DEEP DIVES

Deep Dive: How to Build a Smart Chatbot in 10 mins with LangChain

Building Machine Learning Solutions

DAMIEN BENVENISTE

25 MAI 2023 · PAID

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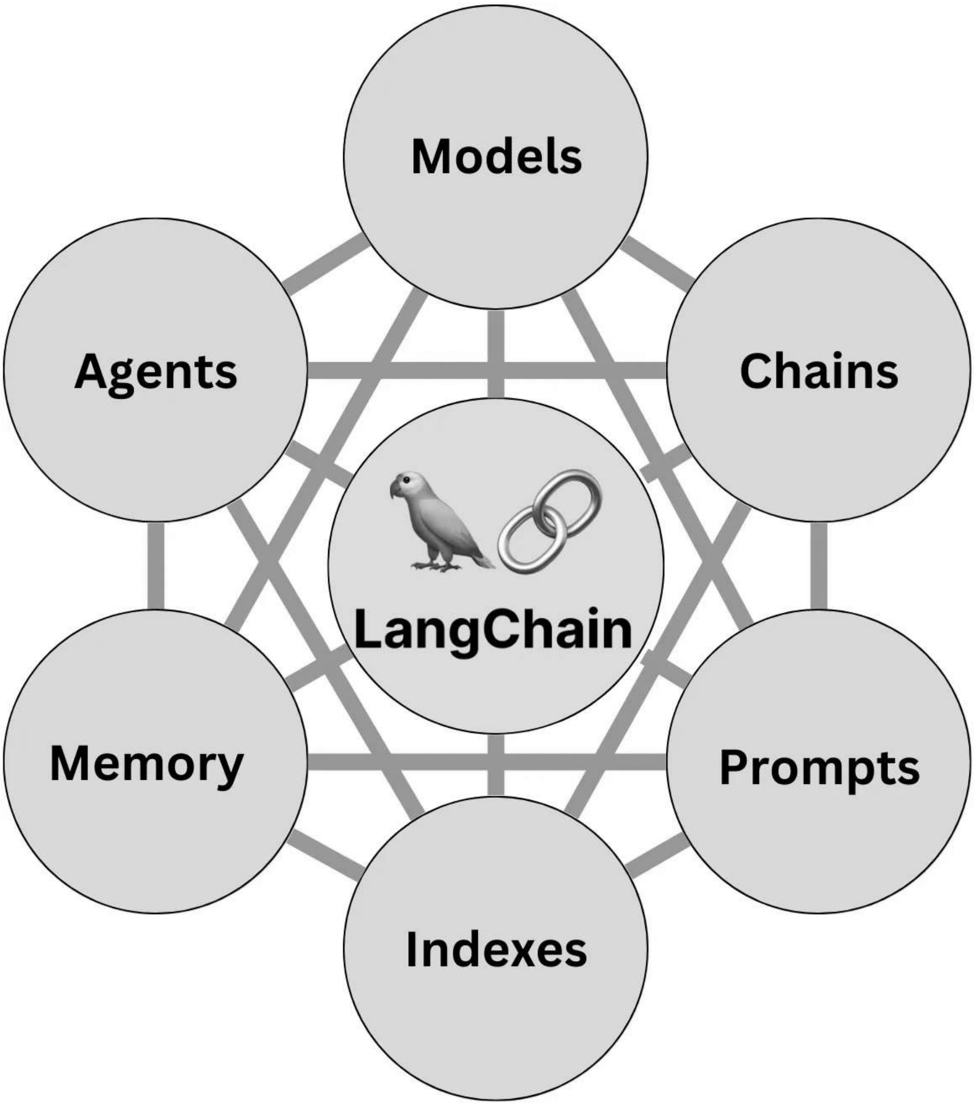
LangChain is an incredible tool to interact with LLMs. In this Deep Dive, I'll show how to use databases, tools and memory to build a smart Chatbot. At the end, I even show to ask investment advices to ChatGPT. We cover:

- ***What is LangChain?***
- ***Indexing and searching new Data***
    - ***Let's get some data***
    - ***Pinecone: A vector database***
    - ***Storing the data***
    - ***Retrieving data with ChatGPT***
- ***Giving ChatGPT access to tools***
- ***Providing a conversation memory***
- ***Putting everything together***
    - ***Giving access to Google Search***
    - ***Utilizing the database as a tool***
    - ***Solving a difficult problem: Should I invest in Google today?***

What is LangChain?

