Introduction to RAG & Fine-Tuning

Building Smarter AI with Your Own Data

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GAIN Dialogue Series
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Outline

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The Problem with Generic AI

LLMs Don't Know Your Data

- GPT doesn't know Ghana's 2021 census results
- Doesn't understand your company's data
- No access to your research papers

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- Doesn't understand "Ashanti Region"
- Doesn't know "GLSS" surveys
- Missing Ghana-specific terminology

Hallucinations

- Makes up statistics
- Sounds plausible but wrong
- No source verification

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The Solution

Combine two powerful techniques:

- **RAG** - Retrieval-Augmented Generation
- **Fine-Tuning** - Domain Adaptation

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What is RAG?

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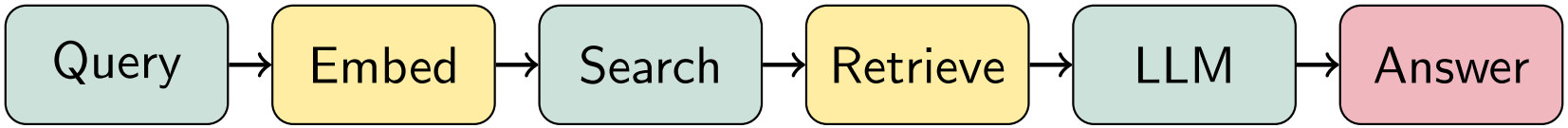

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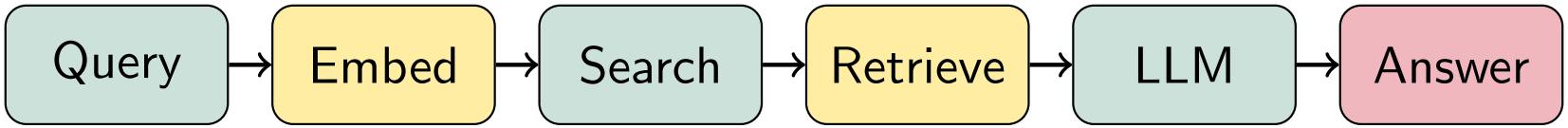

Grounded	No Hallucinations	Citable	Updatable
Answers backed by real documents	Can't make up facts	Shows sources	Add new data easily

Outline

What is Fine-Tuning?

Definition

Fine-Tuning = Train an existing model on your data to improve domain performance.

Before Fine-Tuning

Query: "Kumasi region population"

- ✗ Retrieves wrong documents
- ✗ Doesn't know Kumasi = Ashanti
- ✗ Generic keyword matching

After Fine-Tuning

Query: "Kumasi region population"

- ✓ Returns Ashanti Region: 5.4M
- ✓ Learned Ghana terminology
- ✓ Semantic understanding

Today: Fine-Tuning all-MiniLM-L6-v2

Teaching: "Kumasi" → "Ashanti", "GLSS" → "Living Standards"

Outline

RAG + Fine-Tuning = Better Together

RAG Alone	Fine-Tuning Alone	Combined
✓ Grounds responses	✓ Domain understanding	✓ Accurate retrieval
✗ May miss relevant docs	✗ No data access	✓ Domain-aware
		✓ Grounded answers

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Our Architecture

Query → **Fine-Tuned Embeddings** → **ChromaDB** → **Census Docs** → **OpenAI GPT** → **Answer + Sources**

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✓
Better Retrieval for Ghana Terms

✓
Cited Sources with Every Answer

2 hrs
Build & Deploy Today

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What We'll Build Today

Workshop Modules

1. **Data Preparation** *20 min*
   Load & chunk Ghana census data
2. **RAG Pipeline** *25 min*
   Embeddings + ChromaDB + GPT
3. **Fine-Tuning** *25 min*
   Train on Ghana-specific pairs
4. **Streamlit Deploy** *25 min*
   Build & launch chat interface

Tech Stack

- **Python** 3.10+
- **all-MiniLM-L6-v2**
- **Sentence-Transformers**
- **ChromaDB**
- **OpenAI GPT-4o-mini**
- **Streamlit**

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Data Source

Ghana Statistical Service
2021 Population & Housing Census

Outline

Let's Build!

Ghana Census Q&A Agent

with RAG + Fine-Tuned Embeddings