

# Workshop 1 - Get Started with AI Vector Search

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## 3. Vorbereitungen für Workshop 1 - Get Started with AI Vector Search

(wenn nicht in der Cloud-Sandbox)

- : Oracle Database 26ai Free VirtualBox Appliance installiert (<https://www.oracle.com/database/technologies/databaseappdev-vm.html>)

### 3.1 Datenbank vorbereiten

#### in der PDB FREEPDB1 MAX\_STRING\_SIZE auf EXTENDED setzen

Hintergrund: siehe <https://docs.oracle.com/en/database/oracle/oracle-database/26/vecse/create-hybrid-vector-index.html> "When your database is configured with MAX\_STRING\_SIZE=EXTENDED, you can leverage this database setting to index significantly larger text chunks (up to 32,767 bytes) for hybrid vector indexing using the DBMS\_VECTOR\_CHAIN.CREATE\_PREFERENCE PL/SQL function."

```
[oracle@localhost dbs]$ sqlplus sys/oracle@FREEPDB1 as sysdba

SQL*Plus: Release 23.26.0.0.0 – Production on Tue Feb 10 17:02:10 2026
Version 23.26.0.0.0
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Oracle AI Database 26ai Free Release 23.26.0.0.0 – Develop, Learn, and Run
for Free
Version 23.26.0.0.0

SQL> alter system set max_string_size=EXTENDED scope=spfile;
System altered.

SQL> alter session set container=CDB$ROOT;
Session altered.

SQL> alter pluggable database FREEPDB1 close immediate;
Pluggable database altered.

SQL> alter pluggable database FREEPDB1 open upgrade;
Pluggable database altered.

SQL> alter session set container=FREEPDB1;
Session altered.
```

SQL> @?/rdbms/admin/utl32k

Session altered.

Session altered.

DOC>#####

DOC>#####

DOC> The following statement will cause an "ORA-01722: invalid number"  
DOC> error if the database has not been opened for UPGRADE.

DOC>

DOC> Perform a "SHUTDOWN ABORT" and  
DOC> restart using UPGRADE.

DOC>#####

DOC>#####

DOC>#

no rows selected

DOC>#####

DOC>#####

DOC> The following statement will cause an "ORA-01722: invalid number"  
DOC> error if the database does not have compatible >= 12.0.0

DOC>

DOC> Set compatible >= 12.0.0 and retry.

DOC>#####

DOC>#####

DOC>#

PL/SQL procedure successfully completed.

Session altered.

448 rows updated.

Commit complete.

System altered.

PL/SQL procedure successfully completed.

Commit complete.

System altered.

Session altered.

Session altered.

Table created.

Table created.

Table created.

Table truncated.

0 rows created.

PL/SQL procedure successfully completed.

STARTTIME

-----  
----

02/10/2026 17:04:42.264055000

PL/SQL procedure successfully completed.

No errors.

PL/SQL procedure successfully completed.

Session altered.

Session altered.

0 rows created.

no rows selected

no rows selected

DOC>#####

DOC>#####

DOC> The following statement will cause an "ORA-01722: invalid number"

DOC> error if we encountered an error while modifying a column to

DOC> account for data type length change as a result of enabling or

DOC> disabling 32k types.

```
DOC>
DOC> Contact Oracle support for assistance.
DOC>#####
DOC>#####
DOC>#
```

PL/SQL procedure successfully completed.

PL/SQL procedure successfully completed.

Commit complete.

Package altered.

Session altered.

```
SQL> alter session set container=CDB$ROOT;
Session altered.
```

```
SQL> alter pluggable database FREEPDB1 close immediate;
Pluggable database altered.
```

```
SQL> alter pluggable database FREEPDB1 open;
Pluggable database altered.
```

```
SQL> alter session set container=FREEPDB1;
Session altered.
```

```
SQL> show parameter MAX_STRING_SIZE
```

NAME	TYPE	VALUE
max_string_size	string	EXTENDED

### Tablespace DATA in der PDB FREEPDB1 anlegen

```
SQL> create tablespace DATA datafile
'/opt/oracle/oradata/FREE/FREEPDB1/data01.dbf' size 100M autoextend on next
100M maxsize 4000M;
Tablespace created.
```

### Benutzer NATIONALPARKS anlegen

```

SQL> create user nationalparks identified by "Welcome_12345"
      2 default tablespace data temporary tablespace temp;
User created.

SQL> alter user nationalparks quota unlimited on data;
User altered.

SQL> grant connect,resource to nationalparks;
Grant succeeded.

SQL> BEGIN
ORDS_ADMIN.ENABLE_SCHEMA(
    p_enabled => TRUE,
    p_schema => 'NATIONALPARKS',
    p_url_mapping_type => 'BASE_PATH',
    p_url_mapping_pattern => 'nationalparks',
    p_auto_rest_auth=> TRUE
);
commit;
END;
/

```

den folgenden Teil ignorieren wir erstmal, da es das Package C##ADP\$SERVICE.DBMS\_SHARE in der lokalen Oracle AI Database 26ai FREE nicht gibt

```

BEGIN
-- ENABLE DATA SHARING
C##ADP$SERVICE.DBMS_SHARE.ENABLE_SCHEMA(
    SCHEMA_NAME => 'NATIONALPARKS',
    ENABLED => TRUE
);
commit;
END;
/

