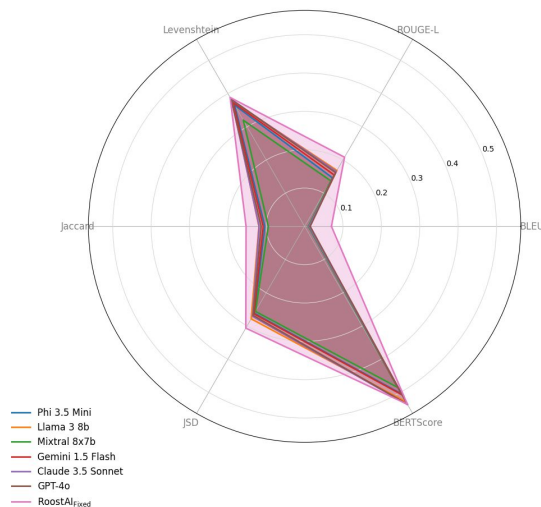


*Estimated parameter counts (unofficial).

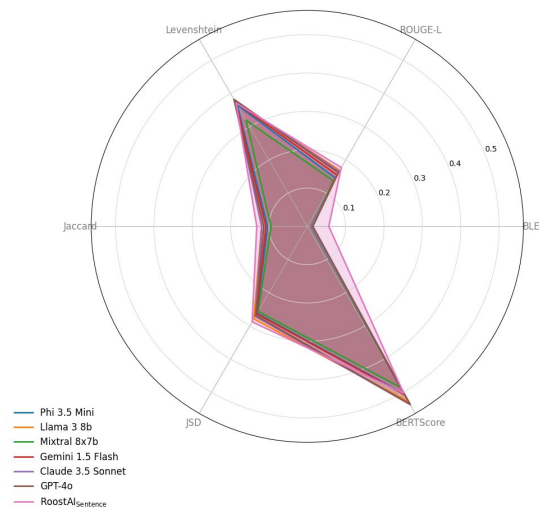
** Total parameter count given; however, not all parameters are used during inference.

NLP Results

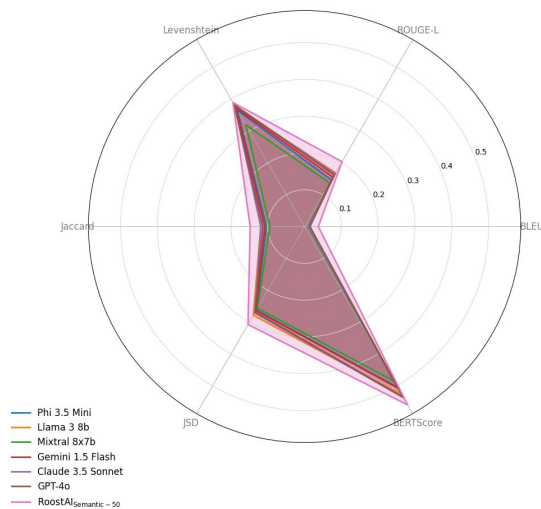
Multiple Systems Performance Across NLP Metrics



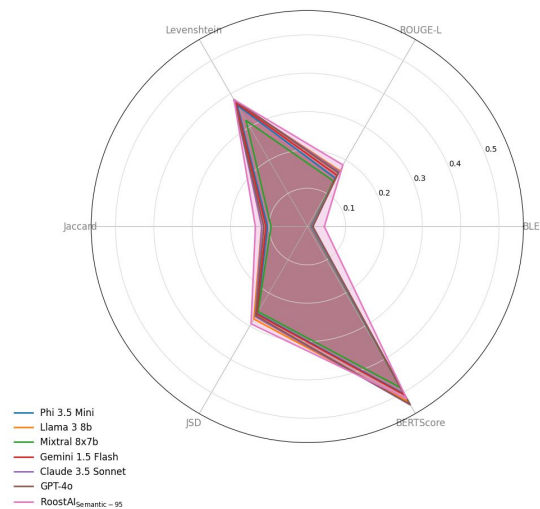
Multiple Systems Performance Across NLP Metrics



