The LangChain ecosystem

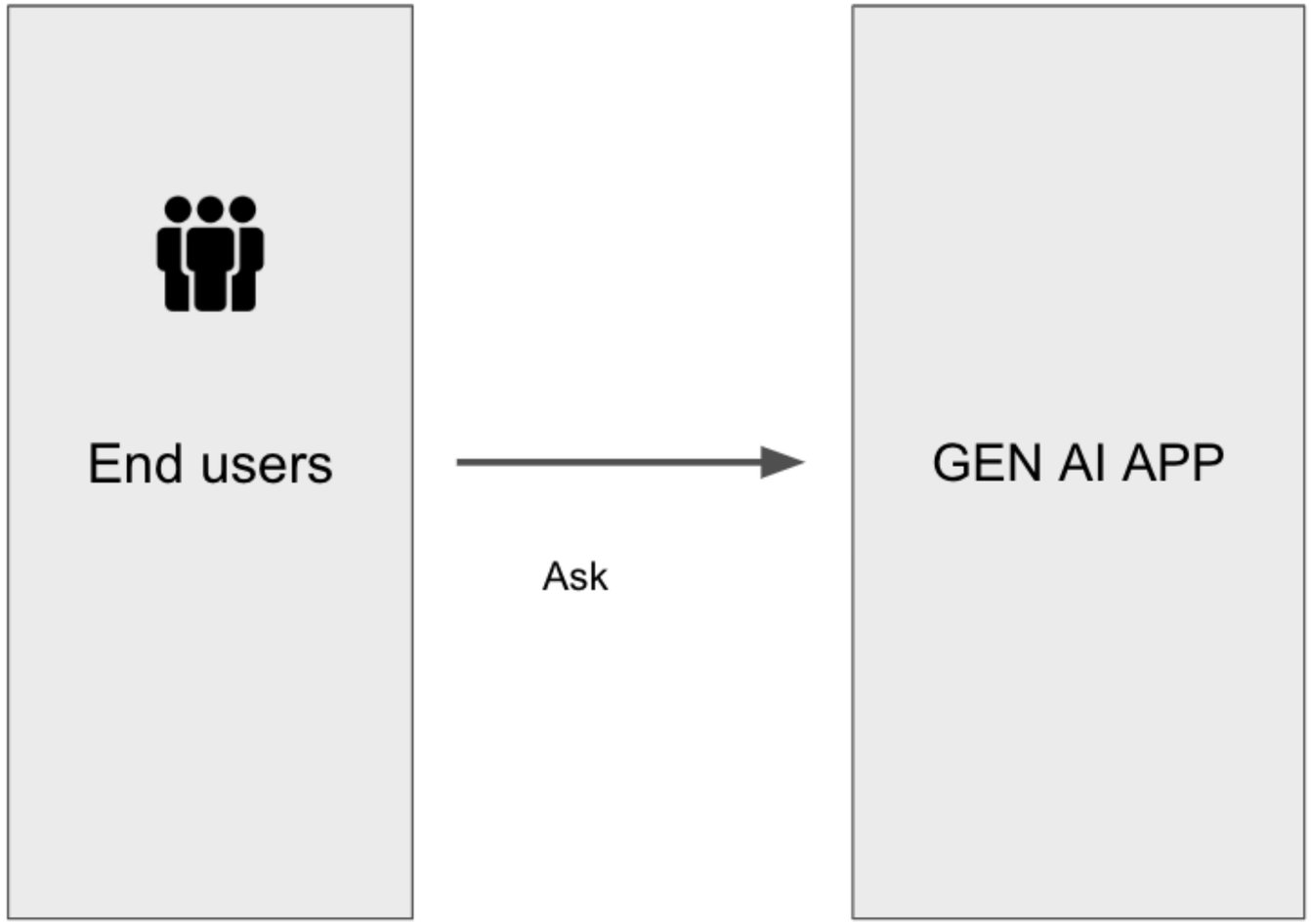
DEVELOPING LLM APPLICATIONS WITH LANGCHAIN

Jonathan Bennion
AI Engineer & LangChain Contributor

