DATASTAX

# Concorra a kits da DataStax

**A melhor solução para Vector Search e RAG**

DATASTAX

# Workshop: Criando Apps de IA Generativa com NodeJS e NextJS

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Solution Engineer at DataStax

# Agenda

- Aplicações com IA Generativa
- Vector Search & DataStax Astra
- O que é RAG?
- Ex1: Implementando RAG *na mão*
- Ex2: Simplificando com LangchainJS
- Ex3: Usando Functions

# Ganhe um Badge


Envie o seu DB ID e um screenshot da aplicação:

samuel.matioli@datastax.com

para receber seu Badge!

DATASTAX DEVELOPERS

# Sorteio de brindes

Cadastre-se aqui para participar do sorteio.

**bit.ly/datastax-tdcsc**

# Housekeeping – tdclover / #tdclover

Versões: NodeJS 18.

Clonar: **https://github.com/smatiolids/workshop-genai-js**

Criar conta em:

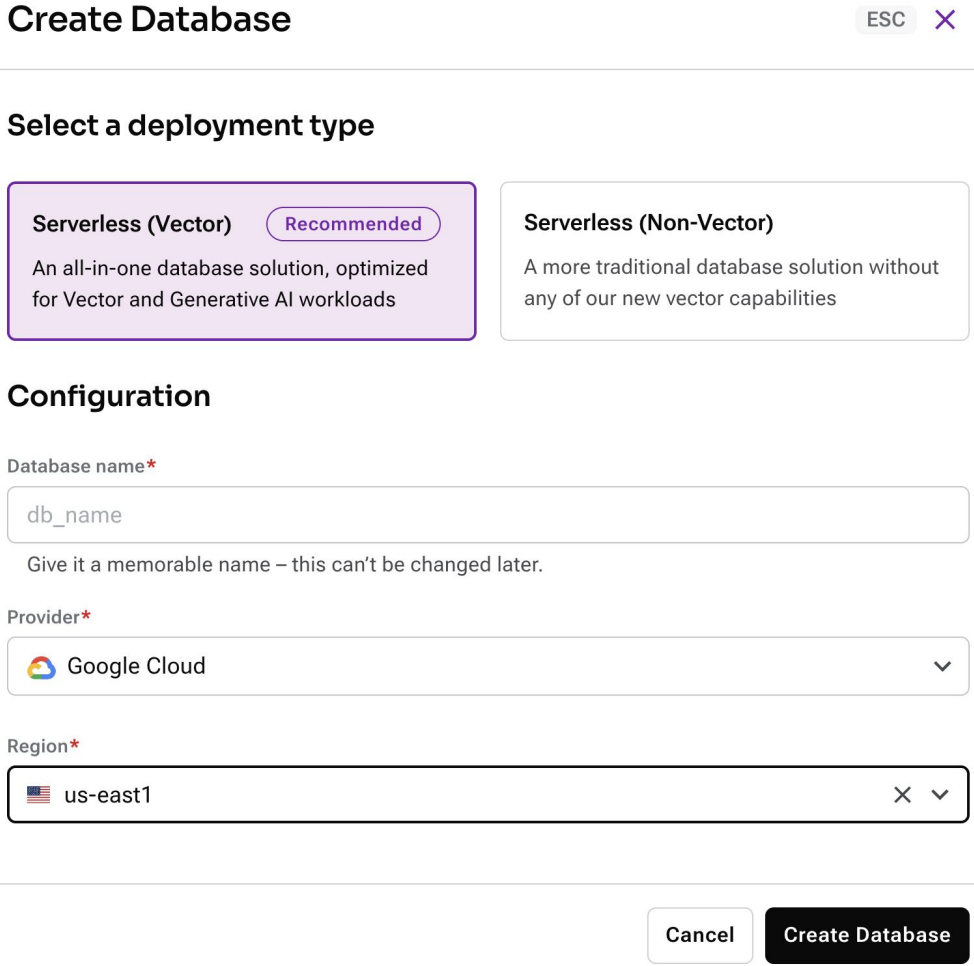
**OpenAI** (https://platform.openai.com/)

