



Search, Search, Search

APEX World 2024

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Dimitri Gielis

- Founder & CEO of **United Codes**
- 25+ years of Oracle Experience (OCP & APEX Certified)
- Oracle ACE Director
- “APEX Developer of the year 2009” by Oracle Magazine
- “Oracle Developer Choice award (ORDS)” in 2015
- Author Expert **Oracle APEX**
- Presenter at Conferences



www.united-codes.com



APEX Office Print



APEX Media Extension



APEX Office Edit



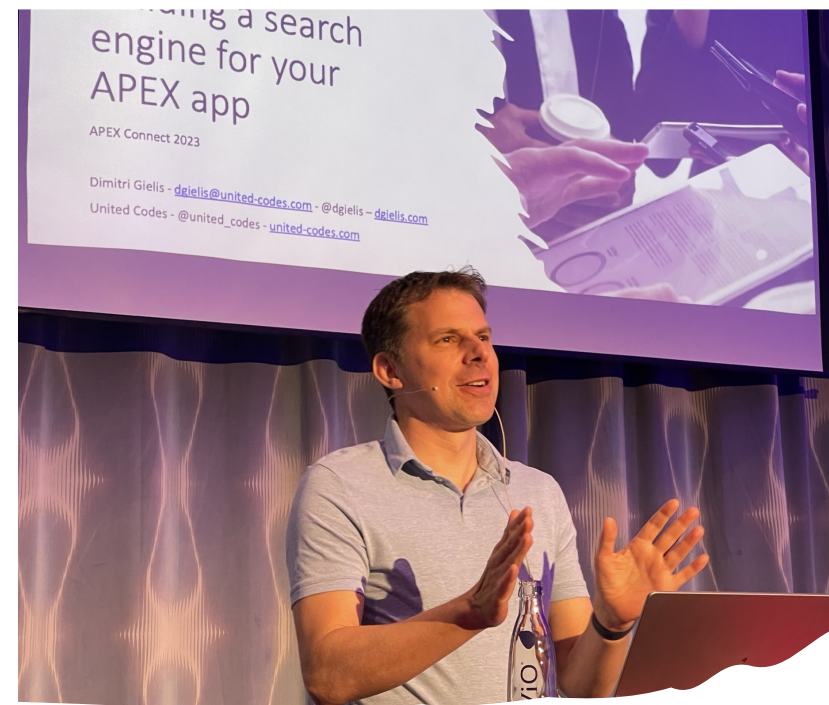
APEX Project Eye



Plug-ins Pro



APEX Message Service



2023... me talking
about... Search



How to do Google like
searches?

New in APEX 22.2

Create Search Page

Based on
Shared Components >

Search Configurations

- Simple
- Oracle Text
- Lists

Create Search Page

Page Definition

* Page Number

5

?

* Name

?

Page Mode

Normal

Modal Dialog

Drawer

?

Search Configurations

	Label	Search Type
☐	Oracle Text	Oracle Text
☐	Standard Customers	Standard
☐	Standard Travel	Standard

1 - 3

▶ Navigation

< Cancel

Create Page

Example

Search



IB

Illumina Biotech

Life Sciences

AF

A-Frame Aerospace

Aerospace & Defense

CC

Carlton Closets

Consumer Goods

L3

Logistics 36

Engineering & Construction

CY

Cyphria

Life Sciences

MG

Make Good

Education & Research

OF

Organic Farms

Wholesale Distribution

Custom Layout with Template Directives

For example

- {if ?ICON_VALUE/}
- {case ICON_TYPE/}

Use Pagination ☒

Results per Page 15

Show Result Count No

Custom Layout ☒

Result Row Template

```
<div class="a-ResultsItem &RESULT_CSS_CLASSES!ATTR.">
  {if ?ICON_VALUE/}
  {case ICON_TYPE/}
  {when INITIALS/}
  <div class="a-ResultItem-initials u-color-var">&ICON_VALUE.</div>
  {when URL/}
  <div class="a-ResultItem-image">
</div>
  {when CLASS/}
  <div class="a-ResultItem-icon u-color-var"><span class="fa &ICON_VALUE!ATTR." aria-hidden="true"></span>
</div>
  {endcase/}
{endif/}
<div class="a-ResultsItem-content">
  <div class="a-ResultsItem-header">
    {if ?LINK/}
    <span class="a-ResultsItem-title"><a href="&LINK!ATTR.">&TITLE.</a></span>
    {else/}
    <span class="a-ResultsItem-title">&TITLE.</span>
    {endif/}
    {if ?BADGE/}<span class="a-ResultsItem-badge">&BADGE.</span>{endif/}
  </div>
  {if ?SUBTITLE/}<div class="a-ResultsItem-subTitle">&SUBTITLE </div>{endif/}
```

Last Modified

Format Mask

Overall Sort - Select -

No Query Entered Message

No Results Found Message

PL/SQL API

```
select config_label, title, subtitle, badge
  from table( apex_search.search(
                p_search_static_ids => apex_t_varchar2( 'PRODUCTS', 'CUSTOMERS' ),
                p_search_expression => 'oracle APEX',
                p_apply_order_bys   => 'N' ) );
```

CONFIG_LABEL	TITLE	SUBTITLE	BADGE
Products	APEX vacation app	Subscription Based App	
Products	APEX time entry	On-Premises License	
:			
Customers	John Doe Corp	Software Development	5000
Customers	Development Corp	Software Development	1000
:			

Oracle Text



Create a text index

```
create index eba_project_tasks_ctx  
on eba_project_tasks(description)  
indextype is ctxsys.context;
```



Use the index

```
select *  
from eba_project_tasks  
where contains(description, 'web') > 0
```

Oracle Text Queries

Combine Query Terms

... where **contains**(text, 'dog AND cat') >0

Use Wild Cards

... where contains(text, 'do% AND c_t') >0

Powerful Name Searching

... where contains(text, 'NDATA(name, lary elisn)') >0

Fuzzy matching

... where contains(text, '?apeks') >0

Multi Lingual Stemming

... where contains(text, '\$runs') >0

Create a User Data Store on relational data

```
create or replace procedure eba_cus_search_uds (rid in rowid, tlob in out nocopy clob)
is
begin
    for r in (select c.customer_name, c.summary, t.name, t.title
              from eba_cust_customers c
              join eba_cust_contacts t on c.id = t.customer_id
              where c.rowid = rid)
    loop
        tlob := tlob || ' ' ||
            '<CUST_NAME>' || r.customer_name || '</CUST_NAME>' ||
            '<CUST_DESC>' || r.summary || '</CUST_DESC>' ||
            '<CONT_NAME>' || r.name || '</CONT_NAME>' ||
            '<CONT_DESC>' || r.title || '</CONT_DESC>';
    end loop;
end eba_cus_search_uds;
```