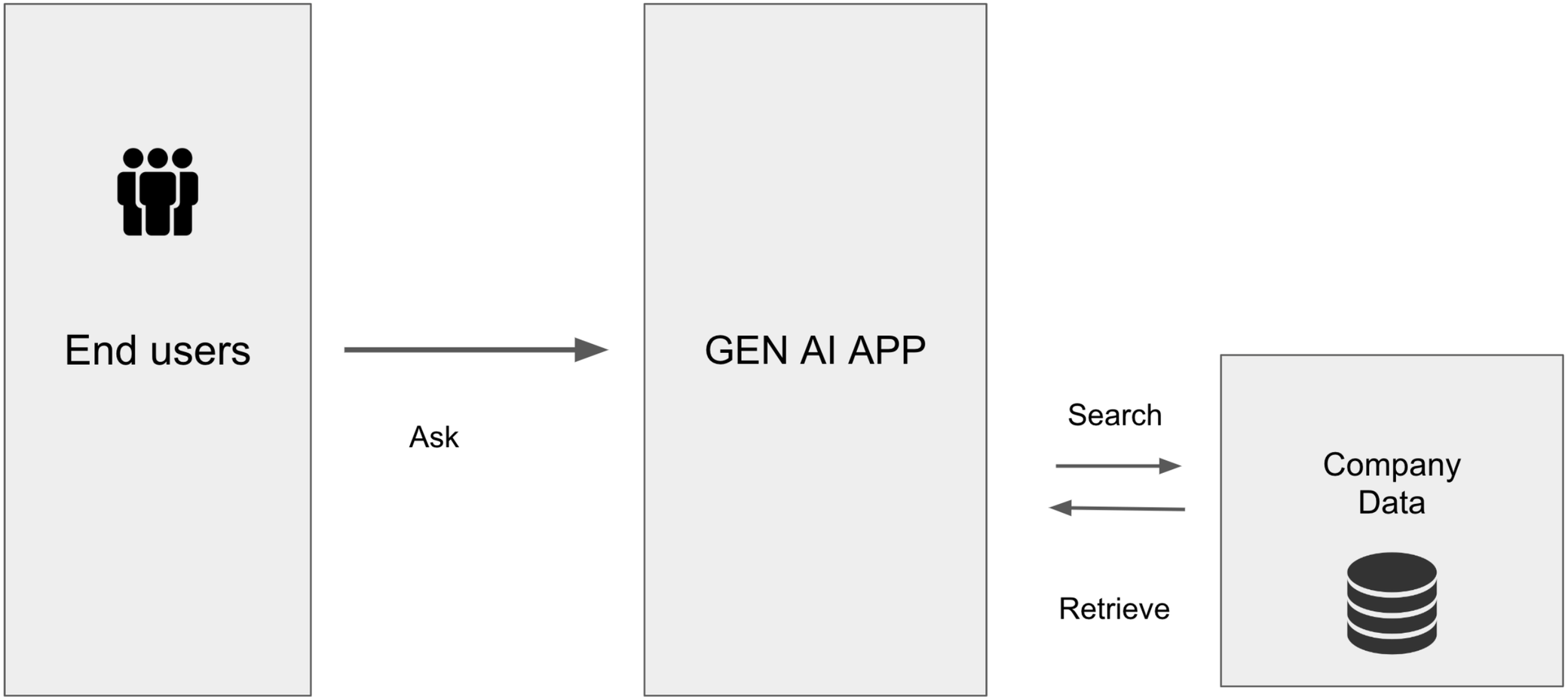
datacamp

Retrieval Augmented Generation (RAG)

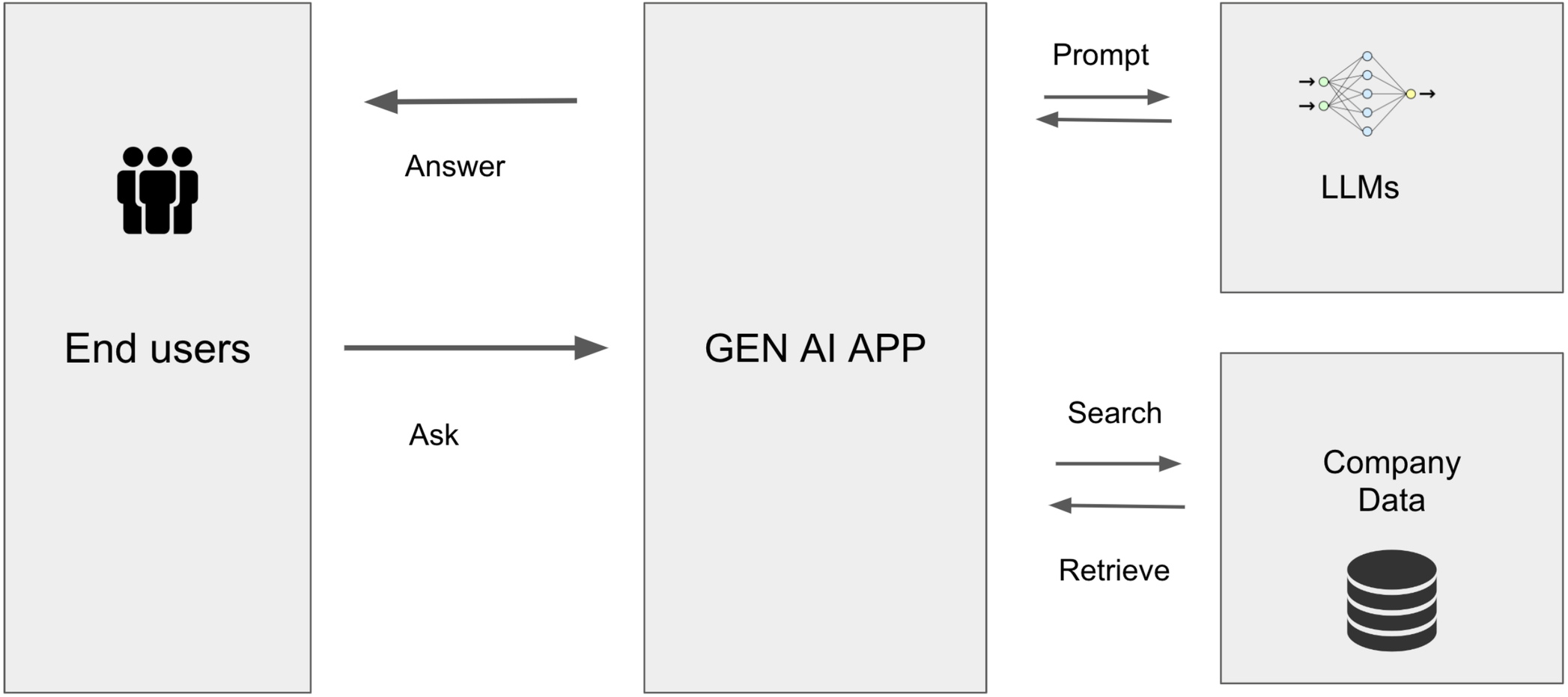
Retrieval Augmented Generation (RAG)



