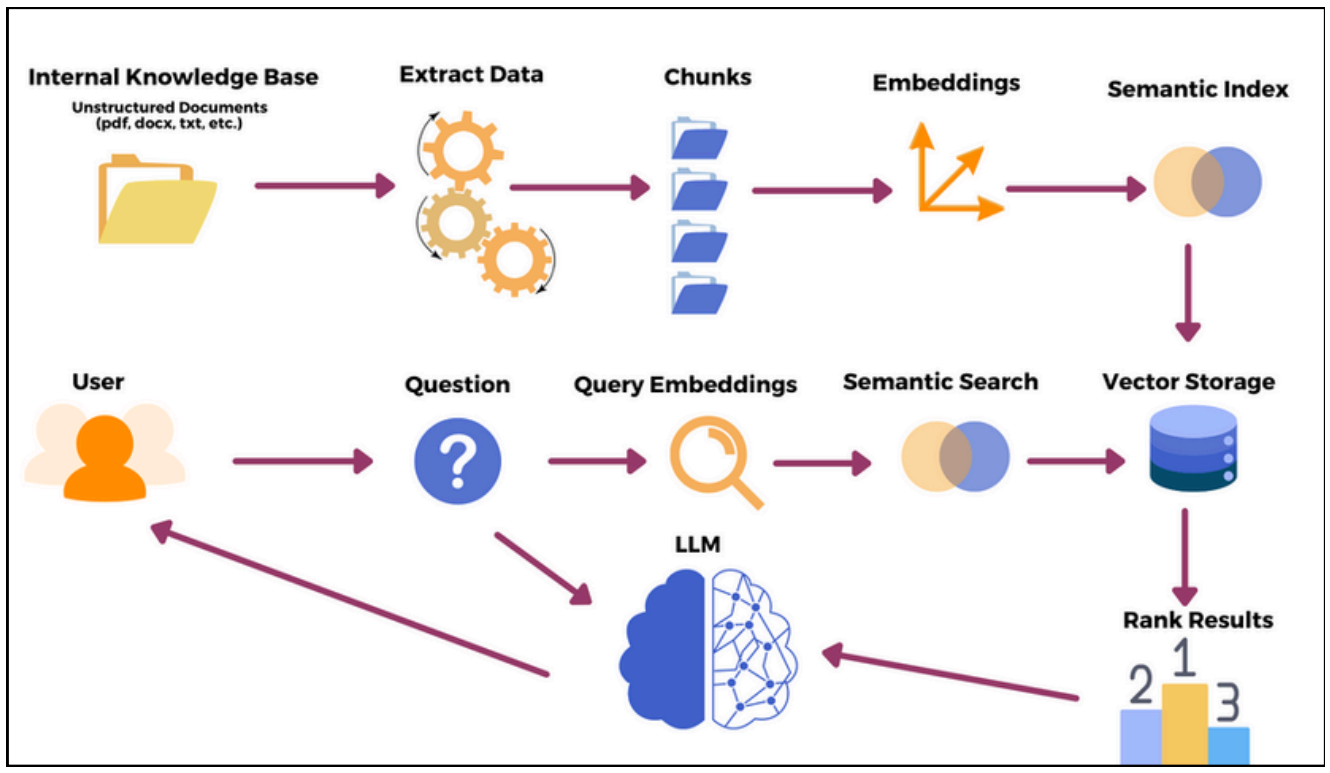
RAG Dictionary

Your A-to-Z Guide to Mastering RAG!

Bhavishya Pandit

A - Augmentation

- Enhances generative models by incorporating external knowledge.
- Ensures outputs are factually accurate and contextually rich.
- Reduces hallucinations in AI responses.
- Widely used in customer support and document analysis systems.



Credit:sych.io

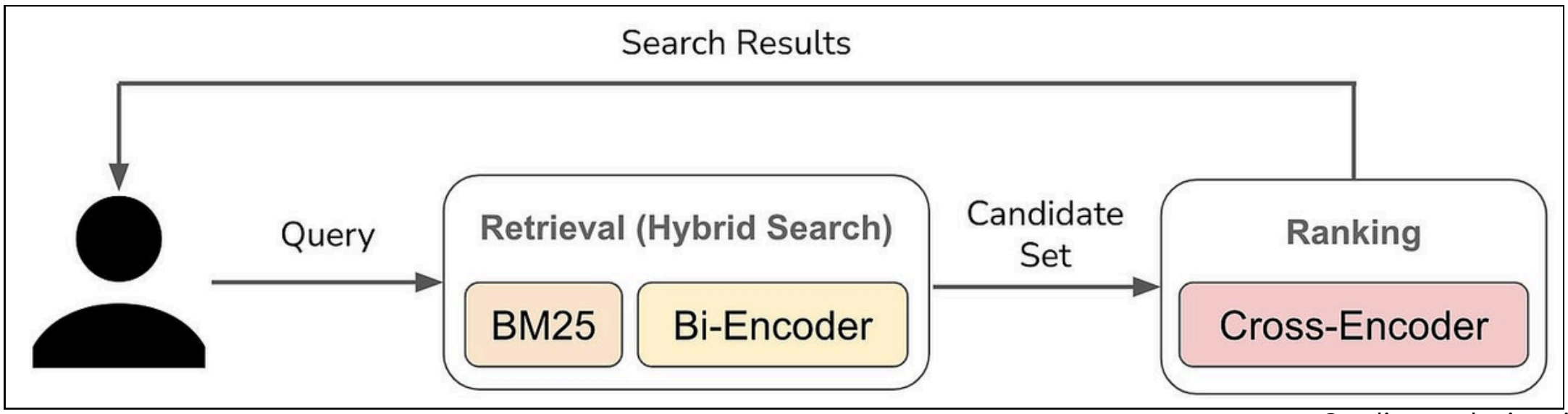
B - BM25

$$BM25 = \sum_{t \in q} \log\left[\frac{N}{df(t)}\right] \cdot \frac{(k_1 + 1) \cdot tf(t,d)}{k_1 \cdot \left[(1-b) + b \cdot \frac{dl(d)}{dl_{avg}}\right] + tf(t,d)}$$

- k_1, b – parameters
- $dl(d)$ – length of document d
- dl_{avg} – average document length

Credit:Medium .com

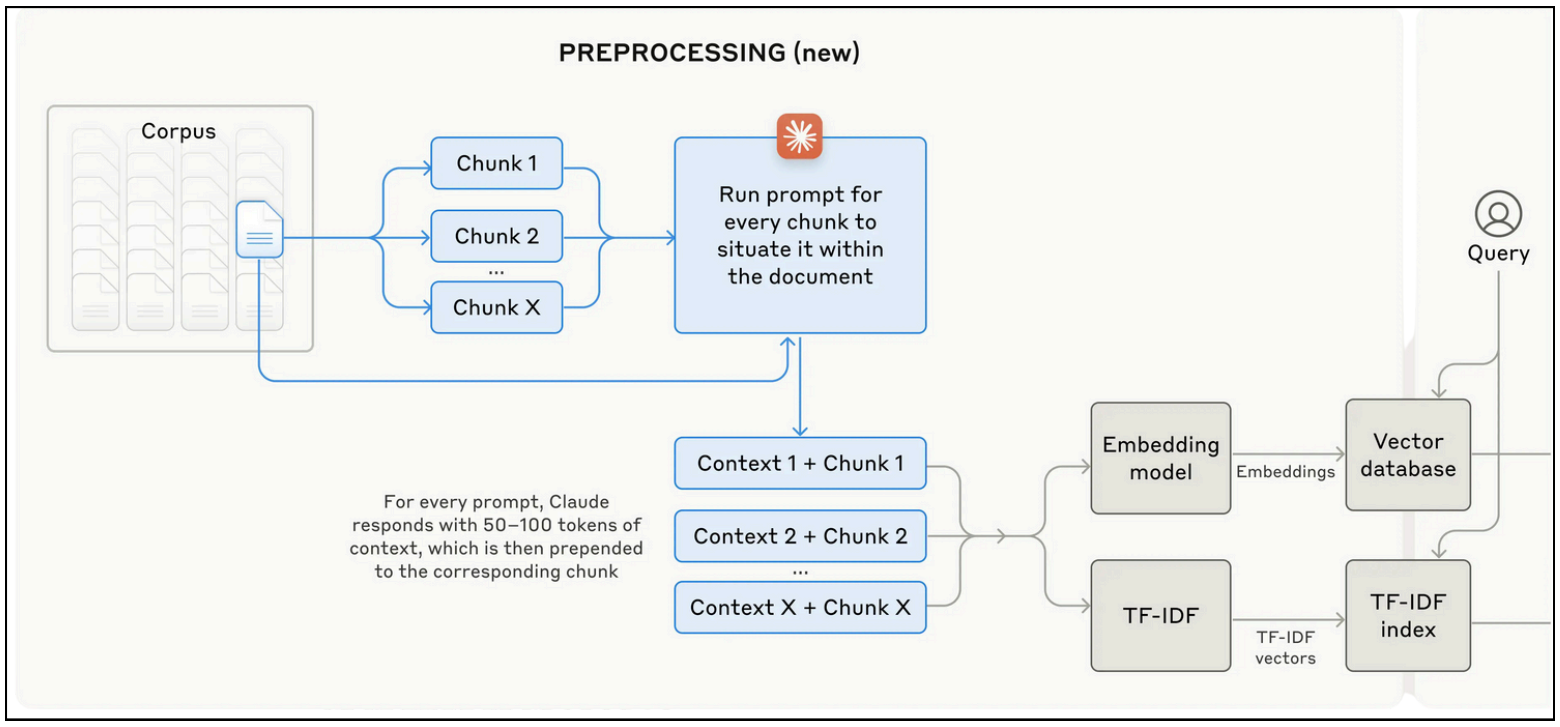
- A traditional ranking algorithm for scoring document relevance.
- Operates on the frequency and distribution of query terms in documents.
- Ideal for keyword-based sparse retrieval tasks.
- Forms the baseline for many RAG pipelines.



