Thank you sponsors!



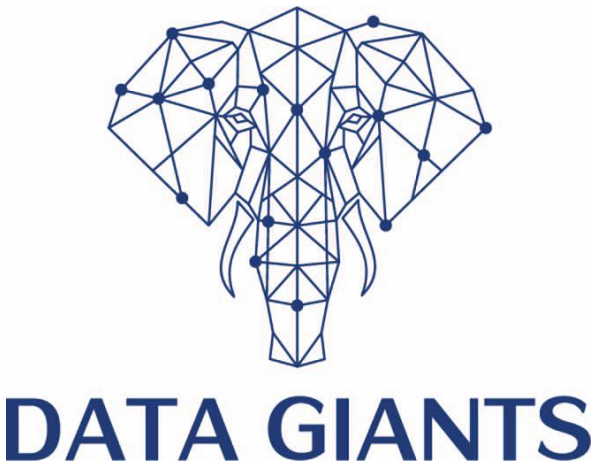




















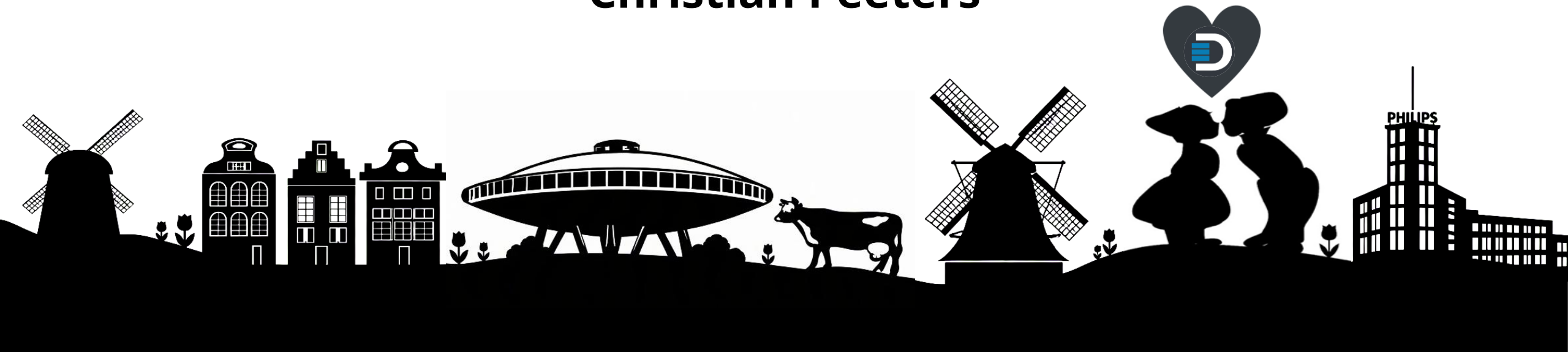




T-SQL Meets AI

Unleashing
SQL Server 2025's Vector & RAG Power

Christian Peeters

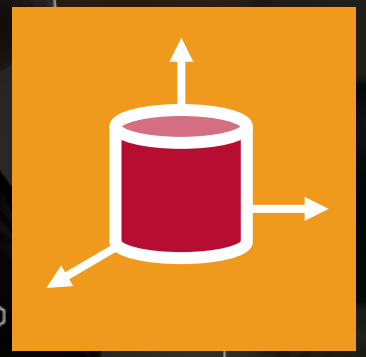


Topics

RAG



Vector Databases



SQL Server



AI Models



Introduction

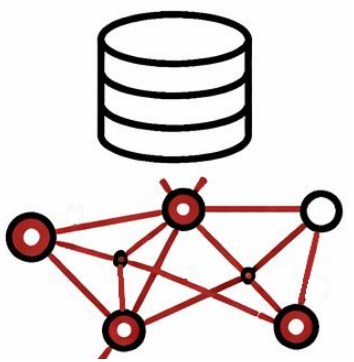
Christian Peeters

- Betabit
- Principal Cloud Architect





SQL History



1989

Relational database

2005

<XML>
semi structured

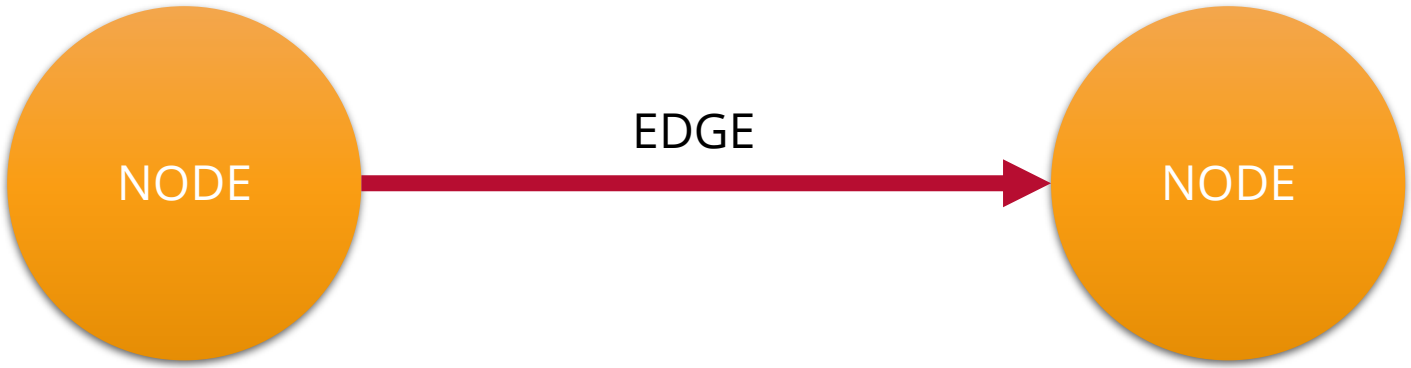
2016

{json}
“NoSQL”

2017

Graph

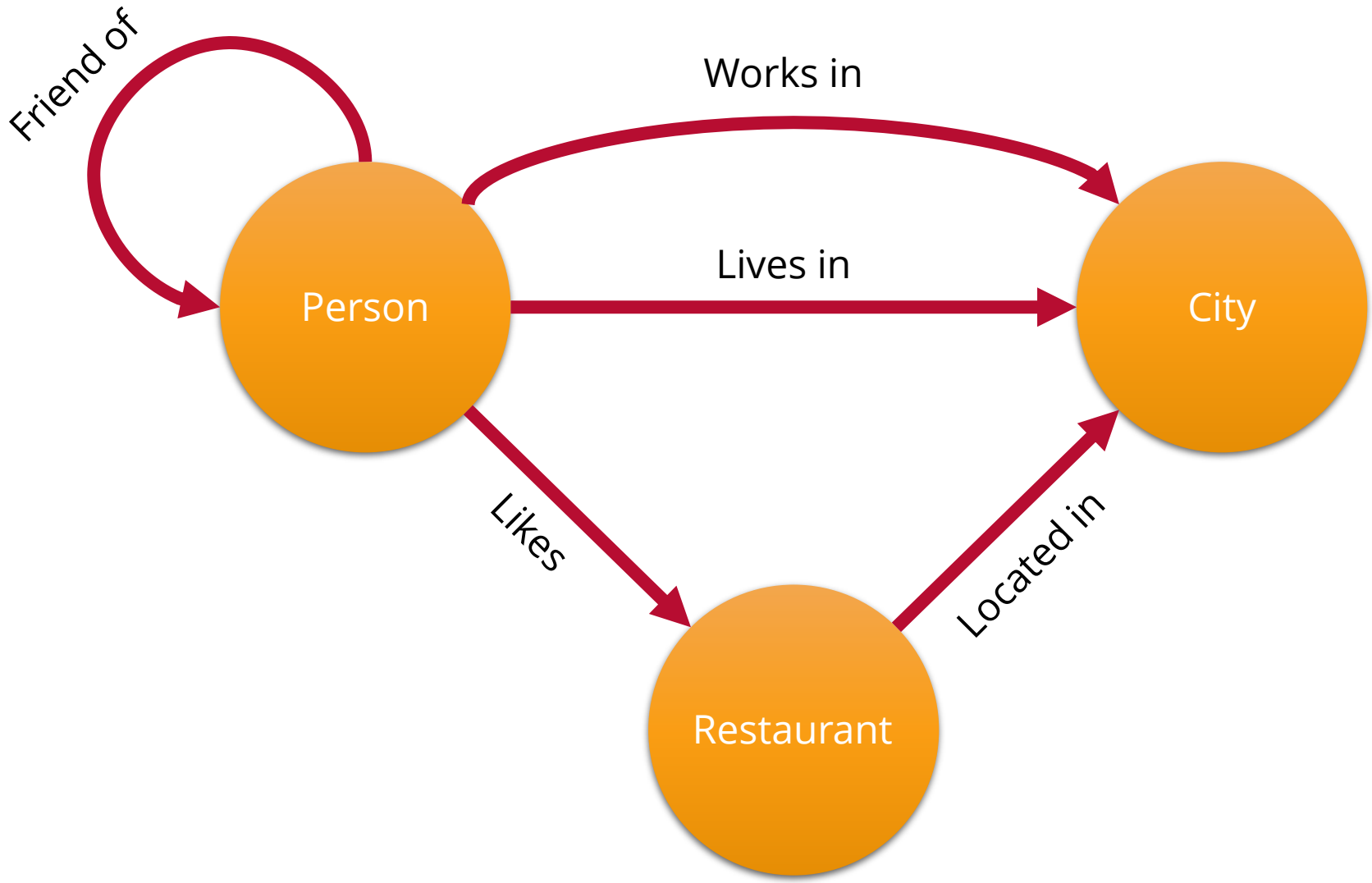
Graph databases



Graph databases



Graph databases



SQL History



1989 Relational database

2005 <XML> semi structured

2016 {json} “NoSQL”