Oracle TEXT: Your Search engine within SQL

- Providing indexes for full-text (keyword) searching
- Text summarization: snippets, themes, entity extraction, sentiment analysis
- Easy to use in any application which speaks SQL
 - CREATE INDEX statement to create an index
 - CONTAINS clause to search within a SQL Query
- **Free** with all versions and editions of Oracle, from XE to Enterprise Edition
- Available on all Oracle's Cloud Database offerings

* From video Office Hours

Oracle TEXT: Your Search engine within SQL

- Multilingual (48+ languages) with many document formats (150+ types)
- Not just an indexed equivalent of the LIKE operator (20+ query operators)
Stemming, Fuzzy, Name Searching, and much more...
- Flexible indexing of data
 - Index and Search on a **single column**
 - Index and Search on **multiple Columns in the same table** (Multicolumn Datastore)
 - Index and Search on **multiple Columns in different tables** (User Datastore)



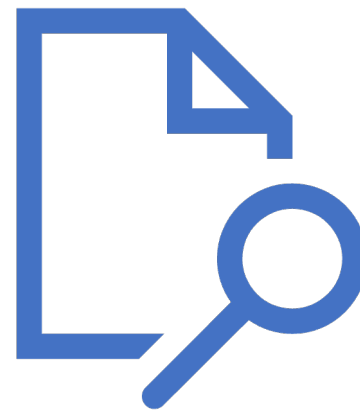
Today

Two new 23c DB features to create better searches

Ubiquitous Database Search

new in Oracle Database 23c
new in Oracle APEX 23.2

Oracle Text on steroids!



Step 1: Index Creation for Ubiquitous DB Search

```
begin
  dbms_search.create_index(index_name => 'UDS_SEARCH_PRODUCTS');
end;
/
```

SQL> desc UDS_SEARCH_PRODUCTS

Name	Null?	Type
-----	-----	-----
METADATA	NOT NULL	JSON
DATA		JSON
OWNER		VARCHAR2 (128)
SOURCE		VARCHAR2 (128)
KEY		VARCHAR2 (1024)

Step 2: Add Data Sources

```
begin
  dbms_search.add_source(
    index_name => 'UDS_SEARCH_PRODUCTS',
    source_name => 'SHIPMENTS');

  dbms_search.add_source(
    index_name => 'UDS_SEARCH_PRODUCTS',
    source_name => 'STORES');
end;
/
```

!!! Primary key required on table
All columns indexed of table, external table, or view
Sync on commit by default

Step 3: Review the virtual document

```
SQL> select dbms_search.get_document(  
            index_name          => 'UDS_SEARCH_PRODUCTS',  
            document_metadata => metadata) output  
from UDS_SEARCH_PRODUCTS;
```

OUTPUT

```
-----  
{ "CO": { "STORES": { "LOGO_CHARSET": null, "LOGO_FILENAME": null, "LONGITUDE": 34.8621  
38, "STORE_ID": 23, "LOGO": null, "LOGO_MIME_TYPE": null, "LATITUDE": 32.100664, "STOR  
E_NAME": "Tel Aviv", "LOGO_LAST_UPDATED": null, "WEB_ADDRESS": null } } }  
...
```

Step 4: Run queries against your index

```
SQL> select metadata
      from UDS_SEARCH_PRODUCTS
      where contains(data, 'fuzzy(los)') > 0;
```

METADATA

```
-----
{"OWNER":"CO","SOURCE":"STORES","KEY":{"STORE_ID":10}}
{"OWNER":"CO","SOURCE":"SHIPMENTS","KEY":{"SHIPMENT_ID":976}}
```

-- let's check

```
SQL> select * from STORES where store_id=10;
```

PHYSICAL_ADDRESS

```
-----
C/ Echegaray 6B, Las Rozas
```

```
SQL> select * from SHIPMENTS where shipment_id=976;
```

DELIVERY_ADDRESS

```
-----
Los Angeles, CA 90026 USA
```

Step 4: Run queries against your index (JSON)

```
SQL> select metadata
      from UDS_SEARCH_PRODUCTS
     where json_textcontains(
           data,
           '$.CO.STORES.PHYSICAL_ADDRESS',
           'fuzzy(los)');
```

METADATA

```
{ "OWNER": "CO", "SOURCE": "STORES", "KEY": { "STORE_ID": 10 } }
```

Step 4: Run queries against your index (JSON)

```
SQL> select metadata
      from UDS_SEARCH_PRODUCTS
     where json_exists(
           data,
           '$.CO.STORES?(@.STORE_ID <= 100)');
```