Multiple Systems Performance Across NLP Metrics

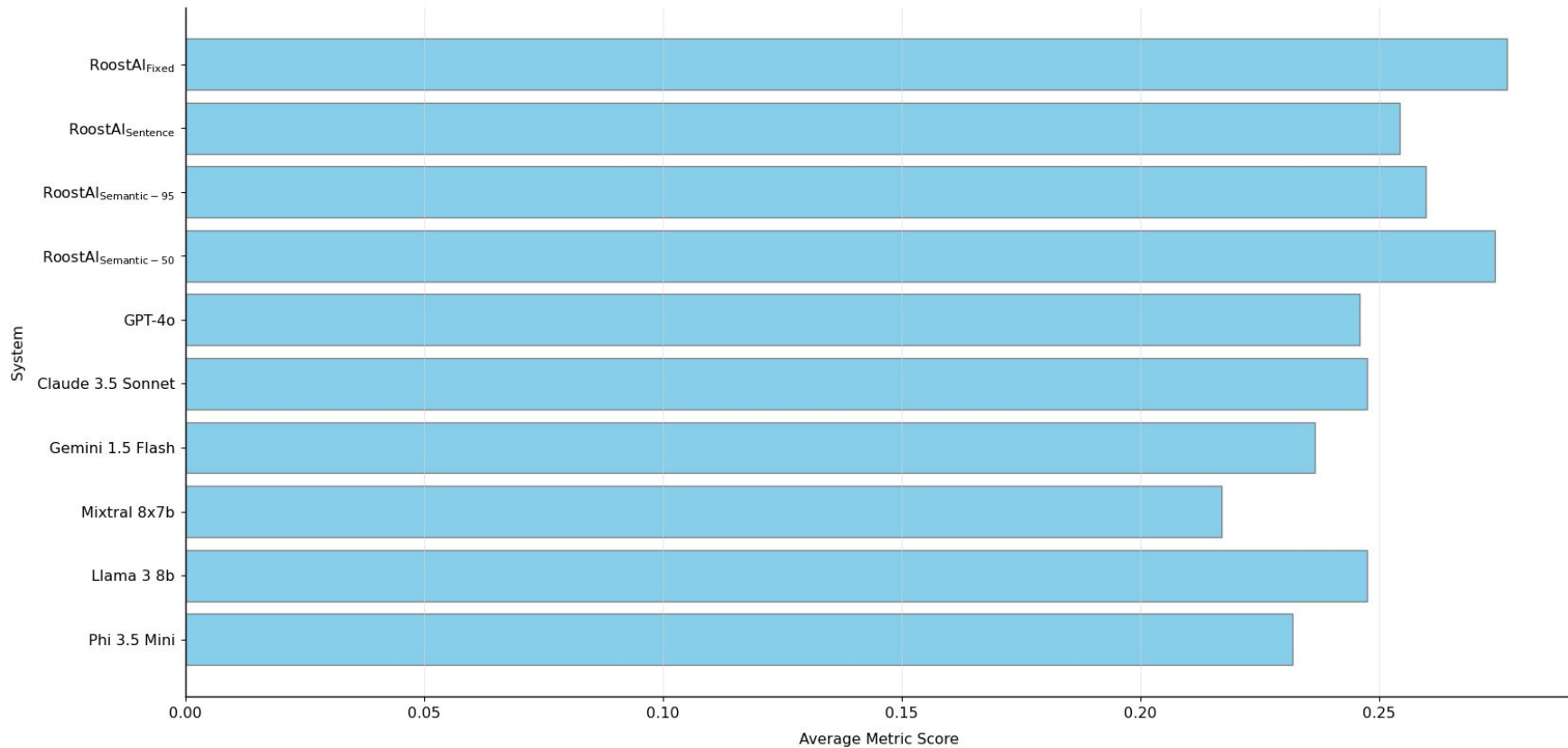


Multiple Systems Performance Across NLP Metrics



NLP Results (cont.)

Average Performance of Multiple Systems Across NLP Metrics

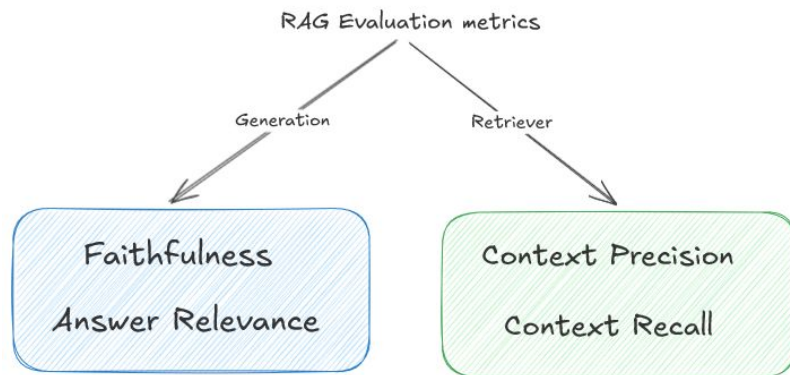


RAG Evaluation

Data: USC FAQs (Question + Reference Answer)