```

### Package DBMS\_CLOUD anlegen

Auch das Package DBMS\_CLOUD fehlt, aber dieses können wir nachträglich installieren (Dank an Tim Hall, [https://oracle-base.com/articles/21c/dbms\\_cloud-installation](https://oracle-base.com/articles/21c/dbms_cloud-installation)).

```

$ORACLE_HOME/perl/bin/perl $ORACLE_HOME/rdbms/admin/catcon.pl \
-u sys/oracle \
--force_pdb_mode 'READ WRITE' \
-b dbms_cloud_install \
-d $ORACLE_HOME/rdbms/admin/ \

```

```
-l /tmp \  
catclouduser.sql
```

```
$ORACLE_HOME/perl/bin/perl $ORACLE_HOME/rdbms/admin/catcon.pl \  
-u sys/oracle \  
--force_pdb_mode 'READ WRITE' \  
-b dbms_cloud_install \  
-d $ORACLE_HOME/rdbms/admin/ \  
-l /tmp \  
dbms_cloud_install.sql
```

Rechte vergeben:

### Rechte vergeben

```
GRANT ORDS_RUNTIME_ROLE TO nationalparks;  
GRANT EXECUTE ON dbms_cloud TO nationalparks;  
GRANT EXECUTE ON DBMS_NETWORK_ACL_ADMIN TO nationalparks;  
GRANT READ,WRITE ON directory data_pump_dir TO nationalparks;  
GRANT CREATE mining model TO nationalparks;  
GRANT SELECT ON sys.v_$vector_memory_pool TO nationalparks;  
GRANT SELECT ON sys.v_$vector_index TO nationalparks;
```

## 3.2 ONNX-Modell importieren

### Daten aus dem Object-Storage runterladen

```
[oracle@localhost ~]$ pwd  
/home/oracle
```

```
wget https://c4u04.objectstorage.us-ashburn-1.oci.customer-  
oci.com/p/EcTjWk2IuZPZeNd_fYMcgUhdNDIDA6rt9gaFj_WZMiL7VvxPBNMY60837hu5hga/n  
/c4u04/b/livelabsfiles/o/labfiles/clip-vit-base-patch32_txt.onnx
```

```
[oracle@localhost ~]$ wget https://c4u04.objectstorage.us-ashburn-  
1.oci.customer-  
oci.com/p/EcTjWk2IuZPZeNd_fYMcgUhdNDIDA6rt9gaFj_WZMiL7VvxPBNMY60837hu5hga/n  
/c4u04/b/livelabsfiles/o/labfiles/all_MiniLM_L12_v2.onnx
```

```
wget
```

```
wget wget https://c4u04.objectstorage.us-ashburn-1.oci.customer-  
oci.com/p/EcTjWk2IuZPZeNd_fYMcgUhdNDIDA6rt9gaFj_WZMiL7VvxPBNMY60837hu5hga/n  
/c4u04/b/livelabsfiles/o/labfiles/natparks.dmp
```

```
SQL> connect nationalparks/"Welcome_12345"@FREEPDB1
```

```
Connected.
```

### Pfad des DATA\_PUMP\_DIR der PDB FREEPDB1 ermitteln

```
[oracle@localhost ~]$ sqlplus sys/oracle@FREEPDB1 as sysdba
```

```
SQL*Plus: Release 23.26.0.0.0 – Production on Tue Feb 10 18:00:30 2026
```

```
Version 23.26.0.0.0
```

```
Copyright (c) 1982, 2025, Oracle. All rights reserved.
```

```
Connected to:
```

```
Oracle AI Database 26ai Free Release 23.26.0.0.0 – Develop, Learn, and Run  
for Free
```

```
Version 23.26.0.0.0
```

```
SQL> select directory_path from dba_directories where  
directory_name='DATA_PUMP_DIR';
```

```
DIRECTORY_PATH
```

```
-----  
-----  
/opt/oracle/admin/FREE/dpdump/41998495EF3A327FE0630100007FEF3A
```

```
SQL> exit
```

```
Disconnected from Oracle AI Database 26ai Free Release 23.26.0.0.0 –  
Develop, Learn, and Run for Free
```

```
Version 23.26.0.0.0
```

### Dateien in das DATA\_PUMP\_DIR kopieren

```
[oracle@localhost ~]$ cp *.onnx
```

```
/opt/oracle/admin/FREE/dpdump/41998495EF3A327FE0630100007FEF3A/.
```

```
[oracle@localhost ~]$ cp natparks.dmp
```

```
/opt/oracle/admin/FREE/dpdump/41998495EF3A327FE0630100007FEF3A/.
```

### ONNX-Modell importieren

```
SQL> show user
```

```
USER is "NATIONALPARKS"
```

```
begin
```

```
    dbms_vector.load_onnx_model(directory=>'DATA_PUMP_DIR',  
                                file_name=>'clip-vit-base-patch32_txt.onnx',
```

```
model_name=>'clip_vit_txt',
```

```
    metadata=>JSON('{"function" : "embedding", "embeddingOutput" :
```

```
"embedding" , "input": {"input": ["DATA"]})});  
end;  
/
```

(Das Modell all\_MiniLM\_L12\_v2.onnx wird später geladen :))