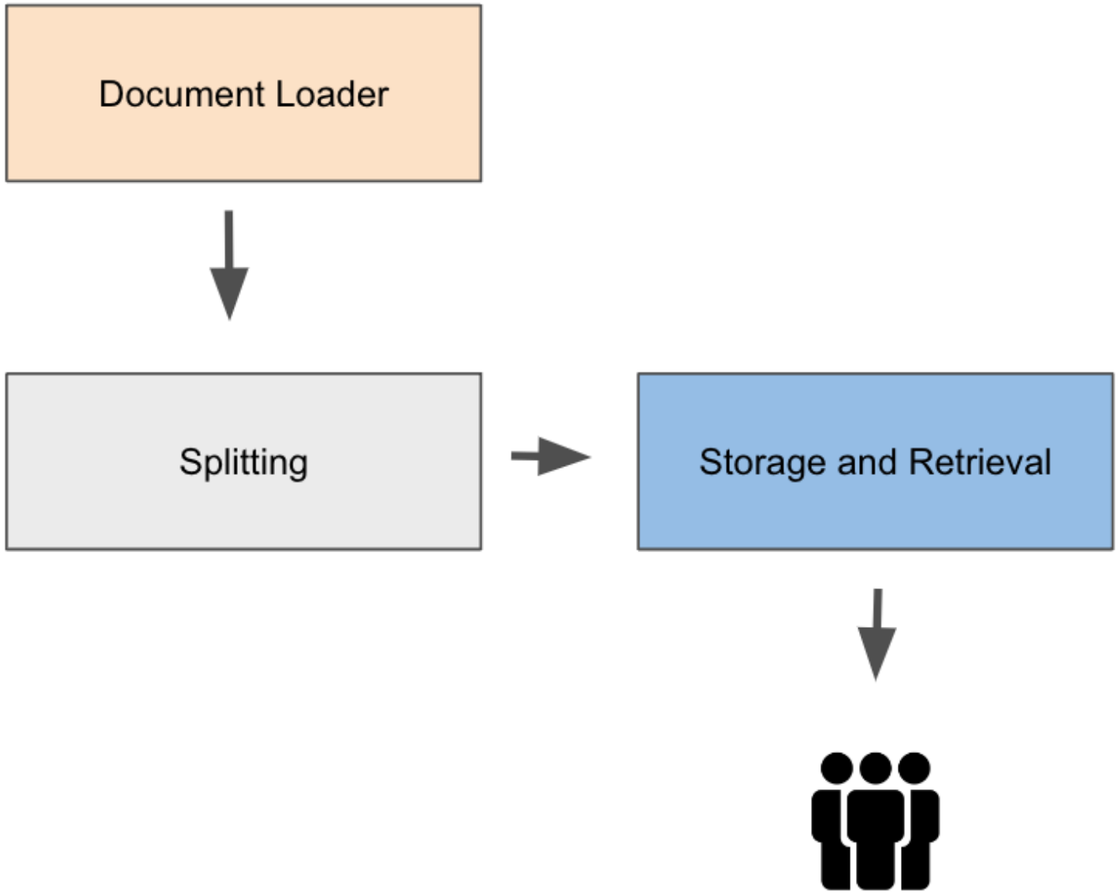
Retrieval Augmented Generation (RAG)



