

GraphRAG and Knowledge Integration

Week 8: From Vector Search to Knowledge Graphs

PhD Course in Agentic Artificial Intelligence

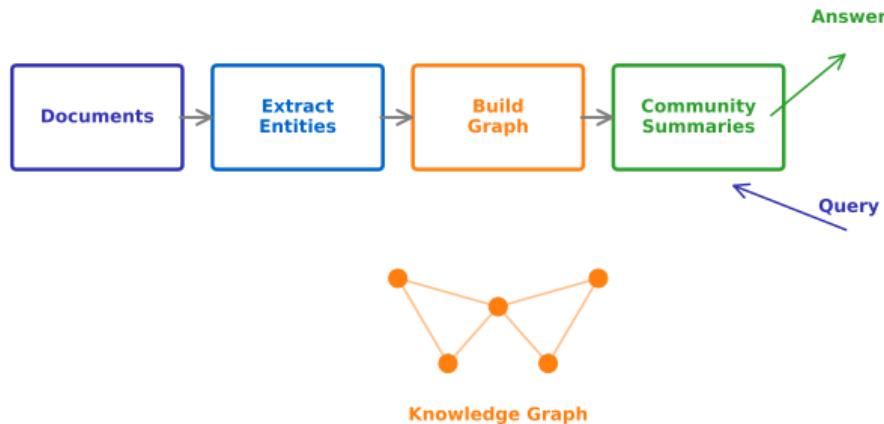
Bloom's Taxonomy Levels

- **Remember:** Define knowledge graphs, entities, relations, communities
- **Understand:** Explain how GraphRAG enhances retrieval with structure
- **Apply:** Build a knowledge graph from unstructured text
- **Analyze:** Compare vector-only vs graph-enhanced retrieval
- **Evaluate:** Assess when GraphRAG provides value over standard RAG
- **Create:** Design a hybrid retrieval system for a domain

end of lecture, you will understand structured knowledge integration in agents.

By

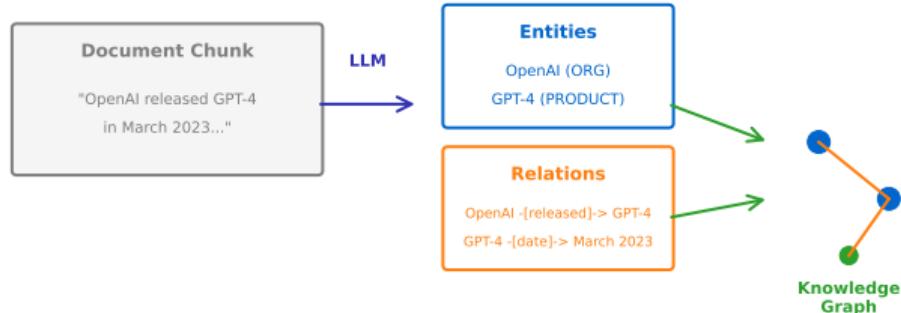
GraphRAG: Knowledge Graph + RAG



builds structure from documents before retrieval.

Graph

Entity Extraction Pipeline



Extraction Stats:

Entities: ~50/chunk

Relations: ~30/chunk

extract entities and relations to build the knowledge graph.

LLMs

Hierarchical Community Detection



Community Summaries (LLM-generated)

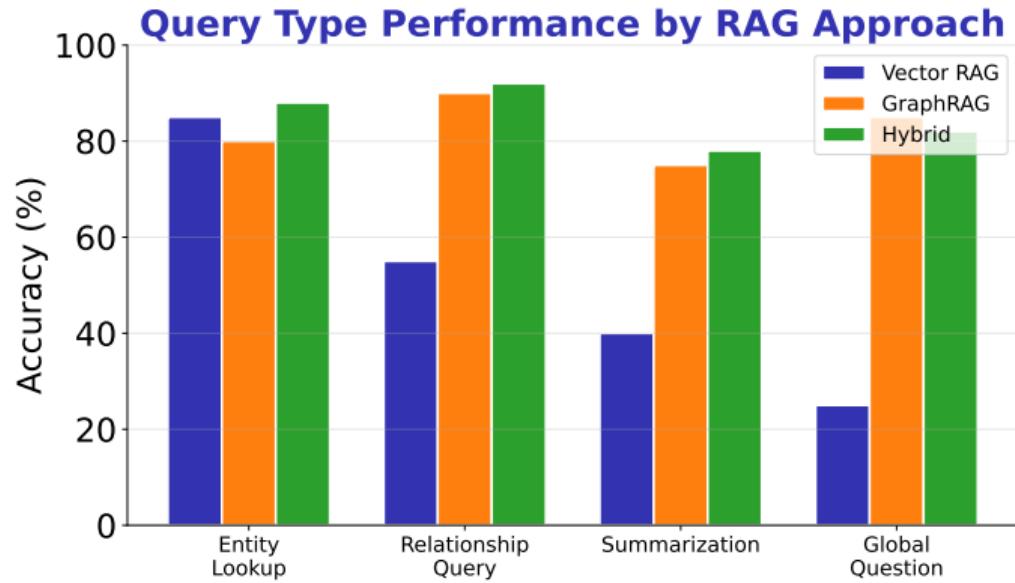
C1: "AI models..."

C2: "Training data..."

C3: "Applications..."

algorithm clusters related entities for hierarchical summarization.

Query Routing by Type



query types benefit from different retrieval strategies.

Differ

This Week

- Edge et al. (2024). "From Local to Global: A GraphRAG Approach." Microsoft Research
- Pan et al. (2024). "Unifying Large Language Models and Knowledge Graphs." arXiv:2306.08302

Supplementary

- Besta et al. (2024). "Graph of Thoughts." arXiv:2308.09687
- Gutierrez et al. (2024). "HippoRAG." arXiv:2405.14831

on the Microsoft GraphRAG paper for implementation details.

Key Concepts

- **GraphRAG:** Combine knowledge graphs with vector retrieval
- **Entity Extraction:** LLM-based NER and relation extraction
- **Communities:** Hierarchical clustering for global queries
- **Hybrid Retrieval:** Route queries to appropriate strategy

Next Week

- Hallucination Prevention and Verification

= Structure + Vectors for comprehensive retrieval.