
powered by
Cheshire Cat AI
Don't Get Lost
in
Vector Space

WHO I AM

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Cheshire Cat - Core Contributor

Contacts

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Actually @ FINCONS GROUP

Previous Main Experiences

healthware international

integris

ICAR CNR

UNIVERSITÀ DELLA CALABRIA

Communities and Open Source Projects

AI DEMOCRATIZE

tag Talent Garden Cosenza

iaml ITALIAN ASSOCIATION FOR MACHINE LEARNING

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PRODUCTION-READY AI ASSISTANT FRAMEWORK

- **ready to fight**
  dockerized
  model agnostic

- **RAG + action agent**
  (docs, convos and procedures)

- **plugin system and registry**
  (hooks, tools and forms)

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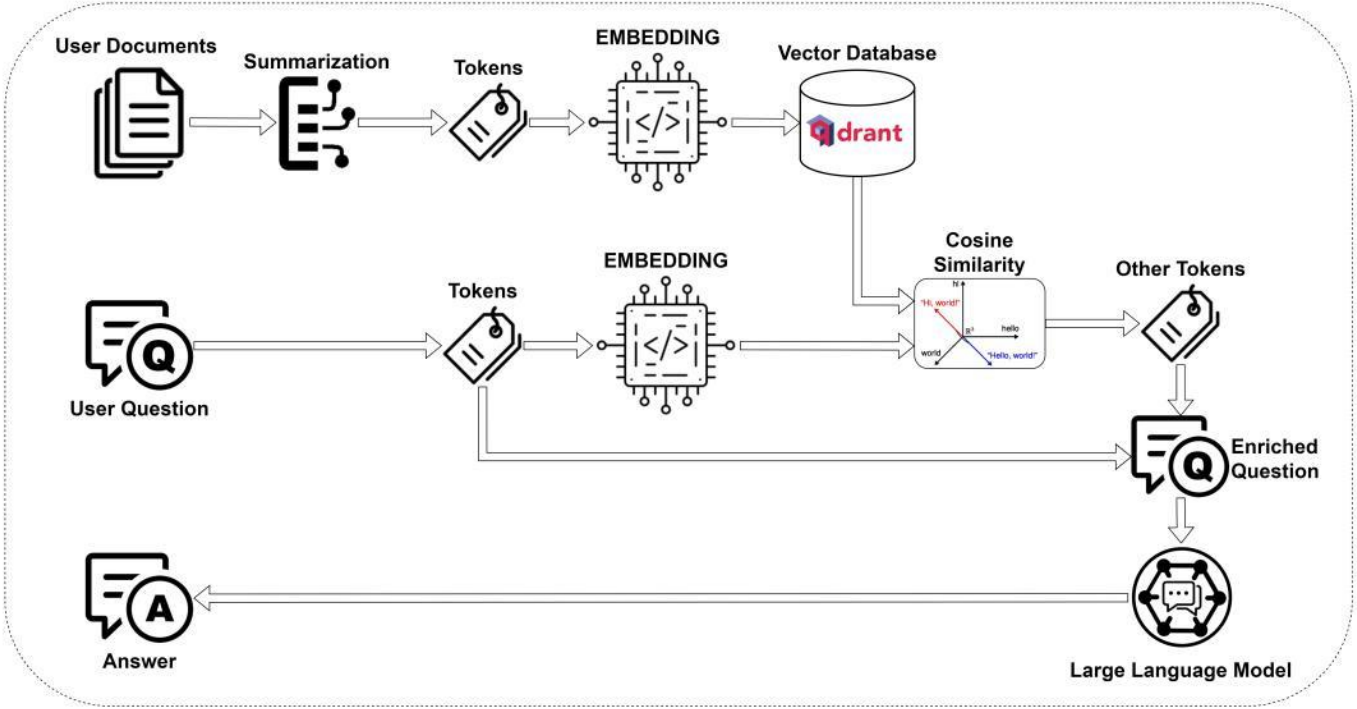
CHESHIRE CAT's "VANILLA" RAG PIPELINE



Customize it using **hooks, tools** and **plugins!**

[documentation]