LangChain is a package to build applications using LLMs. It is composed of 6 modules:



- **Prompts:** This module allows you to build dynamic prompts using templates. It can adapt to different LLM types depending on the context window size and the input variables used as context (conversation history, search results, previous answers, ...).
- **Models:** This module provides an abstraction layer to connect to most 3rd party LLM APIs available. It has API connections to ~40 of the public LLMs, chat and embedding models.
- **Memory:** It gives to the LLMs access to the conversation history.
- **Indexes:** Indexes refer to ways to structure documents so that LLMs can best interact with them. This module contains utility functions for working with

documents, different types of indexes, and then examples for using those indexes in chains.

- **Agents:** Some applications will require not just a predetermined chain of calls to LLMs/other tools, but potentially an unknown chain that depends on the user's input. In these types of chains, there is an "agent" with access to a suite of tools. Depending on user input, the agent can decide which, if any, of these tools to call.
- **Chains:** Using an LLM in isolation is fine for some simple applications, but many more complex ones require chaining LLMs - either with each other or with other experts. LangChain provides a standard interface for Chains, as well as some common implementations of chains for ease of use.

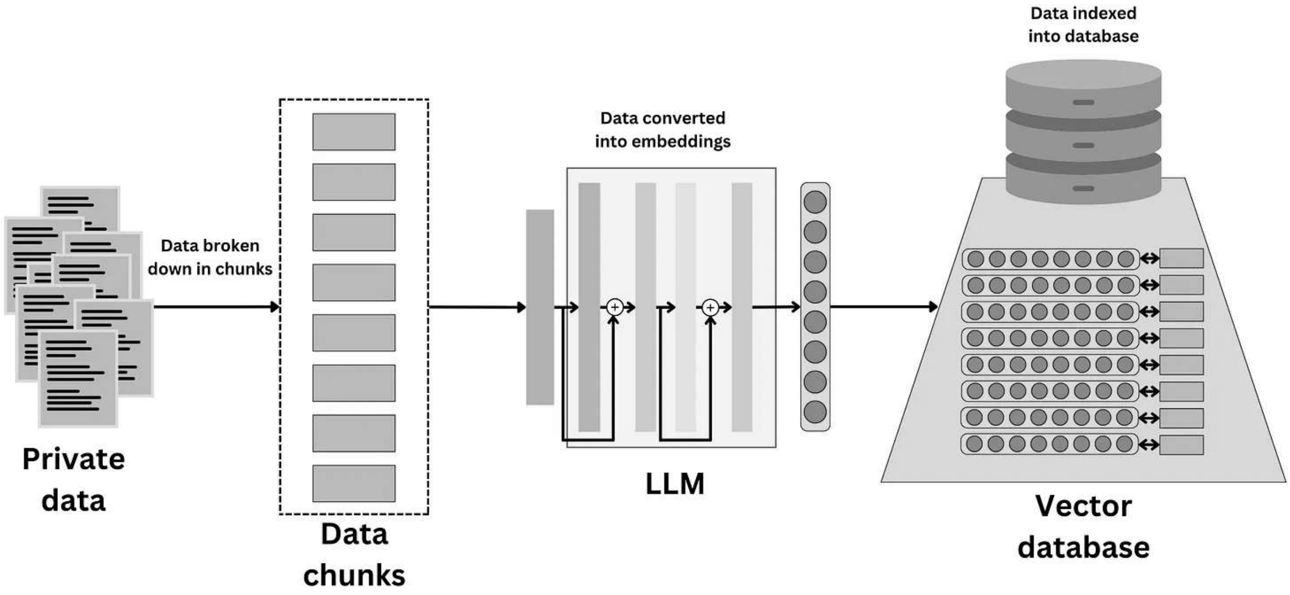
Currently the API is not really well documented and all over the place, but if you are willing to dig into the source code, it is well worth the price. I advise you to watch the following introductory video to get more familiar with what the tool is about:

```
pip install pinecone-client langchain openai wikipedia google-api-python-client unstructured tabulate pdf2image
```