Credit:perplexity.ai

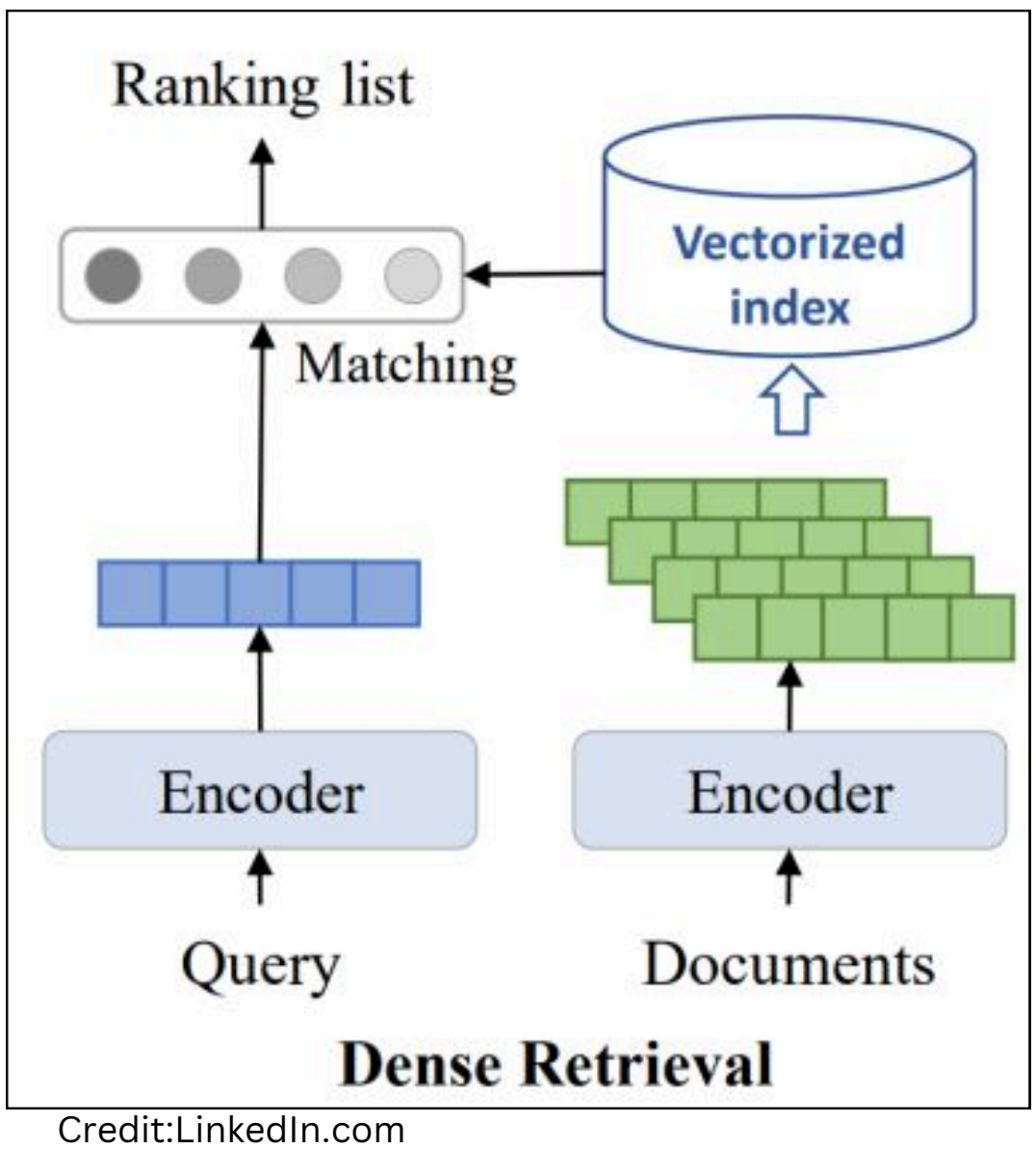
C - Contextual Embedding

- Represents words based on their surrounding text.
- Captures nuances and relationships in a sentence or document.
- Key for aligning retrieved documents with queries.
- Used in models like BERT to improve relevance.



Credit:Anthropic.com

D - Dense Retrieval

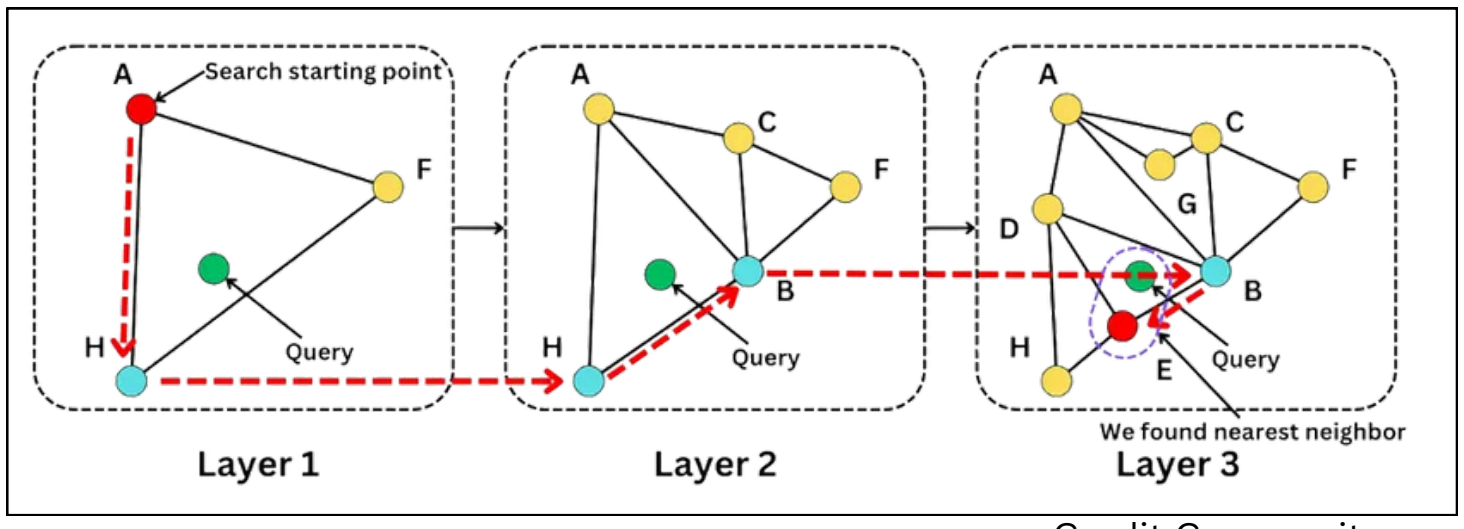


Credit:LinkedIn.com

- Uses embeddings to match queries with semantically similar documents.
- Powered by neural networks for high accuracy.
- Excels at capturing contextual relevance.
- Often paired with sparse retrieval for hybrid approaches.

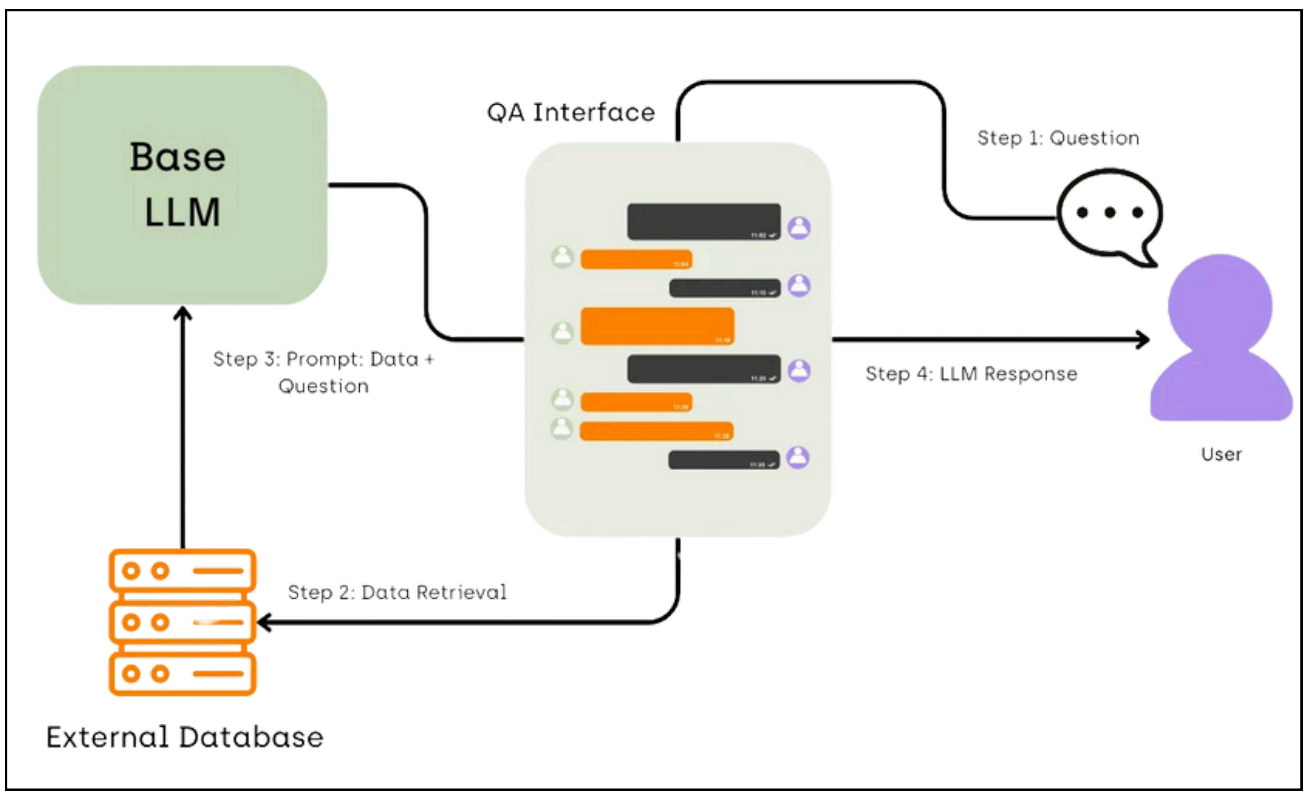
E - Embeddings

- Converts text or queries into fixed-size numerical vectors.
- Essential for comparing similarities in latent space.
- Enables dense retrieval and semantic search.
- Used in tasks like recommendation systems and RAG.



Credit:Community.aws

F - Fine-tuning

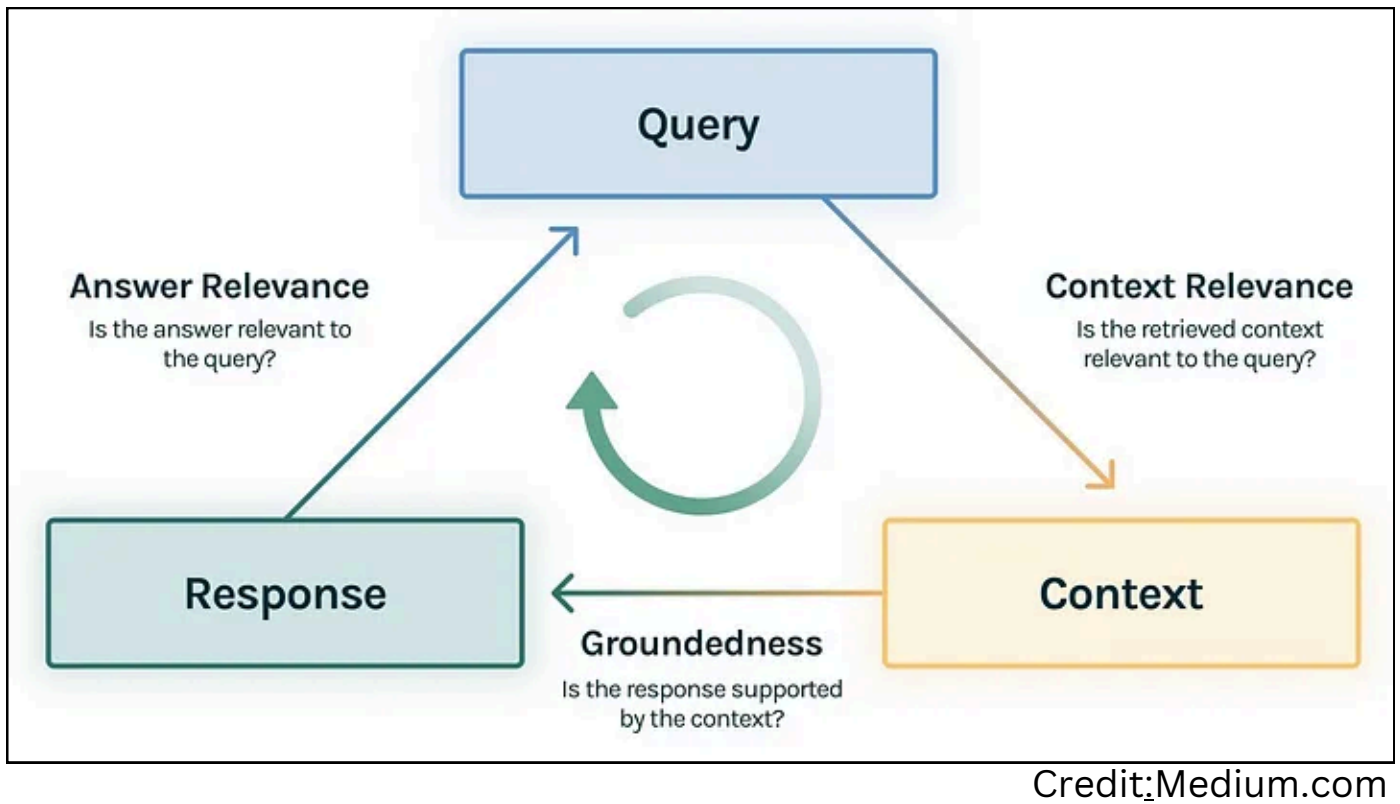


Credit:kili-technology.com

- Customizes pre-trained models for domain-specific tasks.
- Aligns retrieval and generative models for better performance.
- Increases accuracy for industry-specific use cases.
- Requires labeled data for optimal results.