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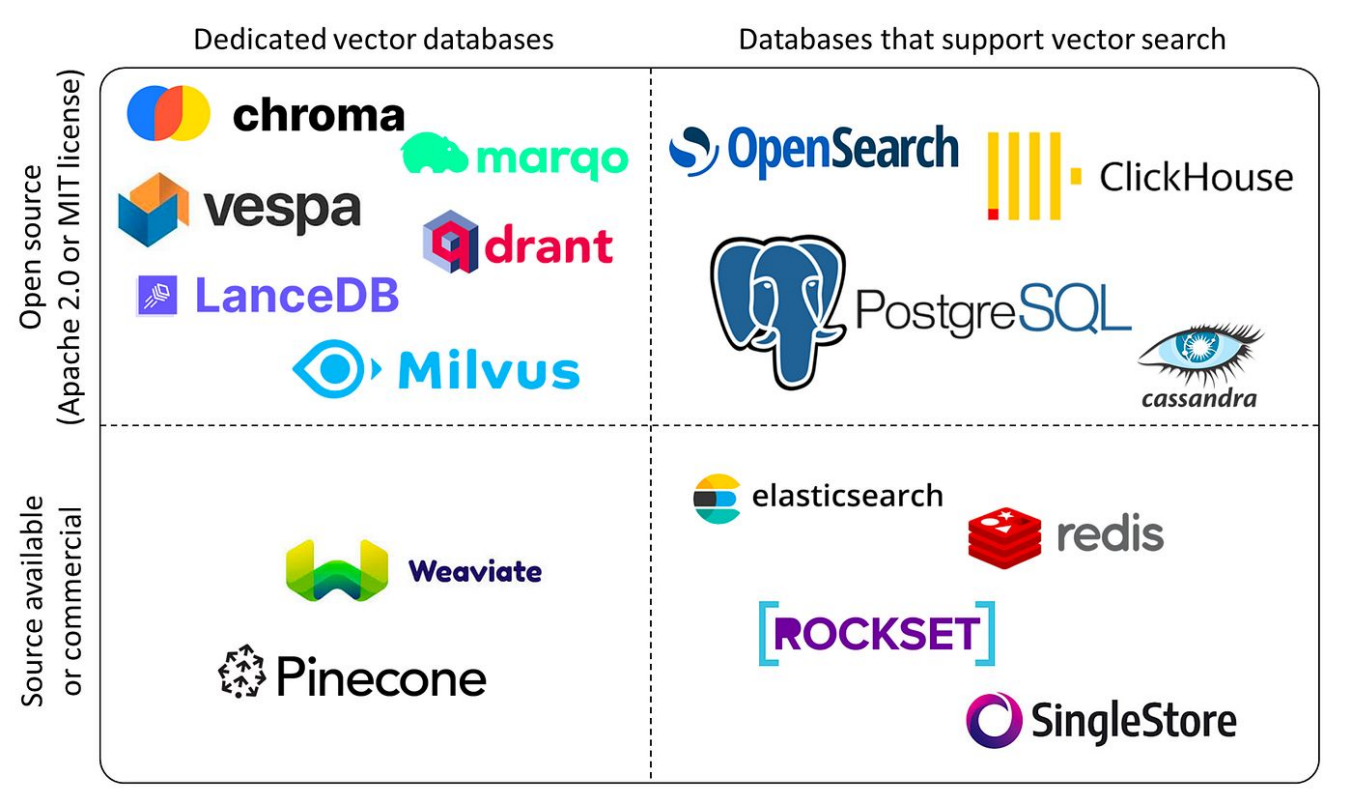
WHY QDRANT?



[Vector Database Benchmarks]