METADATA

```
{ "OWNER": "CO", "SOURCE": "STORES", "KEY": { "STORE_ID": 10 } }
```

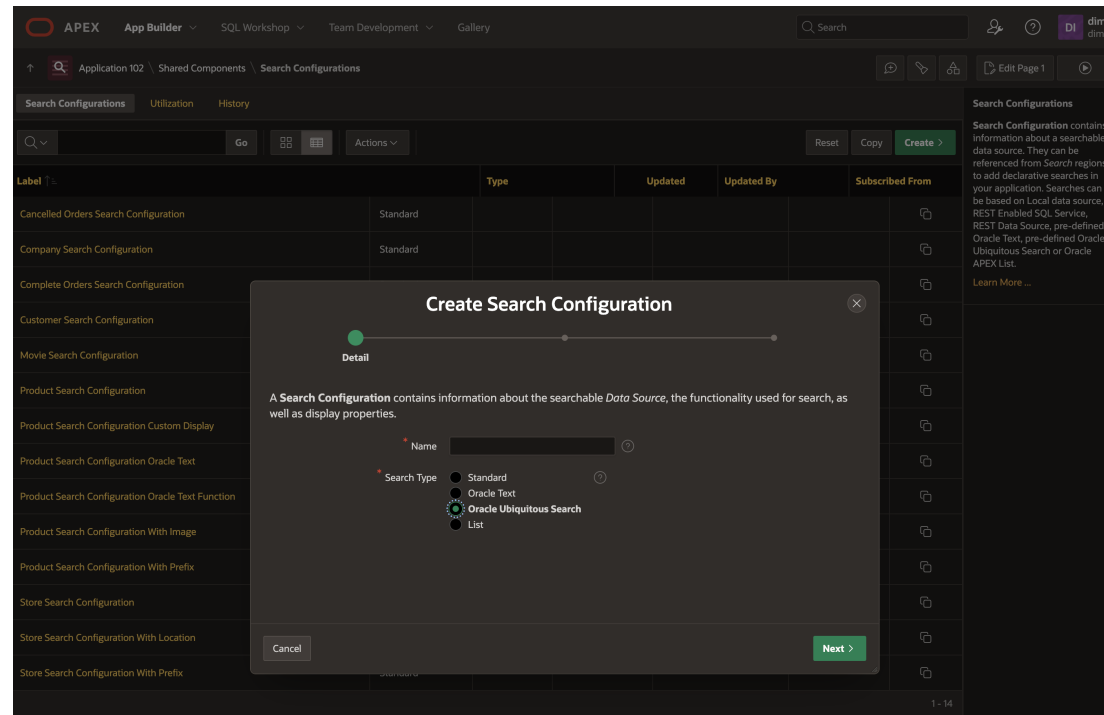
Ubiquitous Database Search

- Easier (and more powerful) than previous with Oracle Text
- Very useful to search on things you don't know where they are
- Ability to do sophisticated searching and Google like search (useful parser function?)
- Integrated with APEX Search
- (!) Need partitioning enabled → License EE + Partitioning
- (!) Impact: 30%-50% of data, extra disk space

More info

- New full-text search in 23c: Ubiquitous Database Search
<https://blogs.oracle.com/coretec/post/ubiquitous-database-search-in-23c>
- Easy Database Search with APEX in 23c
<https://blogs.oracle.com/coretec/post/easy-database-search-with-apex-in-23c>
- Learn about Oracle Text
<https://blogs.oracle.com/database/post/learn-about-oracle-text>
- Part 3: APEX and Ubiquitous Database Search in Oracle Database 23c
<https://www.youtube.com/watch?v=QzcsHrzYC98>

Oracle APEX integration – Database 23c



When no index exists

Create Search Configuration



Source



Oracle Ubiquitous Search index does not exist

There is **no Ubiquitous Search index** in the current parsing schema.

The Application Developer's Guide provides information on how to use Ubiquitous Database Search and the DBMS_SEARCH package.

When not the right database features enabled

```
ORA-00439: feature not enabled: Partitioning  
ORA-06512: at "CTXSYS.DBMS_SEARCH", line 400  
ORA-06512: at line 2
```

```
2. dbms_search.create_index(index_name => 'UDS_SEARCH_PRODUCTS');  
3. end;
```

Following the wizard to create Ubiquitous Search

Create Search Configuration

Detail

A **Search Configuration** contains information about the searchable *Data Source*, the functionality used for search, as well as display properties.

*

Name

Search Customers?

*

Search Type

☐ Standard?

☐ Oracle Text

☒ Oracle Ubiquitous Search

☐ List

Cancel

Next >

Select Index + Source

Create Search Configuration

✓ — Source —

* Search Index Name UDS_SEARCH_PRODUCTS ?

* Search Source Name

- ✓ - Select Value -
- EBA_DEMO_SEARCH_PRODUCTS
- EBA_DEMO_SEARCH_STORES

< Cancel Next >

Map the columns

Create Search Configuration

✓

✓

●

Column Mapping

* Primary Key Column

PRODUCT_ID (Number)

?

* Title Column

PRODUCT_NAME (Varchar2)

?

Description Column

PRODUCT_DETAILS (Blob)

?

Icon Source

Initials

Icon Class

Icon Class Column

?

<

Cancel

Create Search Configuration

Customize

↑



Application 100 \ Shared Components \ Search Configurations \ Edit







Search Configuration: Search Customers

Cancel

Delete

Apply Changes

Show All

Settings

Subscription

Source

Column Mapping

Icon and Display

Link

Server-Side Condition

Advanced

Column Mapping

* Primary Key Column ?

PRODUCT_ID (Number) ▾

* Title Column ?

PRODUCT_NAME (Varchar2) ▾

Custom Column 1 ?

- Select Column - ▾

Badge Column ?

- Select Column - ▾

Primary Key Column 2 ?

- Select Column - ▾

Subtitle Column ?

- Select Column - ▾

Custom Column 2 ?

- Select Column - ▾

Score Column ?

- Select Column - ▾

Description Column ?

PRODUCT_DETAILS ▾

Custom Column 3 ?

- Select Column - ▾

Last Modified Column ?