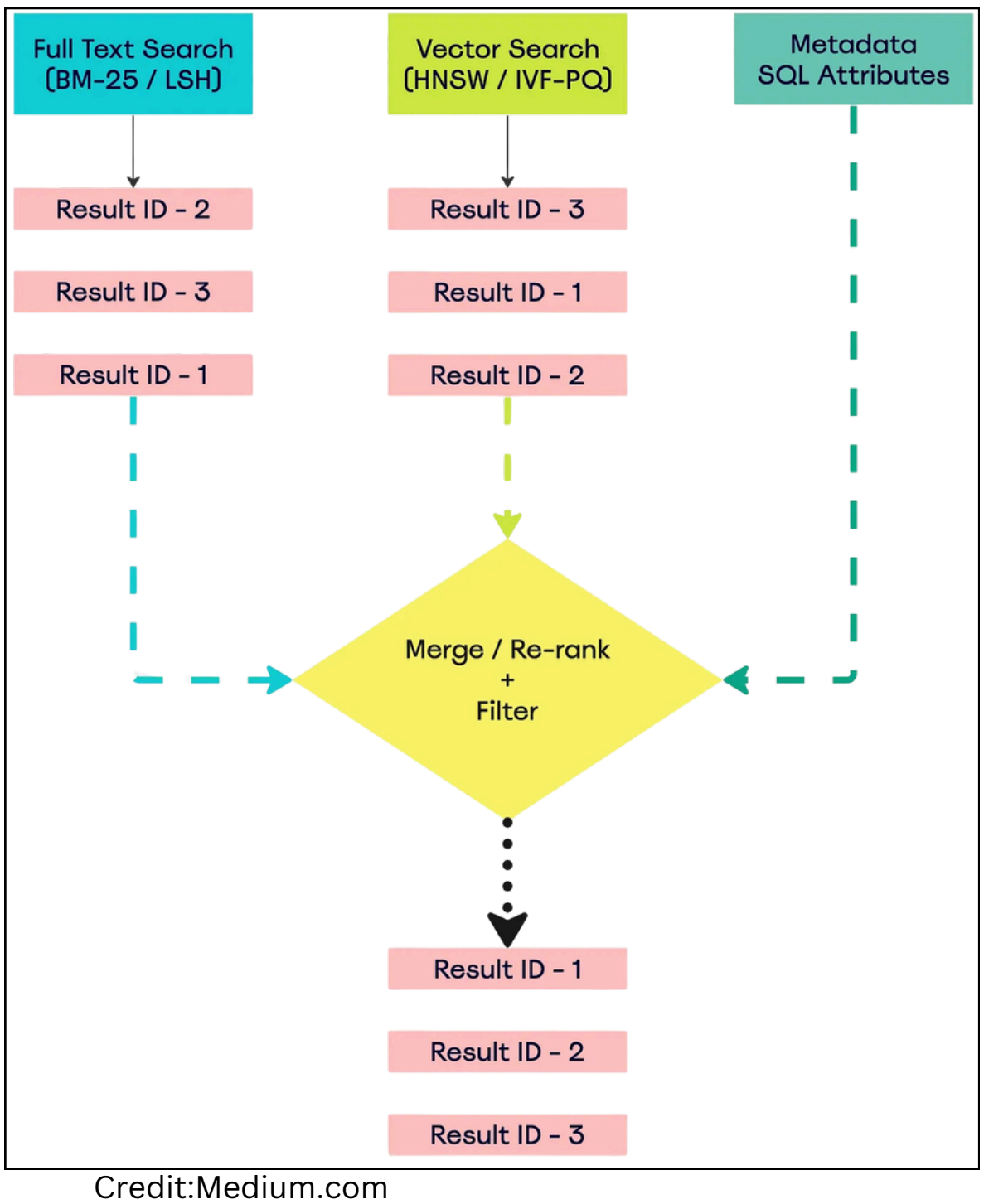
G - Grounding

- Ensures that generated outputs are supported by retrieved knowledge.
- Helps models stay factually consistent and trustworthy.
- Critical in applications like medical AI and legal tech.
- Mitigates the risk of hallucinated or false information.



Credit:Medium.com

H - Hybrid Search

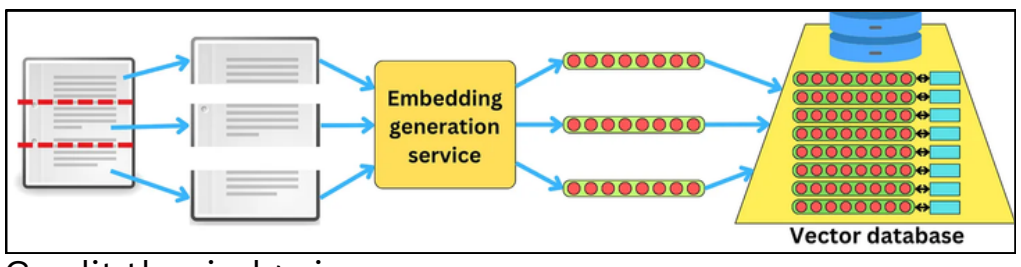


Credit:Medium.com

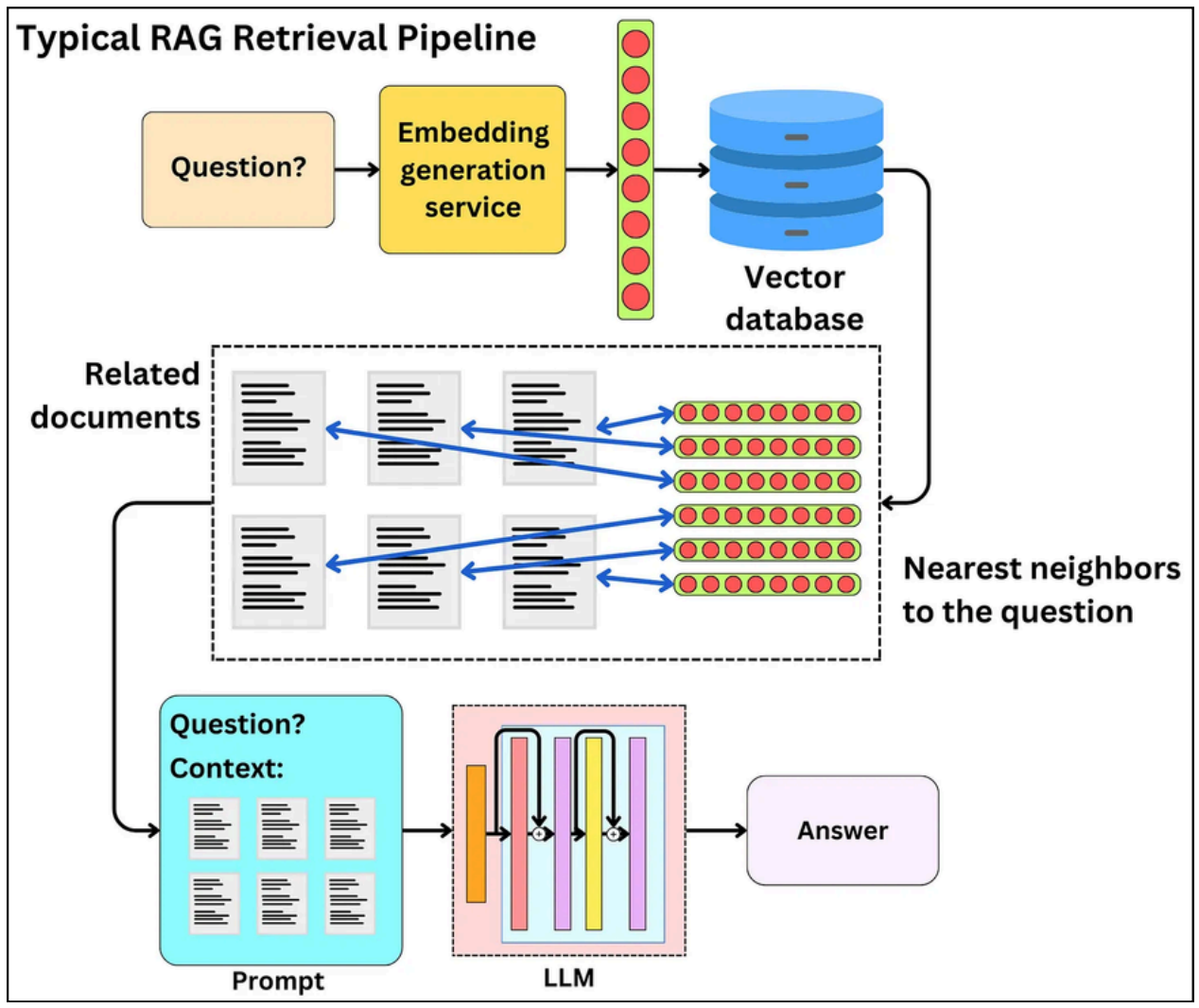
- Combines sparse (e.g., BM25) and dense (embedding-based) methods.
- Balances efficiency and accuracy for document retrieval.
- Reduces reliance on a single retrieval approach.
- Common in real-world RAG systems for scalability.

I - Indexing

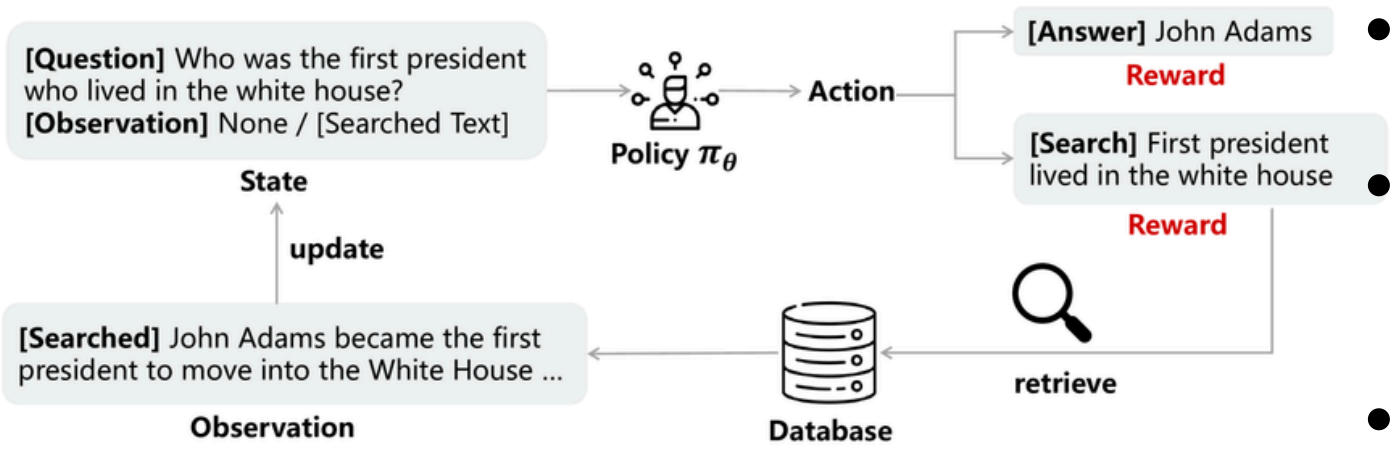
- Organizes data for quick and efficient retrieval.
- Structures documents into formats compatible with retrieval systems.
- Reduces query latency in RAG pipelines.
- Supports scalable search across large datasets.