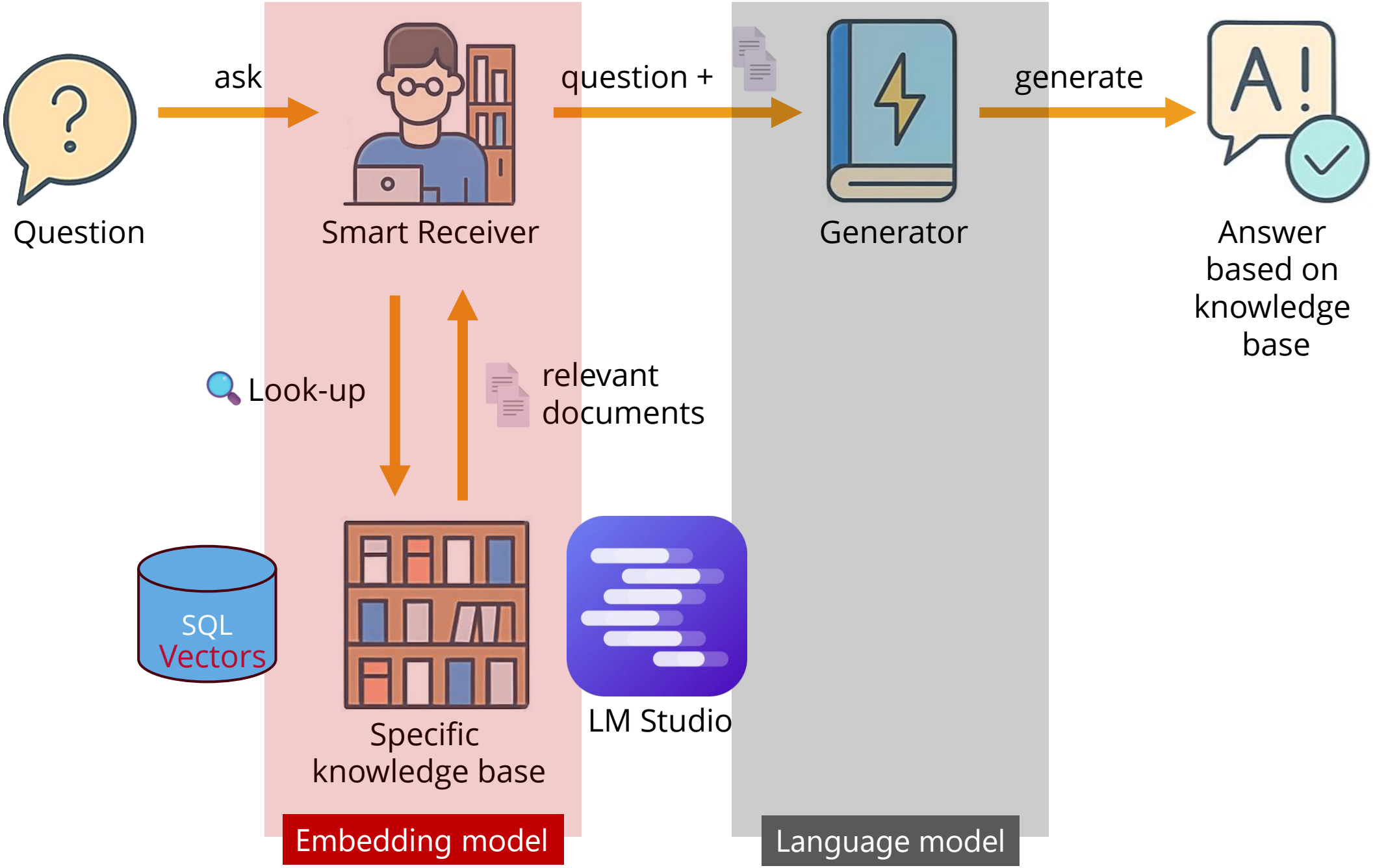
2017 Graph

2025 Vector

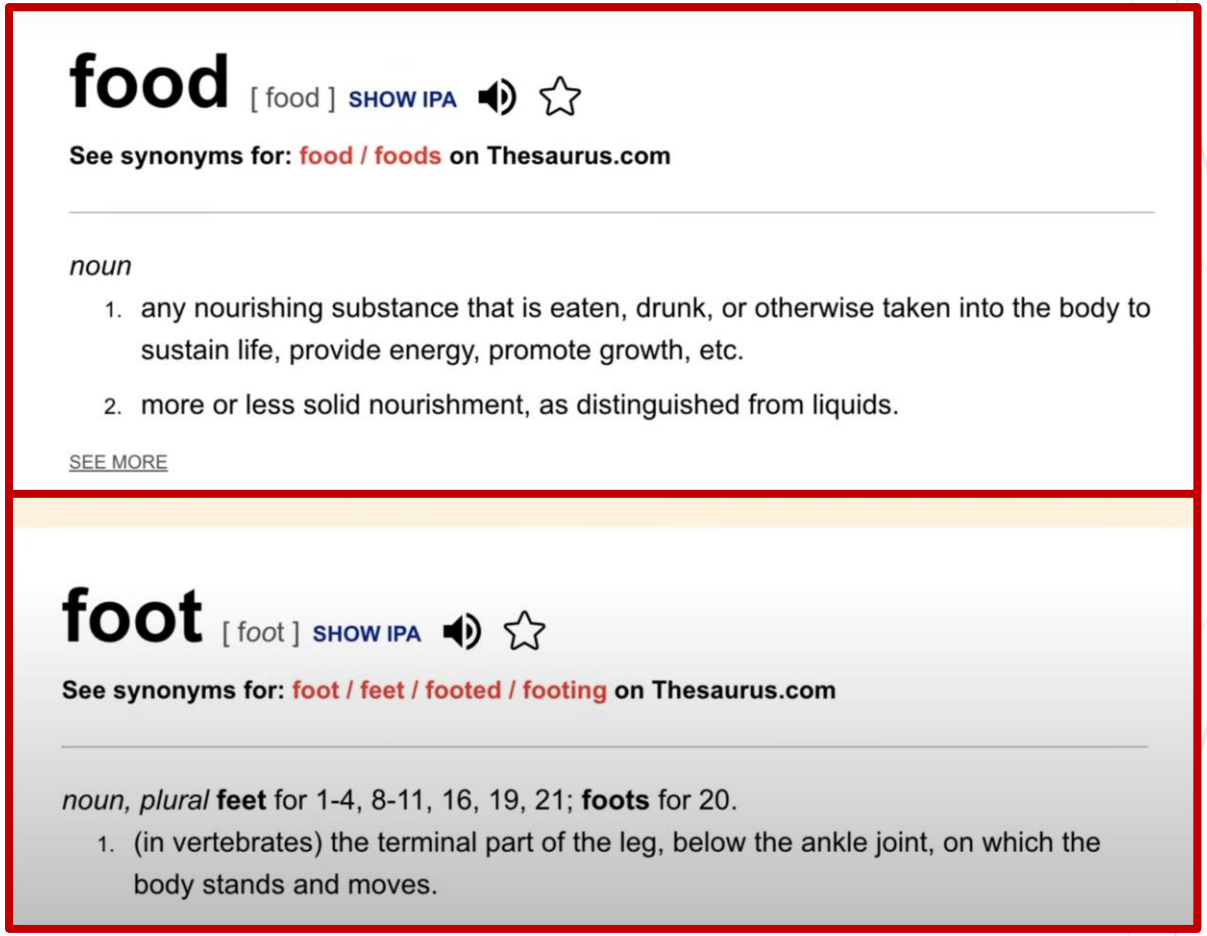

RAG



Retrieval-Augmented Generation


ask
question +
generate
Question
Smart Receiver
Generator
Answer based on knowledge base
Look-up
relevant documents
SQL
Vectors
Specific knowledge base
LM Studio
Embedding model
Language model

Semantics



food [food] SHOW IPA

See synonyms for: food / foods on Thesaurus.com

noun

1. any nourishing substance that is eaten, drunk, or otherwise taken into the body to sustain life, provide energy, promote growth, etc.
2. more or less solid nourishment, as distinguished from liquids.

SEE MORE

foot [foot] SHOW IPA

See synonyms for: foot / feet / footed / footing on Thesaurus.com

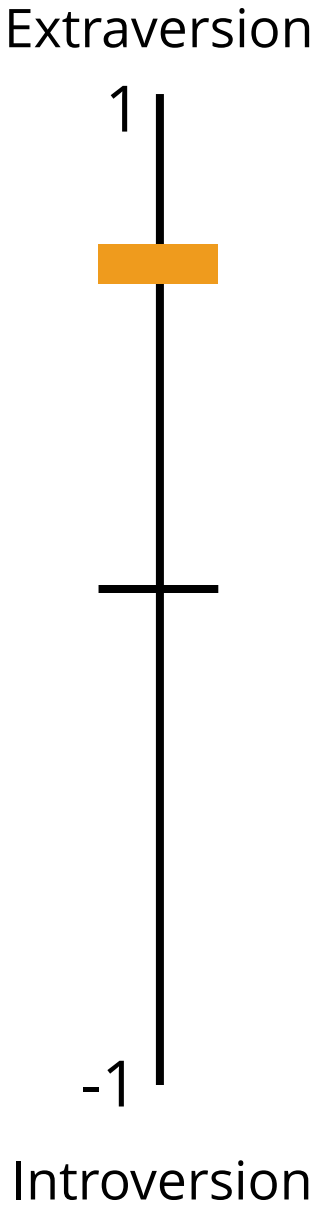
noun, plural **feet** for 1-4, 8-11, 16, 19, 21; **foots** for 20.