- Select Column - ▾

Create Search Page

Create Search Page

Page Definition

Page Number

2

Name

S

Page Mode

Normal

Modal Dialog

Drawer

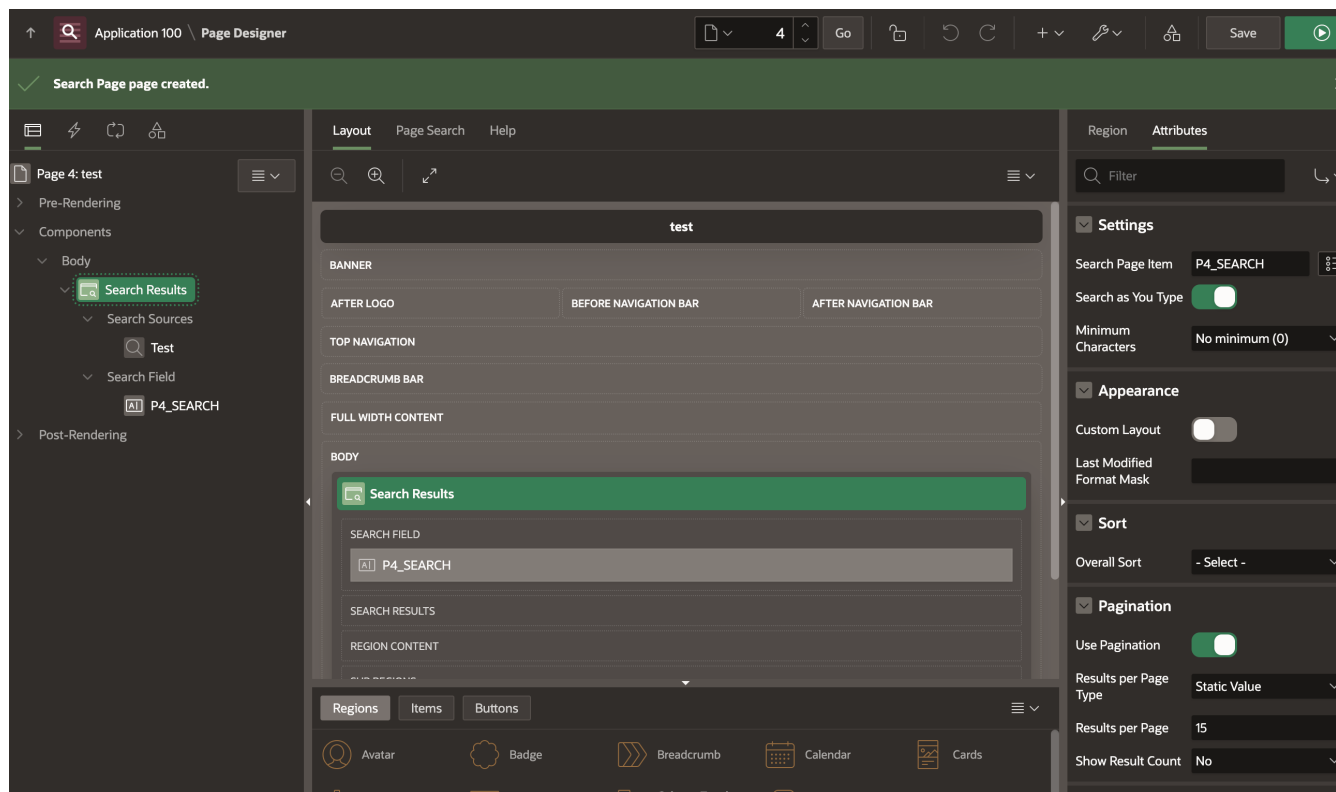
Search Configurations

	Label	Search Type
☐	Cancelled Orders Search Configuration	Standard
☐	Company Search Configuration	Standard
☐	Complete Orders Search Configuration	Standard
☐	Customer Search Configuration	Standard
☐	Movie Search Configuration	Standard
☐	Product Search Configuration	Standard
☐	Product Search Configuration Custom Display	Standard
☐	Product Search Configuration Oracle Text	Oracle Text
☐	Product Search Configuration Oracle Text Function	Oracle Text
☐	Product Search Configuration With Image	Standard
☐	Product Search Configuration With Prefix	Standard
☒	Search Customers	Oracle Ubiquitous Search
☐	Store Search Configuration	Standard
☐	Store Search Configuration With Location	Standard
☐	Store Search Configuration With Prefix	Standard

< Cancel

Create Page

Customize (Region Attributes)



Customize (Application Definition)

The screenshot displays the APEX Application Builder interface for editing the definition of 'Application 100'. The 'Properties' tab is selected, showing various application settings. A modal window titled 'Oracle Text Function' is open on the right, providing an overview of Oracle Text query syntax and a PL/SQL function example.

Application 100 Properties:

- Friendly URLs: ☐
- Allow Feedback: ☒
- Logging: ☒
- Debugging: ☒
- Compatibility Mode: 21.2 / 22.1 / 22.2 / 23.1 / 23.2
- Application Email From Address: [Empty field]
- Proxy Server: [Empty field]
- Oracle Text Function: [Empty field]
- Tokenize Row Search: ☒
- Maximum Background Page Process Jobs: [Empty field]

Oracle Text Function Modal:

The Oracle Text query syntax is very complex and powerful, that provide a rich set of query operators to deal with wildcards, stemming, fuzzy searches and so forth. But for end users, this syntax is most often hard to understand; they simply want to type text and have query features applied automatically.

For that reason, you can specify the name of a PL/SQL function which converts end user input to an Oracle Text query. The function takes the end user input as VARCHAR2 and returns the Oracle Text query as a result.

This example uses Oracle Text Fuzzy Search for all queries

```
function convert_end_user_search (
    p_search in varchar2 )
return varchar2
is
begin
    return 'FUZZY({' || replace( p_search, ' ', '\ ' ) || '}, 30, 2000)';
end;
```

This example makes use of *Query Relaxation*, it executes the exact queries first and adds fuzzy or wildcard features later on, when the exact query does not return enough rows. This is all transparent to the end user.

```
create or replace function convert_end_user_search (
    p_search in varchar2 )
return varchar2
is
    c_xml constant varchar2(32767) := '<query><textquery><progression>' ||
        '<seq> #SEARCH# </seq>' ||
        '<seq> ?#SEARCH# </seq>' ||
        '<seq> #SEARCH#% </seq>' ||
        '<seq> %#SEARCH#% </seq>' ||
        '</progression></textquery></query>';

    l_search varchar2(32767) := p_search;
begin
    -- remove special characters; irrelevant for full text search
    l_search := regexp_replace( l_search, '[<>{}()/!*%&!$?.:;,+&#]', '' );

    return replace( c_xml, '#SEARCH#', l_search );
end;
```

For more information about Oracle Text query syntax and the relaxation feature see the [Oracle Text Application Developers Guide](#).

Result

Presentation: APEX Search (Customers)

search...

FeedbackHelpdimi

Customers19

Competitors

Contacts28

Administration>

St Search

Ot Search (Projects)

Ot Search (Projects*)

Ot Search (Customers)

L Search

Oracle Text Search with Function (Projects*)

wep AND dev

No Convert
0 results

Convert
1 result

CW**Configure Web Listeners**

Configure the three Web Listeners for Web development tool to support the Dev, QA, and Prod environments.
Sc: 3

i

Try at Yatra (ENTER)
?wep / ?wep AND dev / wep AND dev

Table with BLOB?