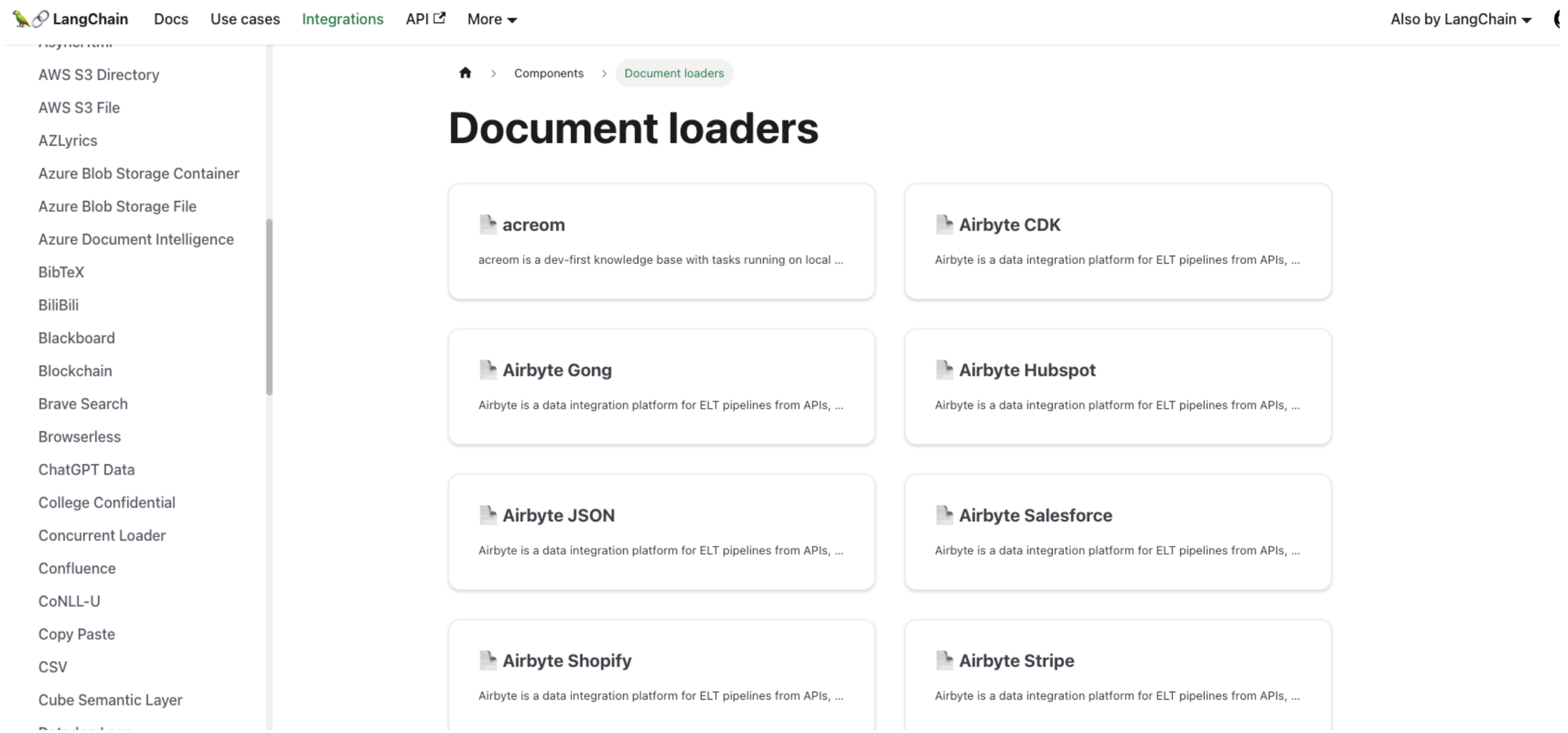
Retrieval Augmented Generation (RAG)



RAG development steps are threefold



Document loaders in LangChain



[1] https://python.langchain.com/docs/integrations/document_loaders

PDF document loader

```
from langchain_community.document_loaders import PyPDFLoader
```

- Requires installation of the `pypdf` package

```
loader = PyPDFLoader("attention_is_all_you_need.pdf")

data = loader.load()
print(data[0])
```

```
Document(page_content='Provided proper attribution is provided, Google hereby grants
permission to\nreproduce the tables and figures in this paper solely for use in [...]
```

CSV document loader

```
from langchain_community.document_loaders.csv_loader import CSVLoader

loader = CSVLoader(file_path='fifa_countries_audience.csv')

data = loader.load()
print(data[0])
```

```
Document(page_content='country: United States\nconfederation: CONCACAF\npopulation_share: [...]
```

Third-party document loader

```
from langchain_community.document_loaders import HNLoader

loader = HNLoader("https://news.ycombinator.com")
data = loader.load()

print(data[0])
print(data[0].metadata)
```

```
Document(page_content='Nrsc5: Receive NRSC-5 digital radio stations [...]
{'source': 'https://news.ycombinator.com',
 'title': 'Nrsc5: Receive NRSC-5 digital
```

Let's practice!

