

AI Vector Search Oracle Database 23ai

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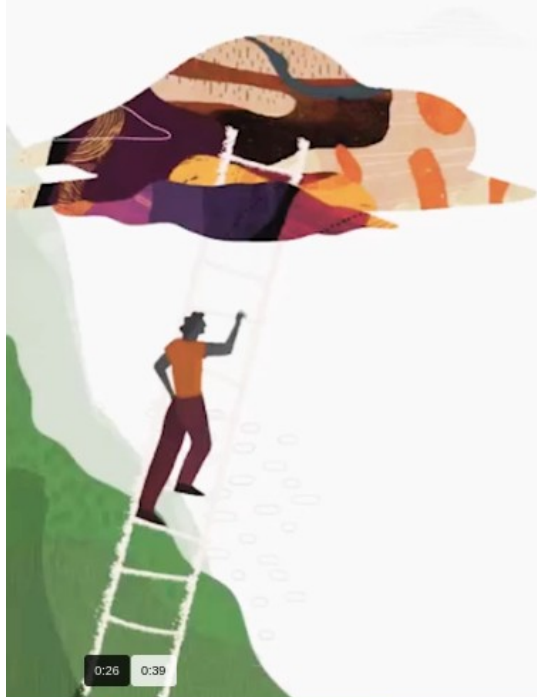


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Agenda



AI Vector Search in Oracle Database 23ai

AI Vector Search powers Gen AI pipelines

Oracle AI Vector Search

Oracle Database 23ai

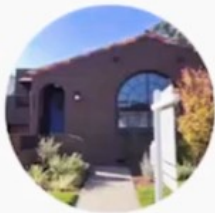
- > SQL support for vector generation
- > Vector Data Type
- > Similarity search with SQL syntax and functions
- > Approximate search indexes



Database-Native Vector Embedding Generation

Generate vector from query image

```
VECTOR_EMBEDDING(resnet_50 USING query_image)
```



Load image
as BLOB

Query Image
Embedding
Generation

Vector
embedding



Vector Search
for similar
matches

Top 2 results

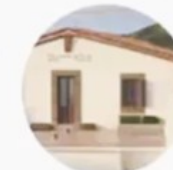
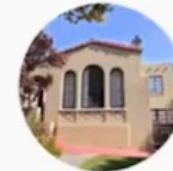


Image dataset already embedded into vectors and
stored in Oracle Database 23ai

```
VECTOR_EMBEDDING(resnet_50 USING data_image)
```

Vector Datatype

New VECTOR datatype

```
CREATE TABLE my_images (  
  id      NUMBER,  
  data_image BLOB,  
  image_vec VECTOR(768, FLOAT32));
```

Optional dimension count

Optional dimension format

Dimension format can be:
INT8, FLOAT32, and FLOAT64

Simpler VECTOR specification

```
CREATE TABLE my_images (  
  id      NUMBER,  
  data_image BLOB,  
  image_vec VECTOR);
```

Why is this useful?

You can embed your data with newer ML embedding models as AI technology evolves, but your schema can stay the same, and applications don't need to be rewritten

Vector Distance Function

The key operation is vector distance computation to gauge similarity

```
VECTOR_DISTANCE(VECTOR1, VECTOR2, <optional distance metric>)
```

Different embedding models can use different metrics, but the basic concept remains the same:

The Distance between two vectors is smaller for entities that are more similar

Distance functions supported in Oracle Database 23ai are:

COSINE (default), EUCLIDEAN, EUCLIDEAN_SQUARED, HAMMING, MANHATTAN, DOT

Vector Search SQL

Vector Search is used to find Top K closest matches to a given query item

Find the top 10 positions matching a candidate's resume that are offered in a city among the candidate's preferred cities

```
SELECT ...  
FROM   Job_Postings  
WHERE  city IN (SELECT preferred_cities FROM Applicants ...)  
ORDER BY vector_distance(job_desc_vectors, :resume_vector)  
FETCH FIRST 10 ROWS ONLY;
```



Jane Doe
jane@doe.com

Application as a
developer in AI/ML

- BSc in Comp Sc, ABC college
- MS in Data Science, Univ of DEF
- Worked 5 years at XYZ.com
- Languages: Python, Java, C++
Maintained GIT repositories
- References: John Smith, XYZ.com

Vector Index Syntax

Basic index creation

```
CREATE VECTOR INDEX photo_idx ON customer(photo_vec)
ORGANIZATION [INMEMORY NEIGHBOR GRAPH | NEIGHBOR PARTITIONS]
DISTANCE COSINE | EUCLIDEAN | MANHATTAN | ... WITH TARGET ACCURACY 90
```