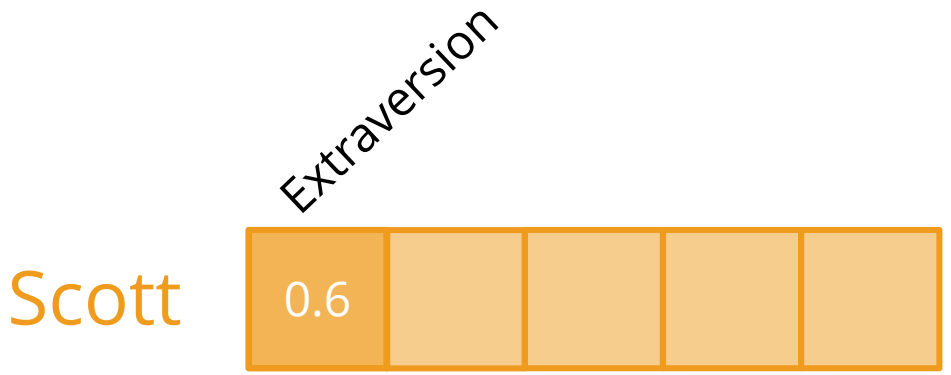
1. (in vertebrates) the terminal part of the leg, below the ankle joint, on which the body stands and moves.

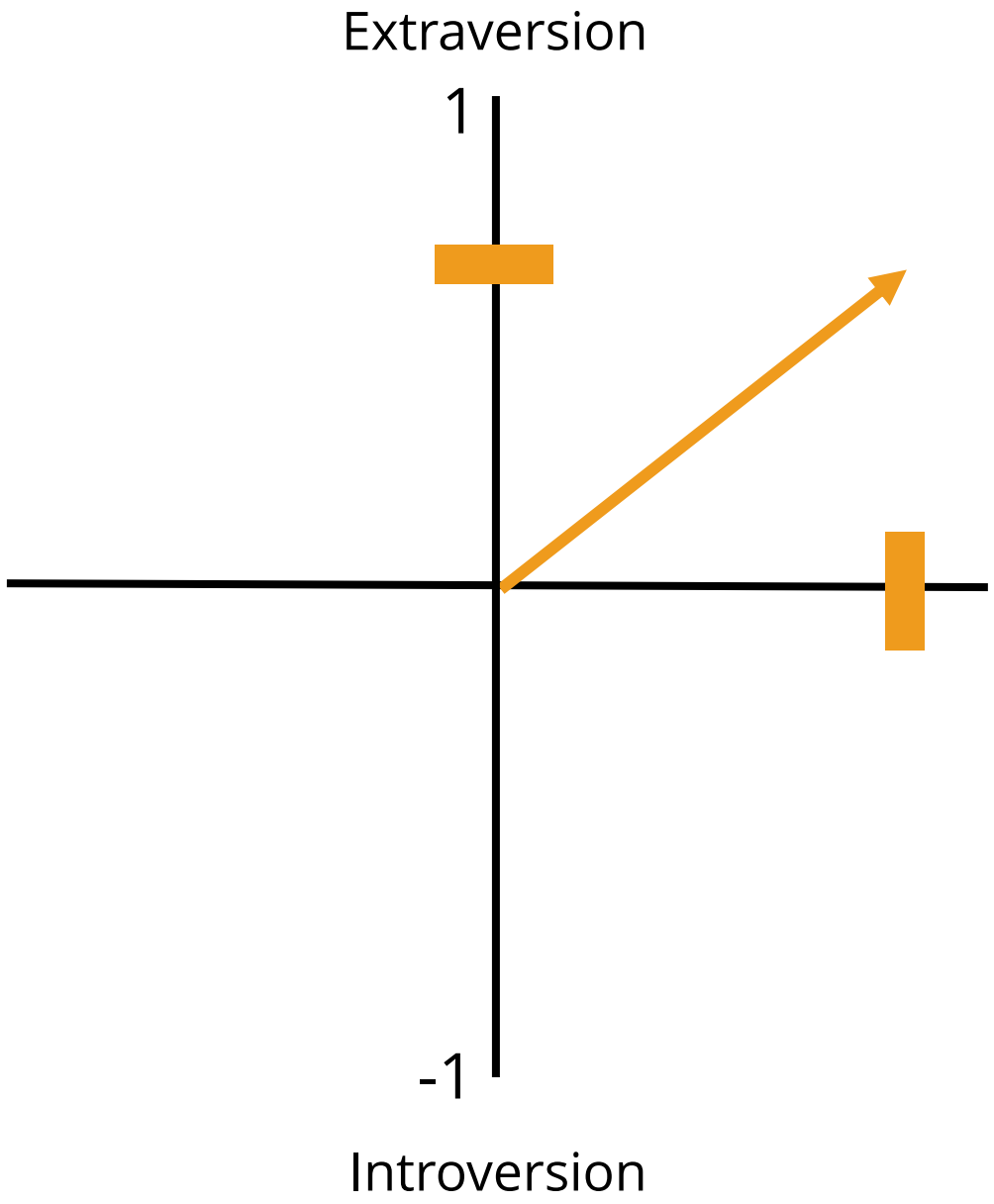
Semantics

Big Five personality traits

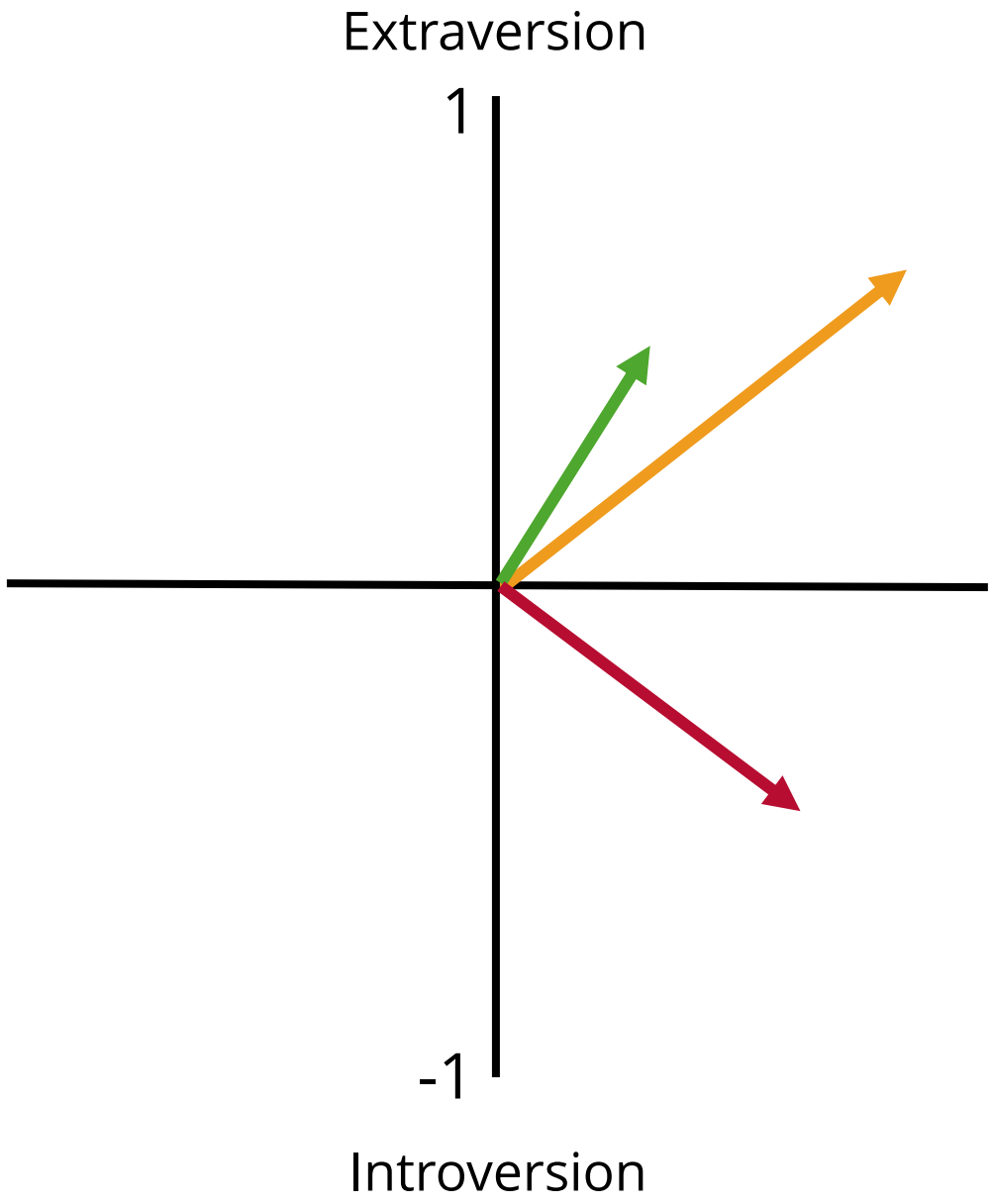
Trait	Score (1-100)
Openness	80
Conscientiousness	75
Extraversion	42
Agreeableness	35
Neuroticism	70


Extraversion
1
-1
Introversion


Extraversion
Scott
0.6


Extraversion
1
-1
Introversion

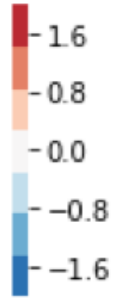

Extraversion
Trait #2
Scott
0.6
0.8


Extraversion
1
-1
Introversion


Extraversion
Trait #2
Scott
0.6
0.8
Olaf
0.4
0.2
Johan
-0.5
0.4

“King”





“Man”



“Woman”



“Water”