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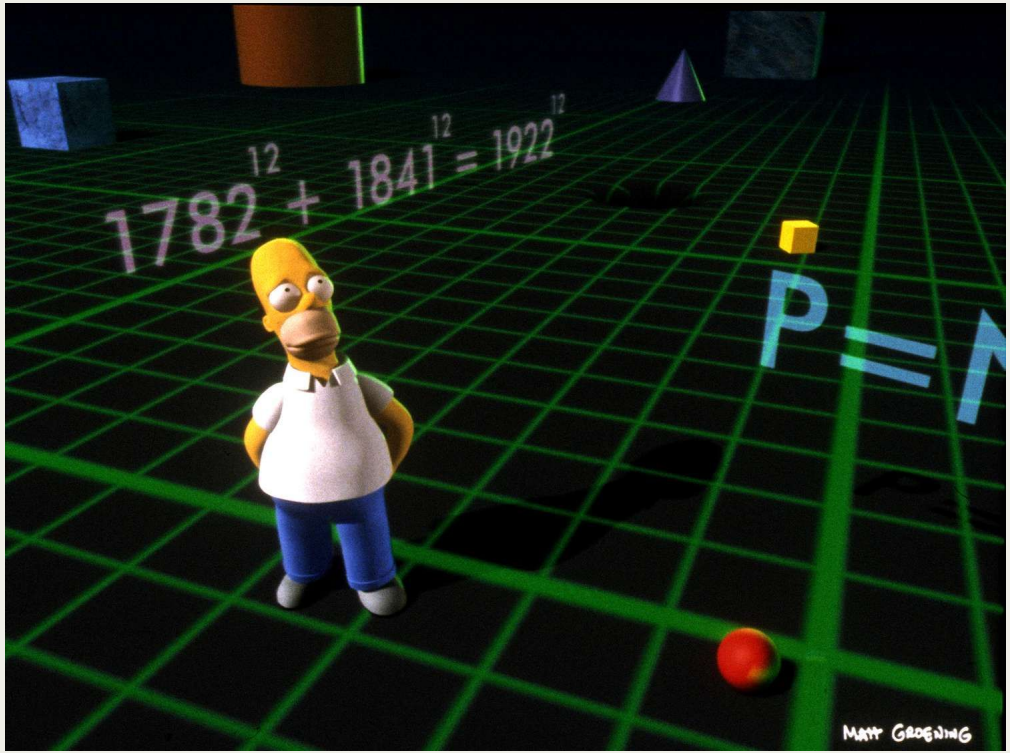
WHAT'S VECTOR SPACE?

A **multi-dimensional continuous space** where the **objects** are **represented** as **vectors.**

In NLP also called **semantic space** and the objects are words, sentences, documents.

The dimension of the space is defined using **embedders.**



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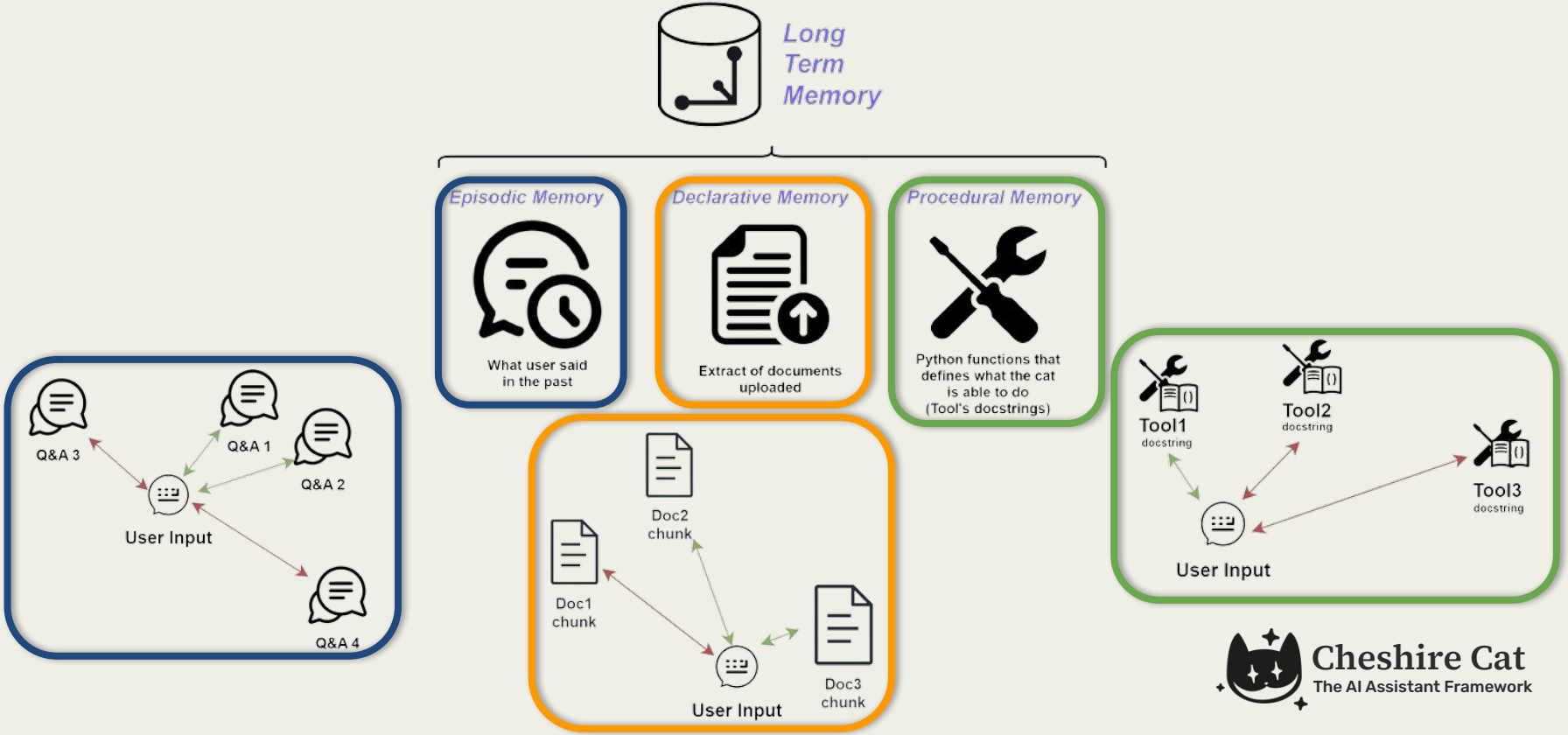
CHESHIRE CAT's MEMORY