ORGANIZATION for an index is based if it will fit in-memory:

- If the index data will fit in-memory, use **INMEMORY NEIGHBOR GRAPH**
- Else use **NEIGHBOR PARTITIONS**

TARGET ACCURACY clause is added to indicate the default accuracy the index should provide for similarity search queries

Vector Search

Specifying approximate searches

A new **APPROXIMATE** keyword in the Row Limiting (FETCH) clause indicates that the user wants to perform a similarity search using a Vector Index

Find the top 5 customers by similarity with a search photo vector:

```
SELECT id, name, photo
FROM Customers
ORDER BY VECTOR_DISTANCE(photo_vec, :QUERY_VEC)
FETCH APPROXIMATE FIRST 5 ROWS ONLY;
```

Exact search may be performed if there is no index or based on the SQL Optimizer costs

Similarity Search Over Joins

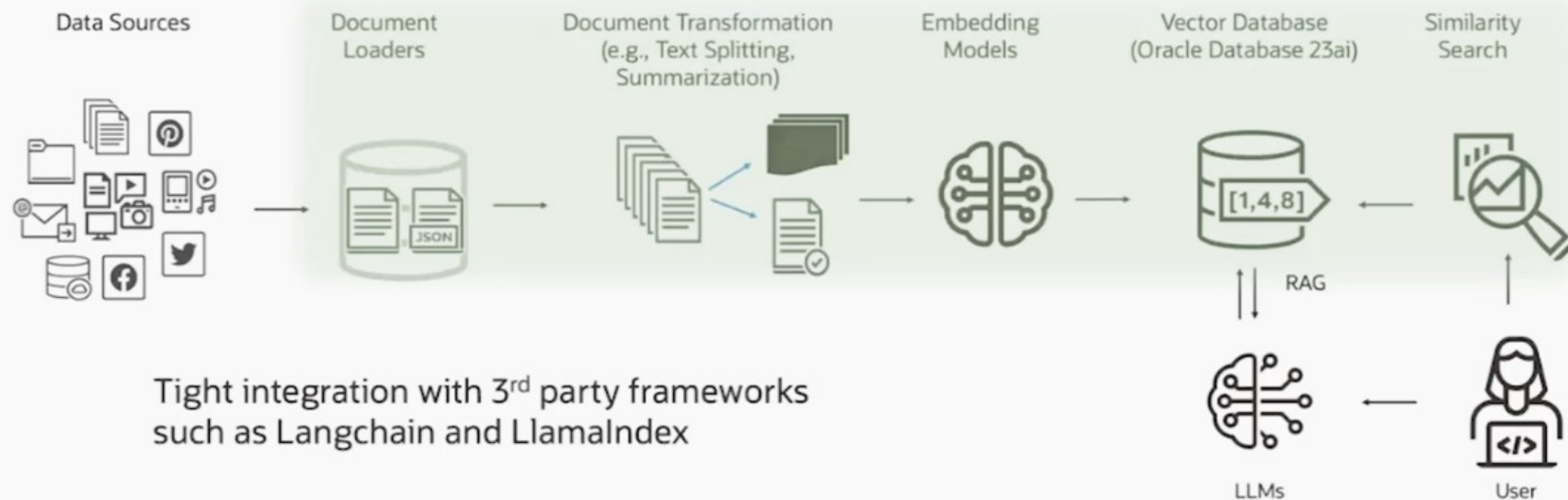
- Join with normalized enterprise data
- 3 Tables: Authors, Books, and Pages
- Pages table has each page individually embedded into vector column pageVec
- Return the top 5 books containing text similar to this query text
- Genre is 'Fiction'
- Author comes from 'India'



```
SELECT pageID FROM Authors, Books, Pages
WHERE Authors.authorID = Books.authorID
AND Books.bookID = Pages.bookID
AND Books.genre = 'Fiction'
AND Author.country = 'India'
ORDER BY vector_distance(pageVec, :queryVec)
FETCH APPROX FIRST 5 ROWS ONLY;
```

AI Vector Search powers Gen AI pipelines

AI Vector Search in Oracle Database 23ai



Simplest way to get answers
about your business

Key Takeaways



AI Vector Search is seamlessly
integrated with Oracle Database 23ai



Simple to combine relational and AI
vector Search in single query



Efficient orchestration of Gen-AI
pipelines