- Vamos usar os embeddings e o LLM para gerar conteúdo

**DataStax Astra** (astra.datastax.com) – **Conta GRATUITA!**

- Armazenar dados proprietários e memória

# Criando o Vector DB



# Como criar aplicações GenAI

**Language Model (LLM)**

OpenAI

Gemini

ANTHROP\C

cohere

**Código**

Frameworks

LangChain

Linguagens

node

NEXT.JS

**Dados**

- Vector Store and Search
- Contextual Information
- Agent Memory
- Cache

**Deployment**

**Monitoring**

# ❯ Dificuldades com o RAG em produção

## O apps com GenAI "quebram" muito

- Muitas dependências
- APIs externas **sem garantias**
- Novas versões de APIs externas **sem aviso**

## Escala e resiliência:

- Dados em tempo real
- Milhares de usuários
- Milhões de interações
- Muitos dados...

## Necessidade de evolução:

- Agilidade para incrementar e refinar os casos de uso
- Aproveitar novos modelos
- Novas origens de dados
- Ferramentas para a área de negócio

# Exercício 1

# › Iniciando

Passos:

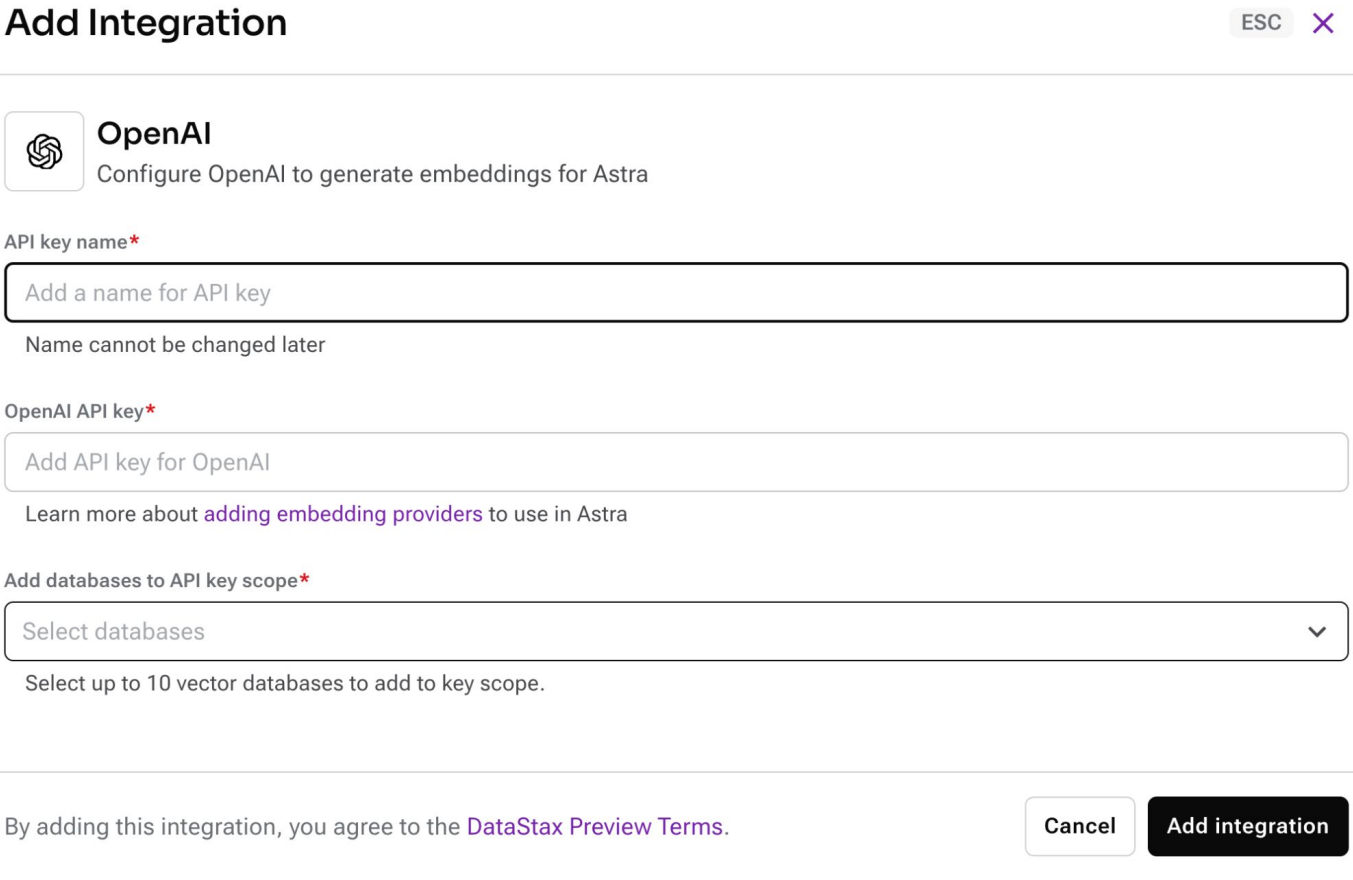
- Conta no Astra
- Clonar: **https://github.com/smatiolids/workshop-genai-js**
- Copiar o .env.example para .env.local
- Atualizar as variáveis
  - OPENAI_API_KEY
  - ASTRA_DB_API_ENDPOINT
  - ASTRA_DB_APPLICATION_TOKEN

