HYBRID SEARCH RAG

Text ⟶ Embedding Vectors

Documents → D1 →
→ D2 →
→ D3 →
⋮
→ Dn →

Text → Dense Vectors

VectorDATABASE [FAISS, CHROMA].
{VectorStoreDB}
{ Cosine Similarity }
⟵ Vector Search
⟶ Vectors

User query
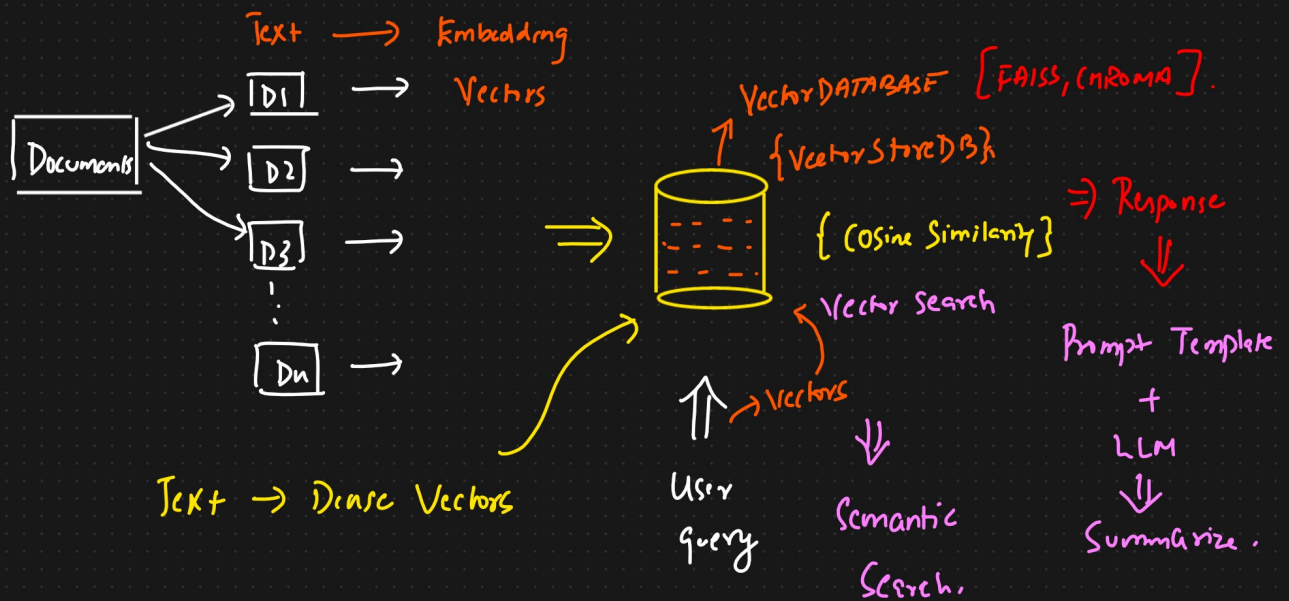
⇒ Response
⇓
Prompt Template
+
LLM
⇓
Summarize.

Semantic Search.