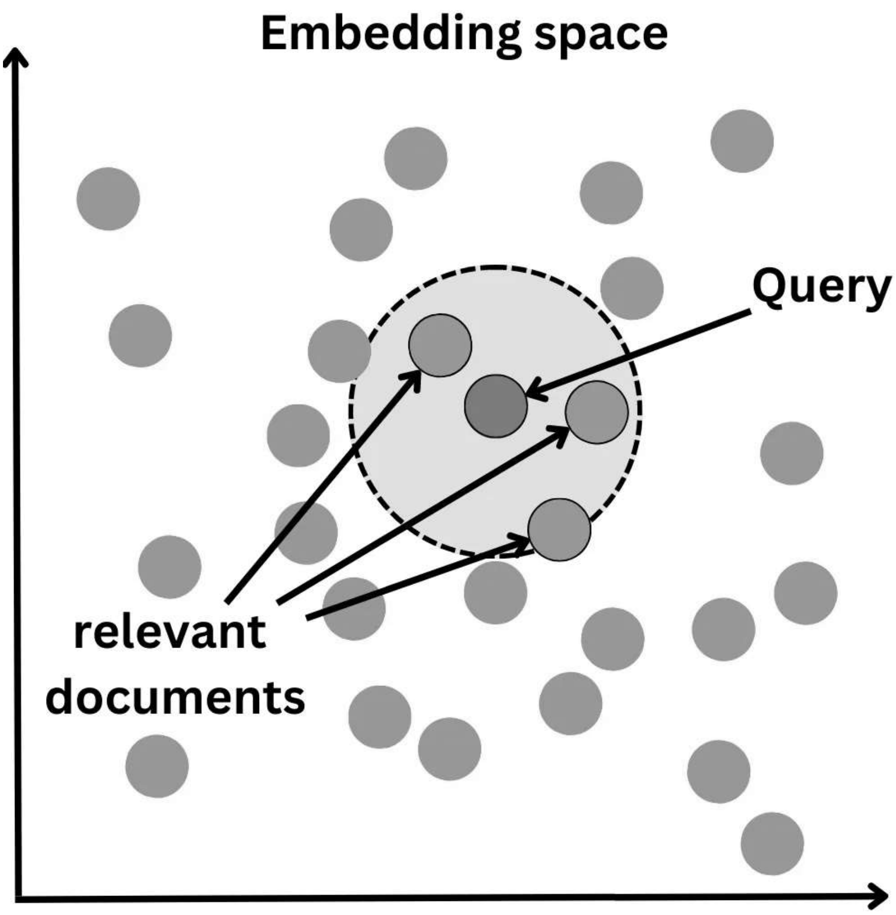
Indexing and searching new Data

One difficulty with Large Language Models is that they only know what they learned during training. So how do we get them to use private data? One way to do it is to make new text data discoverable by the LLM. The typical way to do that is to convert all private data into embeddings stored in a vector database. The process is as follows:

- We chunk the data into small pieces
- We pass that data through a LLM and the resulting final layer of the network can be used as a semantic vector representation of the data
- That data can then be stored in a database of the vector representation used to recover that piece of data.