# ❯ Ex 1: RAG + Vectorize

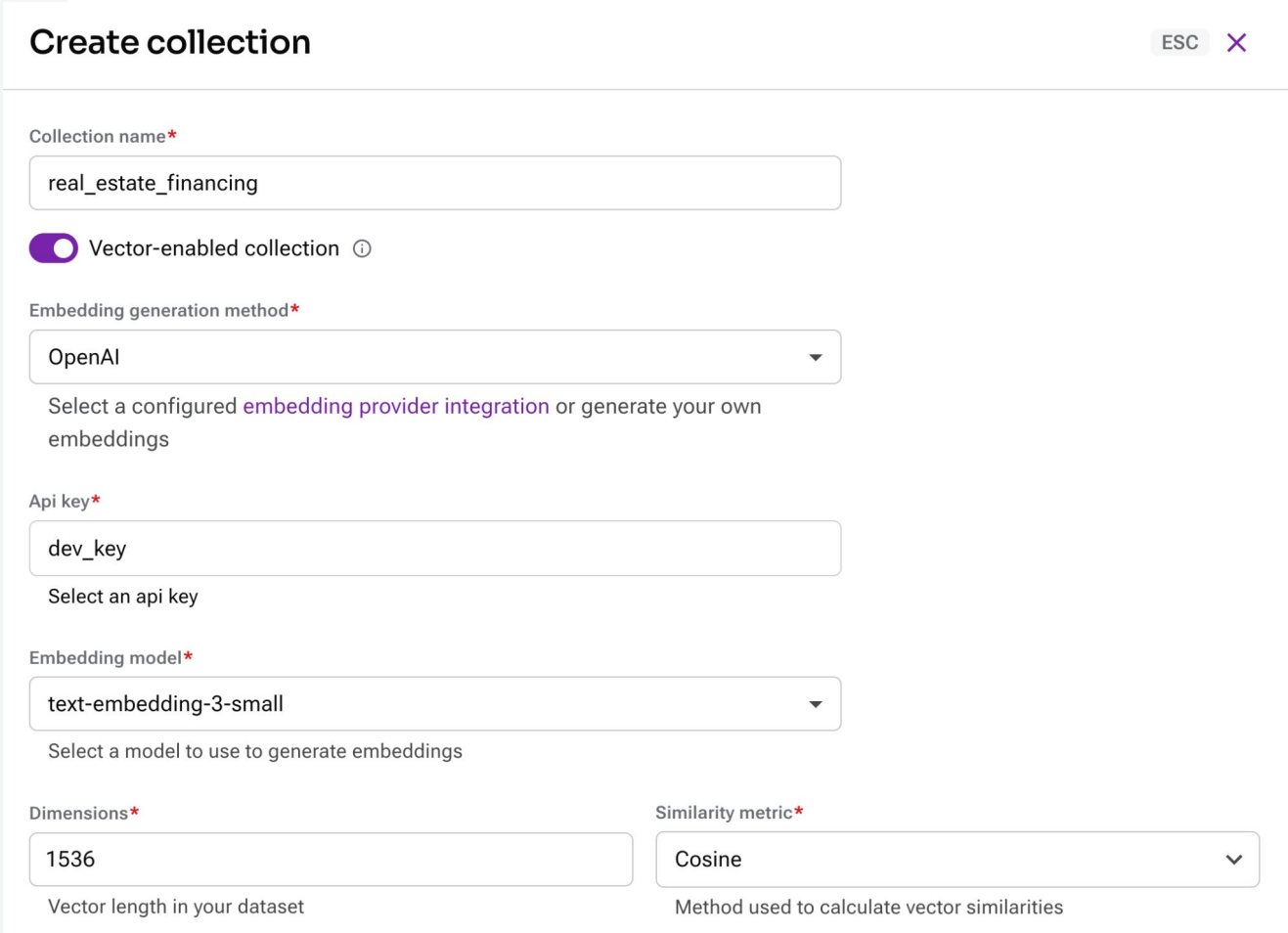
Passos:

- Acessar localhost:3000/v1/chat e fazer perguntas sobre financiamento imobiliario
- Configurar o $vectorize
- Criar collection "**real_estate_financing**" no Astra
- Carregar documento em localhost:3000/v1/upload

# API Key



# Criando a collection

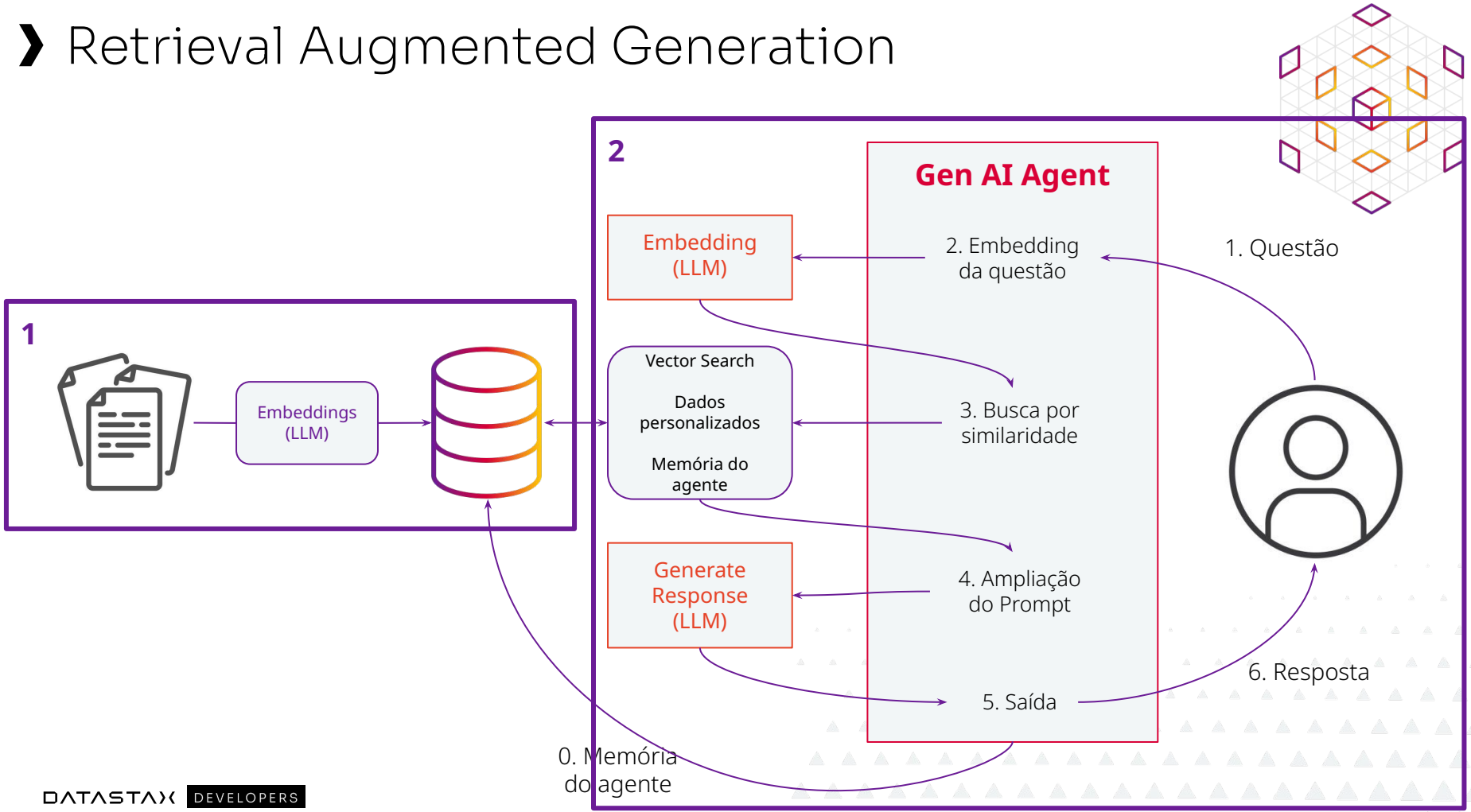


# ❯ Carregar dados para o Astra

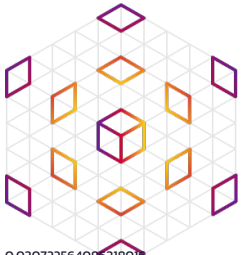
- Criar API Key
  - Vincular DB ao escopo da chave
- Criar collection "**real_estate_financing**"
- Vincular modelo OpenAI "**text-embedding-3-small**"
  - Dimensões: **1536**
  - Similarity Metric: **Cosine**

# Retrieval Augmented Generation (ou RAG)

# Retrieval Augmented Generation



# O que são embeddings



To create a security token that can be used to log into a database, select Token Management from the User Management menu. Then, choose an appropriate role for the user, and click the Generate Token button. Copy the token details to a safe place, as the secret that is shown can never be reproduced in the Astra console for security reasons.