## Daten via Data Pump laden

```
[oracle@localhost ~]$ impdp nationalparks/Welcome_12345@FREEPDB1  
directory=data_pump_dir dumpfile=natparks.dmp logfile=nationalparks_imp.log
```

```
Import: Release 23.26.0.0.0 - Production on Tue Feb 10 18:33:08 2026  
Version 23.26.0.0.0
```

```
Copyright (c) 1982, 2025, Oracle and/or its affiliates. All rights  
reserved.
```

```
Connected to: Oracle AI Database 26ai Free Release 23.26.0.0.0 - Develop,  
Learn, and Run for Free
```

```
ORA-39002: invalid operation
```

```
ORA-39405: Oracle Data Pump does not support importing from a source  
database with TSTZ version 44 into a target database with TSTZ version 43.
```

Workaround (<https://mikedietchde.com/2024/01/22/ora-39405-with-impdp-when-you-have-mixed-time-zone-versions/>, Dank an Mike Dietrich):

```
[oracle@localhost ~]$ sqlplus sys/oracle@freepdb1 as sysdba
```

```
SQL*Plus: Release 23.26.0.0.0 - Production on Tue Feb 10 18:35:40 2026  
Version 23.26.0.0.0
```

```
Copyright (c) 1982, 2025, Oracle. All rights reserved.
```

```
Connected to:
```

```
Oracle AI Database 26ai Free Release 23.26.0.0.0 - Develop, Learn, and Run  
for Free
```

```
Version 23.26.0.0.0
```

```
SQL> alter system set "_datapump_bypass_tstz_check"=TRUE scope=memory;  
System altered.
```

```
SQL> exit
```

```
Disconnected from Oracle AI Database 26ai Free Release 23.26.0.0.0 -  
Develop, Learn, and Run for Free
```

```
Version 23.26.0.0.0
```

Und der nächste Import-Versuch:

```

[oracle@localhost ~]$ impdp nationalparks/Welcome_12345@FREEPDB1
directory=data_pump_dir dumpfile=natparks.dmp logfile=nationalparks_imp.log

Import: Release 23.26.0.0.0 - Production on Tue Feb 10 18:36:40 2026
Version 23.26.0.0.0
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reserved.

Connected to: Oracle AI Database 26ai Free Release 23.26.0.0.0 - Develop,
Learn, and Run for Free
Master table "NATIONALPARKS"."SYS_IMPORT_FULL_01" successfully
loaded/unloaded
Starting "NATIONALPARKS"."SYS_IMPORT_FULL_01":
nationalparks/*****@FREEPDB1 directory=data_pump_dir
dumpfile=natparks.dmp logfile=nationalparks_imp.log
Processing object type SCHEMA_EXPORT/PRE_SCHEMA/PROCACT_SCHEMA/LOGREP
Processing object type SCHEMA_EXPORT/SEQUENCE/SEQUENCE
Processing object type SCHEMA_EXPORT/TABLE/TABLE
Processing object type SCHEMA_EXPORT/TABLE/TABLE_DATA
. . imported "NATIONALPARKS"."PARK_IMAGES"          437.3 MB   176273
rows
. . imported "NATIONALPARKS"."PARKS"                464.2 KB    472
rows
Processing object type SCHEMA_EXPORT/TABLE/INDEX/INDEX
Processing object type SCHEMA_EXPORT/TABLE/CONSTRAINT/CONSTRAINT
Processing object type SCHEMA_EXPORT/TABLE/INDEX/STATISTICS/INDEX_STATISTICS
Processing object type SCHEMA_EXPORT/TABLE/STATISTICS/TABLE_STATISTICS
Processing object type SCHEMA_EXPORT/TABLE/INDEX/DOMAIN_INDEX/INDEX
Processing object type SCHEMA_EXPORT/POST_SCHEMA/PROCACT_SCHEMA/LBAC_EXP
Job "NATIONALPARKS"."SYS_IMPORT_FULL_01" successfully completed at Tue Feb
10 18:38:06 2026 elapsed 0 00:01:23

```

### 3.3 APEX-Applikation importieren

#### Download vom Object Storage

```

wget https://c4u04.objectstorage.us-ashburn-1.oci.customer-
oci.com/p/EcTjWk2IuZPZeNd_fYMcgUhdNDIDA6rt9gaFj_WZMiL7VvxPBNMY60837hu5hga/n
/c4u04/b/livelabsfiles/o/labfiles/w100001.sql
wget https://c4u04.objectstorage.us-ashburn-1.oci.customer-
oci.com/p/EcTjWk2IuZPZeNd_fYMcgUhdNDIDA6rt9gaFj_WZMiL7VvxPBNMY60837hu5hga/n
/c4u04/b/livelabsfiles/o/labfiles/f114.sql

```

```

[oracle@localhost ~]$ ls -ltr *.sql

```

```
-rw-r--r--. 1 oracle dba 14400 Aug 8 2025 w100001.sql
-rw-r--r--. 1 oracle dba 752059 Aug 8 2025 f114.sql
```