“Limitation” in APEX 23.2(.5)

≡ Sample Application Search

S

Q x

1 error has occurred

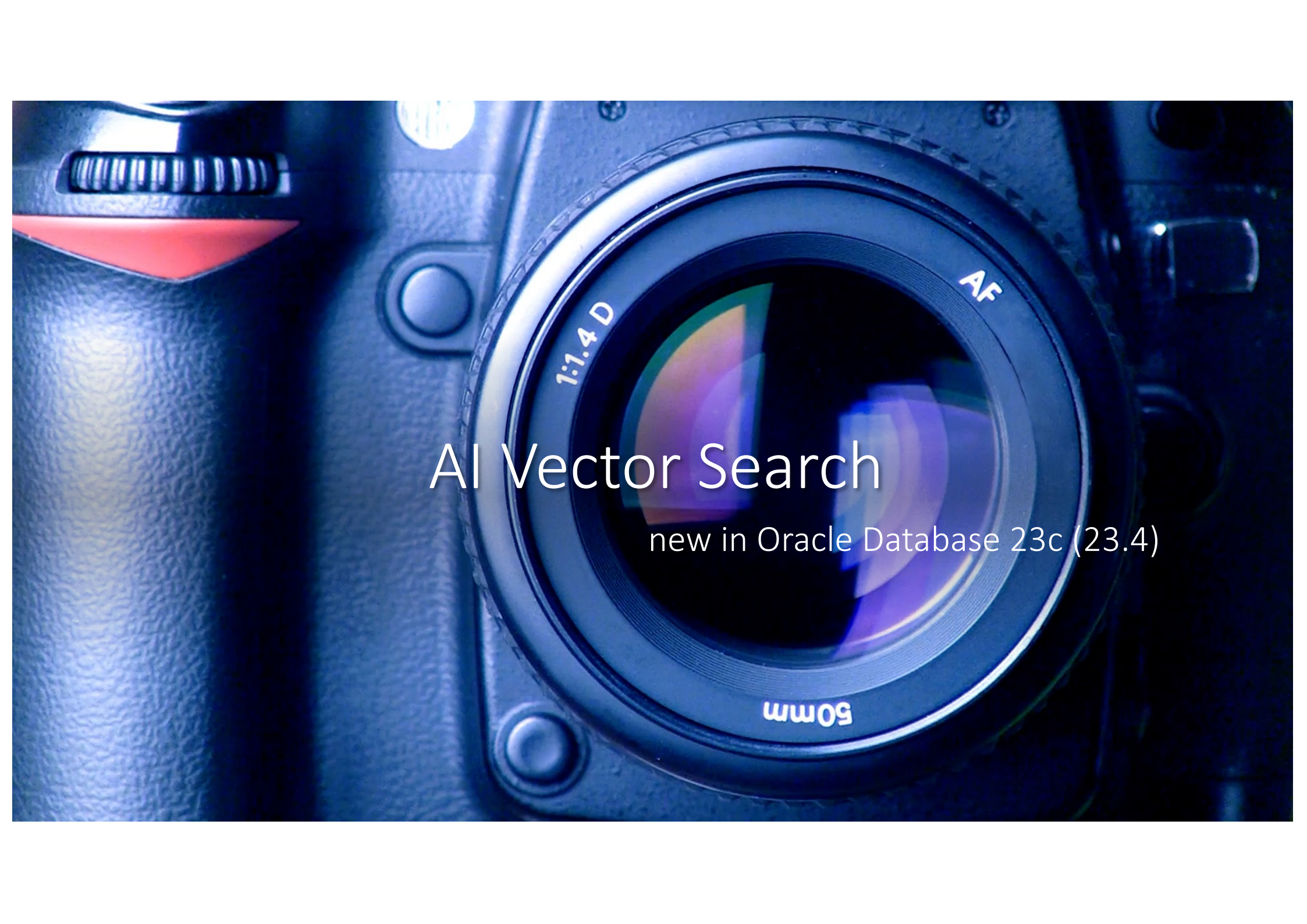
!

- Ajax call returned server error ORA-20987: APEX - WWW_FLOW_SEARCH.DBMS_SEARCH_BLOB_COLUMN_UNSUPPORTED for Search Results.

Workaround is to create a VIEW with URL of ORDS Web Service, which returns BLOB



How to improve the
AOP Support Portal?



AI Vector Search

new in Oracle Database 23c (23.4)