**text-embedding-ada-002**

[-0.029334254562854767, 0.06338247656822205, 0.03711941838264465, 0.06770425289869308, 0.030722564086318016,
-0.03855780512094498, 0.05715630576014519, 0.011225797235965729, 0.03209076076745987, 0.018565965816378593,
0.005725057329982519, 0.003278332995250821, 0.019661232829093933, 0.008483093231916428, 0.01011530589312315,
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-0.06456394493579865, -0.00168662762735039, -0.02538292482495308, -0.013529211282730103, 0.006745325401425362,
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-0.001605408848263 3233, -0.128231540322303 77, 0.005963715258985 758, -0.016070995479822 16,...]

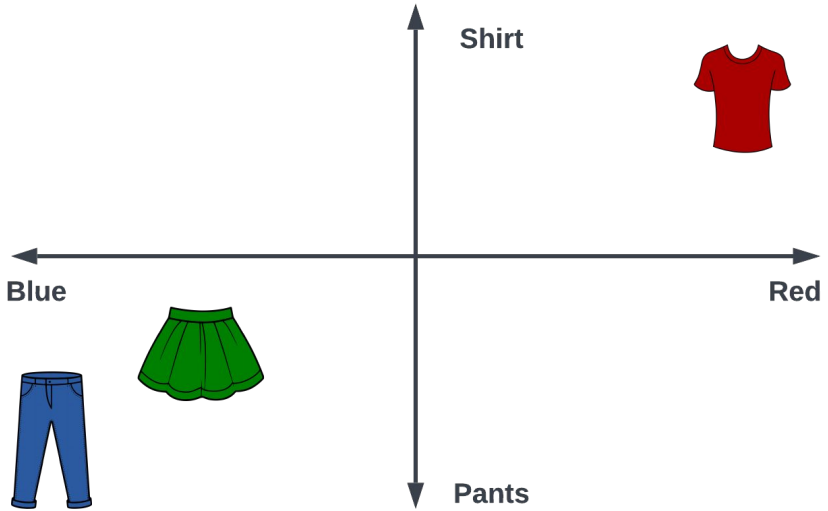
Texto

Embedding

1536 dimensões

# Como funciona o Vector Search?

- Documentos, imagens e outros conteúdos são transformados em **embeddings** (vetores com N dimensões) que representam seu significado.
- Busca semântica é realizada a partir da **similaridade** de de suas representações numéricas (os embeddings)
- As métricas de similaridade mais comuns são: Dot Product, Coseno e Euclidiana.