## Applikation importieren

```
[oracle@localhost ~]$ sqlplus sys/oracle@freepdb1 as sysdba
```

```
SQL*Plus: Release 23.26.0.0.0 – Production on Tue Feb 10 18:42:01 2026
Version 23.26.0.0.0
```

```
Copyright (c) 1982, 2025, Oracle. All rights reserved.
```

```
Connected to:
```

```
Oracle AI Database 26ai Free Release 23.26.0.0.0 – Develop, Learn, and Run
for Free
```

```
Version 23.26.0.0.0
```

```
SQL> @w100001.sql
```

```
[...]
```

```
SQL> @f114.sql
```

```
[...]
```

## 3.4 Aufruf der APEX-Applikation

```
http://<HOST_IP>:8080/ords/f?P=114
```

## 3.5 Vector Embeddings

### Embedding Modell laden

### Vorhandene Modelle anzeigen

```
SQL> show user
```

```
USER is "NATIONALPARKS"
```

```
SQL> SELECT model_name, mining_function, algorithm, algorithm_type,
model_size
```

```
FROM user_mining_models;
```

```
2
```

```
MODEL_NAME
```

```
-----
MINING_FUNCTION
```

```
ALGORITHM
```

```
ALGORITHM_
```

```
-----
MODEL_SIZE
```

```
-----
CLIP_VIT_TXT
```

EMBEDDING	ONNX	NATIVE
255521088		

### Modell-Datei MiniLM\_L12\_v2.onnx laden

BEGIN

```
DBMS_VECTOR.LOAD_ONNX_MODEL('DATA_PUMP_DIR','all_Minilm_L12_v2.onnx','minilm_l12_v2',
  JSON('{"function" : "embedding", "embeddingOutput" : "embedding", "input": {"input": ["DATA"]}}'));
END;
/
```

### Kontrolle

```
SQL> SELECT model_name, mining_function, algorithm, algorithm_type,
model_size
FROM user_mining_models;
2
```

MODEL\_NAME

MINING_FUNCTION	ALGORITHM	ALGORITHM_
-----------------	-----------	------------

MODEL\_SIZE

CLIP\_VIT\_TXT

EMBEDDING	ONNX	NATIVE
255521088		

MINILM\_L12\_V2

EMBEDDING	ONNX	NATIVE
133322334		

### Einzelheiten des Modells

```
SQL> SELECT model_name, attribute_name, attribute_type, data_type,
vector_info
FROM user_mining_model_attributes
where model_name = 'MINILM_L12_V2'
ORDER BY 1,3;
```

2 3 4

MODEL\_NAME

ATTRIBUTE\_NAME

```
-----  
-----  
ATTRIBUTE_TY  
-----
```

```
DATA_TYPE  
-----
```

```
-----  
VECTOR_INFO  
-----
```

```
MINILM_L12_V2
```

```
DATA
```

```
TEXT
```

```
VARCHAR2
```

```
MINILM_L12_V2
```

```
ORA$ONNXTARGET
```

```
VECTOR
```

```
VECTOR
```

```
VECTOR(384, FLOAT32)
```

### Vektor-Beispiel anzeigen

```
SQL> SELECT VECTOR_EMBEDDING(minilm_l12_v2 USING 'hello' AS data);
```

```
VECTOR_EMBEDDING(MINILM_L12_V2USING'HELLO'ASDATA)  
-----
```

```
-----  
[-7.49069825E-002, -1.44330608E-002, 4.86499295E-002, -2.71381028E-002,
```

### Vektor-Spalte für PARKS.DESCRPTION anzeigen (Beispiel)

```
SQL> SELECT description, VECTOR_EMBEDDING(minilm_l12_v2 USING description AS  
data)
```

```
FROM parks
```

```
FETCH FIRST 1 ROWS ONLY;
```

```
2 3
```

```
DESCRIPTION  
-----
```

```
-----  
VECTOR_EMBEDDING(MINILM_L12_V2USINGDESCRIPTIONASDATA)  
-----
```

```
-----  
The rugged beauty of the Badlands draws visitors from around the world.  
These st
```

riking geologic deposits contain one of the world's richest fossil beds. Ancient horses and rhinos once roamed here. The park's 244, 000 acres protect an expansive of mixed-grass prairie where bison, bighorn sheep, prairie dogs, and black-footed ferrets live today.  
[4.99351174E-002, -1.15864873E-002, 2.56994218E-002, 9.18255672E-002,

### Vektor-Spalte in der Tabelle PARKS ergänzen

```
SQL> ALTER TABLE parks ADD (desc_vector VECTOR);  
Table altered.
```

```
SQL> desc parks
```

Name	Null?	Type
PARK_ID	NOT NULL	VARCHAR2(36)
PARK_CODE		VARCHAR2(4)
URL		VARCHAR2(34)
NAME	NOT NULL	VARCHAR2(51)
DESCRIPTION		VARCHAR2(414)
LATITUDE		NUMBER(11,8)
LONGITUDE		NUMBER(11,8)
LOCATION		PUBLIC.SDO_GEOMETRY
DIRECTIONS_INFO		VARCHAR2(524)
DIRECTIONS_URL		VARCHAR2(162)
CONTACT_PHONE		VARCHAR2(13)
EMAIL_ADDRESS		VARCHAR2(44)
STREET		VARCHAR2(95)
CITY		VARCHAR2(35)
STATES		VARCHAR2(2)
POSTAL_CODE		VARCHAR2(10)
COUNTRY_ID	NOT NULL	VARCHAR2(3)
DESC_VECTOR		VECTOR(*, *, DENSE)

### Vektor-Embeddings erzeugen

```
SQL> set timing on  
SQL> UPDATE parks  
SET desc_vector = VECTOR_EMBEDDING(minilm_l12_v2 USING description AS data);  
2  
472 rows updated.
```

```
Elapsed: 00:01:12.08
```

## Kontrolle

```
SQL> SELECT description, desc_vector
  2  FROM parks
FETCH FIRST 3 ROWS ONLY;
  3
DESCRIPTION
```

```
-----
DESC_VECTOR
-----
```

This 29-mile highway connects Baltimore, MD and Washington, D.C. The parkway has carried visitors to and from the capital city since 1954.