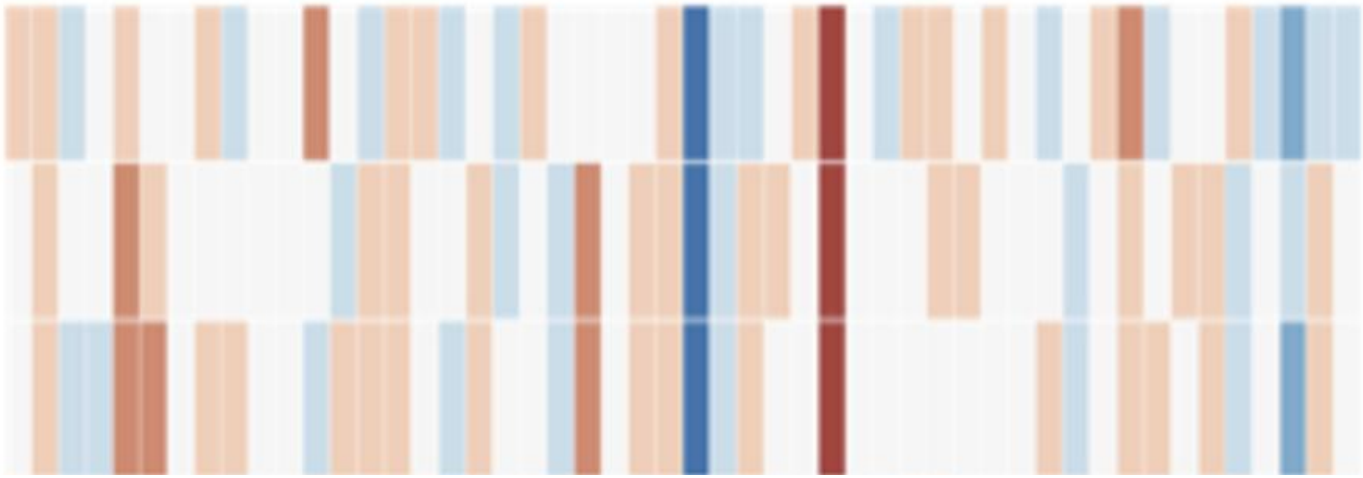


King–man+woman ~= queen

king

man

woman



Embeddings

Food

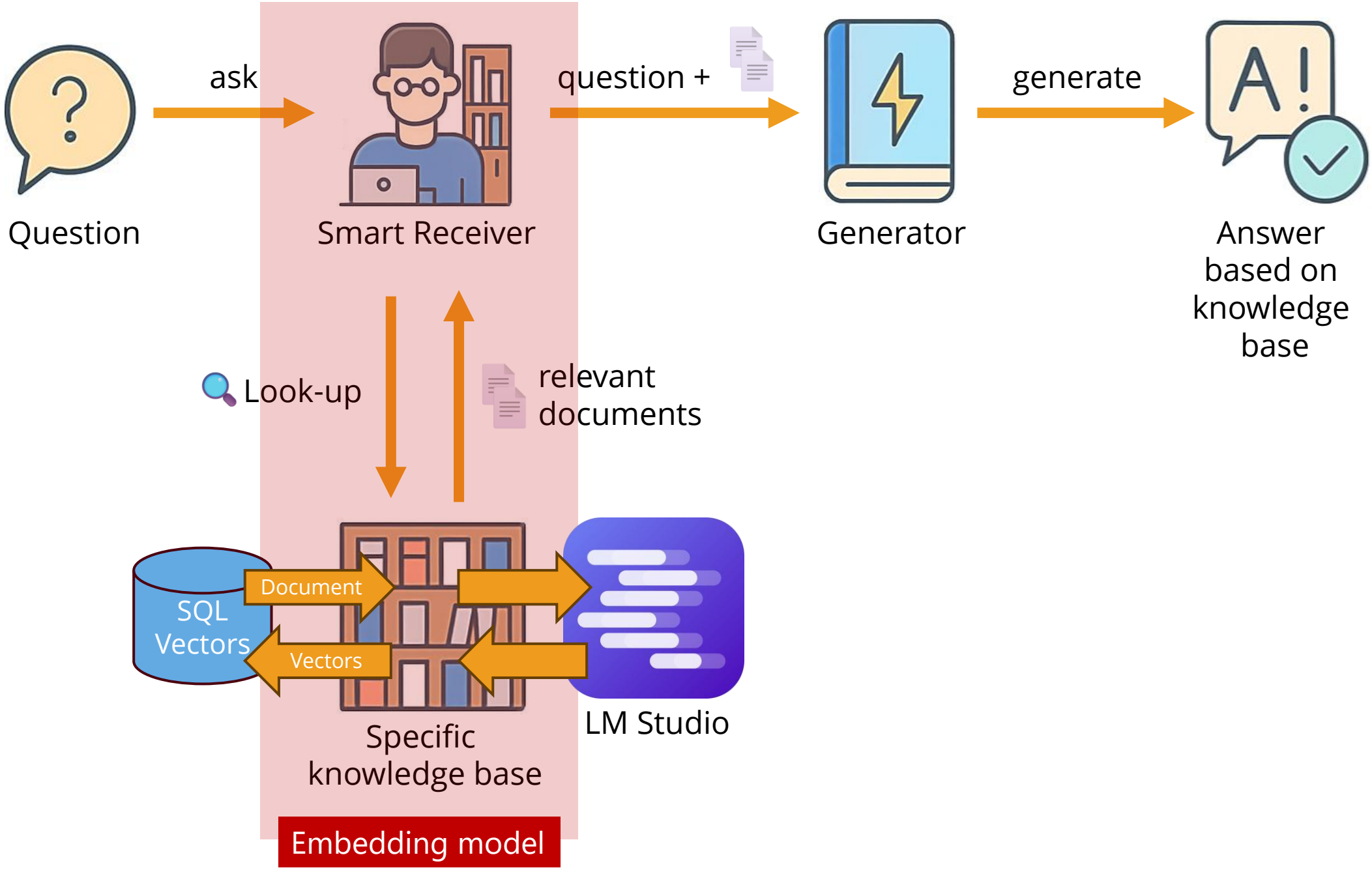
```
[
        0.025782471522688866,
        0.07422986626625061,
        -0.2098851352930069,
        0.020040376111865044,
        -0.019022436812520027,
        -0.008250102400779724,
        -0.07146993279457092,
        0.02848343923687935,
        0.0023473557084798813,
        -0.03299781680107117,
        0.04261593893170357,
        0.07062423229217529,
        0.0410647988319397,
        0.07214976847171783,
        0.002087330212816596,
        -0.029266564175486565,
        -0.009834304451942444,
        -0.05916181579232216,
        0.011945725418627262,
        0.04941047355532646,
        0.0435730405151844,
        0.031036851927638054,
        0.01648855395615101,
        0.0032683848403394222,
        0.0886279046535492,
        -0.030498599633574486,
        -0.01174781285226345,
        ...
]
```

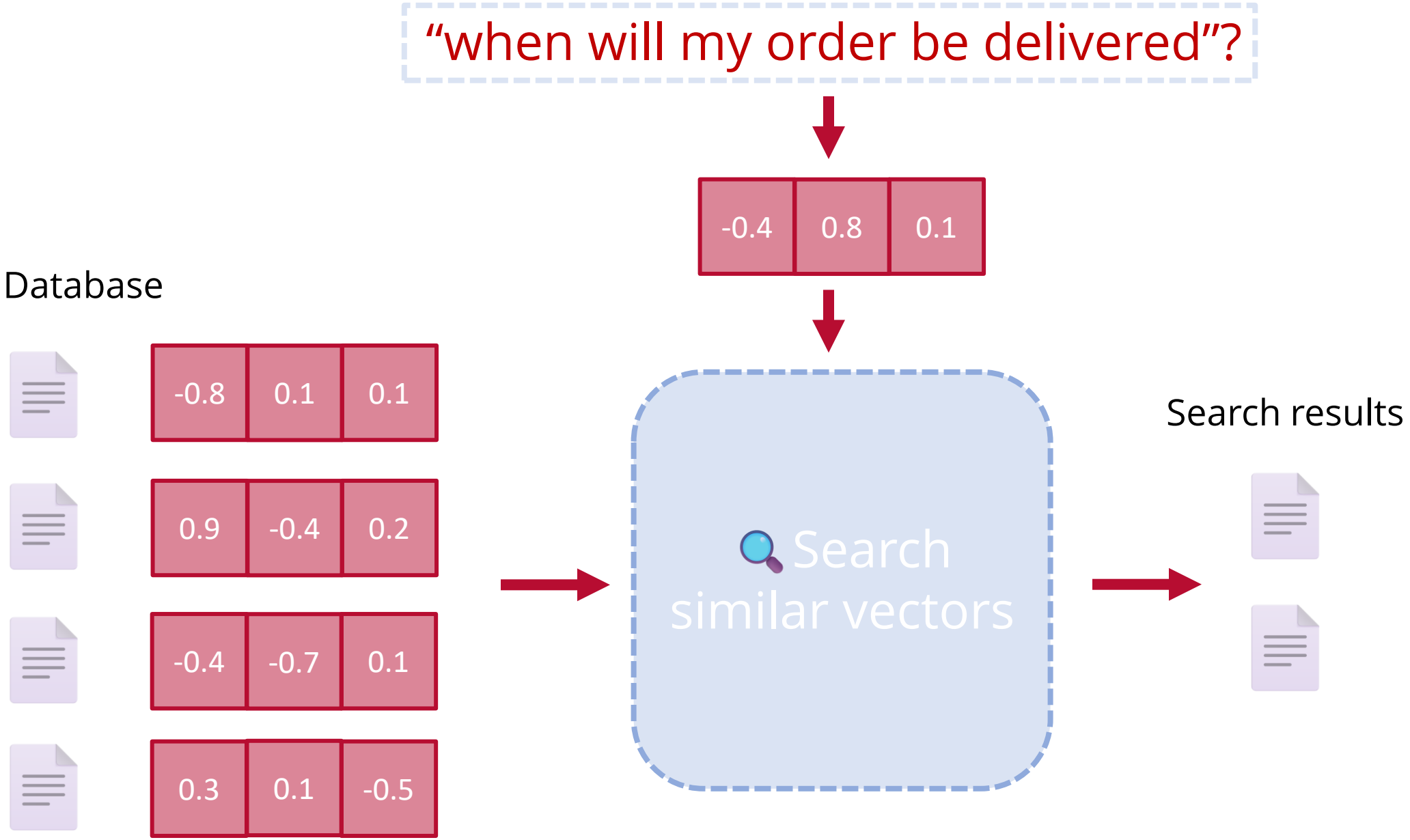
Hamburger

```
[
        0.014136438257992268,
        0.0360647588968277,
        -0.1808205395936966,
        0.045841868966817856,
        -0.059432558715343475,
        0.018855925649404526,
        -0.03157490119338035 6,
        0.08247485011816025,
        -0.02660348266363144,
        0.04140115156769752 5,
        0.0199806559830904,
        0.09198150038719177,
        0.006024873815476894,
        0.07327373325824738,
        0.026077691465616226,
        -0.05948355421423912,
        -0.0021287784911692142,
        -0.03181885927915573,
        -0.0324418768286705,
        0.09538966417312622,
        0.0426008366048336,
        -0.009710087440907955,
        -0.003696443047374487,
        -0.038268785923719406,
        0.10567634552717209,
        -0.04267079383134842,
        0.0031393112149089575,
        ...
]
```