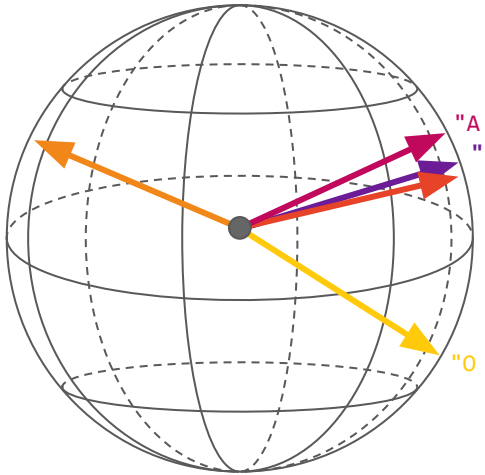

https://www.datastax.com/guides/what-is-a-vector-embedding

# Vector embeddings

**Representação fiel de "coisas" como vetores em um espaço de alta dimensionalidade**

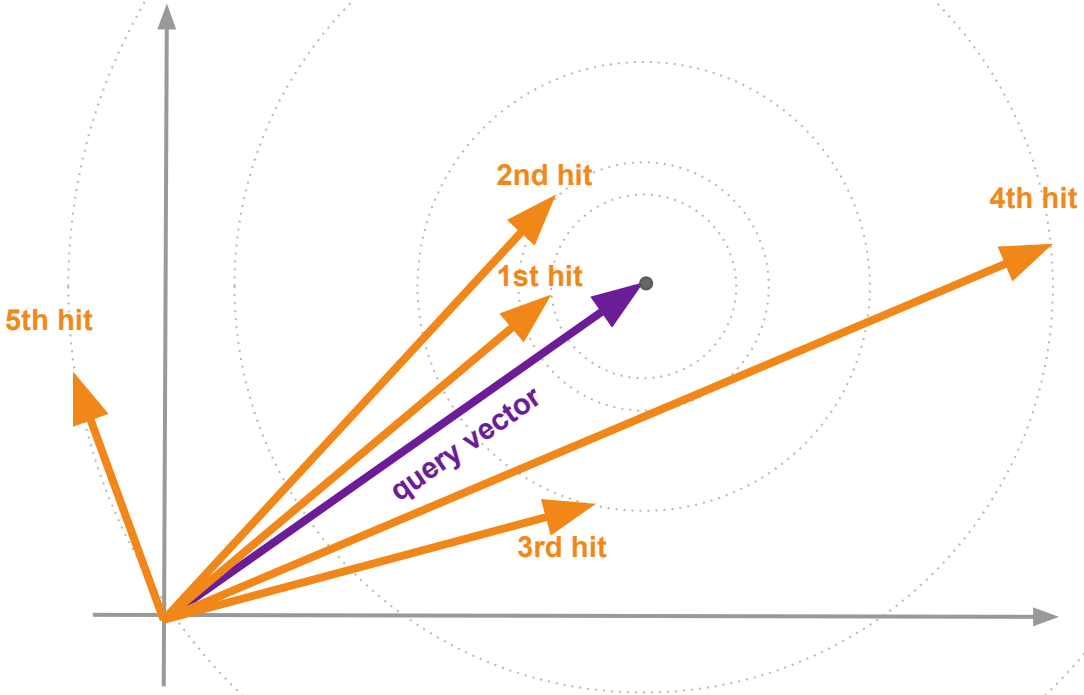
- Quais coisas? Principalmente **texto** (também: imagens, vídeos, sons ...)
- Transformar um problema semântico em um problema geométrico

"Aquele que busca a igualdade entre os desiguais ..."