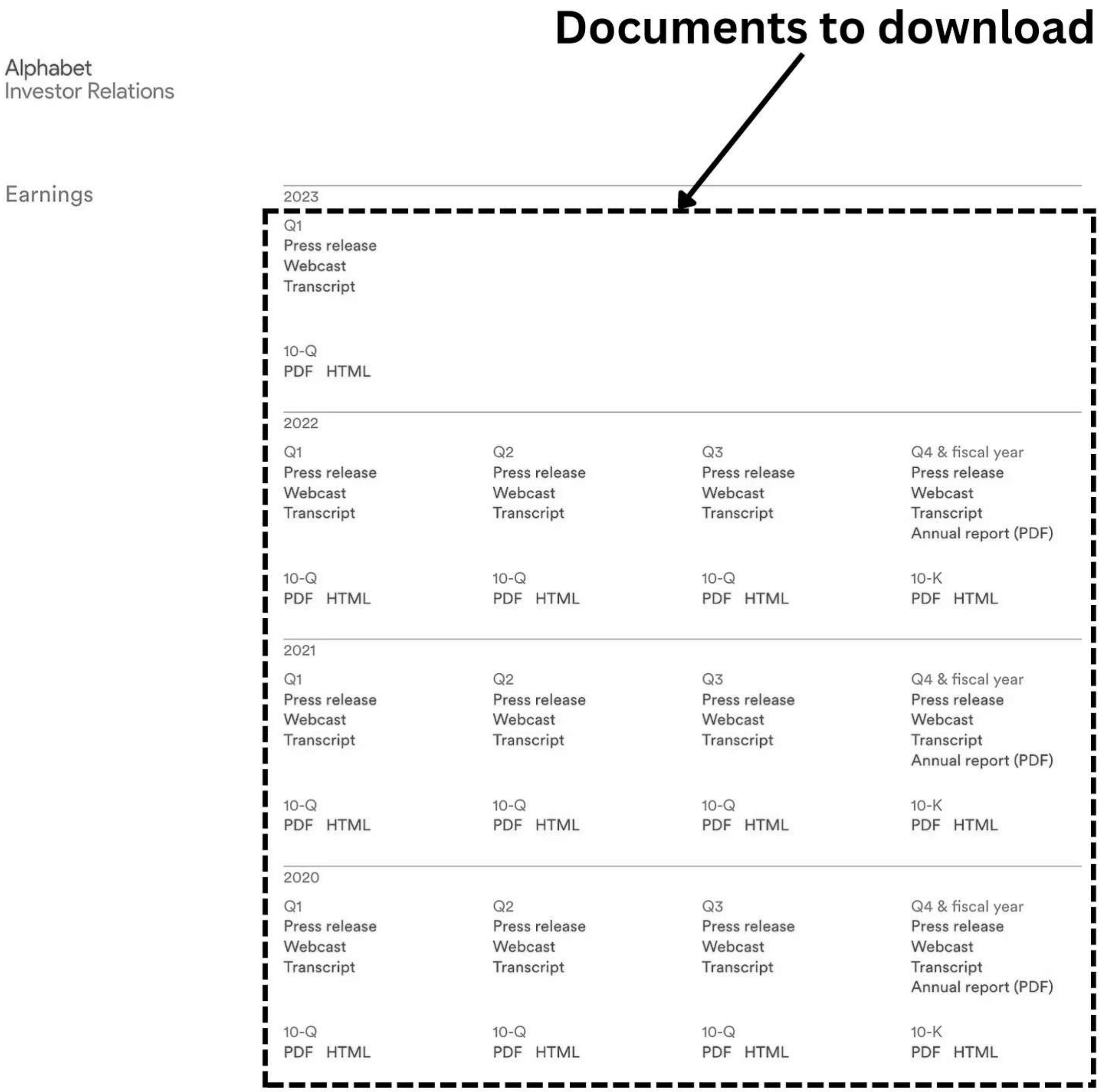

Data indexed into database
Data converted into embeddings
Data broken down in chunks
Private data
Data chunks
LLM
Vector database

When we ask a question we can then convert that question into an embedding (the query) and search for pieces of data close to it in the embedding space. We can then feed those relevant documents to the LLM for it to extract the answer from them:



Let’s get some data

I was looking for interesting data for a demo and I chose the earnings reports from the Alphabet company (Google): https://abc.xyz/investor/previous/



Documents to download

Alphabet
Investor Relations

Earnings

2023

Q1
Press release Webcast Transcript
10-Q PDF HTML

2022

Q1	Q2	Q3	Q4 & fiscal year
Press release Webcast Transcript	Press release Webcast Transcript	Press release Webcast Transcript	Press release Webcast Transcript Annual report (PDF)
10-Q PDF HTML	10-Q PDF HTML	10-Q PDF HTML	10-K PDF HTML