Credit:theaiedge.io



J - Joint Learning

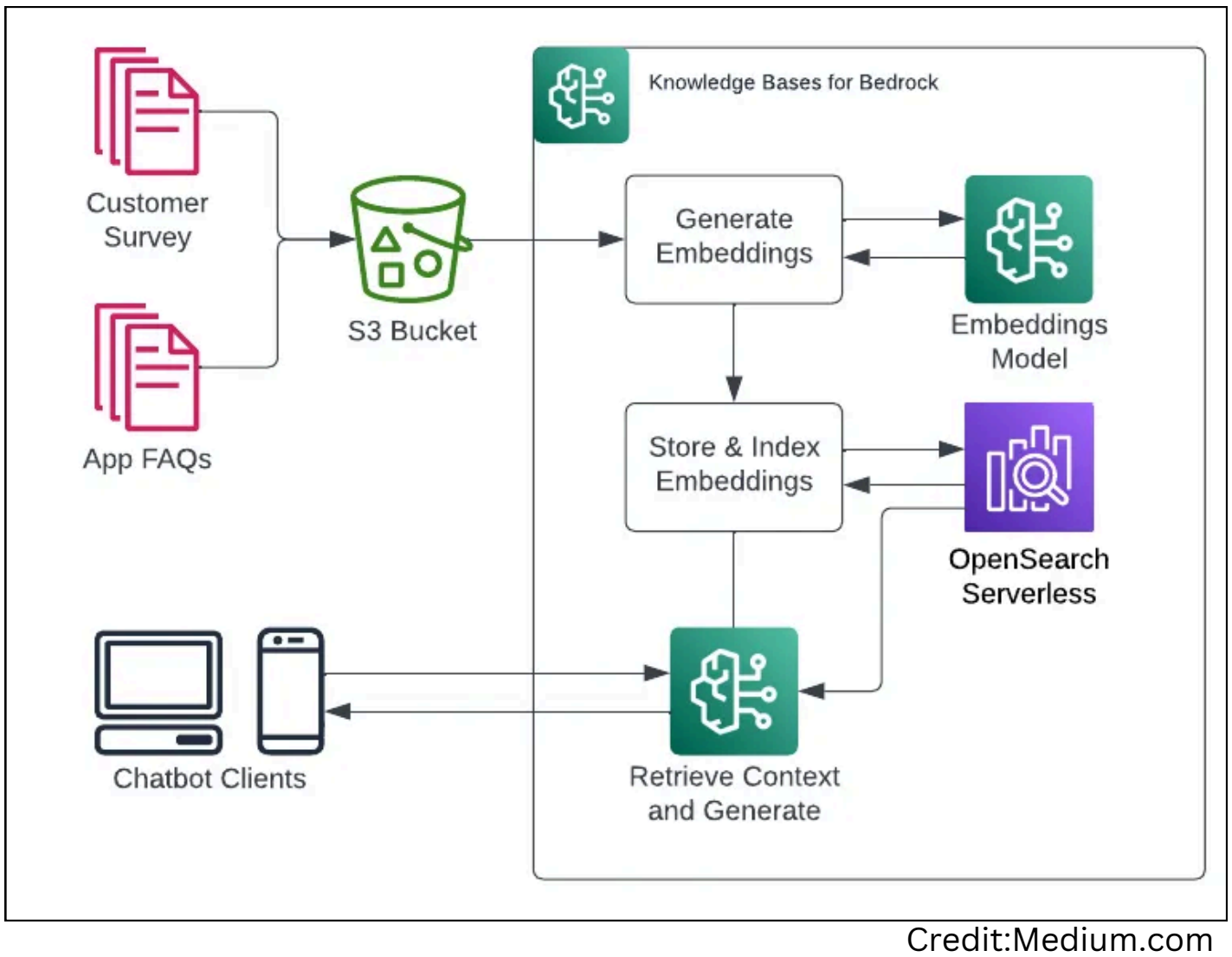


Credit:arxiv.org

- Trains retrieval and generation components simultaneously.
- Ensures better synergy between retrieved data and generated outputs.
- Reduces the need for separate fine-tuning.
- Often leads to improved overall system performance.

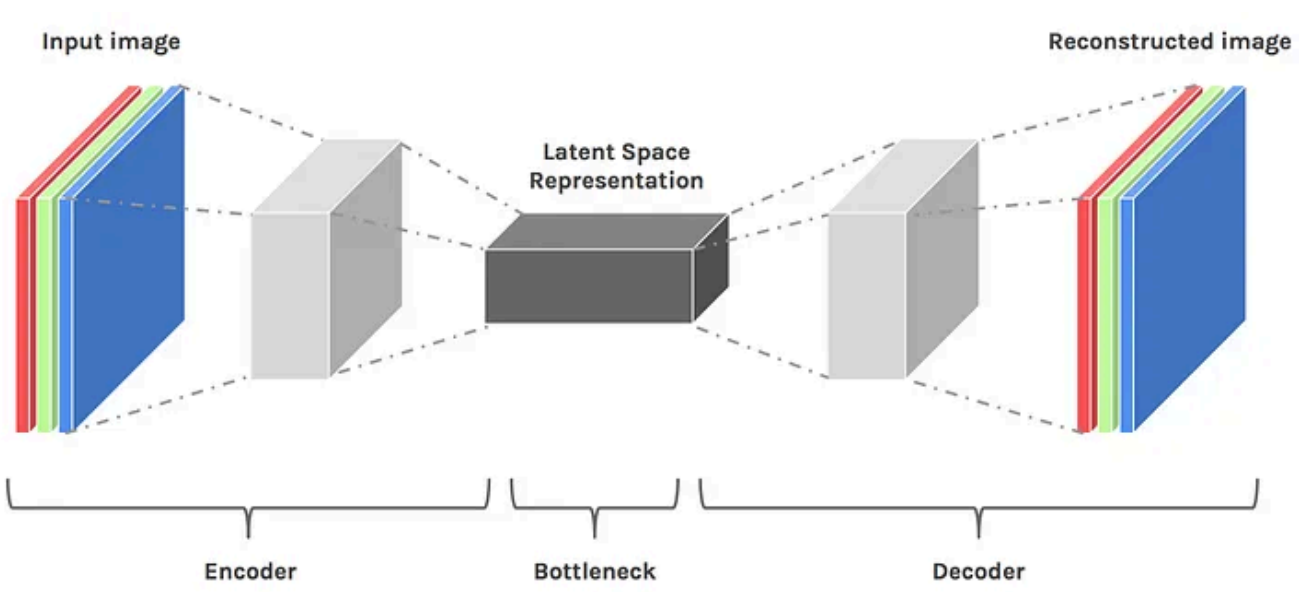
K - Knowledge Base

- A structured repository of data for retrieval purposes.
- Includes formats like databases, ontologies, and indexed documents.
- Powers fact-checking and real-time information retrieval in RAG.
- Ensures reliability and accuracy in responses.



Credit:Medium.com

L - Latent Space

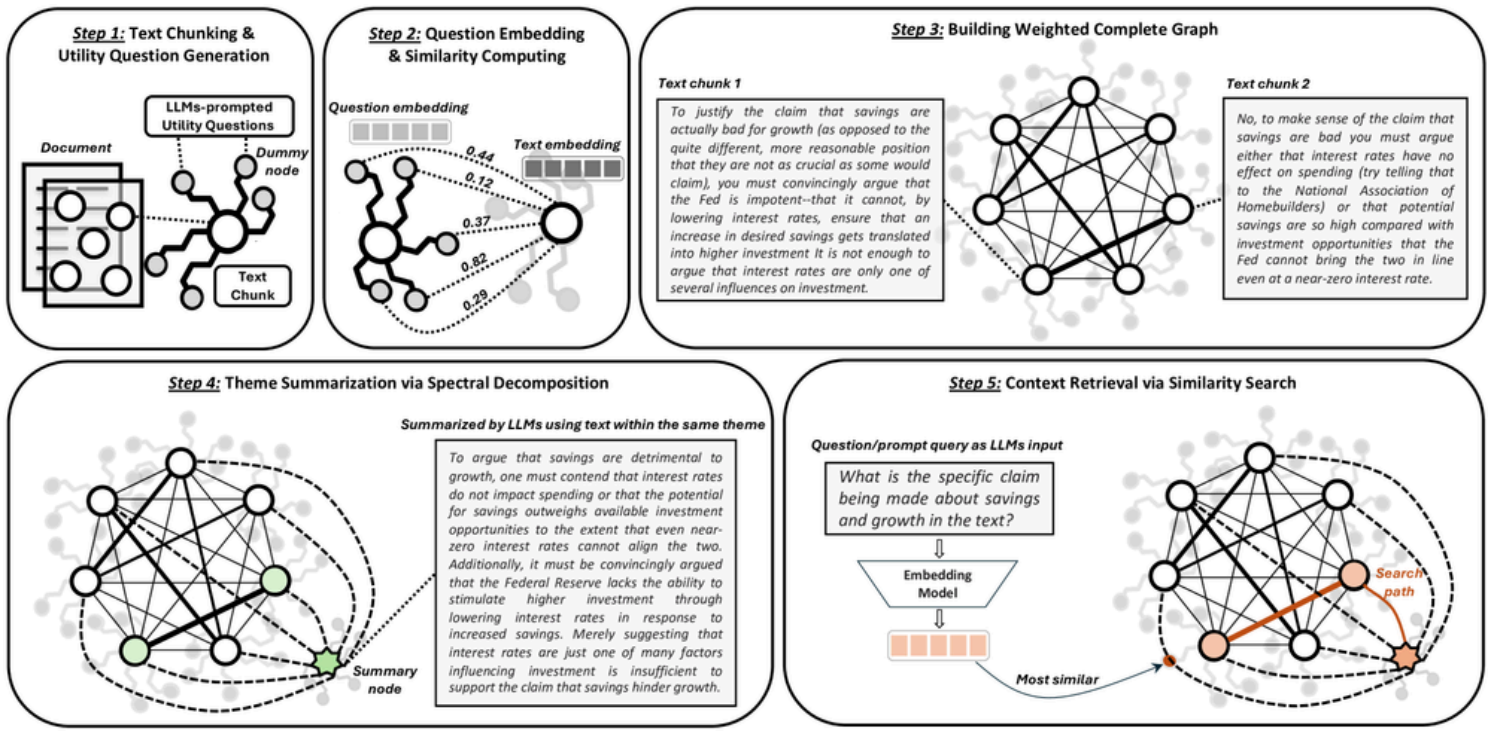


Credit:hopsworks.ai

- A high-dimensional space where embeddings are mapped.
- Enables semantic matching between queries and documents.
- Used for clustering similar concepts or topics.
- Visualized to understand model behaviors and relationships.

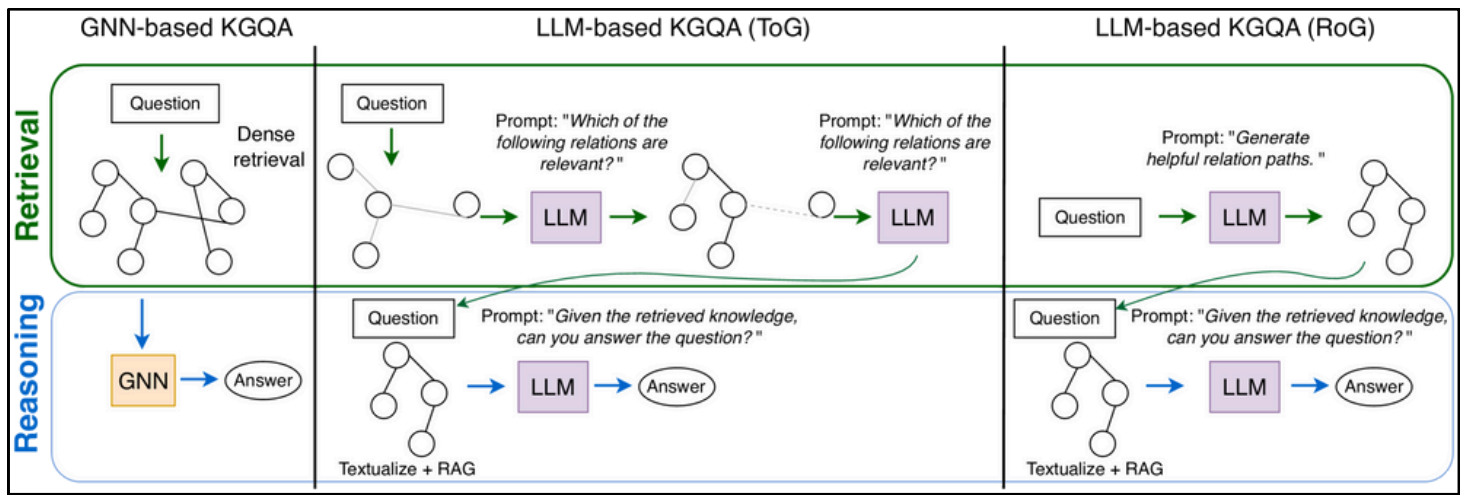
M - Memory Retrieval

- Focuses on fetching historical data or past interactions.
- Helps personalize user experiences.
- Common in chatbots and recommendation systems.
- A subset of retrieval tailored to specific past contexts.



