VECTOR_DISTANCE (Transact-SQL)

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Applies to: Azure SQL Database Azure SQL Managed Instance

> **Note**
>
> This function is in preview and is subject to change. Preview features are not meant for production use and are subject to additional terms of use.

Calculates the distance between two vectors using a specified distance metric.

Syntax

Transact-SQL syntax conventions

```
syntaxsql
VECTOR_DISTANCE ( distance_metric, vector1, vector2 )
```

Arguments

distance_metric

A string with the name of the distance metric to use to calculate the distance between the two given vectors. The following distance metrics are supported:

- `cosine` - Cosine distance
- `euclidean` - Euclidean distance
- `dot` - (Negative) Dot product

vector1

An expression that evaluates to a vector in binary format.

vector2

An expression that evaluates to a vector in binary format.

Distance Metrics

Expand table

Metric	Description	Range	Examples
cosine	Cosine (angular) distance	[0, 2]	`0`: identical vectors `2`: opposing vectors
euclidean	Euclidean distance	[-∞, +∞]	`0`: identical vectors
dot	Dot product-based indication of distance, obtained by calculating the *negative* dot product, or a	[-∞, +∞]	Smaller numbers indicate more similar vectors

Return value

The function returns a scalar value that represents the distance between the two vectors using the specified distance metric.

An error is returned if *distance_metric* isn't a valid metric and if the provided binary values don't represent valid vectors.

Examples

Make sure to check out the Azure SQL DB Vector Search Samples GitHub repo to get end-to-end working samples.

Examples assume the existence of a table named `wikipedia_articles` with a column `title_vector` of type `vector` that stores title's embeddings of Wikipedia articles. `title_vector` is assumed to be an embedding generated with an embedding model like *text-embedding-ada-002* or *text-embedding-3-small* , which returns vectors with 1,536 dimensions.

Example 1

The following example creates a vector with three dimensions from a string with a JSON array.

SQL

```
DECLARE @v1 VECTOR(2) = CAST('[1,1]' AS VECTOR(2))
DECLARE @v2 VECTOR(2) = CAST('[-1,-1]' AS VECTOR(2))

SELECT
    VECTOR_DISTANCE('euclidean', @v1, @v2) AS euclidean,
    VECTOR_DISTANCE('cosine', @v1, @v2) AS cosine,
    VECTOR_DISTANCE('dot', @v1, @v2) AS negative_dot_product;
```

Example 2

The following example returns the top 10 most similar articles to a given article, based on the cosine distance between their title vectors.

SQL

```
DECLARE @v AS VECTOR(1536);
SELECT @v = title_vector FROM [dbo].[wikipedia_articles] WHERE title = 'Alan
Turing';

SELECT TOP(10)
  id,
  title,
  VECTOR_DISTANCE('cosine', @v, title_vector) AS distance
FROM
  [dbo].[wikipedia_articles]
ORDER BY
  distance
```

Example 3

The following example returns all the similar articles to a given article, based on the cosine distance between their title vectors, selecting only those with a distance less than 0.3.

SQL

```
DECLARE @v AS VECTOR(1536);
SELECT @v = title_vector FROM [dbo].[wikipedia_articles] WHERE title = 'Alan
Turing';
```

```
SELECT
  id,
  title,
  VECTOR_DISTANCE('cosine', @v, title_vector) AS distance
FROM
  [dbo].[wikipedia_articles]
WHERE
  VECTOR_DISTANCE('cosine', @v, title_vector) < 0.3
ORDER BY
  distance
```

See also

- Vector Functions (Transact SQL)
- Azure SQL DB Vector Search Samples

Feedback