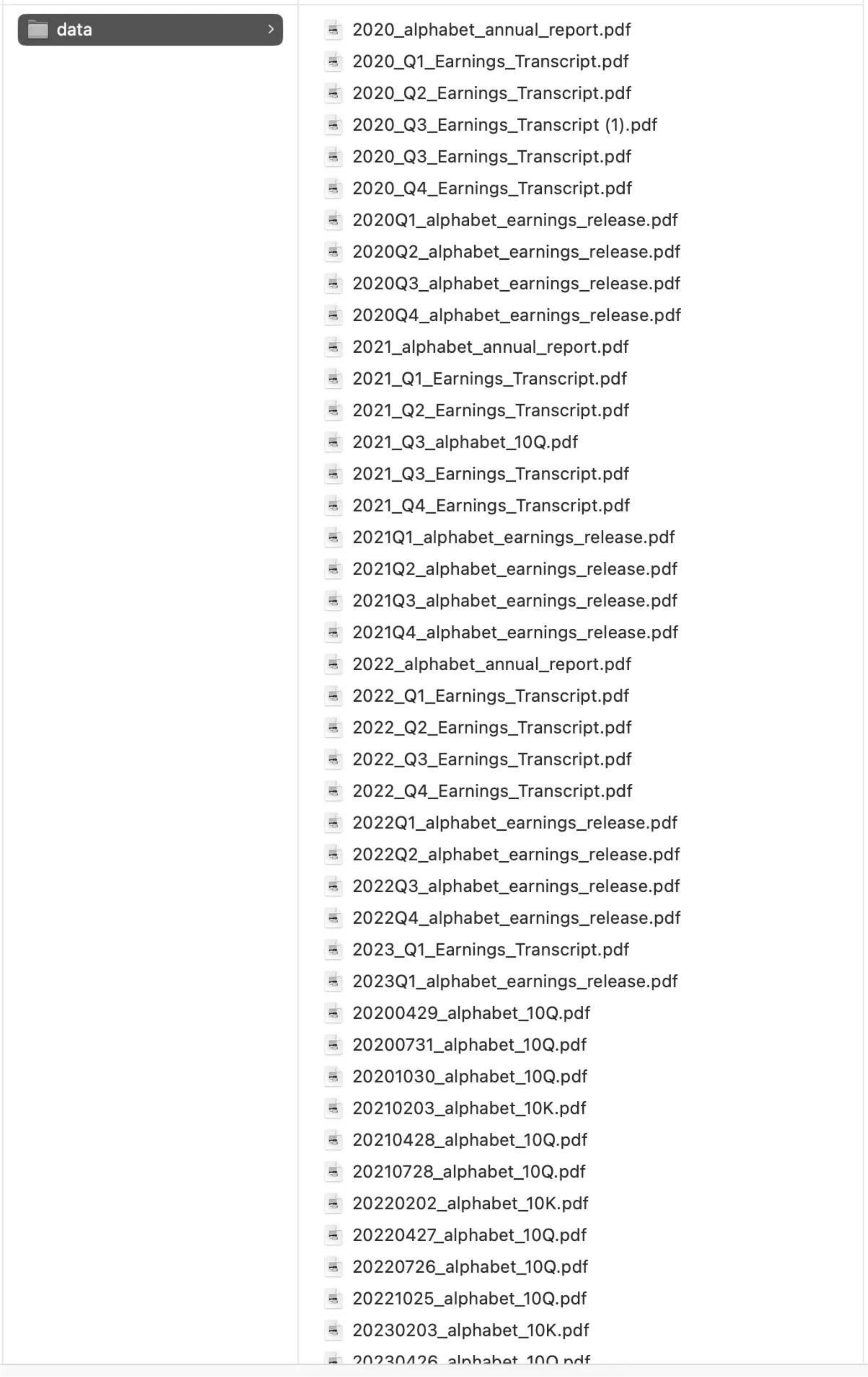
2021

Q1	Q2	Q3	Q4 & fiscal year
Press release Webcast Transcript	Press release Webcast Transcript	Press release Webcast Transcript	Press release Webcast Transcript Annual report (PDF)
10-Q PDF HTML	10-Q PDF HTML	10-Q PDF HTML	10-K PDF HTML

2020

Q1	Q2	Q3	Q4 & fiscal year
Press release Webcast Transcript	Press release Webcast Transcript	Press release Webcast Transcript	Press release Webcast Transcript Annual report (PDF)
10-Q PDF HTML	10-Q PDF HTML	10-Q PDF HTML	10-K PDF HTML