Credit:arxiv.org

N - Neural Retrieval

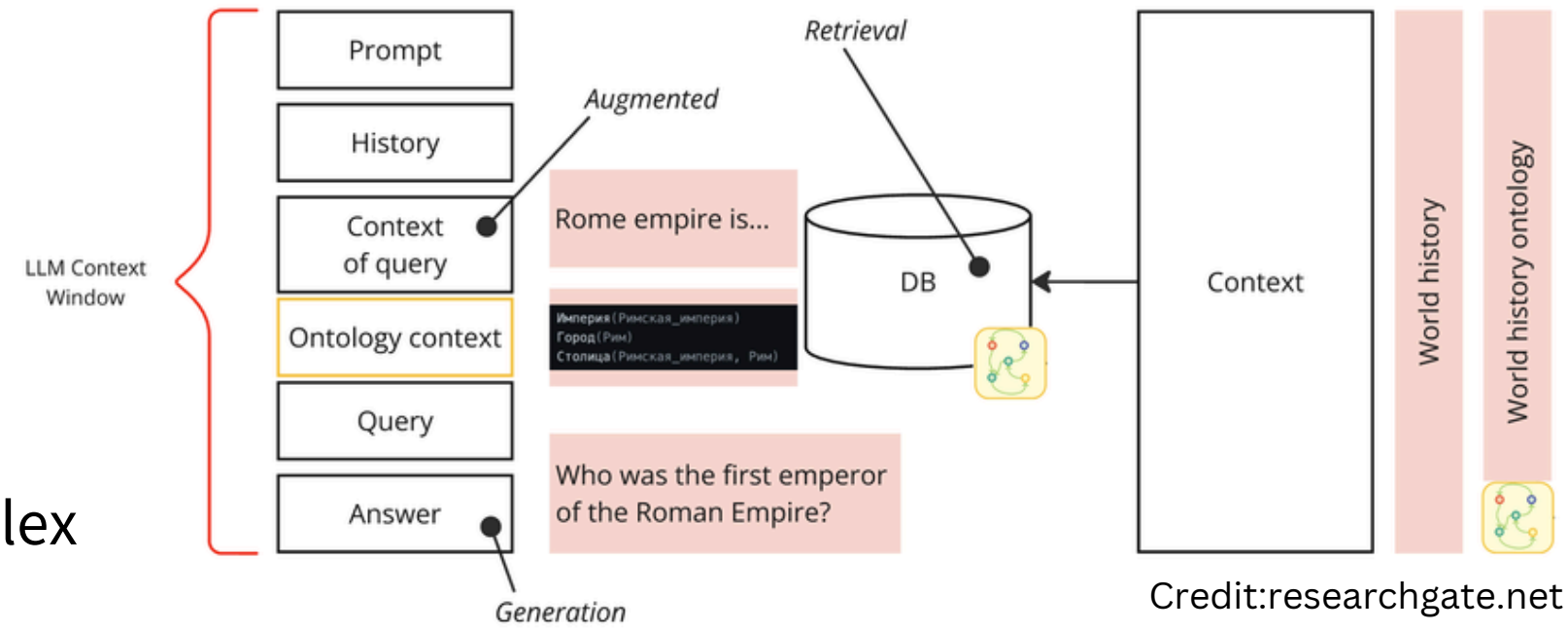


Credit:arxiv.org

- Leverages deep learning for document-query matching.
- Captures semantics beyond exact keyword matches.
- Includes models like DPR (Dense Passage Retrieval).
- Enhances relevance in large-scale document search tasks.

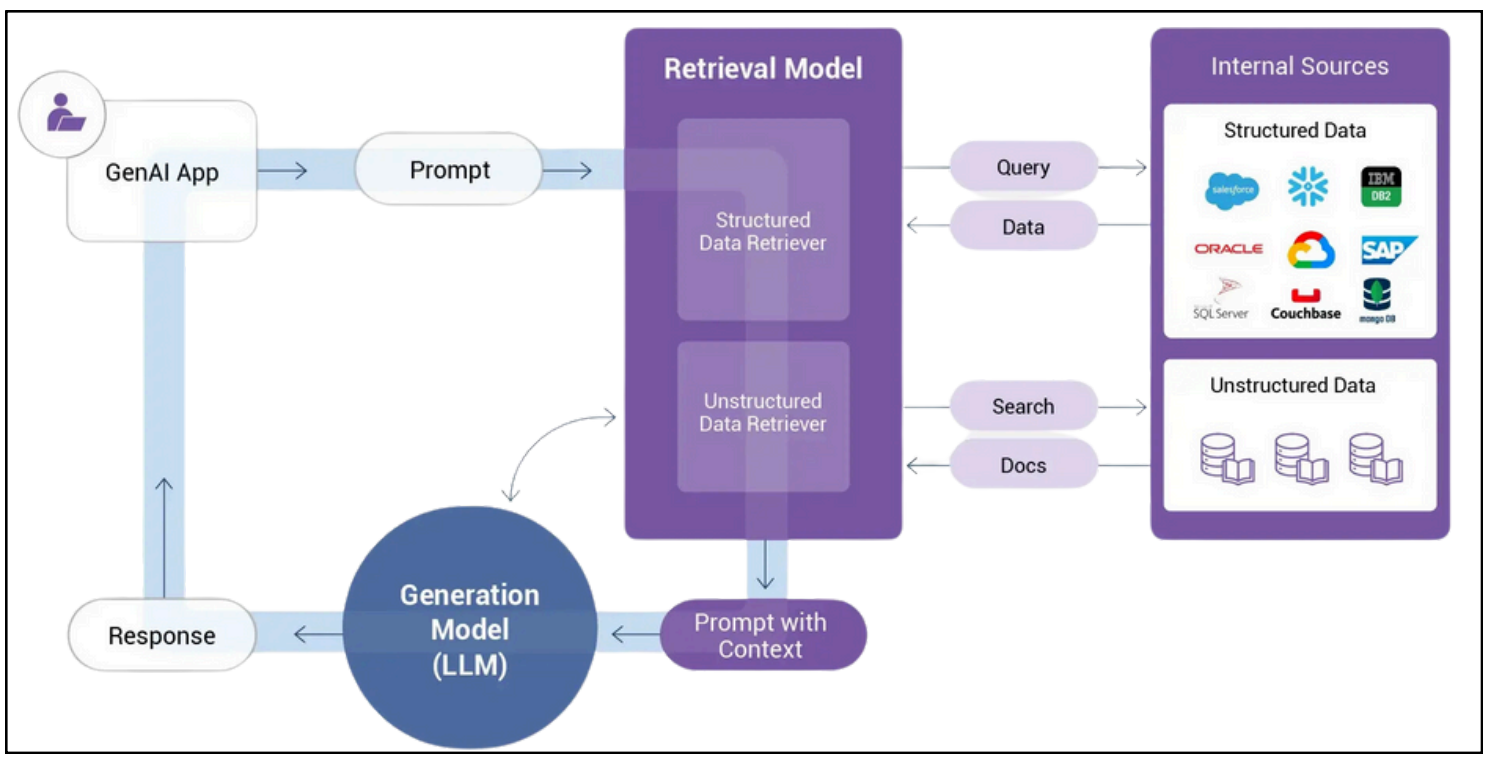
O - Ontology

- Represents structured relationships between entities.
- Used in knowledge representation and retrieval.
- Enables semantic understanding of complex concepts.
- Supports domain-specific search and reasoning.



Credit:researchgate.net

P - Prompt Engineering

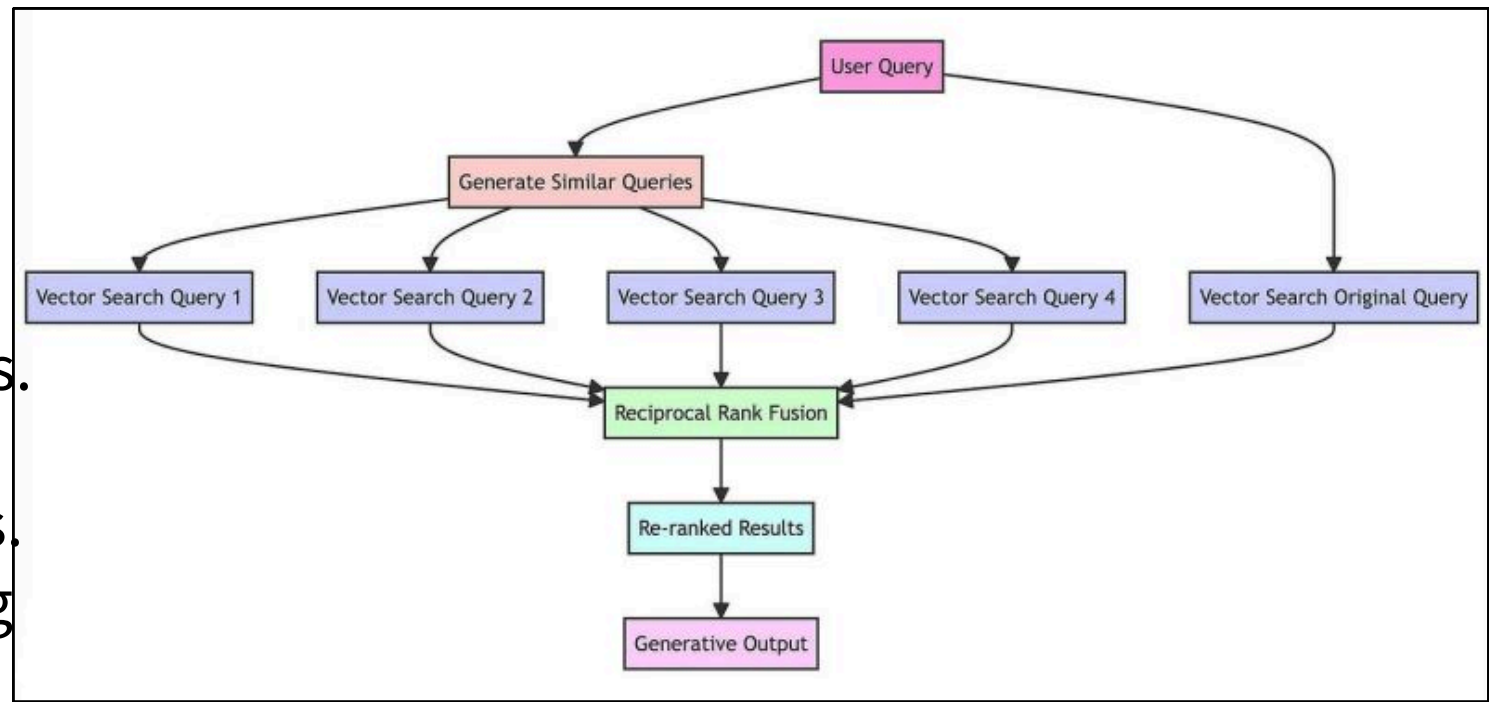


Credit:k2view.com

- Designs prompts to guide generative models effectively.
- Ensures retrieved knowledge is integrated into outputs.
- Essential for achieving task-specific responses.
- Iterative and domain-specific in application.