DEVELOPING LLM APPLICATIONS WITH LANGCHAIN

Splitting external data for retrieval

DEVELOPING LLM APPLICATIONS WITH LANGCHAIN

Jonathan Bennion
AI Engineer & LangChain Contributor

datacamp

What is document splitting and why is it needed?

1 Introduction

Recurrent neural networks, long short-term memory [13] and gated recurrent [7] neural networks in particular, have been firmly established as state of the art approaches in sequence modeling and transduction problems such as language modeling and machine translation [35, 2, 5]. Numerous efforts have since continued to push the boundaries of recurrent language models and encoder-decoder architectures [38, 24, 15].

Line 1:

```
Recurrent neural networks, long short-term memory [13] and gated recurrent [7] neural networks
```

Line 2:

```
in particular, have been firmly established as state of the art approaches in sequence modeling and
```

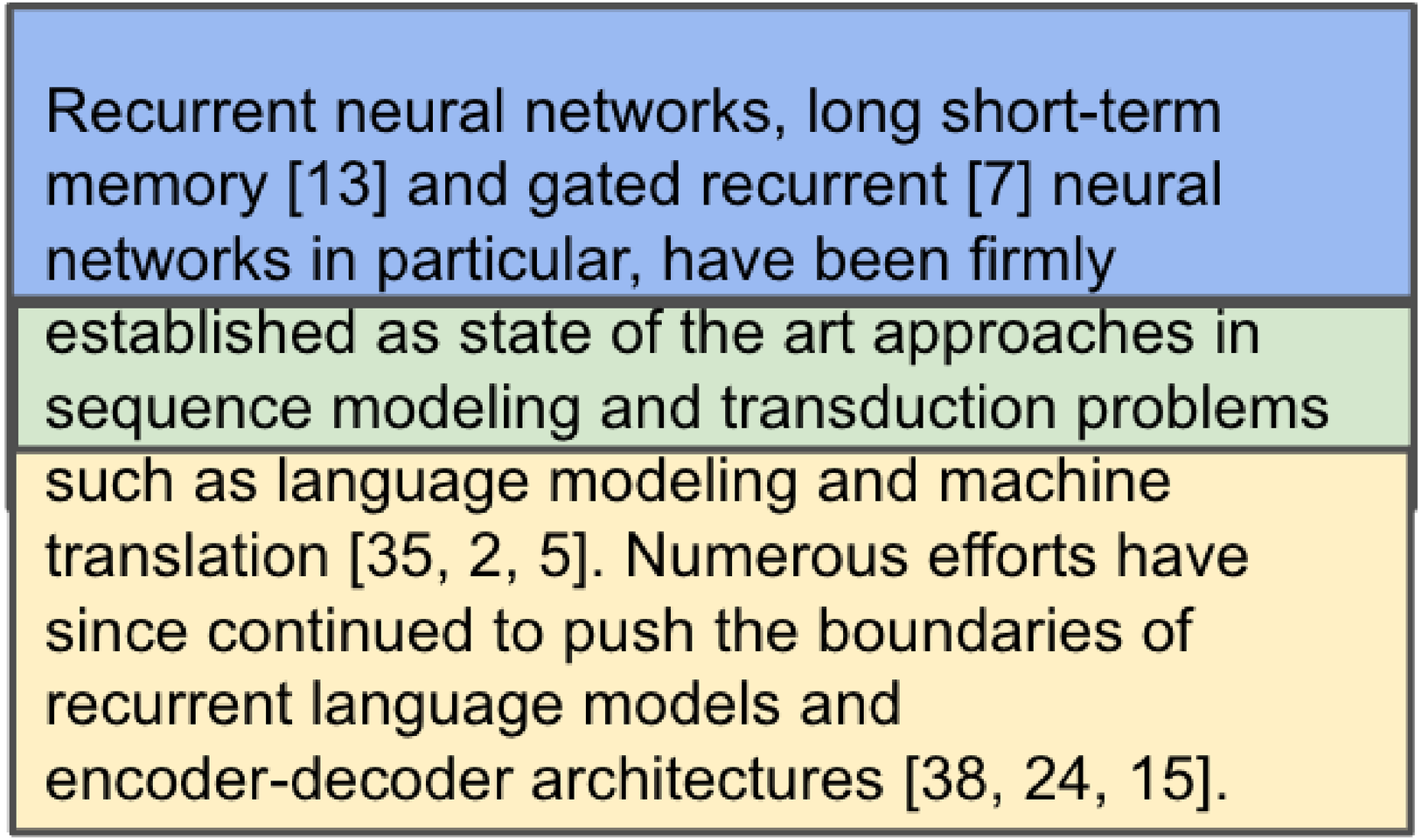
What is the best document splitting strategy?

