SUPERIOR UNIVERSITY

Programming for Artificial Intelligence – Lab

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1. LangChain:

Definition: LangChain is a framework for developing applications powered by large language models (LLMs). It facilitates the creation of complex workflows where LLMs are combined with other external tools like APIs, databases, or custom code to perform multi-step tasks.

Key Points:

- **It allows chaining different components (LLMs, databases, APIs, etc.) to perform complex tasks.**
- **Helps integrate context, data retrieval, and output generation seamlessly in applications.**
- **Often used for building interactive applications like chatbots, knowledge-based systems, and more.**

2. RAG (Retrieval-Augmented Generation):

Definition: RAG is a model architecture that enhances a language model's ability to generate responses by incorporating information retrieved from external data sources like databases or documents. It augments generation by allowing models to search and fetch relevant data before generating text.

Key Points:

- **Combines retrieval (fetching relevant data) and generation (creating text) to provide more informed responses.**
- **Often used in systems that require up-to-date or domain-specific information beyond the model's training data.**
- **Common in applications like question answering, chatbots, and personal assistants.**

3. LLMs (Large Language Models):

Definition: LLMs are deep learning models trained on vast amounts of text data. These models understand and generate human-like text, enabling them to perform tasks like text generation, translation, summarization, and more.

Key Points:

- **Examples include GPT-3, GPT-4, and BERT.**
- **Can perform various language-related tasks with minimal fine-tuning.**
- **Used in natural language processing (NLP) applications like chatbots, content creation, etc.**

4. FAISS (Facebook AI Similarity Search):

Definition: FAISS is a library developed by Facebook for efficient similarity search and clustering of high-dimensional vectors. It's optimized for finding similar data points (e.g., text or image embeddings) in large datasets.

Key Points:

- **Used for nearest neighbor search, clustering, and similarity matching.**
- **Supports both CPU and GPU-based computation to speed up searches.**
- **Typically integrated into systems dealing with large-scale datasets and embeddings.**

5. Vector:

Definition: In AI and machine learning, a vector is a mathematical representation of an object in a high-dimensional space. Vectors are used to encode features or characteristics of data, such as words, sentences, or images, in a form that models can understand and process.

Key Points:

- **Vectors capture the essence or features of data in multi-dimensional space.**
- **Widely used in tasks like text embeddings (word2vec, BERT) and image embeddings (CNNs).**
- **Used for comparing similarities, clustering, and more.**

6. VectorDB (Vector Database):

Definition: A vector database is a specialized database designed for storing, indexing, and querying high-dimensional vectors efficiently. It is typically used for tasks involving similarity search where you need to find vectors close to a query vector.

Key Points:

- **Stores vectorized data (e.g., embeddings from text, images).**
- **Allows fast similarity searches using algorithms like cosine similarity, Euclidean distance, etc.**
- **Examples include Pinecone, Weaviate, and Milvus.**

7. Generative AI:

Definition: Generative AI refers to models and systems capable of generating new content, such as text, images, music, or videos, based on learned patterns from existing data. It contrasts with traditional AI, which focuses on tasks like classification and regression.

Key Points:

- **Used for content creation tasks like writing, artwork, and music composition.**
- **Examples include GPT-3 (text generation), DALL·E (image generation), and DeepMind's WaveNet (audio generation).**
- **Can create entirely new, original content based on training data.**

8. GANs (Generative Adversarial Networks):

Definition: GANs are a type of generative model consisting of two neural networks: a generator and a discriminator. The generator creates fake data, while the discriminator evaluates whether the data is real or fake. Both networks are trained together in a way that the generator improves over time to produce increasingly realistic data.

Key Points:

- **GANs are used for generating realistic media (images, videos, etc.).**

- **The generator creates data, and the discriminator helps refine it by providing feedback.**
- **Widely used in image generation (e.g., deepfake technology, art generation) and video synthesis.**