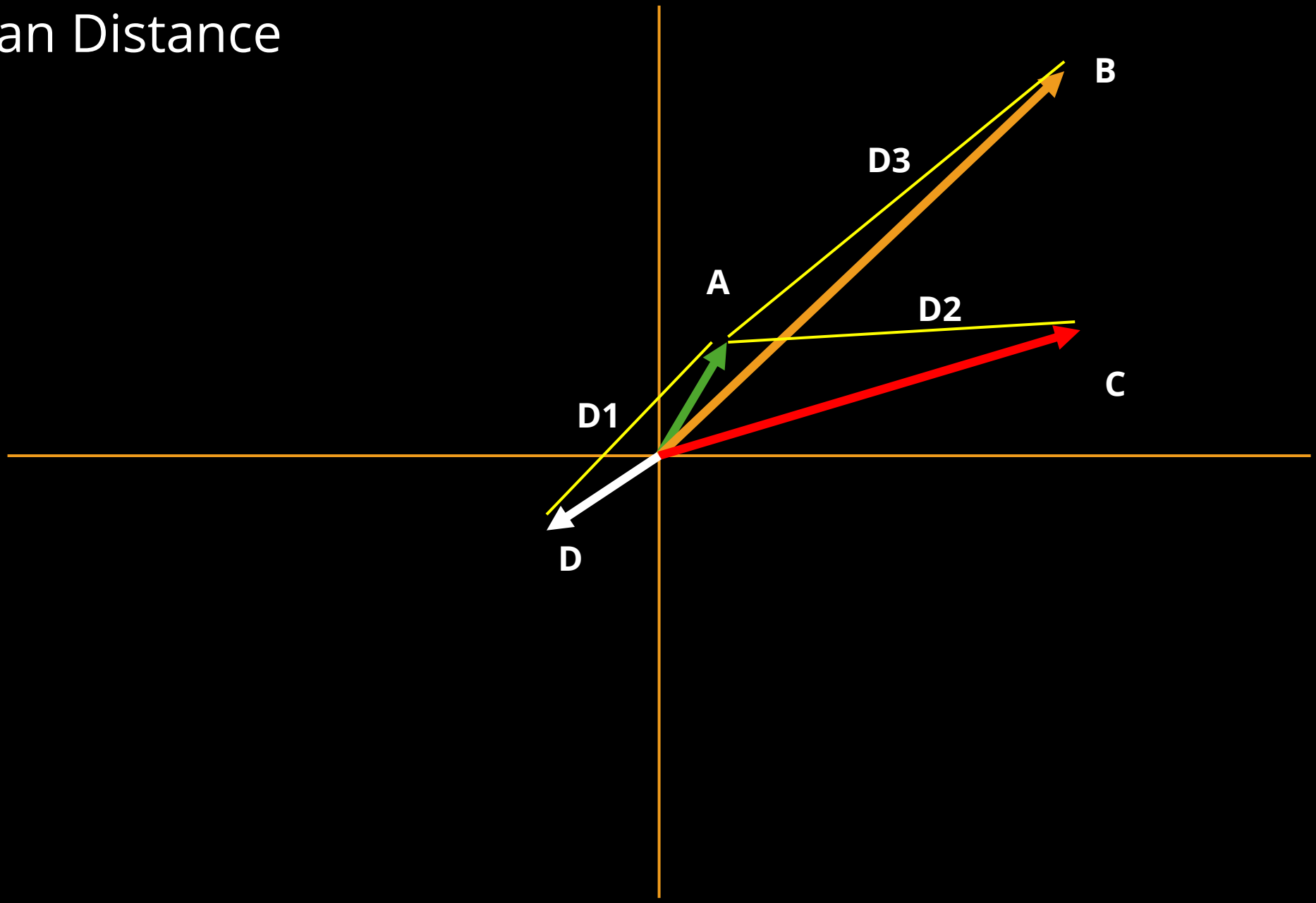
Foot

```
[
        0.025903644040226936,
        0.0852036327123642,
        -0.18330836296081543,
        0.017751013860106468,
        -0.012562904506921768,
        0.03486987575888634,
        0.023129597306251526,
        0.023613210767507553,
        0.03890474885702133,
        -0.03990164026618004,
        -0.020664876326918602,
        0.02378542721271515,
        -0.004096482414752245,
        0.03717511519789696,
        0.00805074255913496,
        -0.014986487105488777,
        0.03145749121904373,
        -0.07804375886917114,
        0.09624208509922028,
        -0.020601678639650345,
        -0.018210534006357193,
        0.021539488807320595,
        -0.032219886779785156,
        -0.0012691615847870708,
        0.07270202785730362,
        -0.028696691617369652,
        -0.02306877262890339,
        ...
]
```

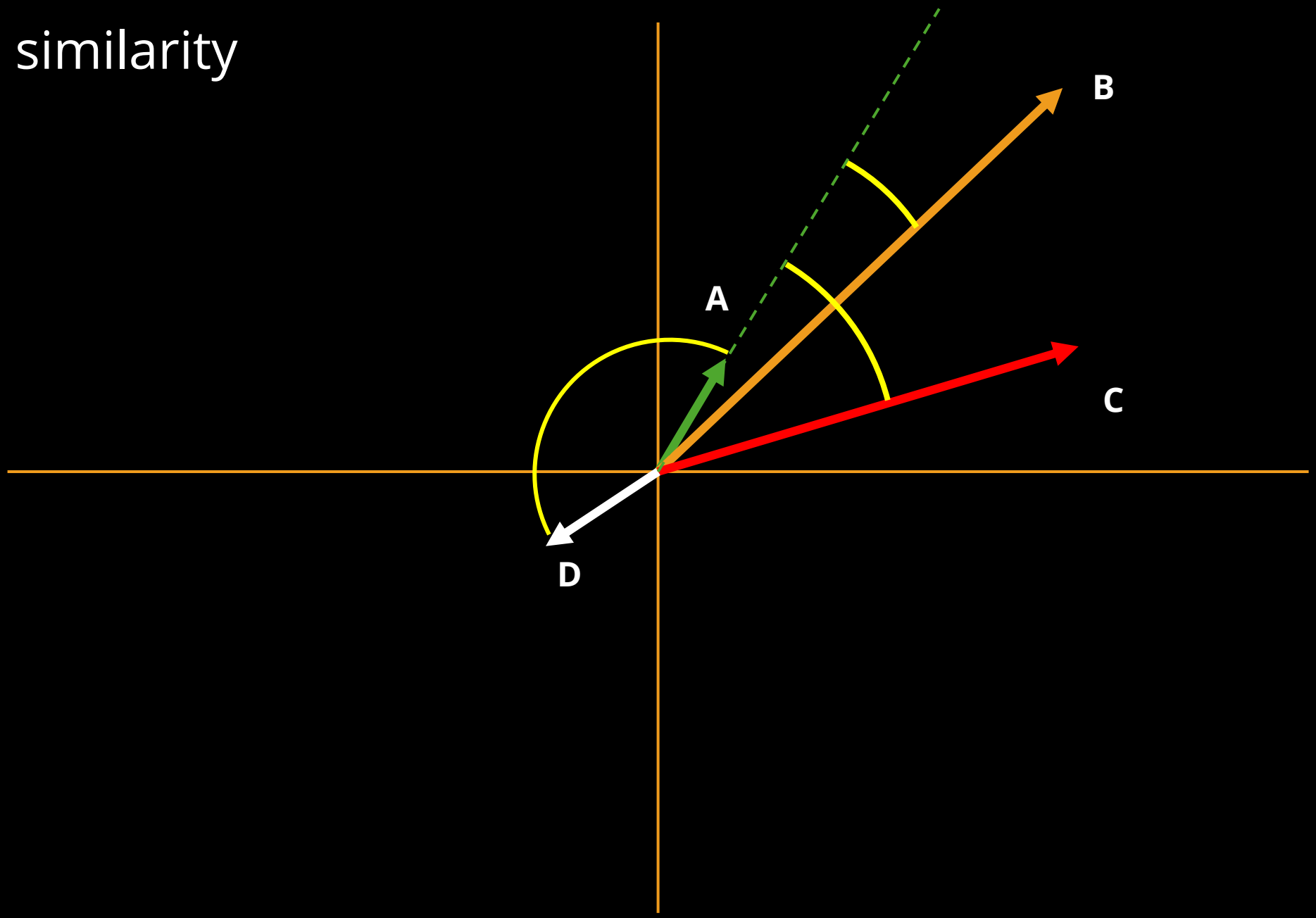

ask
question +
generate
Question
Smart Receiver
Generator
Answer based on knowledge base
Look-up
relevant documents
SQL Vectors
Document
Vectors
Specific knowledge base
LM Studio
Embedding model


