

**Name: Zeeshan Haider**

**Roll number Su92-bsaim-f23-065**

**Section: 4B**

**Task: 11**

**Subject: PAI (lab)**

**Submitted to: Sir Rasikh**

### **1. Lang Chain**

**Definition:**  
Lang Chain is a framework that simplifies building applications with Large Language Models (LLMs) by chaining together components like memory, external tools, and data retrieval.

**Key Features:**

* **Chains:** Sequences of operations involving LLMs or utilities.
* **Agents:** LLMs that choose actions dynamically based on context.
* **Memory:** Maintains state across interactions.
* **Document Loaders & Indexes:** For integrating external data sources.

**Use Cases:**

* Context-aware chatbots
* Automated content workflows
* Custom data Q&A systems

**Difference:**  
Lang Chain orchestrates multi-step workflows, unlike basic LLM calls.

### **2. RAG (Retrieval-Augmented Generation)**

**Definition:**   
RAG integrates document retrieval with LLM generation to produce fact-based responses.

**How It Works:**

1. Retrieves relevant data (e.g., via VectorDB).
2. Feeds it with the query into an LLM for a grounded answer.

**Use Cases:**

* Reducing hallucinations
* Legal, academic, or medical Q&A

**Difference:**   
RAG augments LLMs with real-time data retrieval, unlike standard LLMs.

### **3. LLMs (Large Language Models)**

**Definition:**  
LLMs are AI models trained on massive datasets to generate or understand natural language (e.g., GPT-4, LLaMA).

**Key Features:**

* General-purpose language tasks
* Zero- and few-shot learning

**Limitations:**

* Knowledge cutoff
* Potential hallucinations

**Difference:**  
LLMs are foundational; frameworks like Lang Chain and RAG build around them.

### **4. FAISS (Facebook AI Similarity Search)**

**Definition:**  
A high-performance library for similarity search over dense vectors.

**Key Features:**

* Fast nearest-neighbor search
* GPU support

**Use Cases:**

* Vector retrieval in RAG
* Recommender systems

**Difference:**   
FAISS is a search tool—not a full database—with no persistence layer.

### **5. Vectors (Embeddings)**

**Definition:**  
High-dimensional numerical representations that capture the meaning of text/images.

**Example:**  
“King” - “Man” + “Woman” ≈ “Queen”

**Use Cases:**

* Semantic search
* Clustering
* Input to ML models

**Difference:**  
Vectors are raw data; FAISS and VectorDBs use them for search and storage.

### **6. Vector DB (Vector Database)**

**Definition:**   
Databases optimized for storing and querying vector embeddings (e.g., Pinecone, Weaviate).

**Key Features:**

* Fast vector search (indexing)
* Persistent storage
* Metadata support

**Use Cases:**

* RAG retrieval step
* Long-term memory for AI systems

**Difference:**  
Vector DB = FAISS + storage, scaling, and metadata handling.

### **7. Generative AI**

**Definition:**  
A field of AI focused on generating new content—text, images, audio, etc.

**Examples:**

* Text: GPT-4
* Images: DALL·E, Stable Diffusion
* Multimodal: Models combining text, image, etc.

**Difference:**   
An umbrella term that includes LLMs, GANs, and more.

### **8. GANs (Generative Adversarial Networks)**

**Definition:**  
A generative architecture where two networks (generator and discriminator) compete to produce realistic outputs.

**Use Cases:**

* Realistic image synthesis
* Synthetic data for ML

**Difference:**  
GANs focus on visual/sensory data, while LLMs focus on language.

### **Summary of Key Differences**

| **Term** | **Primary Role** | **Comparison** |
| --- | --- | --- |
| **LangChain** | Workflow framework for LLMs | Integrates tools like RAG, memory, and VectorDB |
| **RAG** | Retrieval + Generation pipeline | Enhances LLMs with external data retrieval |
| **LLMs** | Core language models | Foundation for many NLP tasks |
| **FAISS** | Fast vector similarity search | No persistence; optimized search |
| **Vector** | Embedding of semantic content | Fundamental unit for similarity and ML tasks |
| **Vector DB** | Storage/query system for vectors | Adds persistence, metadata, and scaling to FAISS |
| **Generative AI** | Content creation using AI | Includes LLMs, GANs, and other generative models |
| **GANs** | Synthetic data generation | Visual data focus; a subset of Generative AI |