THE DRUNKEN CAT EFFECT

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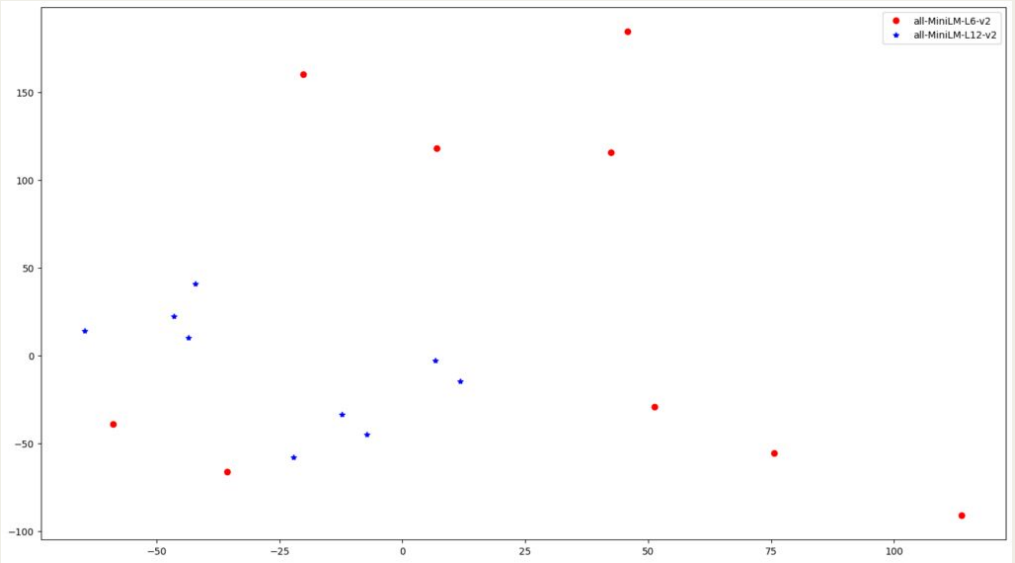
PROBLEM

SAME SENTENCES

- 'A man is eating food.',
- 'A man is eating a piece of bread.',
- 'The girl is carrying a baby.',
- 'A man is riding a horse.',
- 'A woman is playing violin.',
- 'Two men pushed carts through the woods.',
- 'A man is riding a white horse on an enclosed ground.',
- 'A monkey is playing drums.',
- 'Someone in a gorilla costume is playing a set of drums.'