The data model

AOP_ISSUE

Questions
& status

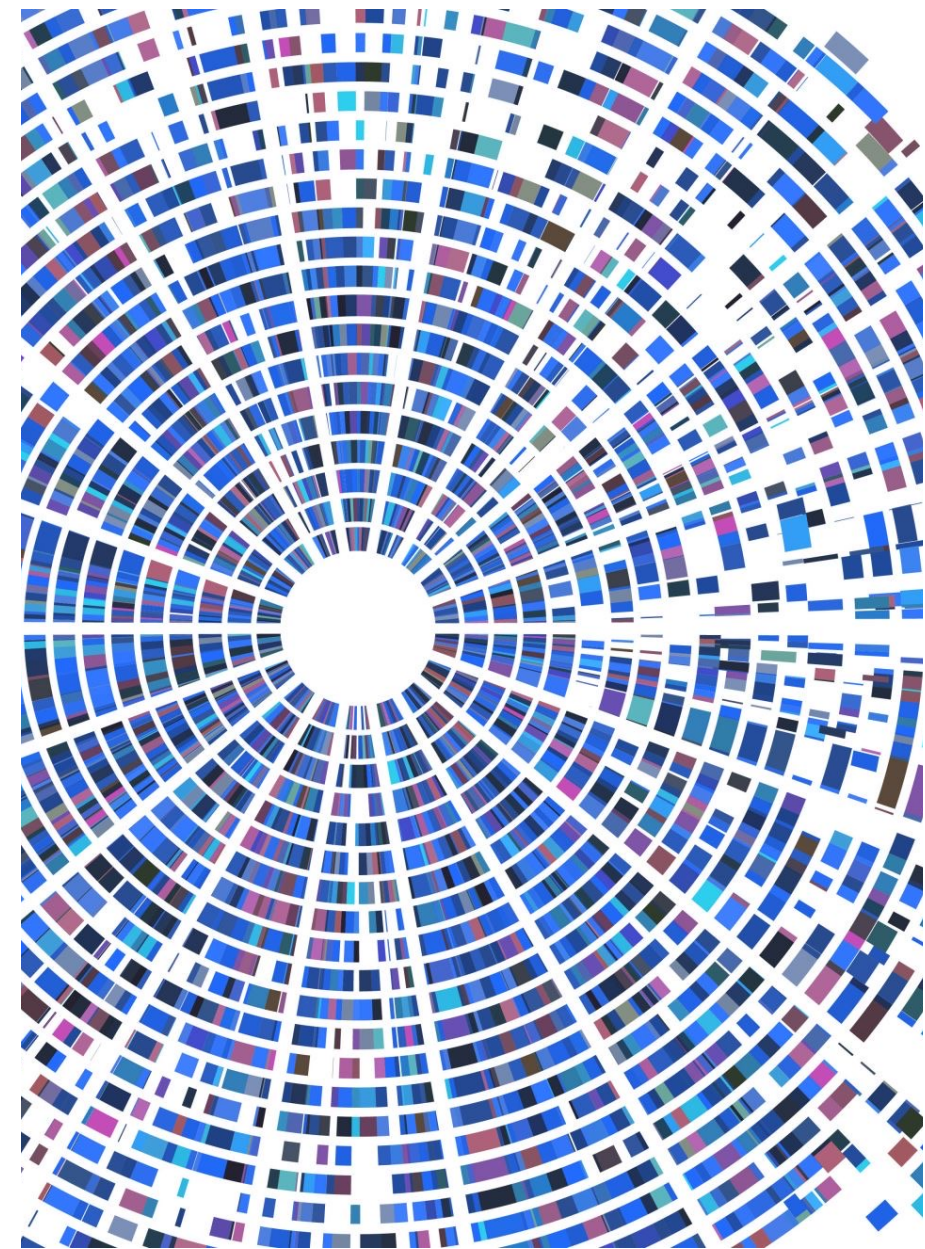
Supporting Files

- Results (PDFs, ...)
- Word, Excel, PowerPoint, Templates
- JSON debug
- Images with error messages

Answers

AOP_ISSUE_FILE

AOP_ISSUE_COMMENT



Searching in
unstructured data!

Vectors in AI represent semantics of unstructured data such as images, documents, videos, etc.



A vector is a sequence of numbers, called dimensions, used to capture the important "features" of the data

Vectors represent the semantic content of data, not the underlying words or pixels

The mathematical distance between two vectors indicates how similar they are

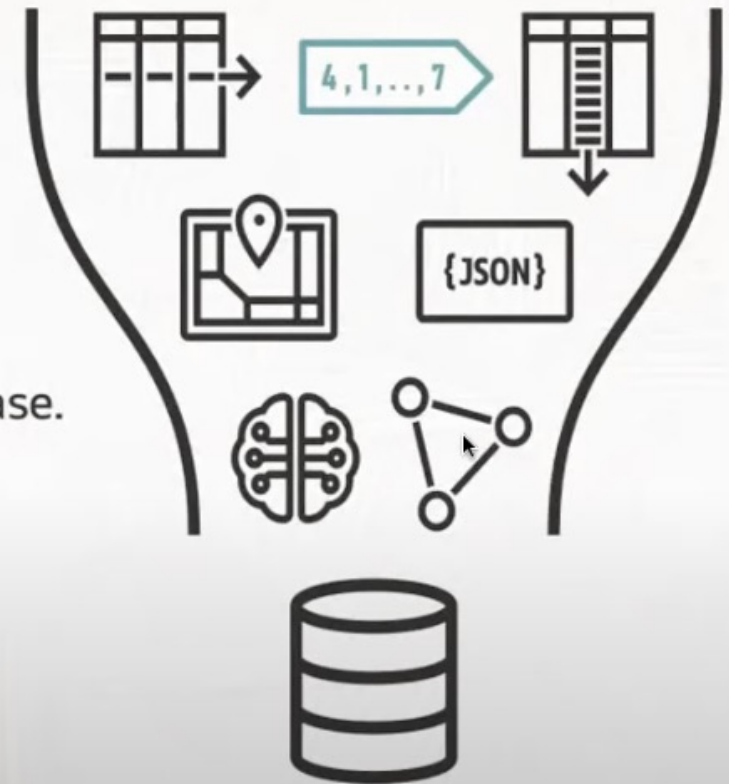
* source: Oracle presentation

Oracle AI Vector Search

AI Vector Search will be in the 23.4 Release early this year

Designed to be simple to use and easy to understand

- **New** VECTOR data type for storing vector embeddings
 - Create table docs (doc_id NUMBER, `doc_vec VECTOR`);
- **New** SQL syntax & functions expresses similarity search with ease.
 - Select id from docs order by `vector_distance(doc_vec, :query_vec)` fetch approximate first 10 rows only;
- **New** Approximate search indexes packaged and tuned for high performance and quality.
 - Create `vector index` doc_idx on docs(doc_vec) organization inmemory neighbor graph



Example VECTOR column

	ID	TEXT	TEXT_V
1	5	Brooklyn is in New York.	[1.28587112E-001,-2.93032881E-002,5.21207266E-002,-8....
2	2005	The Nurburgring is a motorsports complex in the Eifel mount...	[2.85519473E-003,6.07481487E-002,-5.25560044E-002,6...
3	6	Queens is in New York.	[1.48519337E-001,-1.05616778E-001,2.53191181E-002,-1.6...
4	7	Harlem is in New York.	[1.02412835E-001,-7.99447224E-002,-1.03916889E-002,1....
5	1	San Francisco is in California.	[1.72499314E-001,1.66155268E-002,6.94180652E-002,6.1...
6	213	Watermelons originate from the desert...	[-1.74980797E-002,3.24594565E-002,3.7904568E-002,2....
7	8	The Bronx is in New York.	[8.30077901E-002,-6.75041676E-002,-2.24316046E-002,-...
8	9	Manhattan is in New York.	[1.41627759E-001,-6.77322E-002,4.19022627E-002,2.308...
9	3	Los Angeles is in California.	[8.91519412E-002,-3.87281999E-002,1.46208303E-002,-1...
10	2008	Nurburg Castle is in golden sandstone.	[5.42869531E-002,3.08568347E-002,1.09281464E-004,5....
11	13	Orlando is in Florida.	[6.17130697E-002,-3.87211852E-002,2.63711084E-002,6.4....
12	2001	Munchen is the capital and most populated city of the S...	[8.86028484E-002,8.32071248E-003,6.92261849E-003,5....
13	14	Dallas is in Texas.	[9.63563398E-002,-3.48102041E-002,5.01118749E-002,3....
14	2009	Kolner Dom is the largest Gothic church in Northern Europe ...	[4.97599617E-002,3.92848477E-002,2.82337442E-002,-1....
15	16	Austin is in Texas.	[6.49699718E-002,-2.43846769E-003,1.20417506E-001,7....
16	10	Staten Island is in New York.	[8.53157863E-002,-1.93549134E-002,2.81549562E-002,3....
17	18	Las Vegas is in Nevada.	[1.45027339E-001,2.89297421E-002,-5.33112101E-002,7.2...
18	12	Tampa is in Florida.	[3.98651585E-002,-7.47234225E-002,-3.72719429E-002,...