[1.08246505E-001,-3.48854959E-002,1.48542123E-002,8.79330039E-002,

In the 1840s the Arkansas River was the border between territory claimed by the United States and Mexico. Located along the river, Bent's Fort was an adobe trading post on the Santa Fe Trail, where traders, trappers, travelers, and the

Cheyenne and Arapaho tribes came together in peaceful terms for trade. Today, a reconstructed fort allows visitors to explore the front line of Westward Expansion.

[-1.48304878E-002,-4.83461991E-002,-7.25463927E-002,9.71838385E-002,

There is a place in Far West Texas where night skies are dark as coal and rivers

carve temple-like canyons in ancient limestone. Here, at the end of the road,

hundreds of bird species take refuge in a solitary mountain range surrounded by

weather-beaten desert. Tenacious cactus bloom in sublime southwestern sun, and

species diversity is the best in the country. This magical place is Big Bend...

[7.16210455E-002,2.03264854E-003,-1.18637308E-002,9.06888023E-002,

Elapsed: 00:00:00.01

# Exhaustive Similarity Search

## erste Abfrage

(welche Orte haben mit dem amerikanischen Bürgerkrieg zu tun)

```
SQL> SELECT name, city, states, description
FROM parks
ORDER BY VECTOR_DISTANCE(desc_vector,
VECTOR_EMBEDDING
(minilm_l12_v2 USING 'Civil War' AS data), COSINE)
FETCH EXACT FIRST 2 ROWS ONLY; 2 3 4 5 6
```

NAME

CITY

ST

DESCRIPTION

Shiloh

Shiloh

TN

Visit the sites of the most epic struggle in the Western Theater of the Civil War. Nearly 110,000 American troops clashed in a bloody contest that resulted in 23,746 casualties; more casualties than in all of America's previous wars combined. Explore both the Shiloh and Corinth battlefields to discover the impact of this struggle on the soldiers and on the nation.

Monocacy

Frederick

MD

During the summer of 1864, the Confederacy carried out a bold plan to turn the tide of the Civil War in their favor. They planned to capture Washington, DC and influence the election of 1864. On July 9, however, Federal soldiers outnumbered three to one, fought gallantly along the banks of the Monocacy River in an effort to buy time for Union reinforcement to arrive in Washington, DC.

## Beispiel-Abfrage 2 (Orte, die mit "rock-climbing" verbunden sind)

```
SQL>
SQL> SELECT name, city, states, description
FROM parks
ORDER BY VECTOR_DISTANCE(desc_vector,
VECTOR_EMBEDDING
(minilm_l12_v2 using 'rock climbing' AS data), COSINE)
FETCH EXACT FIRST 3 ROWS ONLY;
```

2 3 4 5 6

NAME

CITY

ST

DESCRIPTION

Black Canyon Of The Gunnison

Montrose

CO

Big enough to be overwhelming, yet still intimate enough to feel the pulse of time.

Come see some of the steepest cliffs, oldest rock, and craggiest spires in

North America. Forces of nature and the Gunnison River sculpted this canyon over

two million years. The result is a vertical wilderness of rock, water, and sky.

City Of Rocks

Almo

ID

Emigrants of the California Trail describe the rocks here in vivid detail as "a

city of tall spires, "steeple rocks," and "the silent city." Today, this back

country byway attracts rock climbers, campers, hikers, hunters, and those with

the spirit of adventure. There's inspirational scenery, exceptional opportunities

for geologic study, and remnants of the Old West awaiting your discovery.

.

Timpanogos Cave

American Fork

UT

Hike your way past stunning vistas to explore a hidden underground world.

Taste

the thrill of caving as you twist and bend to enter beautifully decorated rooms.

Learn the science behind formations and hear stories of cave exploration and pr

eservation. Experience and discover as you go ? geologic mysteries await

## Distanz zwischen Vektoren

Je näher der Cosinus der Differenz von zwei Winkeln bei 1 liegt, desto enger liegen die beiden Vektoren zusammen ( $\cos(0)=1$ ).

```
SQL> SELECT name,  
VECTOR_DISTANCE(desc_vector,  
VECTOR_EMBEDDING(minilm_l12_v2 USING 'rock climbing' AS data), COSINE) AS  
distance,  
description  
FROM parks  
ORDER BY 2  
FETCH EXACT FIRST 2 ROWS ONLY;
```

```
  2   3   4   5   6   7
```

```
NAME                                                    DISTANCE
```

```
-----  
DESCRIPTION  
-----  
-----
```

```
Black Canyon Of The Gunnison                            5.593E-001
```

Big enough to be overwhelming, yet still intimate enough to feel the pulse of t

ime. Come see some of the steepest cliffs, oldest rock, and craggiest spires i

n North America. Forces of nature and the Gunnison River sculpted this canyon ov

er two million years. The result is a vertical wilderness of rock, water, and

sky.

```
City Of Rocks                                           5.626E-001
```

Emigrants of the California Trail describe the rocks here in vivid detail as "a

city of tall spires, ? ?steeple rocks, " and "the silent city." Today, this bac

country byway attracts rock climbers, campers, hikers, hunters, and those with the spirit of adventure. There's inspirational scenery, exceptional opportunities for geologic study, and remnants of the Old West awaiting your discovery.