DIFFERENT EMBEDDERS WITH SAME SIZE

- all-MiniLM-L6-v2
- all-MiniLM-L12-v2



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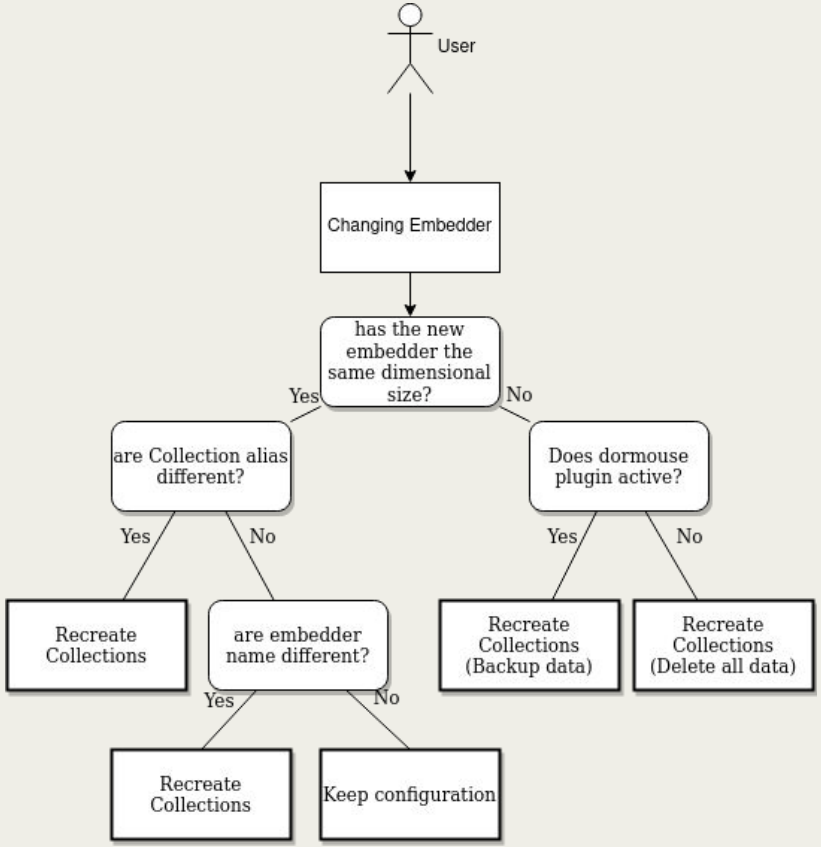
USE QDRANT ALIASES AND DON'T MIX EMBEDDINGS!



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ACCURACY AND PERFORMANCE USING QUANTIZATION

High-dimensional vector embeddings can be memory-intensive, the formula to estimate memory size:

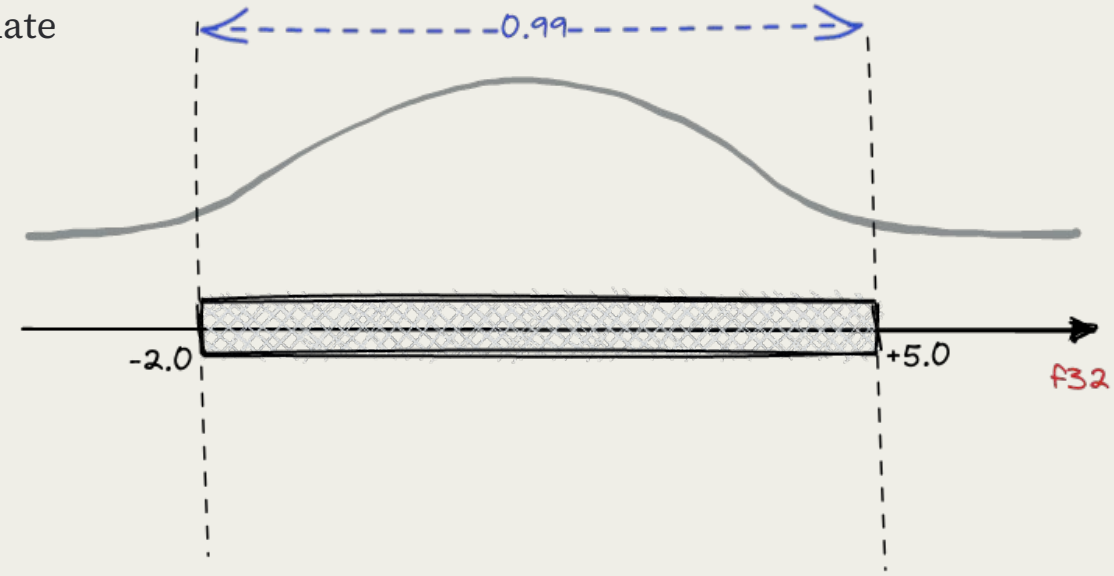
*memory_size = 1.5 * number_of_vectors * vector_dimension * 4 bytes*

Cheshire Cat uses **Scalar Quantization** to use up less memory.