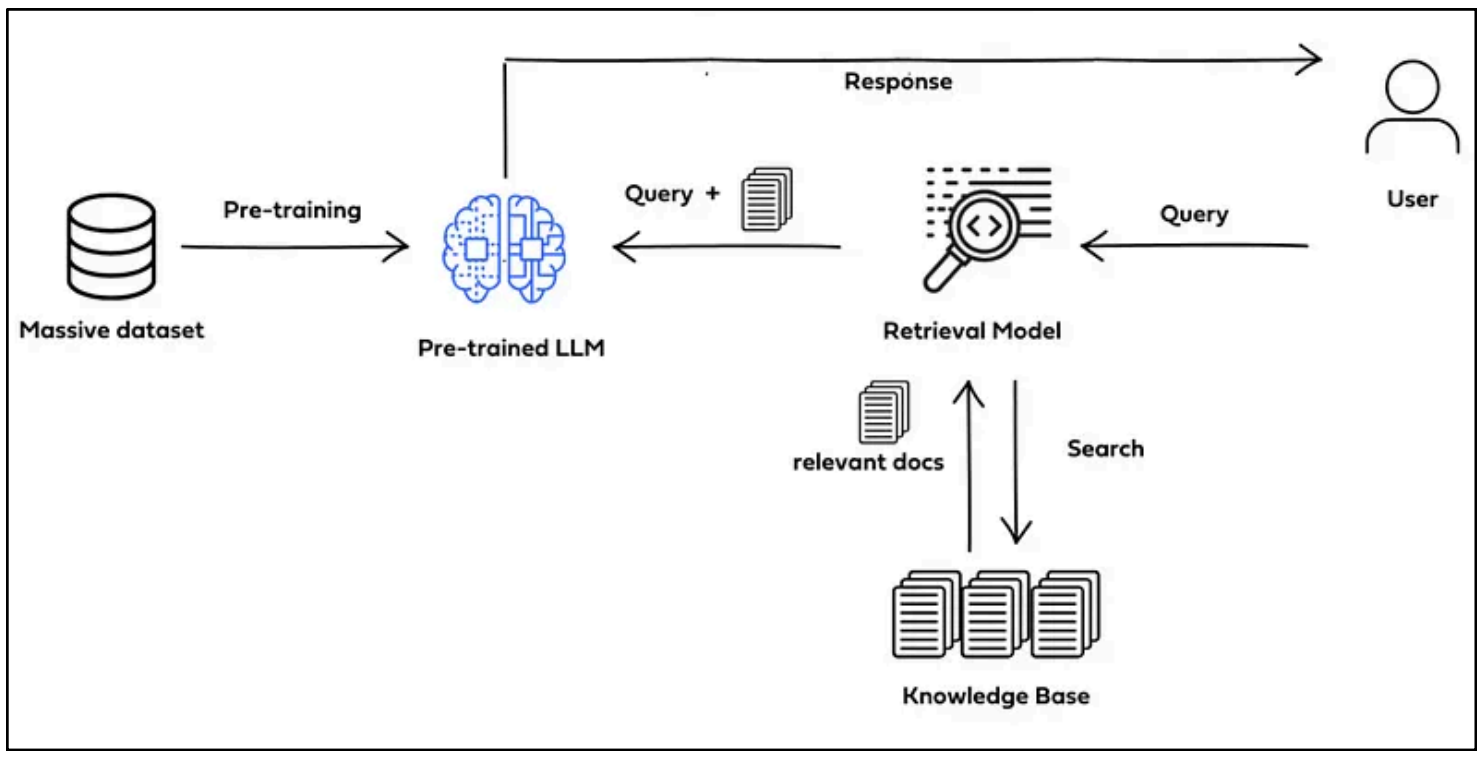
Q - Query Expansion

- Broadens the scope of search by adding related terms or synonyms.
- Improves recall in sparse and dense retrieval systems.
- Mitigates the issue of ambiguous or short queries.
- Often applied in user-facing search systems.



Credit:predli.com

R - Retrieval-Augmented Generation (RAG)

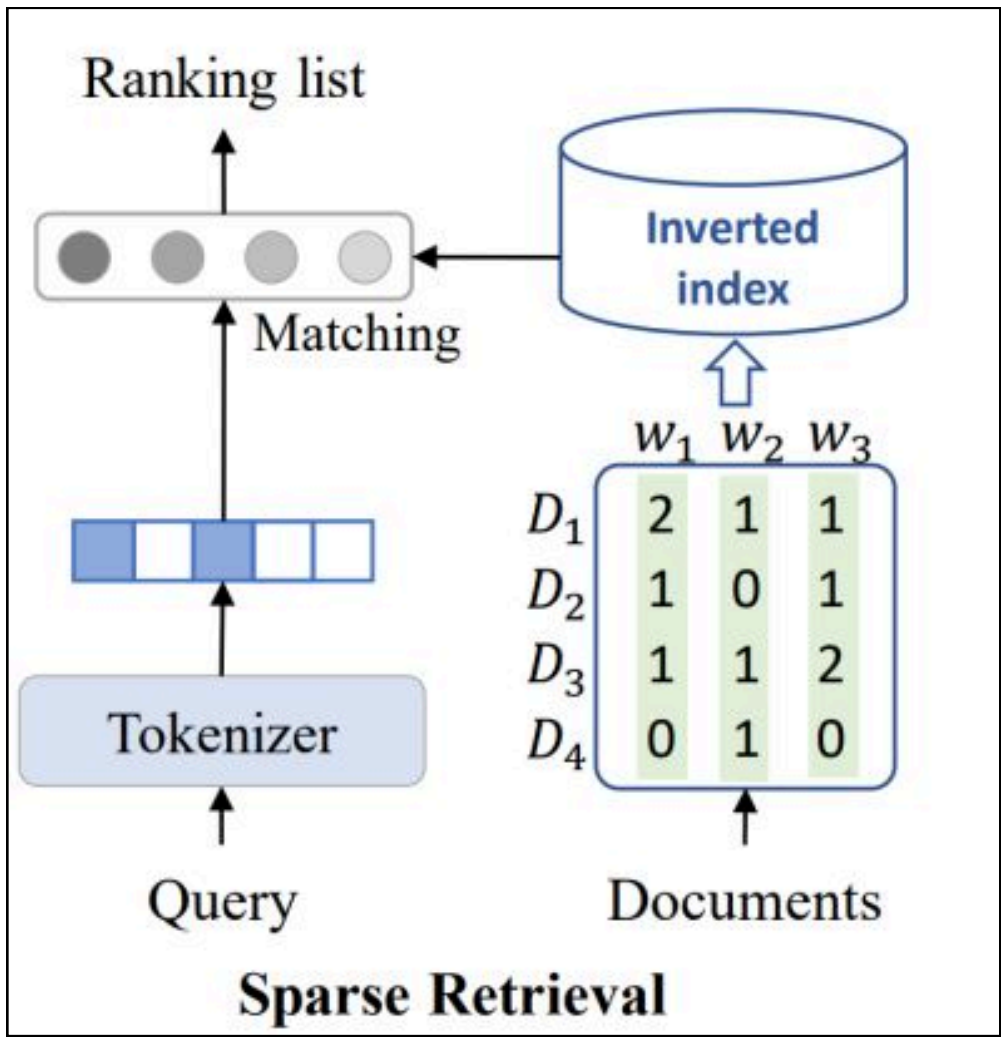


Credit:Medium.com

- Combines retrieval systems with generative models for contextual outputs.
- Minimizes hallucinations by grounding outputs in retrieved data.
- Widely used in knowledge-intensive tasks.
- Represents a hybrid approach to solving information and generation problems.

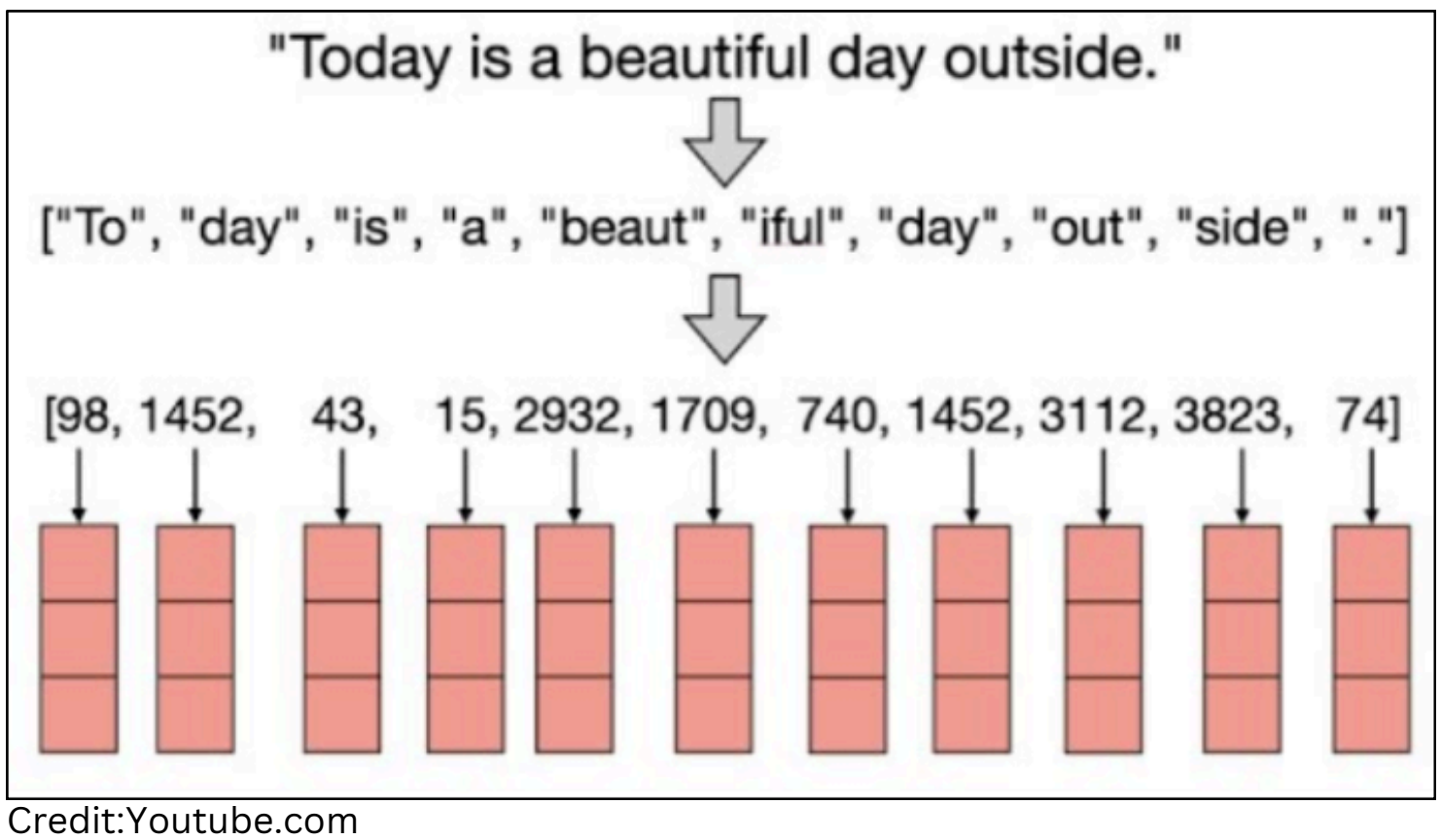
S - Sparse Retrieval

- Relies on keyword-based methods like BM25 and TF-IDF.
- Efficient and interpretable for small-scale datasets.
- Struggles with semantic or contextual understanding.
- Often augmented with dense retrieval for hybrid systems.