## Ausführungsplan

```
[oracle@localhost admin]$ sqlplus sys/oracle@freepdb1 as sysdba
```

```
SQL*Plus: Release 23.26.0.0.0 – Production on Tue Feb 10 19:25:22 2026  
Version 23.26.0.0.0  
Copyright (c) 1982, 2025, Oracle. All rights reserved.
```

```
Connected to:
```

```
Oracle AI Database 26ai Free Release 23.26.0.0.0 – Develop, Learn, and Run  
for Free  
Version 23.26.0.0.0
```

```
SQL> @?/sqlplus/admin/plustrce.sql
```

```
SQL>
```

```
SQL> drop role plustrace;
```

```
drop role plustrace
```

```
*
```

```
ERROR at line 1:
```

```
ORA-01919: Role 'PLUSTRACE' does not exist.
```

```
Help: https://docs.oracle.com/error-help/db/ora-01919/
```

```
[...]
```

```
SQL> grant plustrace to nationalparks;
```

```
Grant succeeded.
```

```
SQL> show user
```

```
USER is "NATIONALPARKS"
```

```
SQL> set autotrace on explain
```

```
SQL> SELECT name,
```

```
VECTOR_DISTANCE(desc_vector,
```

```
VECTOR_EMBEDDING(minilm_l12_v2 USING 'rock climbing' AS data), COSINE) AS  
distance,
```

```
description
```

```
FROM parks
```

```
ORDER BY 2
```



Predicate Information (identified by operation id):

```
-----  
1 - filter(ROWNUM<=2)  
3 - filter(ROWNUM<=2)
```

==> FULL TABLE ACCESS

## Approximate Similarity Search

### Vector Pool anzeigen

```
SQL> SELECT * FROM v$vector_memory_pool;  
no rows selected
```

### Vector Index anlegen

```
SQL> SELECT * FROM v$vector_memory_pool;  
  
no rows selected
```

```
SQL>
```

```
SQL>
```

```
SQL> CREATE VECTOR INDEX parks_hnsw_idx ON parks (desc_vector)  
ORGANIZATION INMEMORY NEIGHBOR GRAPH  
DISTANCE COSINE WITH TARGET ACCURACY 95;
```

```
2 3
```

```
CREATE VECTOR INDEX parks_hnsw_idx ON parks (desc_vector)  
*  
ERROR at line 1:
```

```
ERROR at line 1:
```

```
ORA-51962: The vector memory area is out of space for the current container.  
Help: https://docs.oracle.com/error-help/db/ora-51962/
```

Also müssen wir den Parameter vector\_memory\_size (aktuell 0) setzen

```
SQL> connect sys/oracle@FREE as sysdba
```

```
Connected.
```

```
SQL> alter system set vector_memory_size=200M;
```

```
alter system set vector_memory_size=200M
```

```
*
```

```
ERROR at line 1:
```

```
ORA-02097: parameter cannot be modified because specified value is invalid  
ORA-51950: The Oracle Database Vector Memory size cannot be increased.  
Help: https://docs.oracle.com/error-help/db/ora-02097/
```

```
SQL> alter system set vector_memory_size=200M scope=spfile;
System altered.
```

```
SQL>
```

```
SQL> shutdown immediate;
```

```
Database closed.
```

```
Database dismounted.
```

```
ORACLE instance shut down.
```

```
ERROR:
```

```
ORA-01017: invalid credential or not authorized; logon denied
```

```
Help: https://docs.oracle.com/error-help/db/ora-01017/
```

```
SQL> exit
```

```
[oracle@localhost admin]$ export TWO_TASK=
```

Der ORA-1017 kommt wg. des gesetzten TWO\_TASK-Parameters, daher löschen wir diese Variable

```
[oracle@localhost admin]$ sqlplus / as sysdba
```

```
SQL*Plus: Release 23.26.0.0.0 – Production on Tue Feb 10 19:37:34 2026
```

```
Version 23.26.0.0.0
```

```
Copyright (c) 1982, 2025, Oracle. All rights reserved.
```

```
Connected to an idle instance.
```

```
SQL> startup
```

```
ORACLE instance started.
```

```
Total System Global Area 1603373280 bytes
```

```
Fixed Size 5007584 bytes
```

```
Variable Size 369098752 bytes
```

```
Database Buffers 1006632960 bytes
```

```
Redo Buffers 4530176 bytes
```

```
Vector Memory Area 218103808 bytes
```

```
Database mounted.
```

```
Database opened.
```

```
SQL> show parameter vector_memory_size
```