Trick 1:

Hybrid mode:

- original vector on Disk
- quantized vector in RAM



https://qdrant.tech/articles/scalar-quantization/

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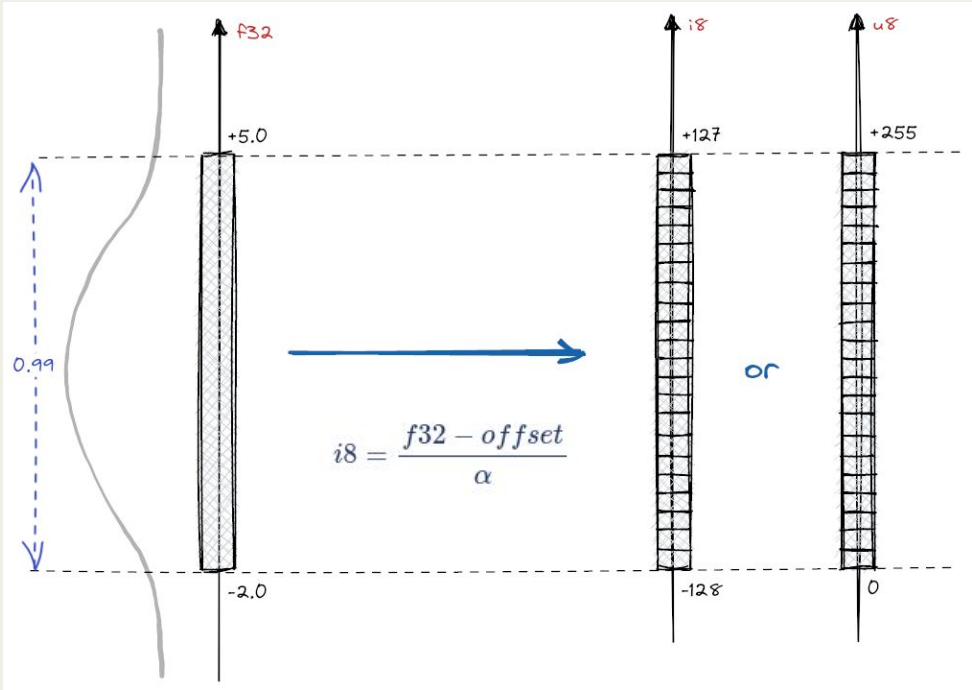
WHAT'S QUANTIZATION?

- **Scalar Quantization** converts the ***float32*** embeddings into ***int8***
- from a range of infinite value to 256 elements
- the calibration dataset greatly influences performance since it defines the quantization buckets



Trick 2:
The **quantile parameter** in scalar quantization determines the quantization bounds.
In Cheshire Cat it's set to 0.95, we exclude the 5% outliers.

https://qdrant.tech/articles/scalar-quantization/

https://huggingface.co/blog/embedding-quantization#scalar-int8-quantization

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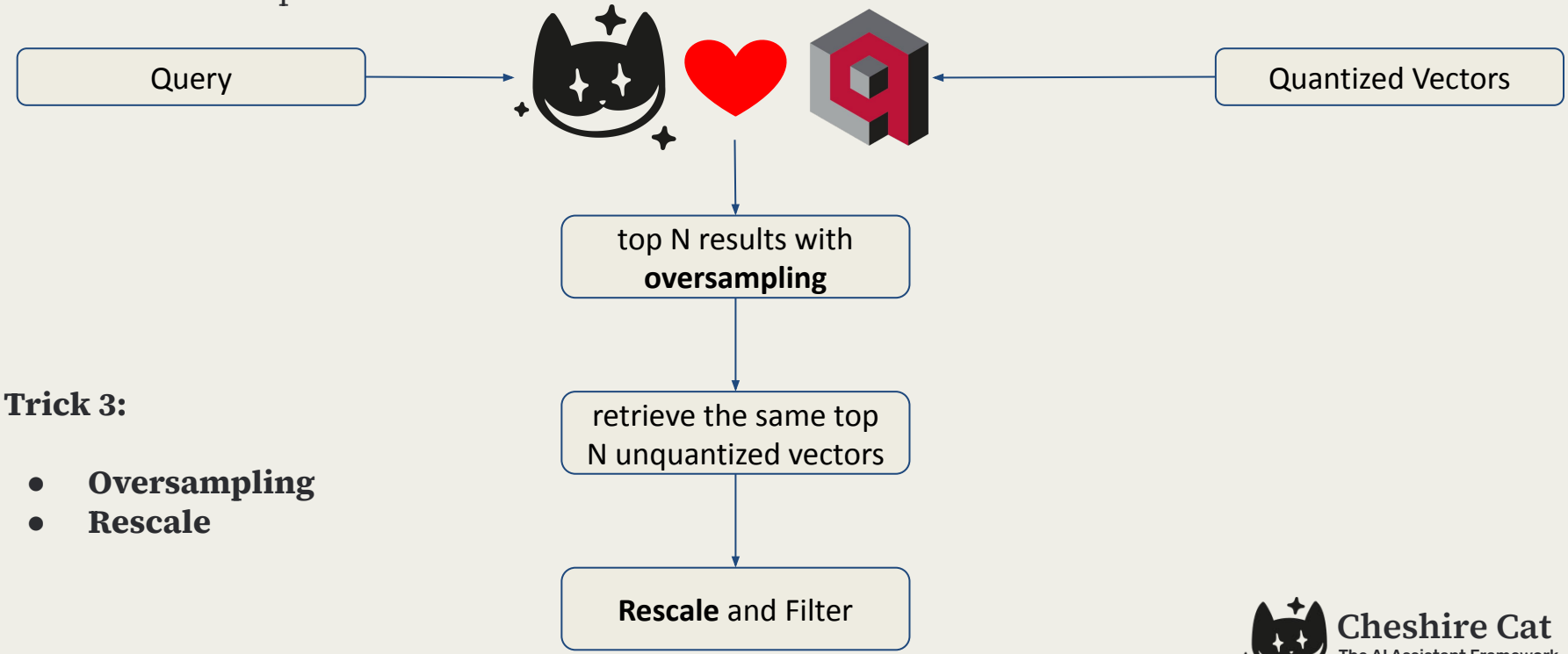
ACCURACY AND PERFORMANCE USING QUANTIZATION