Methods include:

1. `CharacterTextSplitter`
2. `RecursiveCharacterTextSplitter`
3. Many others

[1] Wikipedia Commons

Concept of the chunk overlap



Example text for chunk size comparison

```
quote = 'One machine can do the work of fifty ordinary humans.
No machine can do the work of one extraordinary human.'
```

```
len(quote)
```

```
103
```

```
chunk_size = 24
chunk_overlap = 3
```

[1] Elbert Hubbard

CharacterTextSplitter to split documents

```
from langchain.text_splitter import CharacterTextSplitter

ct_splitter = CharacterTextSplitter(
    separator='.',
    chunk_size=chunk_size,
    chunk_overlap=chunk_overlap)

docs = ct_splitter.split_text(quote)
print(docs)
```

```
['One machine can do the work of fifty ordinary humans.'
'No machine can do the work of one extraordinary human.']
```

RecursiveCharacterTextSplitter

```
from langchain.text_splitter import RecursiveCharacterTextSplitter

rc_splitter = RecursiveCharacterTextSplitter(
    chunk_size=chunk_size,
    chunk_overlap=chunk_overlap)

docs = rc_splitter.split_text(quote)
print(docs)
```

```
['One machine can do the',
 'work of fifty ordinary',
 'humans. No machine can do',
 'do the work of one',
 'extraordinary human.']
```

RecursiveCharacterTextSplitter with HTML

```
from langchain_community.document_loaders import UnstructuredHTMLLoader
from langchain.text_splitter import RecursiveCharacterTextSplitter

loader = UnstructuredHTMLLoader("white_house_executive_order_nov_2023.html")
data = loader.load()

rc_splitter = RecursiveCharacterTextSplitter(
    chunk_size=chunk_size,
    chunk_overlap=chunk_overlap,
    separators=['.'])

docs = rc_splitter.split_documents(data)
print(docs[0])
```

```
Document(page_content="To search this site, enter a search term [...]
```

Let's practice!

DEVELOPING LLM APPLICATIONS WITH LANGCHAIN

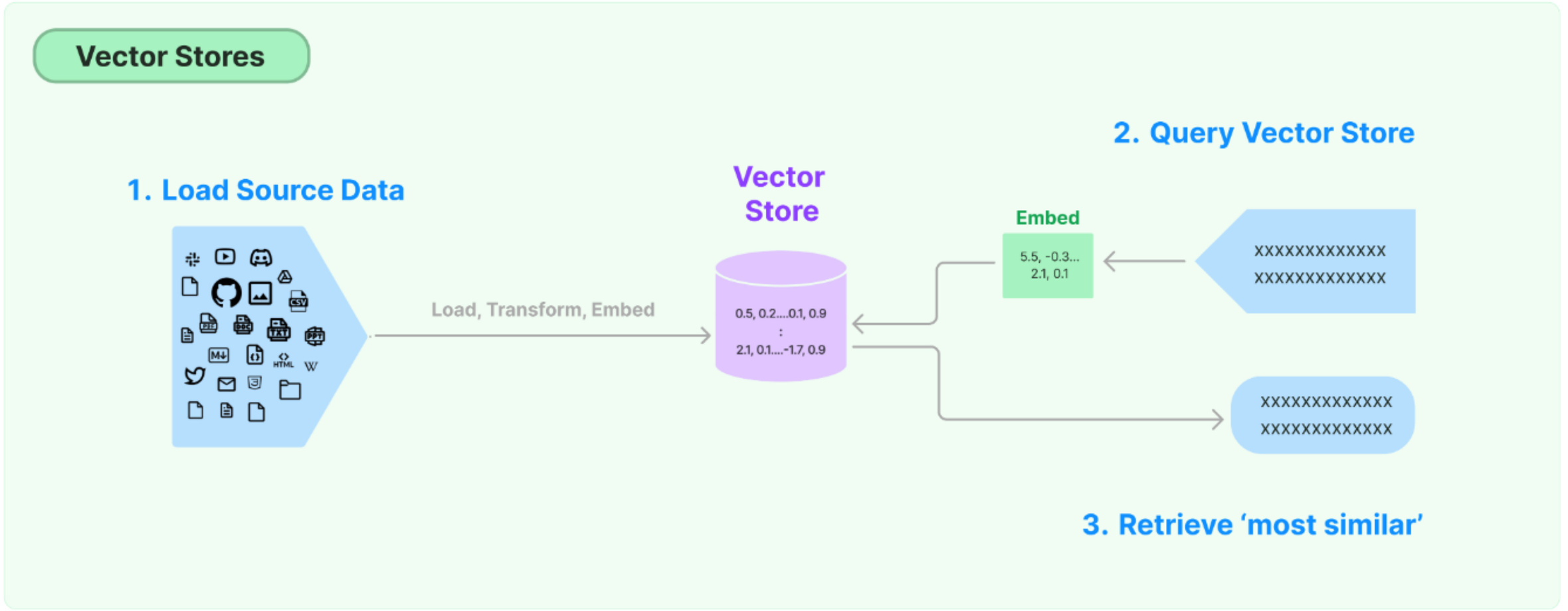
RAG storage and retrieval using vector databases