“when will my order be delivered”?
-0.4
0.8
0.1
Database
-0.8
0.1
0.1
0.9
-0.4
0.2
-0.4
-0.7
0.1
0.3
0.1
-0.5
Search
similar vectors
Search results

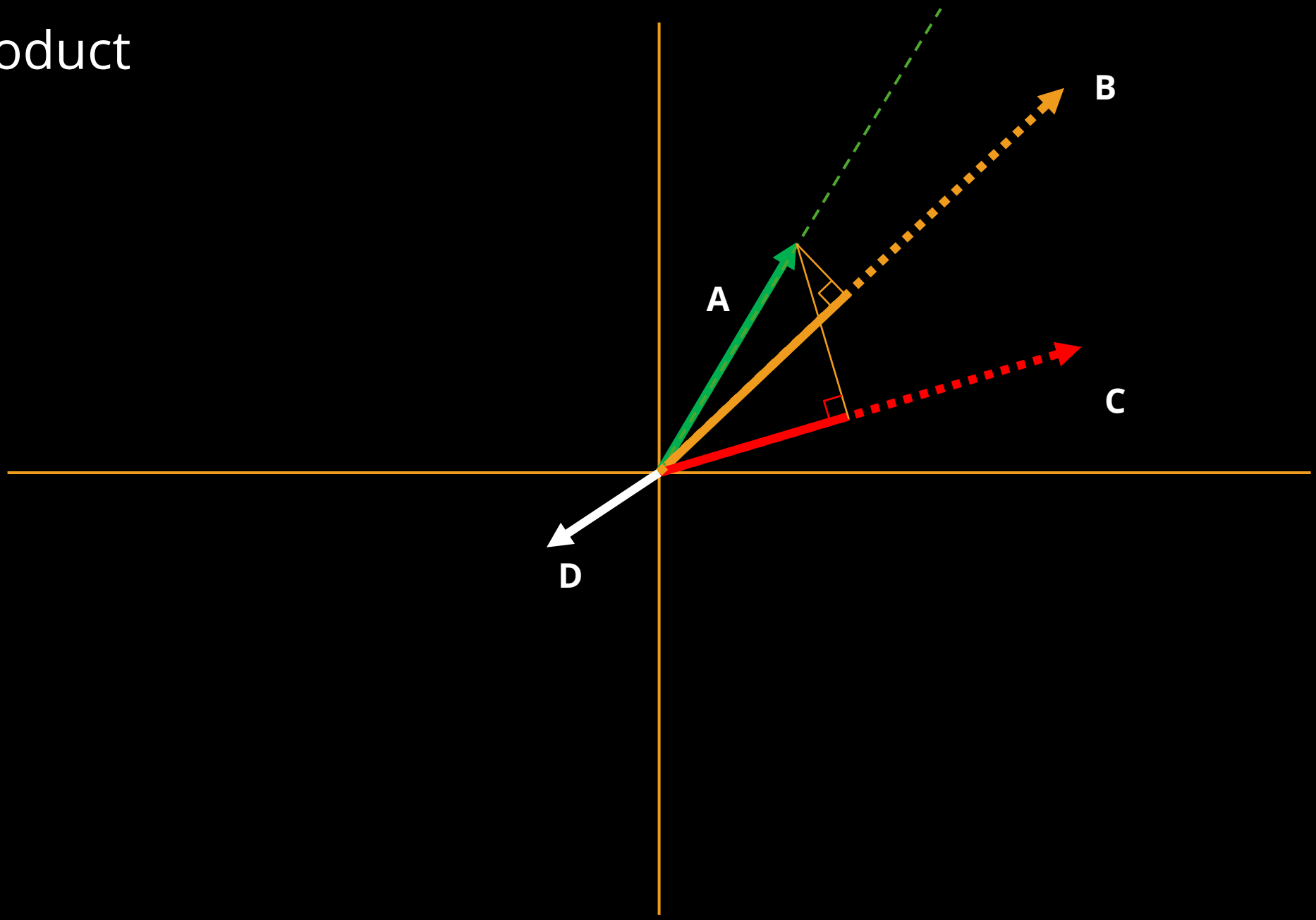
Euclidian Distance



Cosine similarity



Dot product



Cosinse_similarity(Scott 

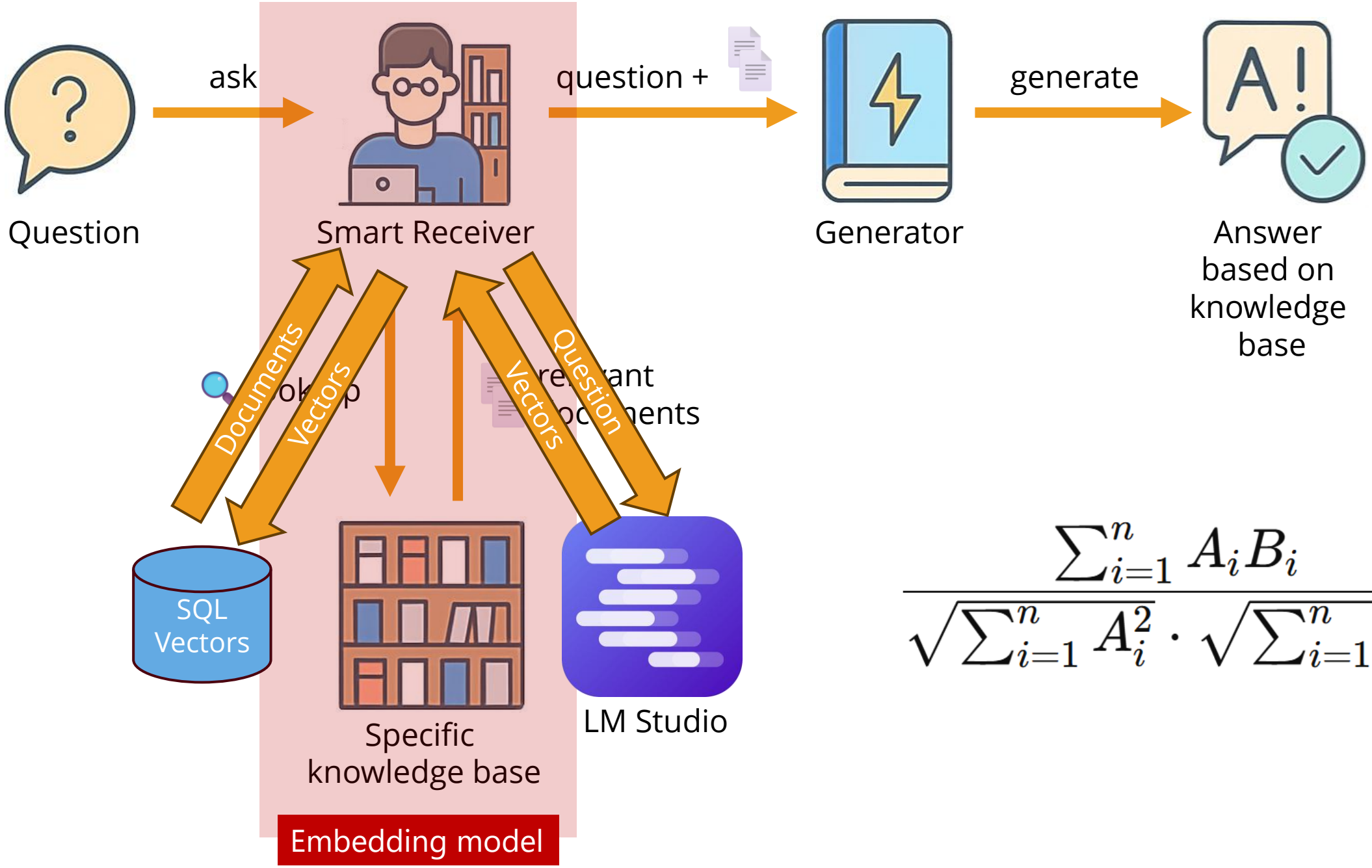
, Olaf 

) = 0.87 

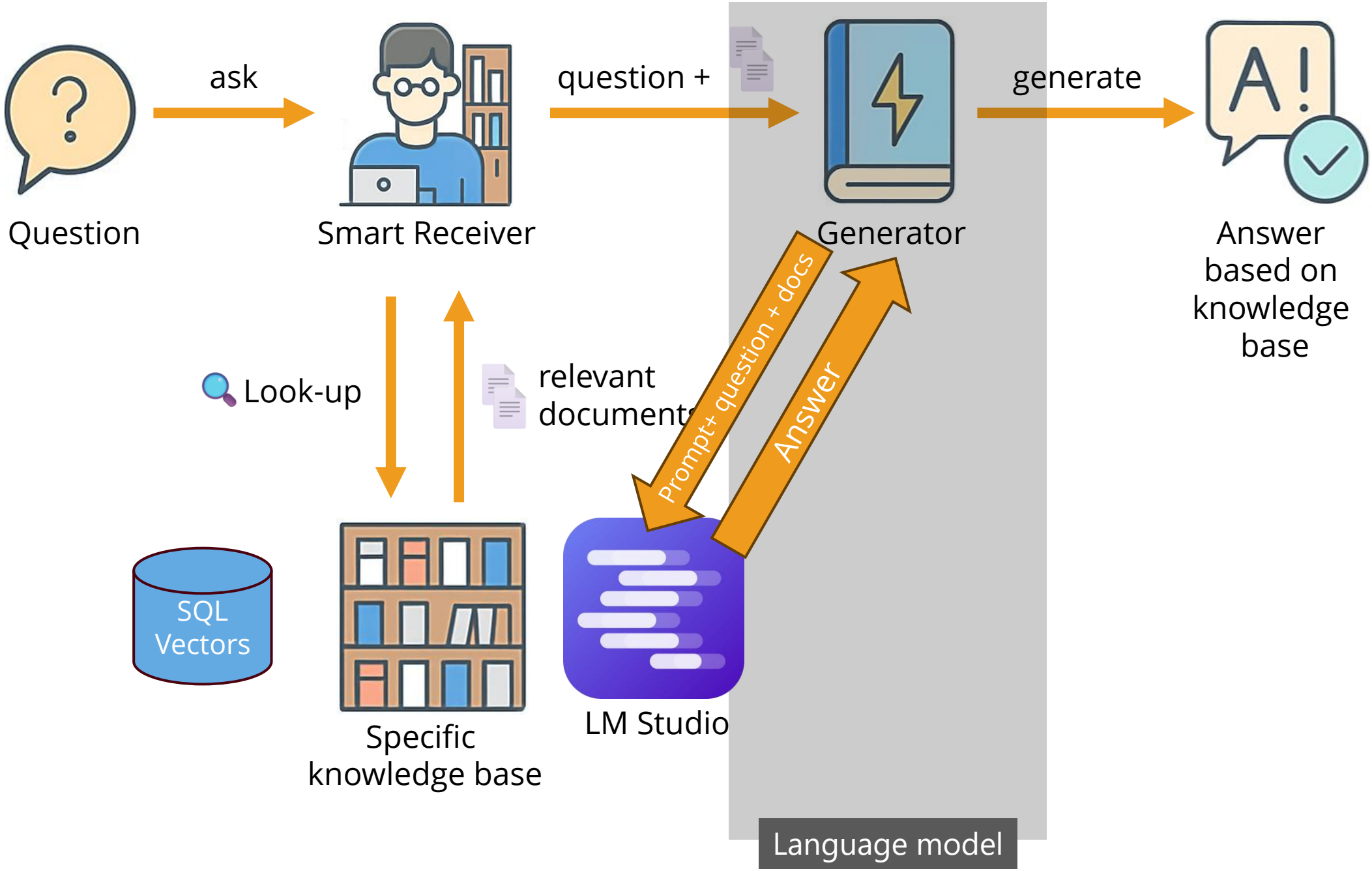
Cosinse_similarity(Scott 

, Johan 

) = -0.20



$$\frac{\sum_{i=1}^{n} A_i B_i}{\sqrt{\sum_{i=1}^{n} A_i^2} \cdot \sqrt{\sum_{i=1}^{n} B_i^2}}$$

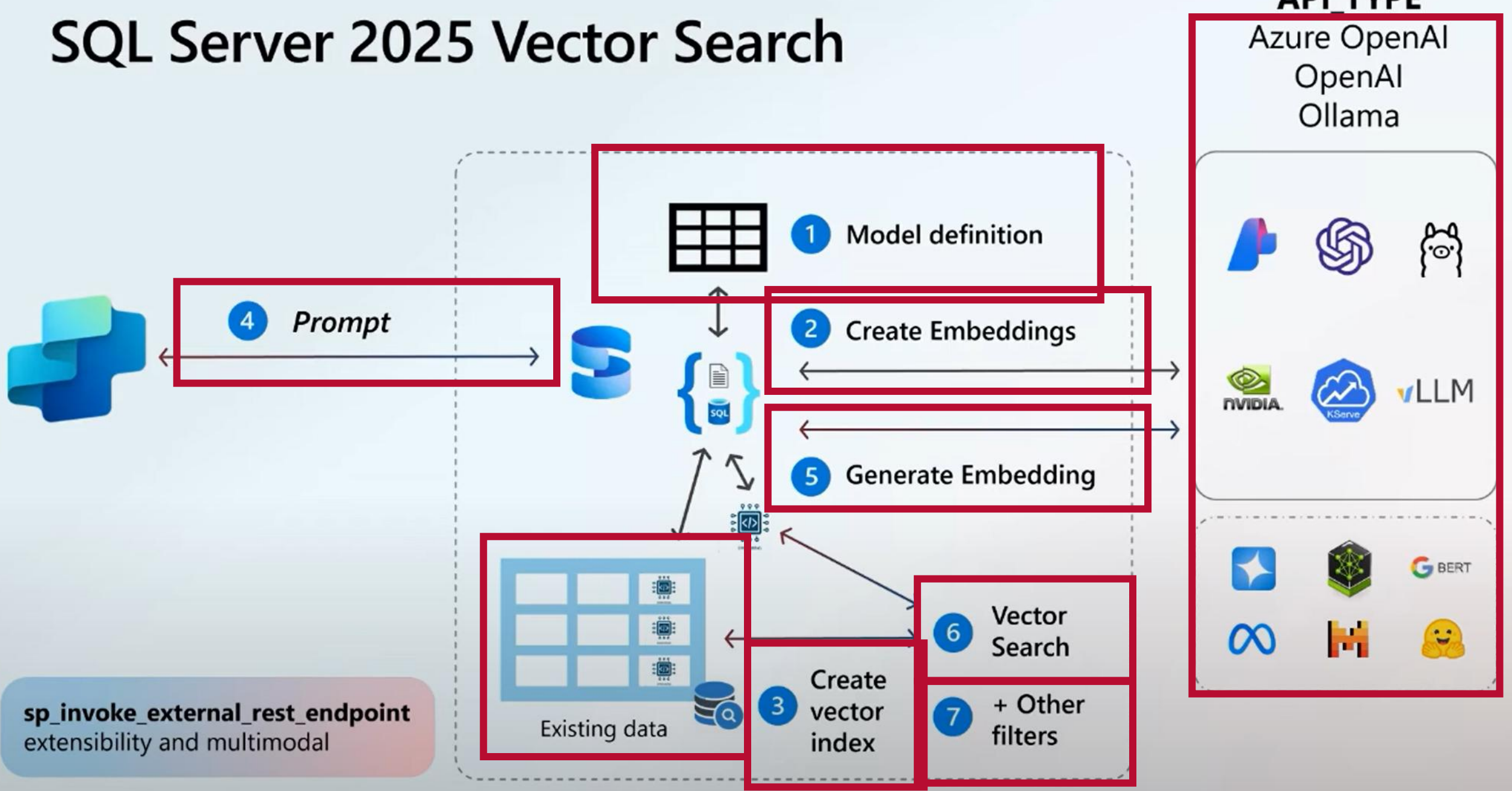

ask
question +
generate
Question