In retrieve step:



Trick 3:

- **Oversampling**
- **Rescale**

https://qdrant.tech/articles/scalar-quantization/

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ACCURACY AND PERFORMANCE USING QUANTIZATION

Using these Tips & Tricks the Cheshire Cat's vector search can achieve up to 4x lower memory footprint and even up to 2x performance increase!

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MATRYOSHKA EMBEDDERS

Matryoshka Representation Learning (MRL) is an advanced machine learning approach that **encodes data at multiple levels of granularity within a single vector representation**.

Like a Matryoshka doll the levels are nested in one embedding, the greater the number of levels, the more detail the embedding maps.

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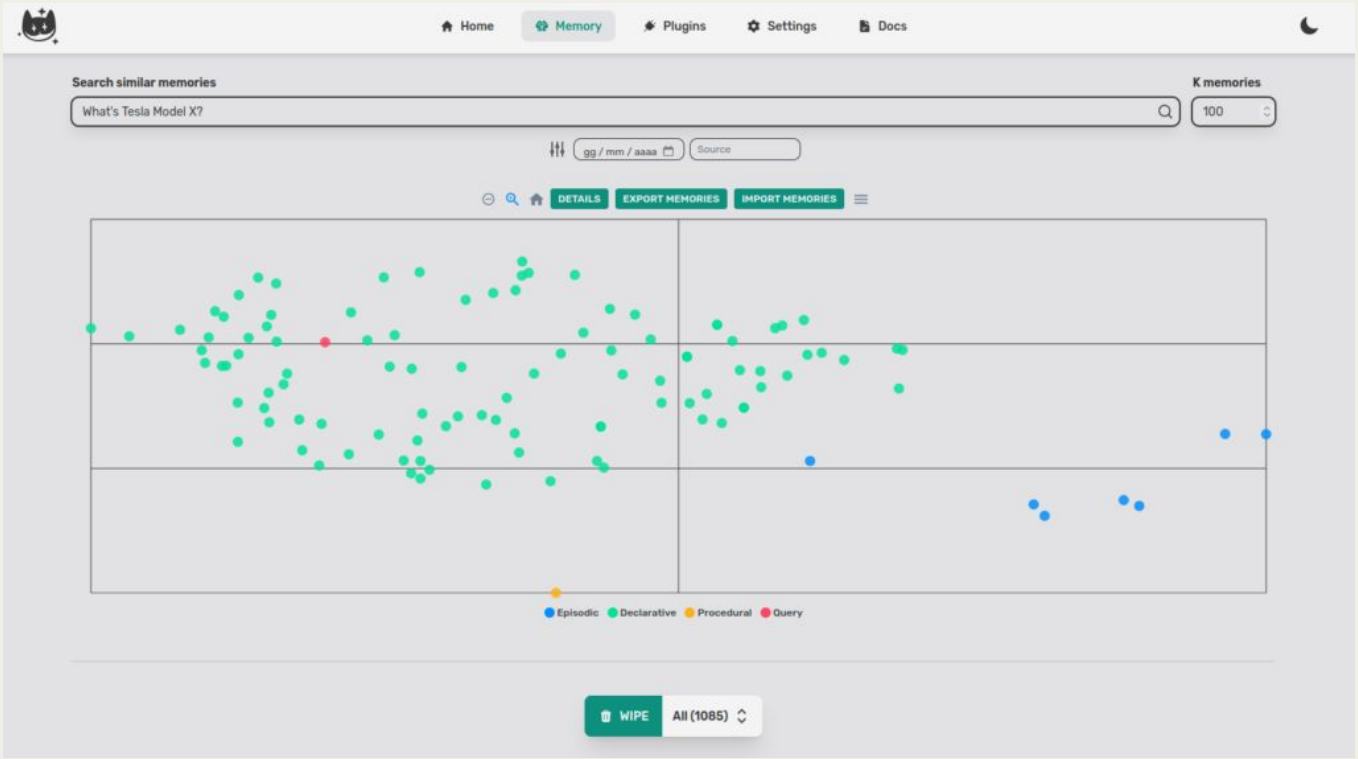
TAKE A LOOK INTO THE CAT's MEMORY