Credit:LinkedIn.com

T - Tokenization

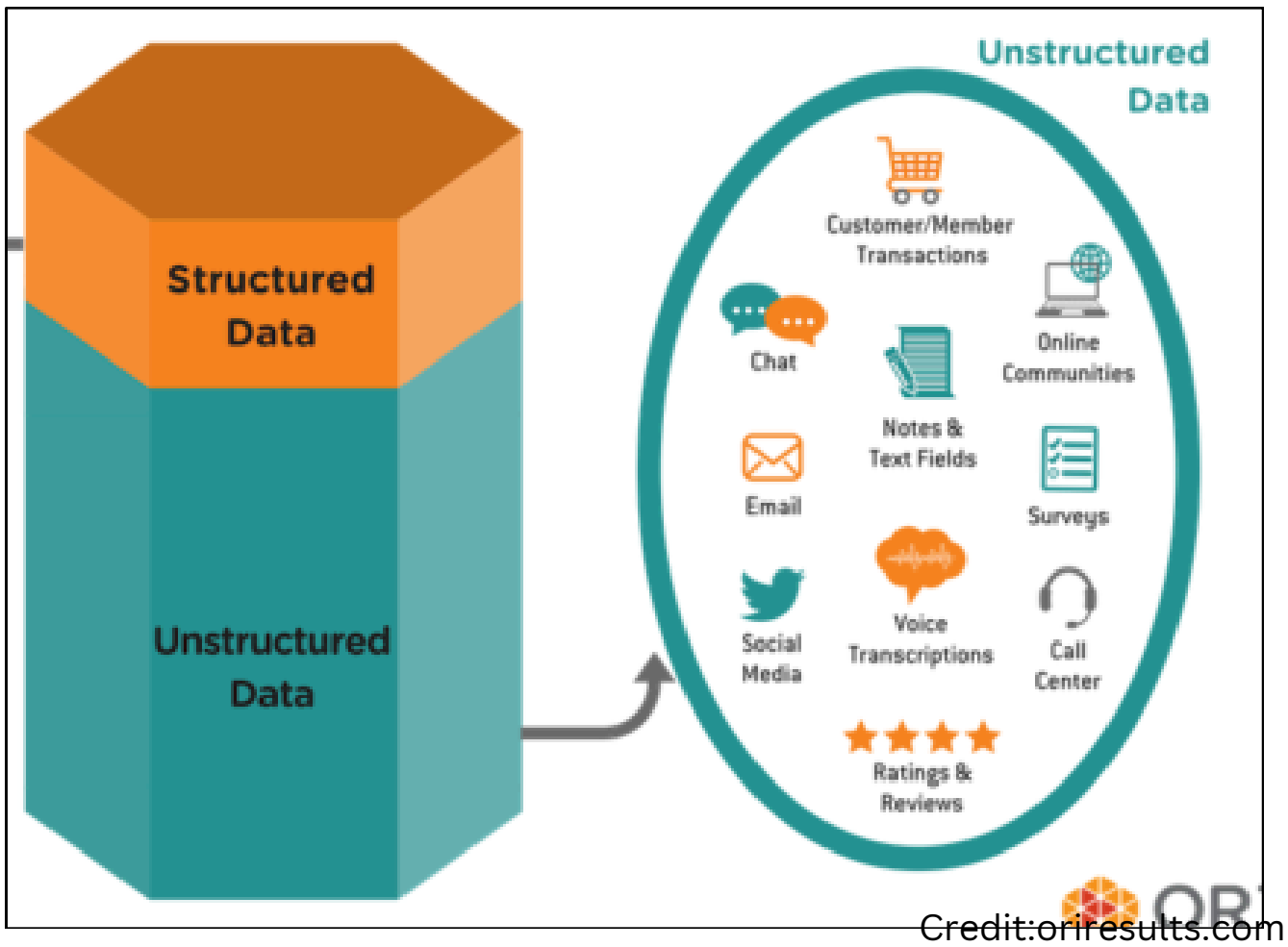


Credit:Youtube.com

- Splits text into smaller units (tokens) for processing.
- Necessary for model compatibility and efficient computation.
- Handles text variations like punctuation and capitalization.
- Used in retrieval and generation pipelines.

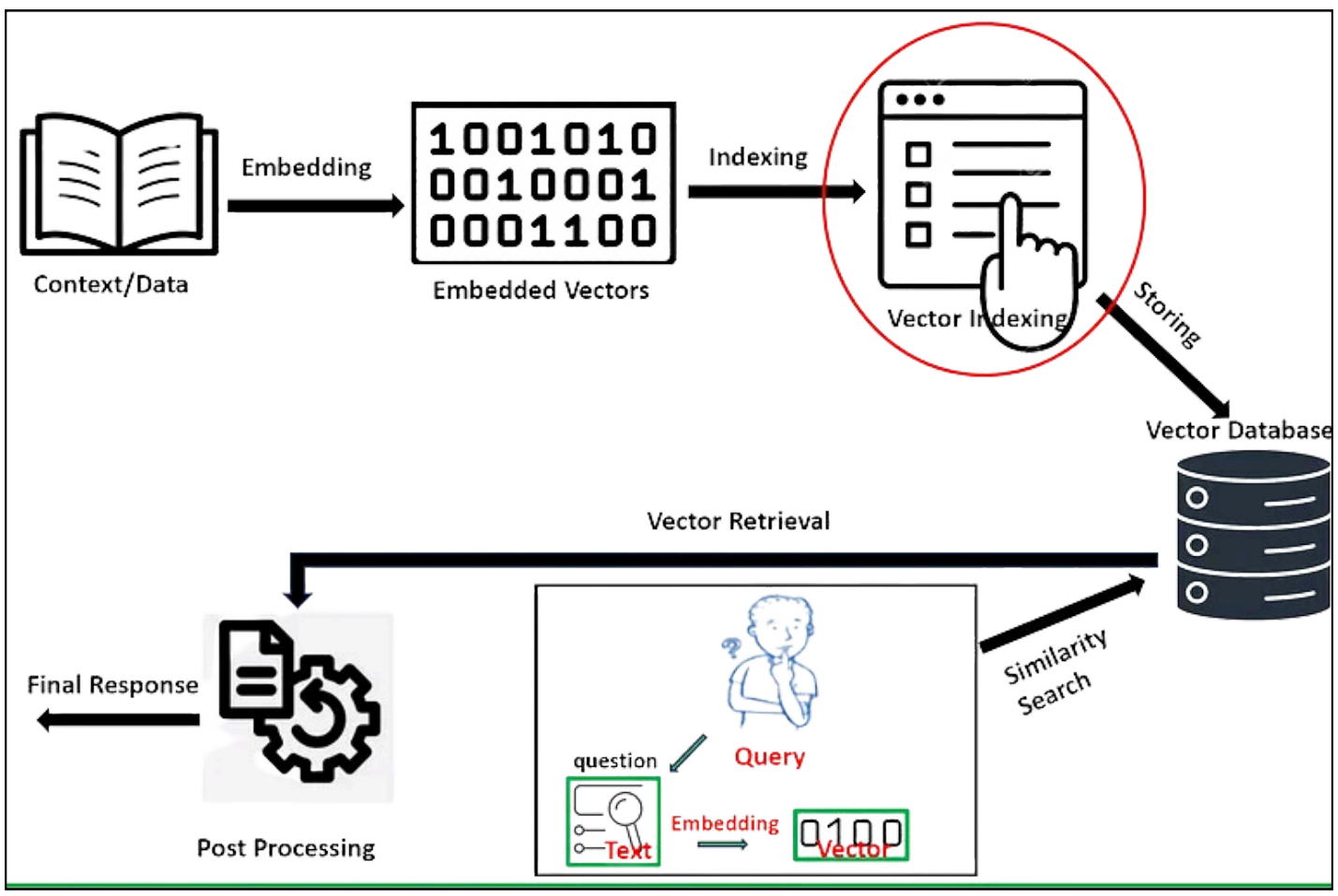
U - Unstructured Data

- Raw data formats like text, images, or videos.
- Requires preprocessing for effective retrieval and generation.
- A significant challenge in RAG systems.
- Powers applications like multimedia search and document summarization.



Credit:oriresults.com

V - Vector Search

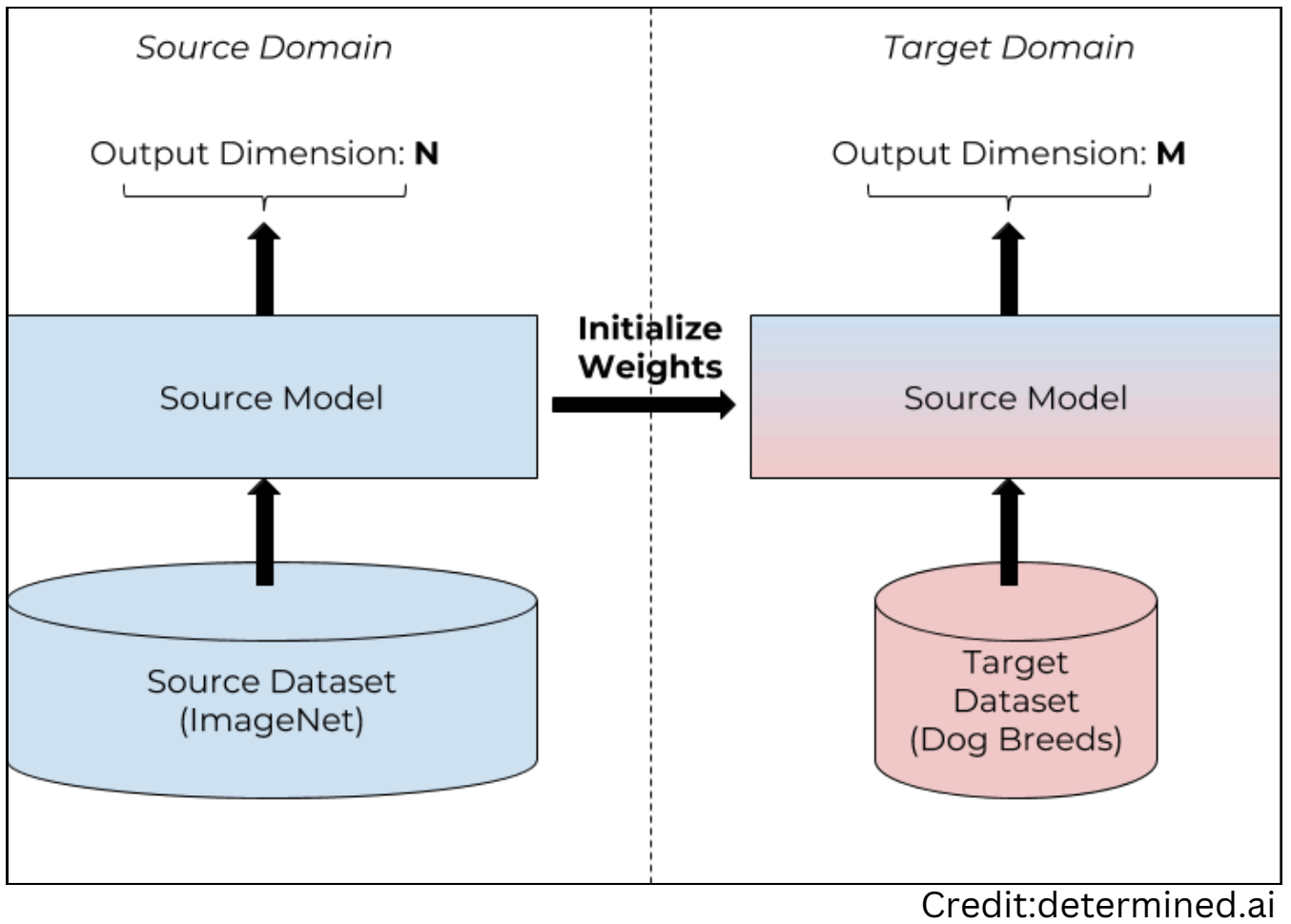


Credit:Medium.com

- Uses embeddings to find semantically similar items.
- Operates in high-dimensional latent space.
- A core method for dense retrieval in RAG systems.
- Supports scalability in real-time search applications.