Smart Receiver
Generator
Answer based on knowledge base
Look-up
relevant documents
Prompt+ question + docs
Answer
SQL Vectors
Specific knowledge base
LM Studio
Language model

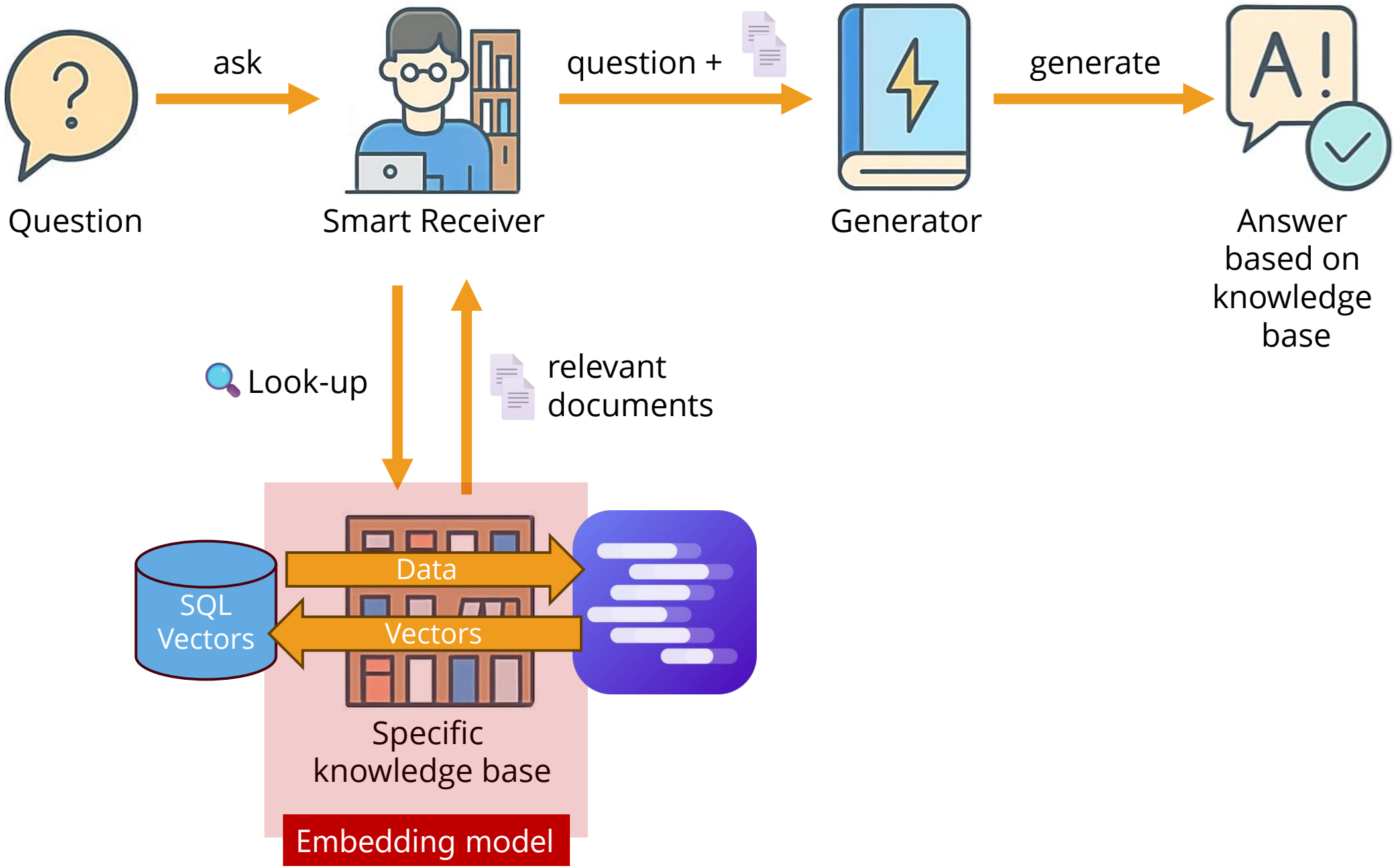
VECTOR Datatype

```
CREATE TABLE [dbo].[Document](
   [ID] [int] IDENTITY(1,1) NOT NULL,
   [Title] [nvarchar](500) NULL,
   [Content] [nvarchar](max) NULL,
   [Embedding] [vector](1536) NULL
)

SELECT TOP 3
   d.ID,
   d.Title,
   d.[Content],
   VECTOR_DISTANCE('cosine', d.Embedding, CAST(@embedding AS VECTOR(1536)))
AS Score
FROM [dbo].[Document] d
ORDER BY Score ASC;
```