Search

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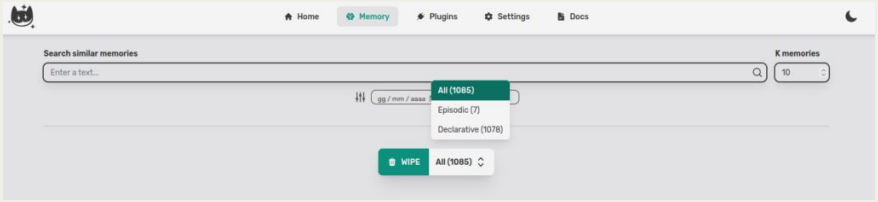
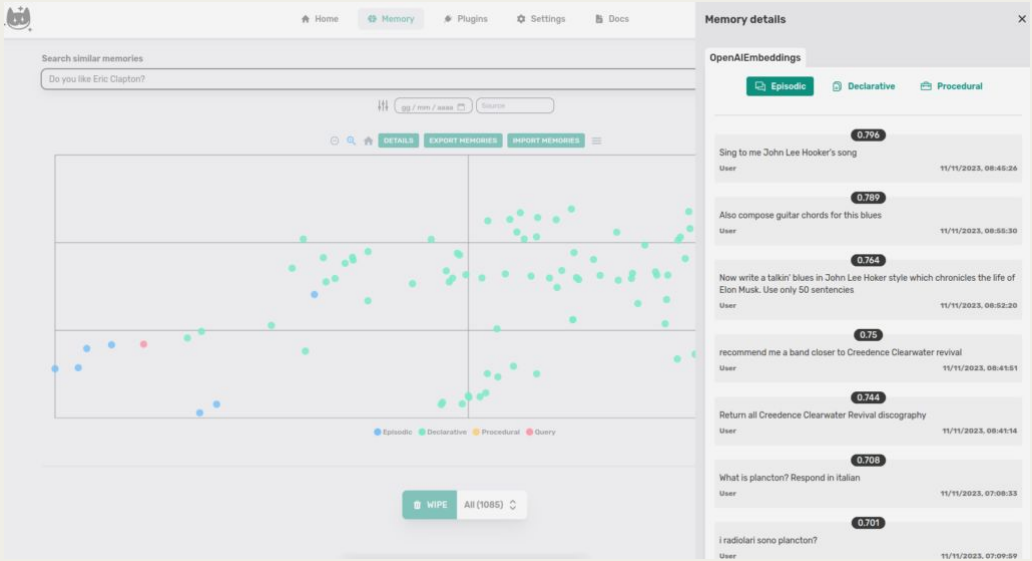
TAKE A LOOK INTO THE CAT's MEMORY



Filter & Wipe



Go Deep using Details

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TAKE A LOOK INTO THE CAT's MEMORY


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          -0.013453993,
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```


Export using Json

Wake up the Dormouse!

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Any Questions?

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Thank you!

CHESHIRE CAT AI

NICOLA PROCOPIO,

CORE CONTRIBUTOR

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Keep in touch!

CHESHIRE CAT AI

https://cheshirecat.ai

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https://www.linkedin.com/company/cheshire-cat-ai

https://medium.com/mad-chatter-tea-party

https://discord.gg/cheshire-cat

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