How to fill the VECTOR column?

- Text

- `VECTOR_EMBEDDING(demo_model USING txt AS DATA)`

- Image

- `VECTOR_EMBEDDING(resnet_50 USING img)`

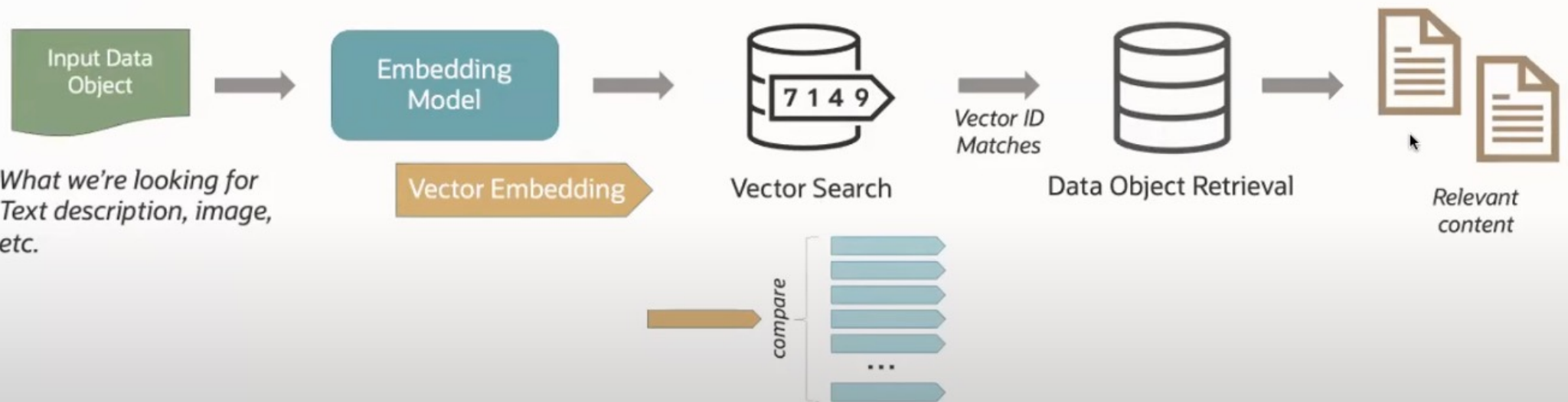
- Documents (break in chunks e.g. pages)

- `DBMS_VECTOR.UTL_TO_TEXT()`
 - `DBMS_VECTOR.UTL_TO_CHUNKS()`
 - `DBMS_VECTOR.UTL_TO_EMBED()`

 - `DBMS_ORACHAIN.UTL_TO_TEXT()`
 - `DBMS_ORACHAIN.UTL_TO_CHUNKS()`
 - `DBMS_ORACHAIN.UTL_TO_EMBEDDINGS()`

Similarity Search

Simple Pipeline



Allows finding data that is semantically similar to an input

Find houses that are similar to this picture



```
SELECT ...  
FROM house_for_sale  
ORDER BY vector_distance(house_vector, :input_vector);
```