SQL Server 2025 Vector Search



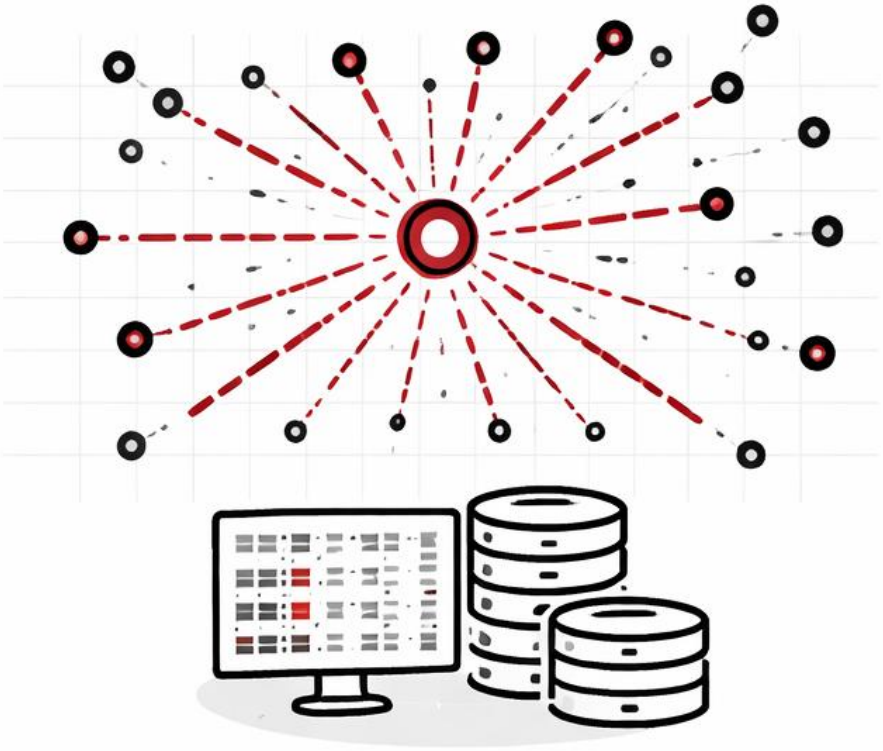

ask
question +
generate
Question
Smart Receiver
Generator
Answer based on knowledge base
Look-up
relevant documents
SQL Vectors
Data
Vectors
Specific knowledge base
Embedding model

VECTOR Search

```
CREATE VECTOR INDEX IX_Document_Embedding
ON dbo.Document (Embedding)
WITH (metric = 'cosine', type = 'diskann');

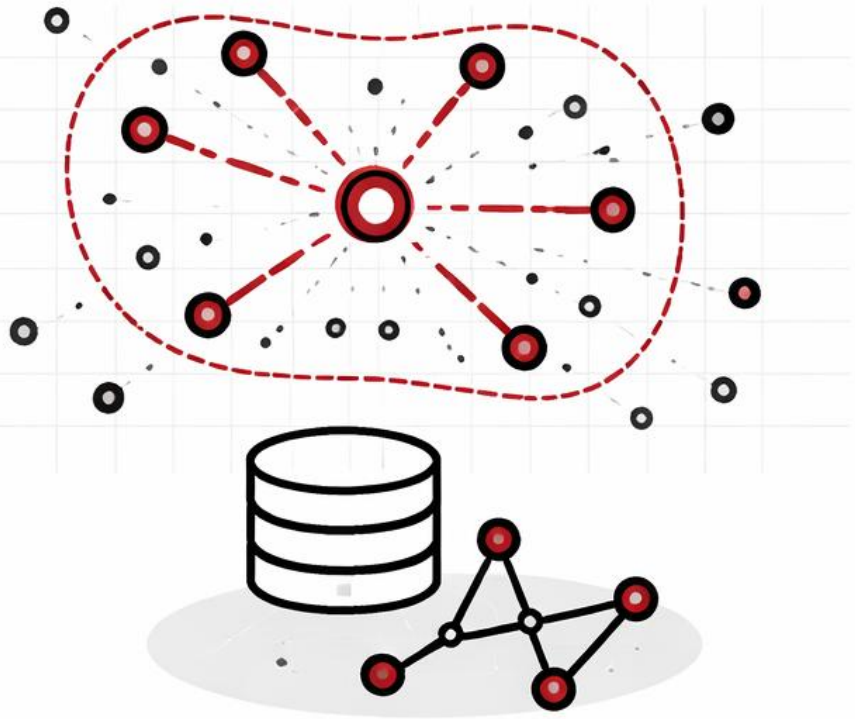
SELECT
    d.ID, d.Title, d.Content, s.distance
FROM
    VECTOR_SEARCH(
        TABLE = dbo.Document AS d,
        COLUMN = [Embedding],
        SIMILAR_TO = AI_GENERATE_EMBEDDINGS(N'<User question>' USE MODEL ModelName),
        METRIC = 'cosine',
        TOP_N = 3
    ) AS s
ORDER BY s.distance
```

Index types



Calculates all distances

KNN



Efficient Graph traversal

ANN

SP_INVOKE_EXTERNAL_REST_ENDPOINT

```
sys.sp_invoke_external_rest_endpoint
    [ @url = ] N'url'
    [ , [ @payload = ] N'payload' ]
    [ , [ @headers = ] N'headers' ]
    [ , [ @method = ] { 'GET' | 'POST' | 'PUT' | 'PATCH' | 'DELETE' | 'HEAD' } ]
    [ , [ @timeout = ] timeout ]
    [ , [ @credential = ] N'credential' ]
    [ , [ @response = ] N'response' OUTPUT ]
    [ , [ @retry_count = ] retry_count ]
[ ; ]
```

Demo



Chunking




MIX&
MATCH

What’s more?

- Copilot in SSMS
- SQL Server as MCP

- **https://www.youtube.com/@BetabitVideos**

Thank you sponsors!



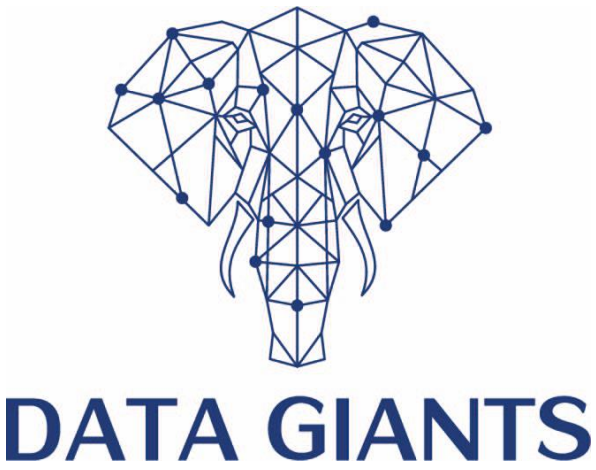
















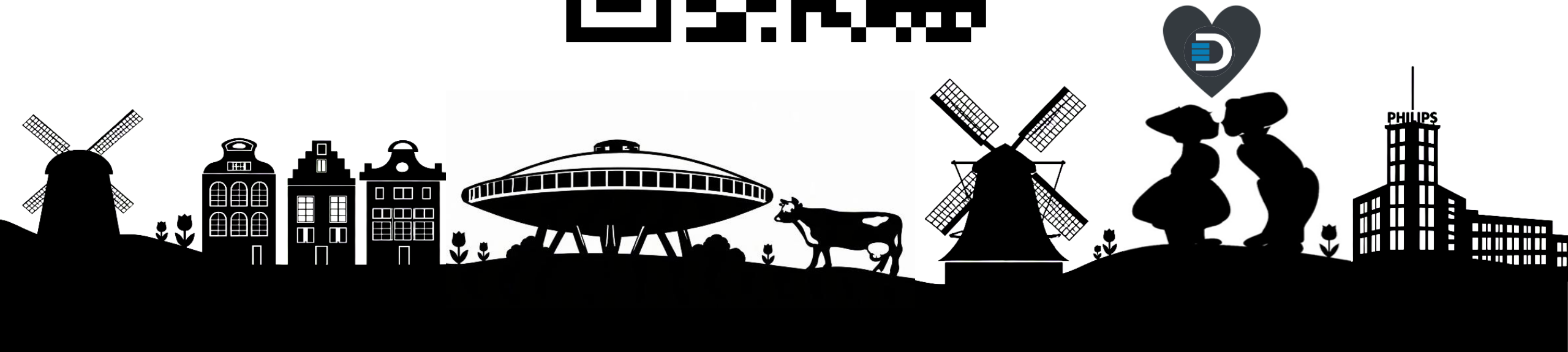








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