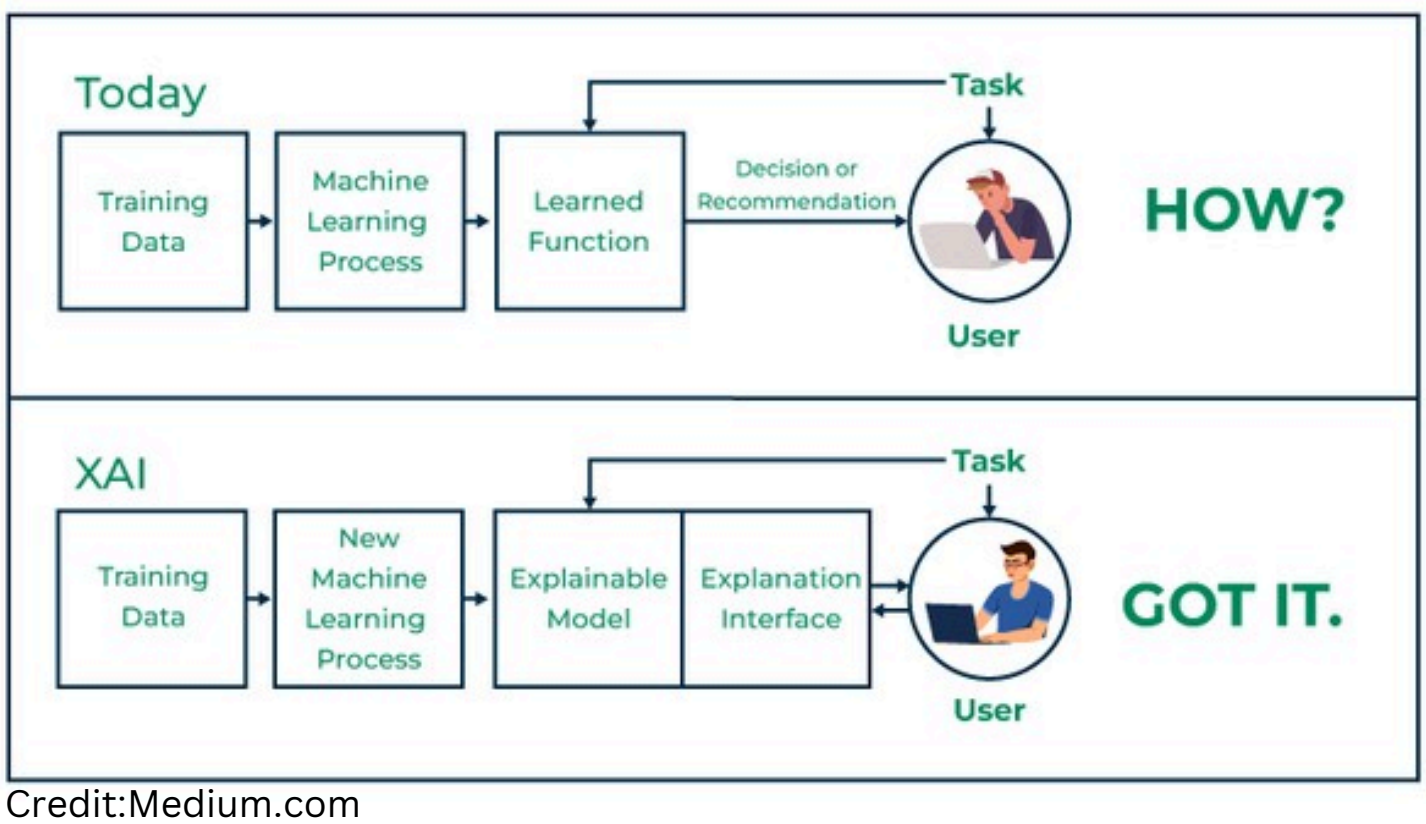
W - Warm-Start Retrieval

- Initializes retrieval systems with pre-trained embeddings or models.
- Speeds up convergence and improves early-stage performance.
- Reduces training time for new tasks.
- Common in transfer learning scenarios.



Credit:determined.ai

X - Explainability

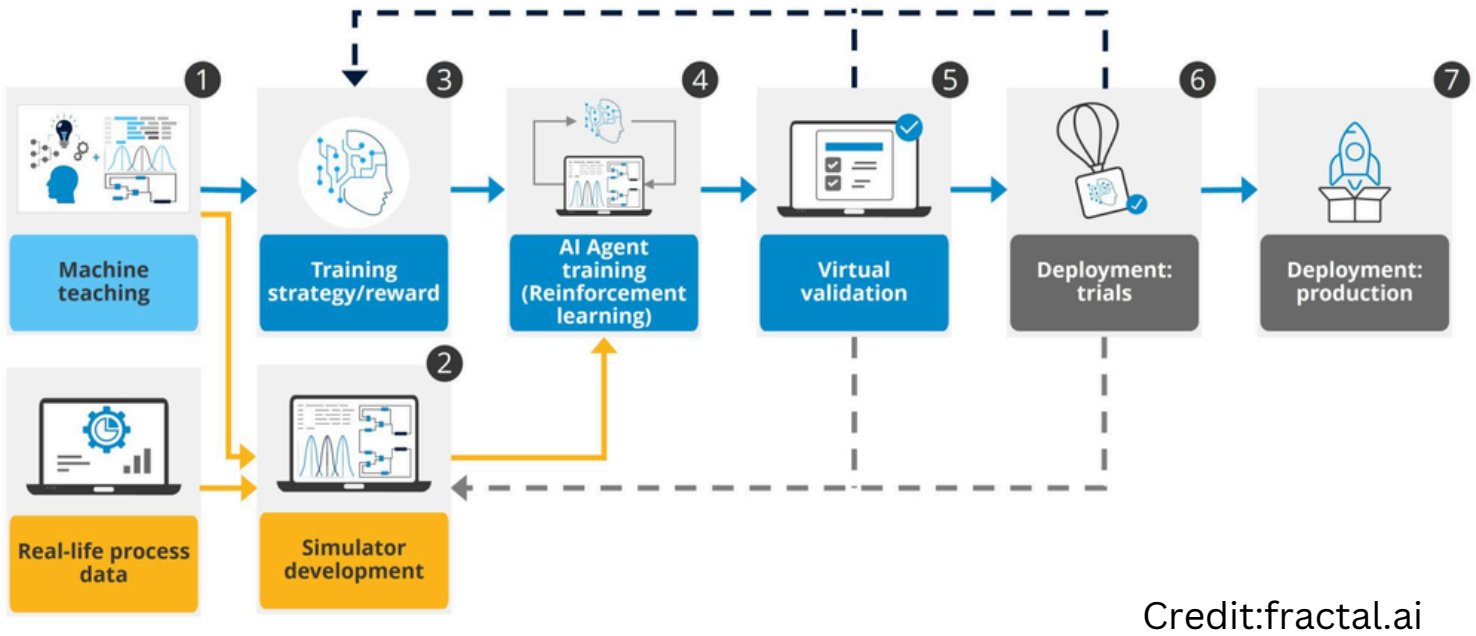


Credit:Medium.com

- Traces how retrieved documents contribute to generated outputs.
- Ensures transparency and accountability in AI systems.
- Critical for high-stakes applications like healthcare or law.
- Helps identify and debug errors in RAG pipelines.

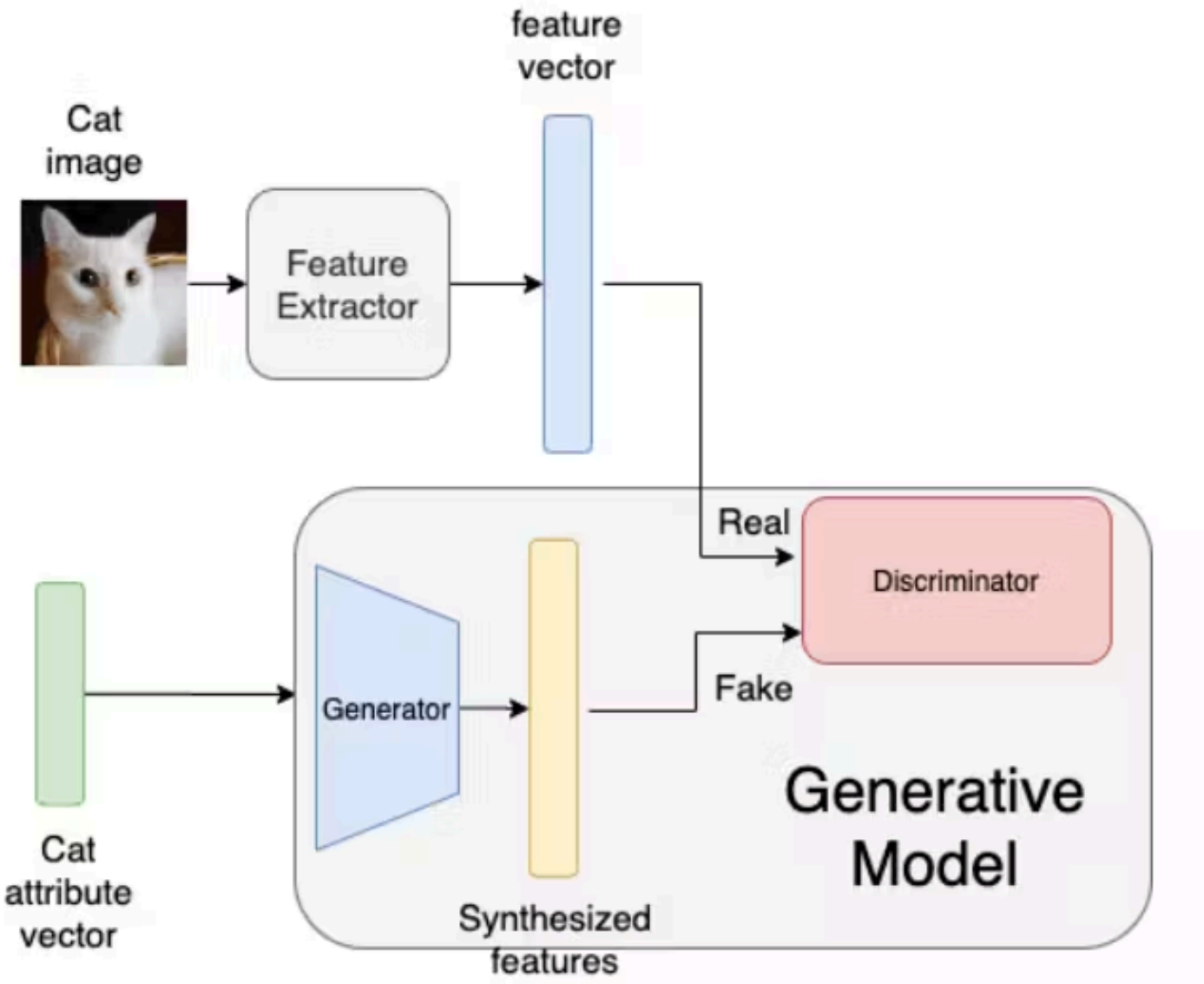
Y - Yield Optimization

- Maximizes the relevance and quality of retrieved documents.
- Focuses on optimizing generative responses based on retrieval.
- Involves fine-tuning retrieval components for performance.
- Enhances user satisfaction in RAG-powered applications.



Credit:fractal.ai

Z - Zero-shot Retrieval



Credit:encord.com

- Retrieves relevant information without prior task-specific training.
- Useful in scenarios with minimal or no labeled data.
- Relies heavily on pre-trained models.
- Key for adapting to new domains or tasks quickly.