DEVELOPING LLM APPLICATIONS WITH LANGCHAIN

Jonathan Bennion
AI Engineer & LangChain Contributor

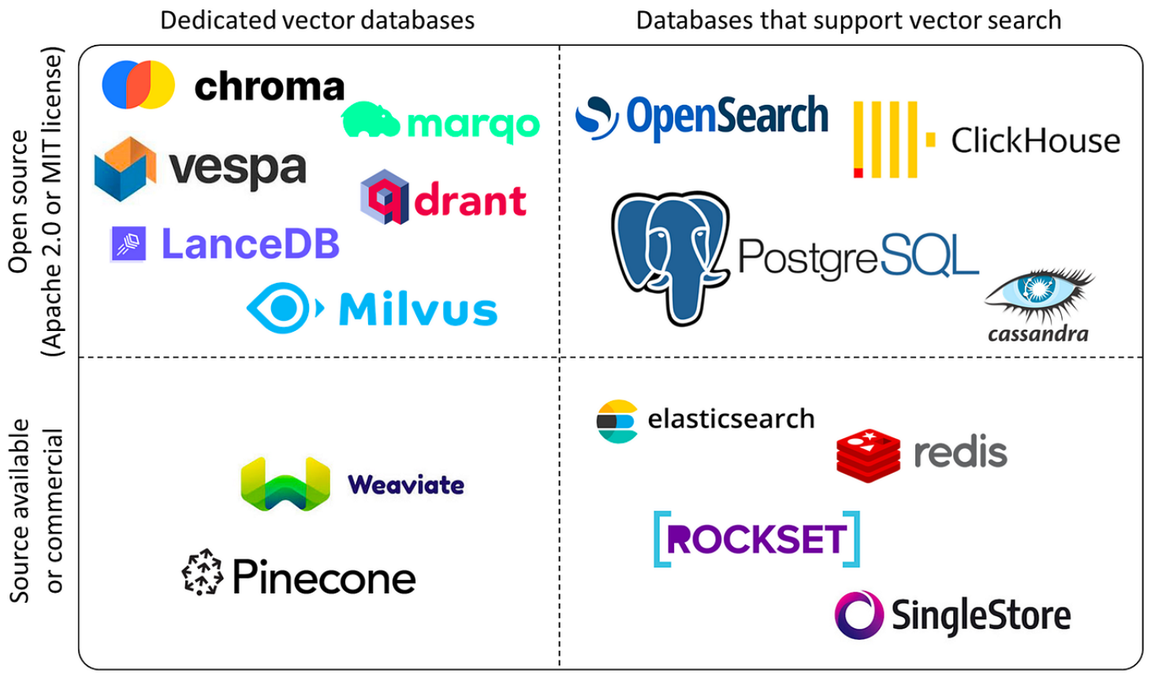
datacamp

What is a vector database and why do I need it?



[1] LangChain

Which vector database should I use?



Need to consider:

- Open source vs. closed source (license)
- Cloud vs. on-premises
- Lightweight vs. powerful for large filestores