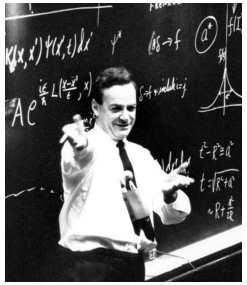


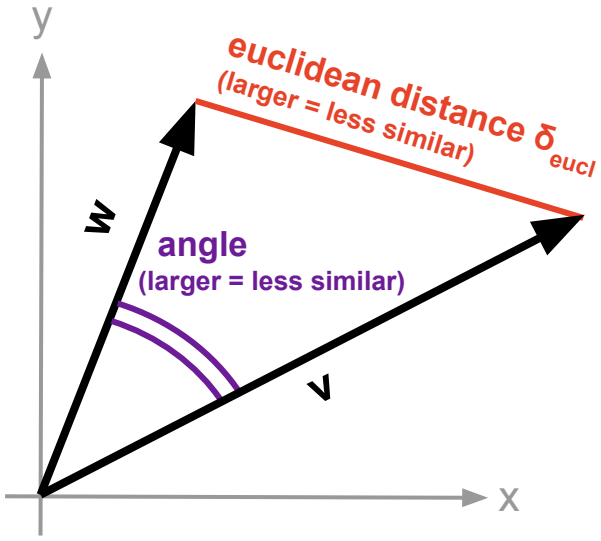

Embedding vector space

# Vector Search em uma imagem



# Similaridades





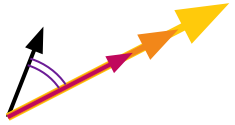

**Euclidean** similarity

$$S_{\text{eucl}}(\mathbf{v},\mathbf{w}) = \frac{1}{1+\sum_i (v_i - w_i)^2} = \frac{1}{1+\delta^2_{\text{eucl}}(\mathbf{v},\mathbf{w})}$$

$$\delta_{\text{eucl}}(\mathbf{v},\mathbf{w}) = \sqrt{\sum_i (v_i - w_i)^2}$$

**Cosine** similarity (a.k.a. "*only the angle counts*")

$$S_{\cos}(\mathbf{v},\mathbf{w}) = \frac{1+\frac{\sum_i v_i w_i}{|\mathbf{v}||\mathbf{w}|}}{2} = \frac{1+\frac{\mathbf{v}\cdot\mathbf{w}}{|\mathbf{v}||\mathbf{w}|}}{2}$$



DATASTAX ASTRA

# Data Platform all in one:

NoSQL, Vector Search, APIs, Streaming, ZeroOps, Multi Cloud, etc...