NAME	TYPE	VALUE
------	------	-------

-----  
----

vector_memory_size	big integer	208M
--------------------	-------------	------

```
SQL> alter session set container=FREEPDB1;
```

Session altered.

```
SQL> show parameter vector_memory_size
```

NAME	TYPE	VALUE
vector_memory_size	big integer	208M

### Vector Index anlegen

```
SQL> CREATE VECTOR INDEX parks_hnsw_idx ON parks (desc_vector)
ORGANIZATION INMEMORY NEIGHBOR GRAPH
DISTANCE COSINE WITH TARGET ACCURACY 95;
  2   3
Index created.
```

```
SQL> SELECT owner, index_name, index_organization, num_vectors
FROM v$vector_index
WHERE index_name = 'PARKS_HNSW_IDX';
```

OWNER	INDEX_NAME	INDEX_ORGANIZATION	NUM_VECTORS
NATIONALPARKS	PARKS_HNSW_IDX	INMEMORY NEIGHBOR GRAPH	472

```
SQL> SELECT * FROM v$vector_memory_pool;
```

POOL	ALLOC_BYTES	USED_BYTES	POPULATE_STATUS
CON_ID			
1MB POOL	184549376	1048576	DONE
3			

## Abfrage an die Datenbank

```
SQL> set pagesize 50
SQL> SELECT name, city, states, description
FROM parks
ORDER BY VECTOR_DISTANCE(desc_vector,
VECTOR_EMBEDDING(minilm_l12_v2 USING 'Civil War' AS data), COSINE)
FETCH APPROX FIRST 3 ROWS ONLY; 2 3 4 5
```

NAME

---

CITY ST

---

DESCRIPTION

---

-----  
Shiloh

Shiloh

TN

Visit the sites of the most epic struggle in the Western Theater of the Civil War. Nearly 110,000 American troops clashed in a bloody contest that resulted in 23,746 casualties; more casualties than in all of America's previous wars combined. Explore both the Shiloh and Corinth battlefields to discover the impact of this struggle on the soldiers and on the nation.

Monocacy

Frederick

MD

During the summer of 1864, the Confederacy carried out a bold plan to turn the tide of the Civil War in their favor. They planned to capture Washington, DC and influence the election of 1864. On July 9, however, Federal soldiers outnumbered three to one, fought gallantly along the banks of the Monocacy River in an effort to buy time for Union reinforcement to arrive in Washington, DC.

Gettysburg

Gettysburg

PA

The Battle of Gettysburg was a turning point in the Civil War, the Union victor  
y that ended General Robert E. Lee's second and most ambitious invasion of  
the North. Often referred to as the "High Water Mark of the Rebellion",  
Gettysburg was  
as the Civil War's bloodiest battle and was also the inspiration for  
President Abraham  
Lincoln's immortal "Gettysburg Address".

```
SQL> SELECT name, city, states, description
FROM parks
ORDER BY VECTOR_DISTANCE(desc_vector,
VECTOR_EMBEDDING(minilm_l12_v2 USING 'rock climbing' AS data), COSINE)
FETCH APPROX FIRST 3 ROWS ONLY;
```

```
2 3 4 5
```

NAME

CITY

ST

DESCRIPTION

Black Canyon Of The Gunnison

Montrose

CO

Big enough to be overwhelming, yet still intimate enough to feel the pulse  
of time. Come see some of the steepest cliffs, oldest rock, and craggiest  
spires in  
North America. Forces of nature and the Gunnison River sculpted this  
canyon over  
two million years. The result is a vertical wilderness of rock, water,  
and  
sky.

City Of Rocks

Almo

ID

Emigrants of the California Trail describe the rocks here in vivid detail as  
"a  
city of tall spires, steeples, and "the silent city." Today, this  
back  
country byway attracts rock climbers, campers, hikers, hunters, and





```
user_mining_models;
```

```
  2   3   4   5
```

```
MODEL_NAME
```

```
-----  
MINING_FUNCTION
```

```
ALGORITHM
```

```
ALGORITHM_
```

```
-----  
MODEL_SIZE
```

```
-----  
MINILM_L12_V2
```

```
EMBEDDING
```

```
ONNX
```

```
NATIVE
```

```
133322334
```

```
CLIP_VIT_TXT
```

```
EMBEDDING
```

```
ONNX
```

```
NATIVE
```

```
255521088
```

(defaultmäßig in 26ai installiert)

### Eigenschaften des Modells

```
SQL> SELECT
```

```
model_name, attribute_name, attribute_type,  
data_type, vector_info
```

```
FROM
```

```
user_mining_model_attributes
```

```
WHERE
```

```
model_name = 'CLIP_VIT_TXT'
```

```
ORDER BY 1,3;
```

```
  2   3   4   5   6   7   8
```

```
MODEL_NAME
```

```
-----  
ATTRIBUTE_NAME
```

```
-----  
ATTRIBUTE_TY
```

```
-----  
DATA_TYPE
```

```
-----  
VECTOR_INFO
```

```
-----  
CLIP_VIT_TXT
```

```
DATA
TEXT
VARCHAR2
```

```
CLIP_VIT_TXT
ORA$ONNXTARGET
VECTOR
VECTOR
VECTOR(512, FLOAT32)
```

