

# GraphRAG and Knowledge Integration

Week 8: From Vector Search to Knowledge Graphs

PhD Course in Agentic Artificial Intelligence

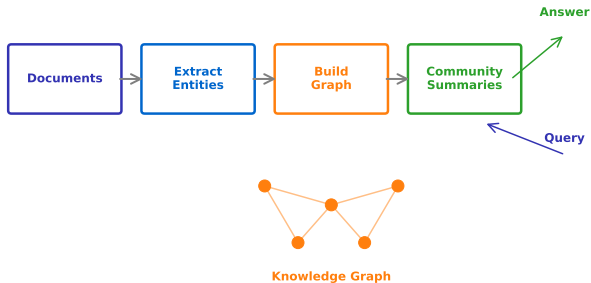
## Bloom's Taxonomy Levels

- **Remember:** Define knowledge graphs, entities (objects), relations (links), communities (clusters)
- **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

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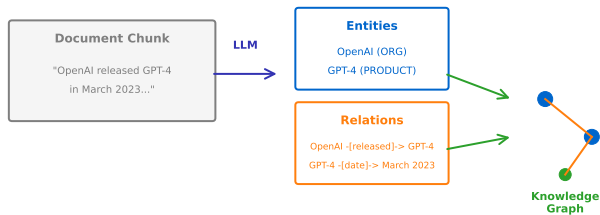
By the end of lecture, you will understand structured knowledge integration in agents.

## GraphRAG: Knowledge Graph + RAG



builds structure from documents before retrieval.

## Entity Extraction Pipeline



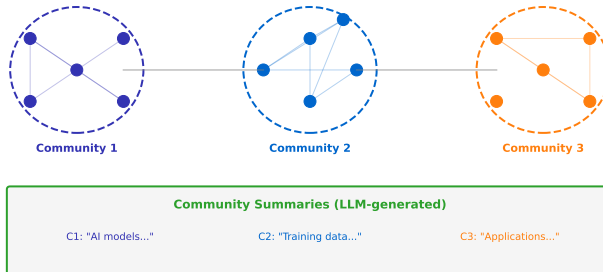
### Extraction Stats:

Entities: ~50/chunk

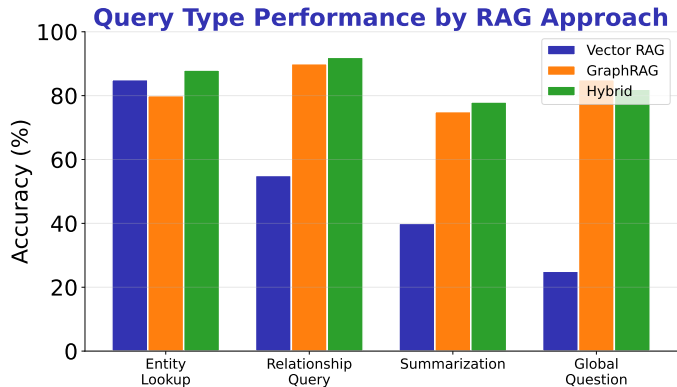
Relations: ~30/chunk

extract entities and relations to build the knowledge graph.

## Hierarchical Community Detection



algorithm (graph clustering method) clusters entities for hierarchical summarization.



query types benefit from different retrieval strategies.

## 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

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on the Microsoft GraphRAG paper for implementation details.

Focus

## Key Concepts

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

## Next Week

- Hallucination Prevention and Verification

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= Structure + Vectors for comprehensive retrieval.