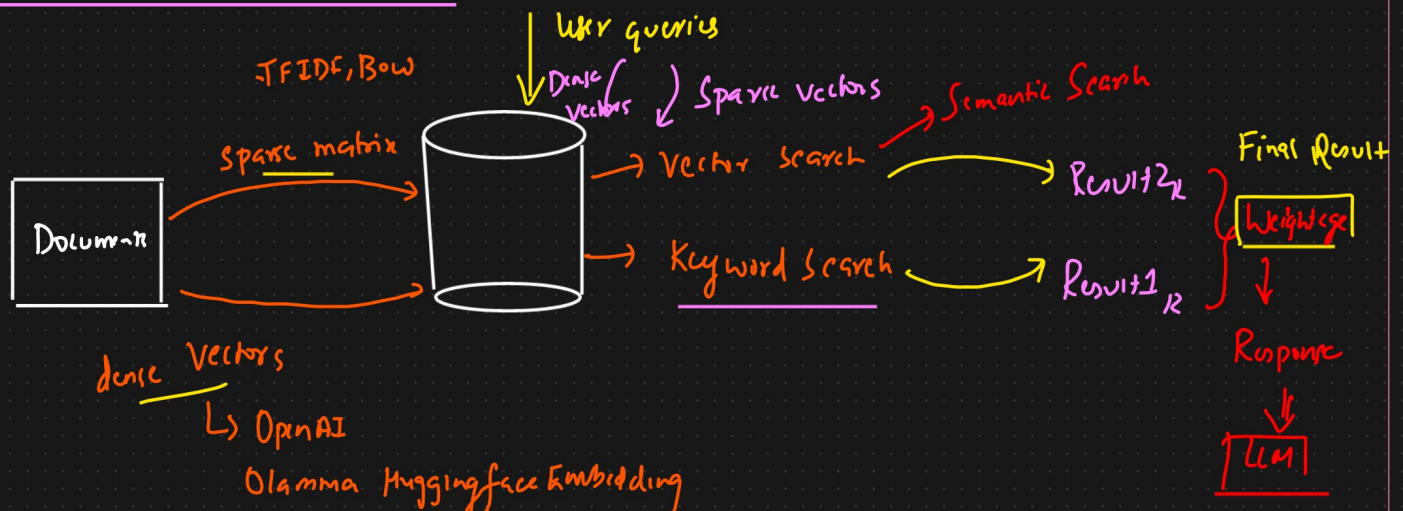
Hybrid Search

⇒ Combine Multiple Search techniques

{
1) Semantic Search ⟶ Dense Vector Search ⟶ Similar
2) Syntatic Search ⟶ Exact Search ⟶ Keyword Search
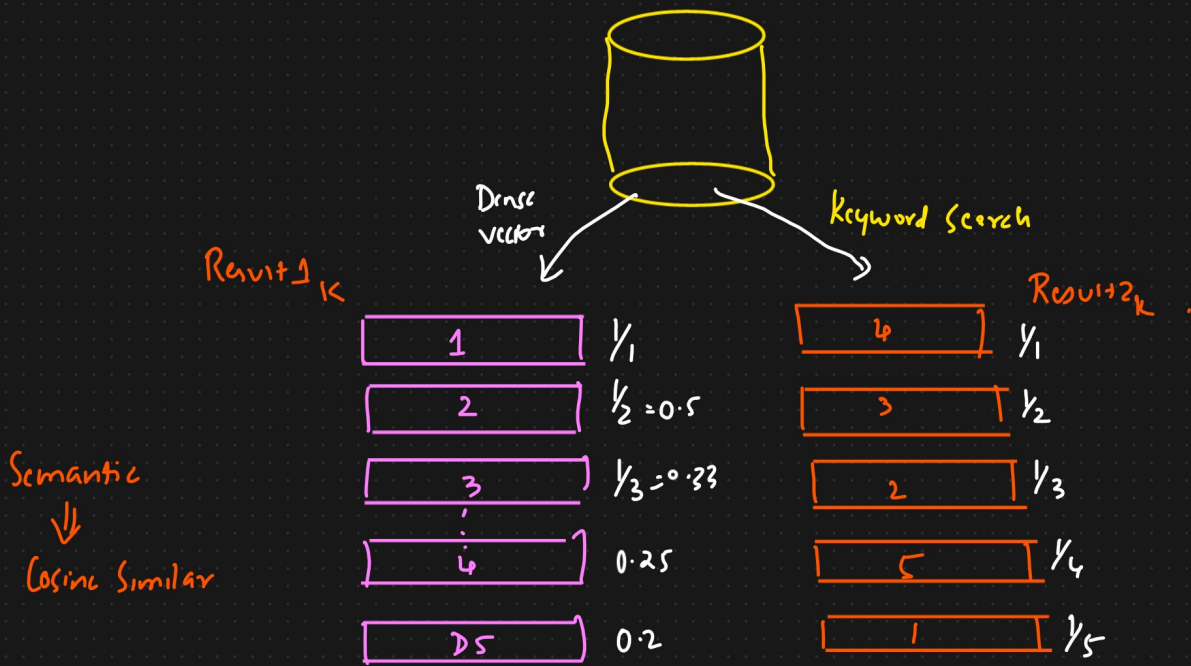↳ Sparse Vector Search
}

Text ⟶ Sparse Matrix

Sparse Matrix ⟶ OHE, Bow, TFIDF ⟶ Text → Sparse Matrix

0 0 0 [1] 0 0 0 ⟵ Sparse Matrix ⟶

How Does Hybrid Search Work?

User queries

TFIDE, Bow

Sparse matrix

Document

dense Vectors
↳ OpenAI
Olamma Huggingface Embedding

Dense Vectors ⟶ Sparse Vectors ⟶ Semantic Search
⟶ Vector Search ⟶ Result2$_R$
⟶ Keyword Search ⟶ Result1$_R$

Final Result
Weightese
⟶ Response
⇓
LLM

Reciprocal Rank Fusion In Hybrid Search

Dense Vector

Keyword Search

Result 1 $_K$

1	$\frac{1}{1}$
2	$\frac{1}{2} = 0.5$
3	$\frac{1}{3} = 0.33$
6	0.25
D5	0.2

Semantic
$\Downarrow$
Cosine Similar

Result 2 $_K$

6	$\frac{1}{1}$
3	$\frac{1}{2}$
2	$\frac{1}{3}$
5	$\frac{1}{4}$
1	$\frac{1}{5}$

$$\text{Final Score} = \sum \frac{1}{(C + R_d)}^x$$

$$= \sum \frac{1}{(R_d)}$$

$C = $ Dependents on Various Databases

$$\boxed{1 \rightarrow 60} \quad \boxed{60}$$

$\boxed{50\%} \Rightarrow$ Keyword Search $\Big\}$
Semantic Search

$[\text{Document 1}] = 1 + 0.2 = 1.2 \checkmark$

$[\text{Document 2}] = 0.5 + 0.33 = 0.83 \checkmark \Big\}$

70%

$\checkmark [\text{Document 3}] = 0.33 + 0.5 = 0.83 \checkmark \Big\}$

$|$
$\vdots$

GRAPH KNOWLEDGE

Graph db   { Neo4j }.

RAG Application with Graph DB

$\Rightarrow$

$\rightarrow$ Keyword Search

$\rightarrow$ Semantic Search

$\rightarrow$ Graph Knowledge Search

User Queries