## Vektor-Spalte in der Tabelle PARK\_IMAGES

```
SQL> SELECT image_vector
FROM park_images
FETCH FIRST 1 ROWS ONLY;
  2      3
IMAGE_VECTOR
```

```
-----
-----
[-6.75002217E-001, 1.48980906E-002, 4.4332552E-001, -3.47053744E-002,
```

## Bild-basierte Ähnlichkeitssuche

### Amerikanischer Bürgerkrieg

```
SQL> set timing on
SQL>
SQL> SELECT description, url
FROM park_images
ORDER BY VECTOR_DISTANCE(image_vector,
VECTOR_EMBEDDING(clip_vit_txt USING 'Civil War' AS data), COSINE)
FETCH EXACT FIRST 5 ROWS ONLY;
  2      3      4      5
```

```
DESCRIPTION
```

```
-----
-----
URL
```

```
Photos of historic military reenactors firing a mountain howitzer. Visitors
look
on as children help swab the barrel after firing.
https://www.nps.gov/npgallery/GetAsset/21FE4D03-3ADA-4469-9E33-6081A70A1EA2
```

Photos of historic military reenactors firing a mountain howitzer. Visitors look

on as children help swab the barrel after firing.

<https://www.nps.gov/npgallery/GetAsset/1D052229-644B-40D1-AF01-2892C92708C9>

That Beautiful Charge is an oil painting by artist Andy Thomas of Carthage Misso

uri. It is one of eleven paintings by Thomas depicting the Battle of Pea Ridge.

The Pea Ridge National Military Park Foundation is currently raising funds to pu

rchase this and eight other paintings to complete the collection.

<https://www.nps.gov/npgallery/GetAsset/F72F5A13-155D-4519-3ED0-77940B0A77D0>

Confederate battle line in action at reenactment.

<https://www.nps.gov/npgallery/GetAsset/1BE0E94F-155D-451F-675F-7FB77E3E2B73>

Cannon Duel, a painting Andy Thomas, an accomplished painter from Carthage Misso

uri. The Pea Ridge National Military Park Foundation is currently raising money

to purchase this painting along with 8 others to complete the collection and own

all 11 Pea Ridge paintings by Andy Thomas.

<https://www.nps.gov/npgallery/GetAsset/F72A576B-155D-4519-3EAE-1F7A0CCD3362>

Elapsed: 00:00:02.59

Wenn man die angegebene URL anklickt, dann sieht man die Bilder.

### **Kletter-Bilder:**

```
SQL> SELECT description, url
FROM park_images
ORDER BY VECTOR_DISTANCE(image_vector,
VECTOR_EMBEDDING(clip_vit_txt USING 'rock climbing' AS data), COSINE)
FETCH EXACT FIRST 3 ROWS ONLY;
  2    3    4    5
```

DESCRIPTION

---

URL

---

Photo by Tug Wilson

<https://www.nps.gov/npgallery/GetAsset/2D16604A-155D-451F-6799-B06D5EC4F2E6>

Spindle City Corps

<https://www.nps.gov/npgallery/GetAsset/F9EEC7B9-155D-451F-676E-F9FF48D98578>

Spindle City Corps

<https://www.nps.gov/npgallery/GetAsset/F9EEC7B9-155D-451F-676E-F9FF48D98578>

Elapsed: 00:00:05.19

## Wasserfälle in Nationalparks in ausgewählten US-Bundesstaaten

```
SQL> SELECT p.description, p.city, p.states, pi.url
FROM park_images pi, parks p
WHERE pi.park_code = p.park_code
AND p.states in ('CA','OR','NV','WA','AZ','CO')
ORDER BY VECTOR_DISTANCE(pi.image_vector,
VECTOR_EMBEDDING(clip_vit_txt USING 'waterfall' AS data), COSINE)
FETCH EXACT FIRST 3 ROWS ONLY;
  2    3    4    5    6    7
```

DESCRIPTION

-----  
CITY ST  
-----

URL  
-----

The Santa Monica Mountains offer easy access to surprisingly wild places. Experience the famous beaches of Malibu or explore more than 500 miles of trails. The park abounds with historical and cultural sites, from old movie ranches to Native American centers. What will you and your family discover?  
Calabasas CA  
<https://www.nps.gov/npgallery/GetAsset/003D077A-155D-4519-3E20-86A8494A9EE4>

The Santa Monica Mountains offer easy access to surprisingly wild places. Experience the famous beaches of Malibu or explore more than 500 miles of trails. The park abounds with historical and cultural sites, from old movie ranches to

Nati

ve American centers. What will you and your family discover?

Calabasas

CA

<https://www.nps.gov/npgallery/GetAsset/003D077A-155D-4519-3E20-86A8494A9EE4>

Explore the timeless rainforests and majestic coastal vistas. Discover the rich heritage of the native people. Unfold the dramatic stories of America's most famous explorers. The park encompasses sites along the Columbia River and the Pacific Coast. Follow in the footsteps of the explorers and have an adventure in history.

Astoria

OR

<https://www.nps.gov/npgallery/GetAsset/C996B2EB-155D-4519-3E22-D63BA8A097DC>

Elapsed: 00:00:04.51

## **Bilder-Suche in APEX**

[http://<HOST\\_IP>:8080/ords/r/nationalparks/nationalparks/image-search](http://<HOST_IP>:8080/ords/r/nationalparks/nationalparks/image-search)