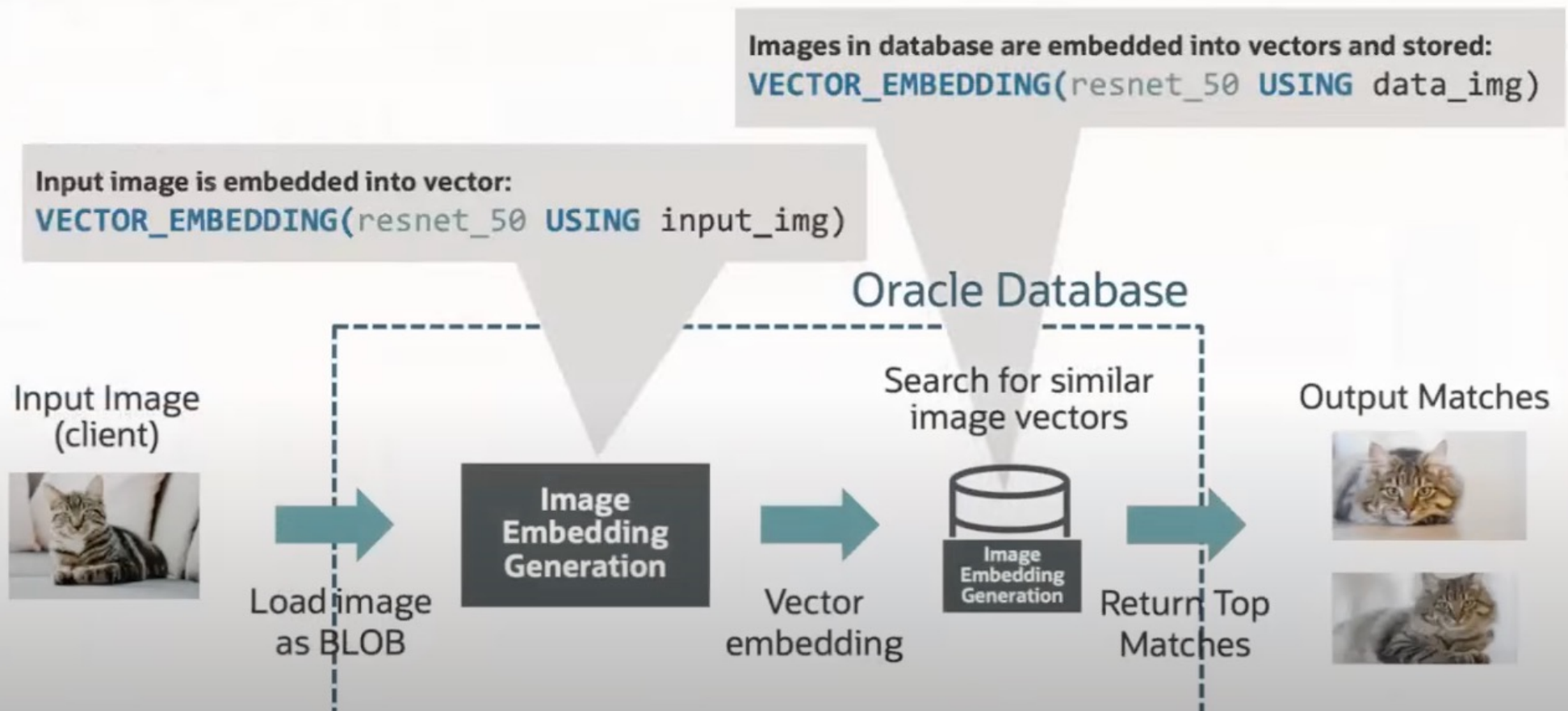


The distance between the vectors
is proportional to their semantic similarity



Oracle AI Vector Search

Native support for generating vectors – **New SQL VECTOR_EMBEDDING Function**



Oracle Building Blocks for Gen-AI Pipeline with DBMS_VECTOR

1. Load Documents

2. Document to Text

3. Text to Chunks

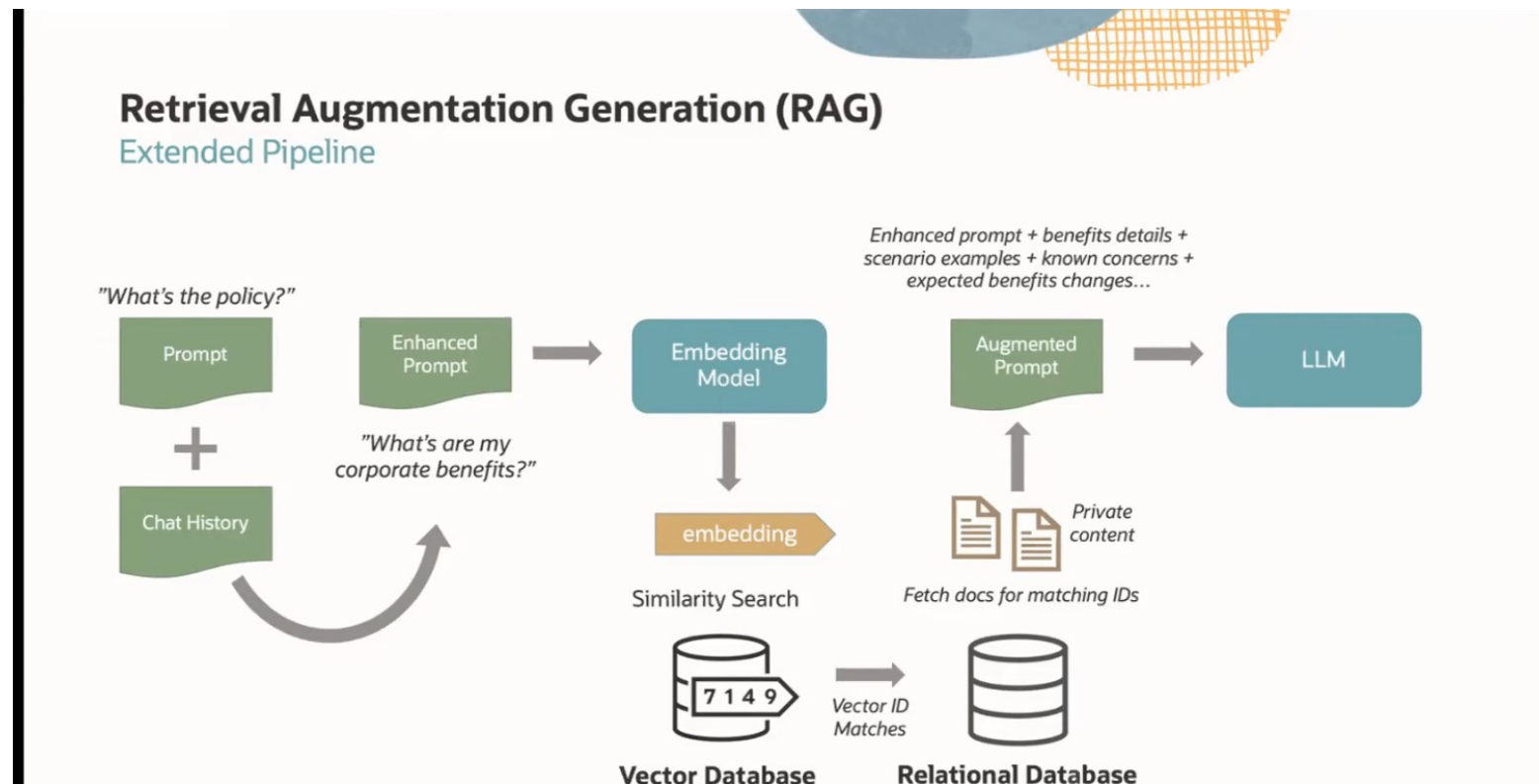
4. Chunks to Vectors



AOP Support Portal

- Question + VECTOR
- ANSWERS + VECTOR
- FILES + VECTOR
 - for documents chunk by page + VECTOR
- USER INPUT
 - QUESTION => MAKE VECTOR => COMPARE TO OTHER QUESTIONS VECTOR
 - FILES => MAKE VECTOR => COMPARE TO OTHER FILES VECTOR
 - => SHOW SIMILAR QUESTIONS AND ANSWERS...

Need even more? → connect to LLM!



AOP Support Portal

- NOT ONLY RELEVANT OTHER QUESTIONS
=> REAL ANSWERS, POSSIBLY COMBINED
- Challenges?
 - How to remove specific customer data or anonymize?
 - How to make it learn?
 - Check made-up answers (hallucinations 😊).
 - **For now:** use AI only internally as suggestion, but verify by AOP Support team



More info

- Fast and Precise Business and Semantic Data Search with AI Vector Search
<https://www.youtube.com/watch?v=TuLc3pK1Ay8>
- GitHub examples in Python
https://github.com/luigisaetta/llamaindex_oracle
- 5 advantages of using an integrated vector database for AI development
<https://www.oracle.com/database/integrated-vector-database-advantages-ai-development/>
- Research Vector (35')
<https://www.youtube.com/watch?v=irtZOznG1Z8>

Q&A

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