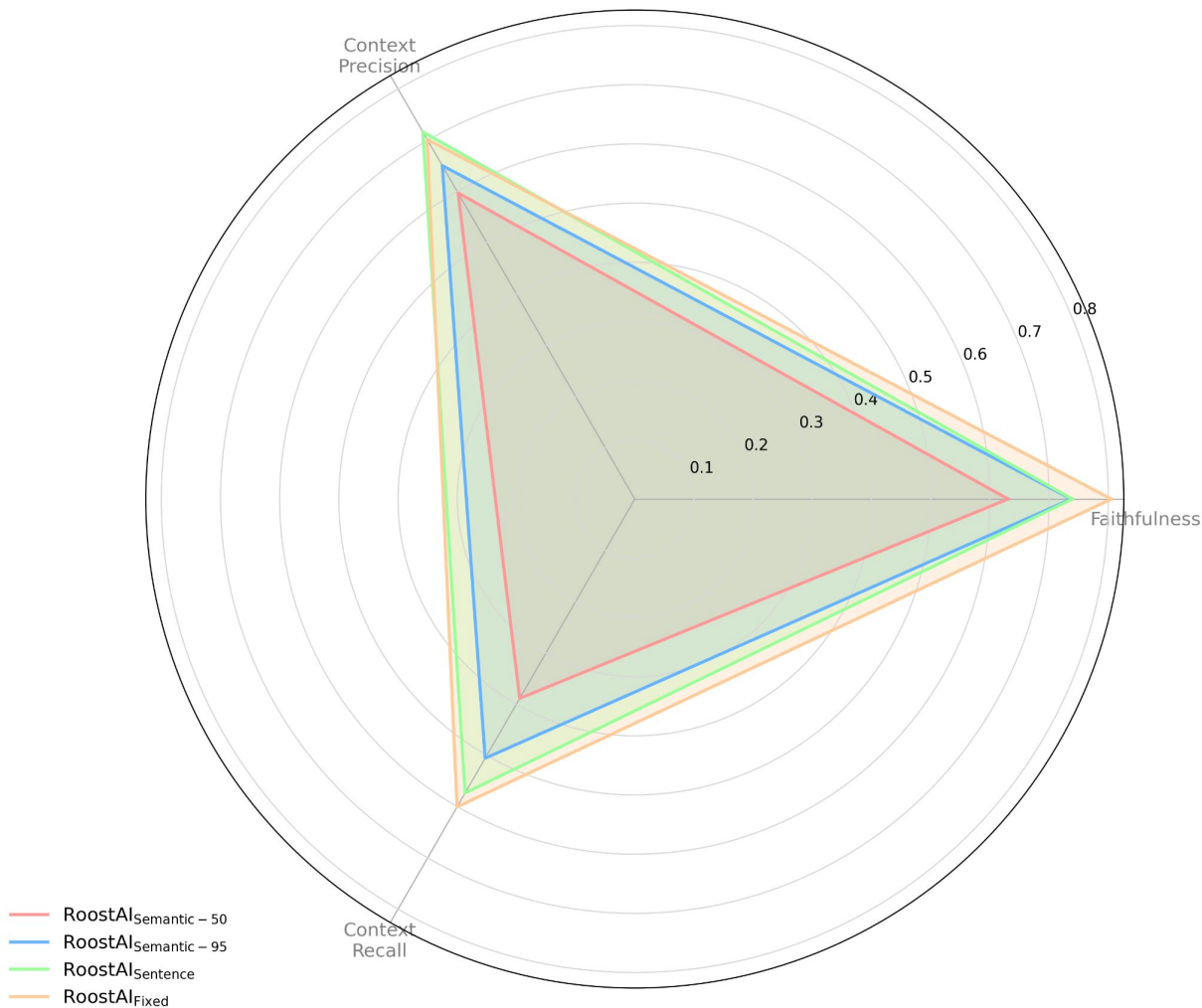
3 Metrics: Context Precision, Context Recall, and Faithfulness

Independent Variables: 4 RoostAI Systems



RAG Results

Multiple RoostAI Systems Performance Across RAGAS Metrics



Discussion

NLP Evaluation:

- RAG elevates the performance of the weakest LLM to outperform the best LLM in all metrics
- Highlights the impact of providing relevant context to LLMs

RAG Evaluation:

- Fixed-token chunking and Sentence-splitting chunking clearly outperform both versions Semantic chunking
- Highlights a cost-effective chunking method for our RAG use case



DEMONSTRATION



Broader Impact of *RoostAI*

- **Impact:**

- A centralized resource for USC's diverse community
- Adaptable blueprint for other universities

- **Limitations:**

- Some queries remain unanswered due to gaps in the knowledge base
- Minor stylistic differences from official USC documentation

- **Future work:**

- Expand dataset
- Conduct a large-scale user study



Thank You!