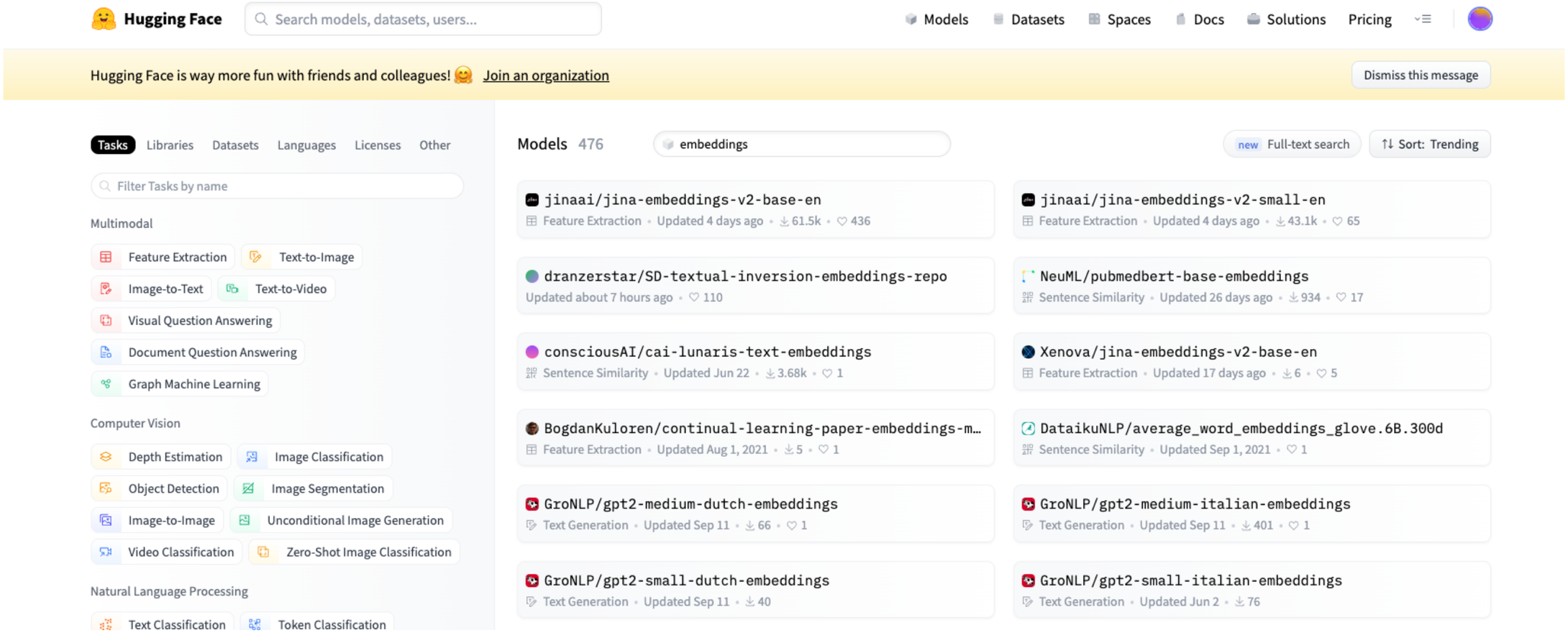
[1] Image Credit: Yingjun Wu

Preparing the data for storage

```
quote = 'There is a kingdom of lychee fruit that are alive and thriving in Iceland, but they feel taken advantage of and are not fast enough for you.'

from langchain.text_splitter import RecursiveCharacterTextSplitter

chunk_size = 40
chunk_overlap = 10

splitter = RecursiveCharacterTextSplitter(
    chunk_size=chunk_size,
    chunk_overlap=chunk_overlap)

docs = splitter.split_text(quote)
```

Choosing an embeddings model

- Hugging Face embeddings models requires `transformers` library



Setting up a Chroma vector database

```
from langchain_openai import OpenAIEmbeddings
from langchain_community.vectorstores import Chroma

embedding_function = OpenAIEmbeddings(openai_api_key=openai_api_key)

vectordb = Chroma(
    persist_directory=persist_directory,
    embedding_function=embedding_function)

vectordb.persist()

docstorage = Chroma.from_texts(docs, embedding_function)
```

RAG generation using a vector database

```
from langchain.chains import RetrievalQA

qa = RetrievalQA.from_chain_type(llm=OpenAI(model_name="gpt-3.5-turbo-instruct", openai_api_key=openai_ap
    chain_type="stuff", retriever=docstorage.as_retriever())

query = "Where do lychee fruit live?"
print(qa.run(query))
```

```
['Lychee fruit live in kingdoms.']
```

```
quote = 'There is a kingdom of lychee fruit that are alive and thriving in Iceland, but they feel
taken advantage of and are not fast enough for you.'
```

Returning references to RAG data sources

```
from langchain.chains import RetrievalQAWithSourcesChain

qa = RetrievalQAWithSourcesChain.from_chain_type(
    OpenAI(temperature=0, openai_api_key=openai_api_key), chain_type="stuff",
    retriever=docstorage.as_retriever())

results = qa({"question": "what is the primary architecture presented in the document?"},
    return_only_outputs=True)
print(results)
```

```
{'answer': ' The primary architecture presented in the document is the Transformer model architecture.
\n', 'sources': 'attention_is_all_you_need.pdf'}
```

Let's practice!

DEVELOPING LLM APPLICATIONS WITH LANGCHAIN