Applications



## Data sources

Web

Applications

IoT

DATASTAX

Starlight

JMS, Kafka, RabbitMQ

gRPC, REST, GraphQL, Document (JSON) and CQL APIs

STARGATE

PULSAR

DATASTAX ASTRA STREAMING

Streaming service based on Apache Pulsar®

Apache CASSANDRA

DATASTAX ASTRA DB

Database as a service based on Apache Cassandra®

CDC

Invisible operations

Infrastructure, Security, Scalability, High Availability, Resiliency

Multi-Cloud & Cloud-Native

Multi-region, Inter-cloud, Serverless and K8S microservices based

## Data ecosystem

Analytics

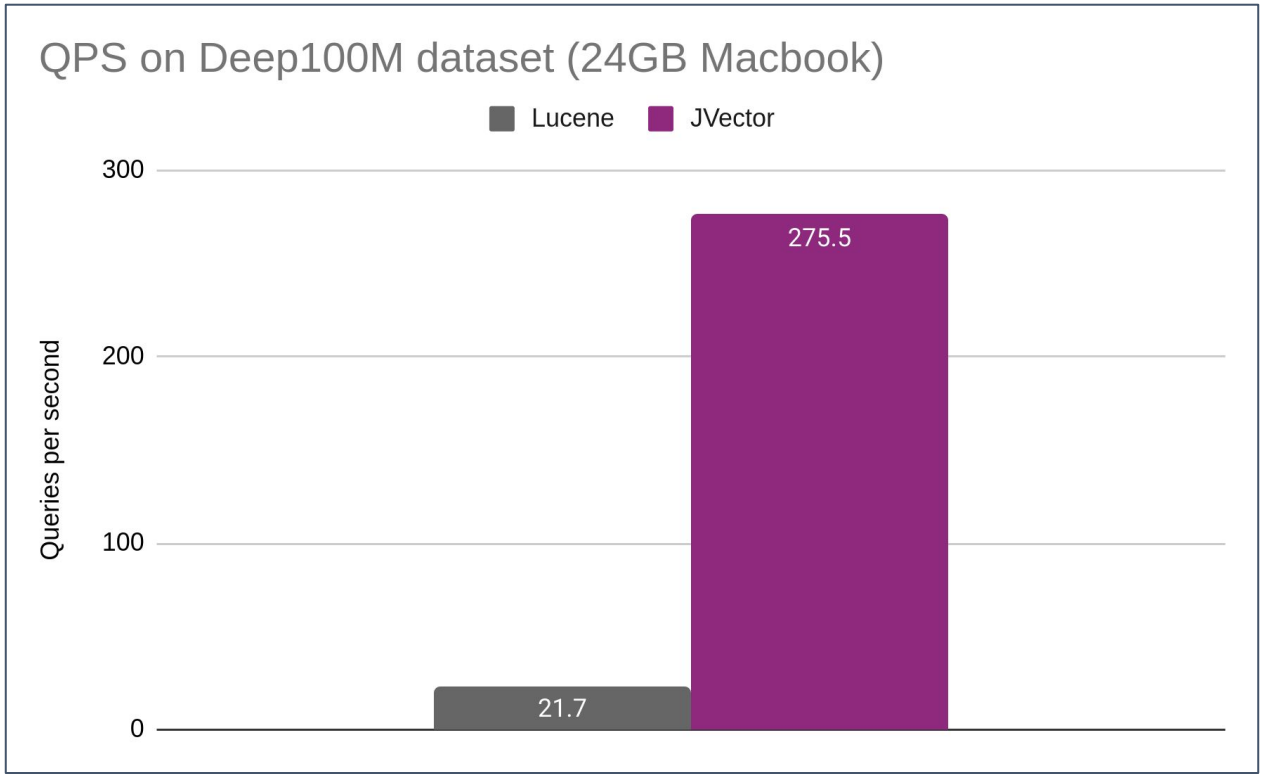
Search

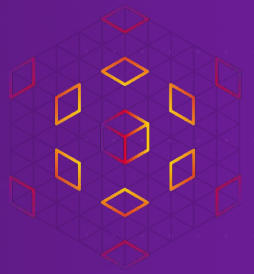
AI

aws

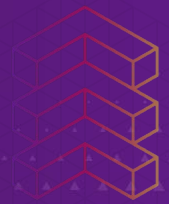

kubernetes

# JVector performance: read throughput



# Ex2 - RAG +  LangchainJS

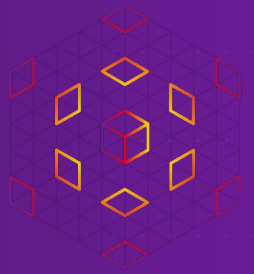




# ❯ Ex 2: Simplificando com LangchainJS

Passos:

- Acessar localhost:3000/**v2**/chat e fazer perguntas sobre financiamento imobiliario
- Criar collection "**real_estate_financing_langchain**" no Astra
- Carregar documento em localhost:3000/**v2**/upload
- Repetir perguntas em v2/chat




# Ex3 - Stocks

# ❯ Ex 3: GenAI + DataAPI + NextJS

Passos:

- Acessar localhost:3000/**stocks**
- Criar collection "**stocks**" no Astra
- Carregar dados para a collection
- Perguntar sobre preço de ação: AAPL, GOOG, SBUX

# Ganhe um Badge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para receber seu Badge!

DATASTAX DEVELOPERS

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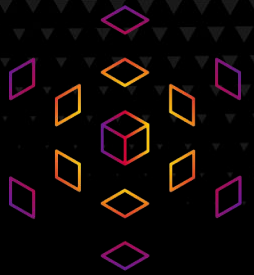


## Samuel Matioli

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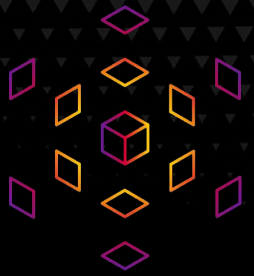

# Appendix

# Referências adicionais

AstraDB no Langchain
https://python.langchain.com/docs/integrations/vectorstores/astradb

RAG na prática
https://www.youtube.com/watch?v=wc22tG5IGUU

AstraDB Vector & Vertex AI
https://www.youtube.com/watch?v=E0Wv4ALVp5w