For simplicity, I downloaded them and stored them on my computer:



data

2020_alphabet_annual_report.pdf
2020_Q1_Earnings_Transcript.pdf
2020_Q2_Earnings_Transcript.pdf
2020_Q3_Earnings_Transcript (1).pdf
2020_Q3_Earnings_Transcript.pdf
2020_Q4_Earnings_Transcript.pdf
2020Q1_alphabet_earnings_release.pdf
2020Q2_alphabet_earnings_release.pdf
2020Q3_alphabet_earnings_release.pdf
2020Q4_alphabet_earnings_release.pdf
2021_alphabet_annual_report.pdf
2021_Q1_Earnings_Transcript.pdf
2021_Q2_Earnings_Transcript.pdf
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2021Q2_alphabet_earnings_release.pdf
2021Q3_alphabet_earnings_release.pdf
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2022_alphabet_annual_report.pdf
2022_Q1_Earnings_Transcript.pdf
2022_Q2_Earnings_Transcript.pdf
2022_Q3_Earnings_Transcript.pdf
2022_Q4_Earnings_Transcript.pdf
2022Q1_alphabet_earnings_release.pdf
2022Q2_alphabet_earnings_release.pdf
2022Q3_alphabet_earnings_release.pdf
2022Q4_alphabet_earnings_release.pdf
2023_Q1_Earnings_Transcript.pdf
2023Q1_alphabet_earnings_release.pdf
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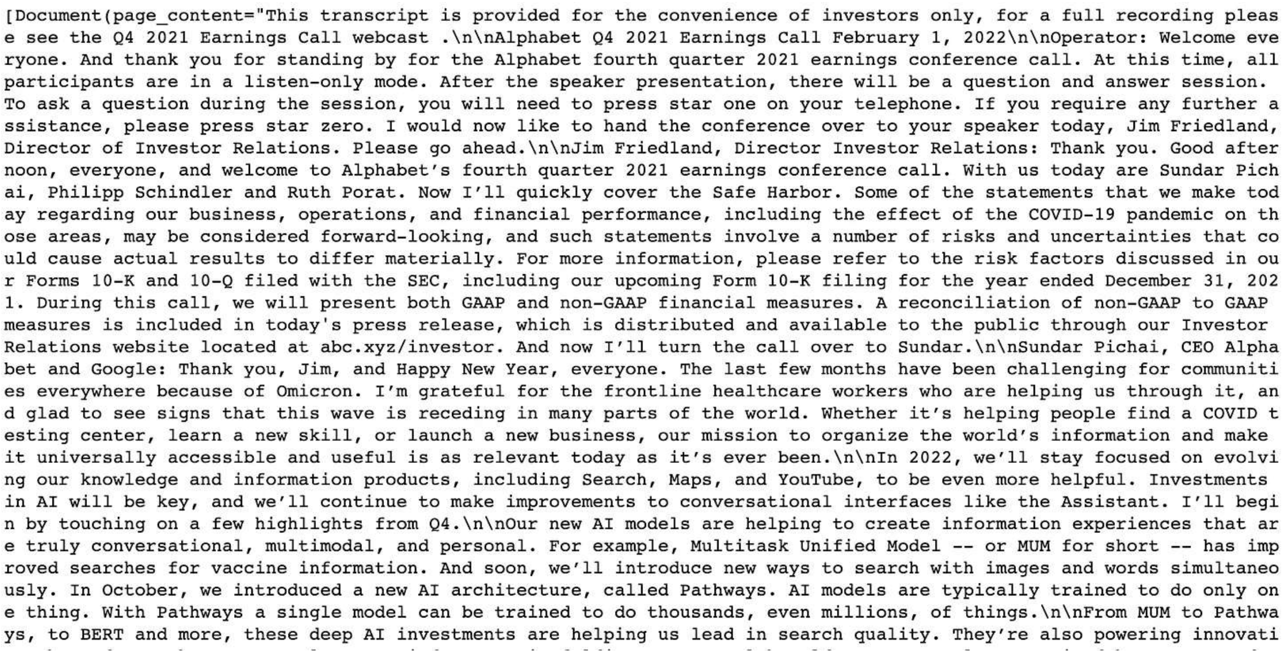
20220726_alphabet_10Q.pdf
20221025_alphabet_10Q.pdf
20230203_alphabet_10K.pdf
20230426_alphabet_10Q.pdf

We can now load those documents into memory with LangChain with 2 lines of code:

```
from langchain.document_loaders import DirectoryLoader

loader = DirectoryLoader(
    './Langchain/data/', # my local directory
    glob='**/*.pdf',     # we only get pdfs
    show_progress=True
)
docs = loader.load()
docs
```



```
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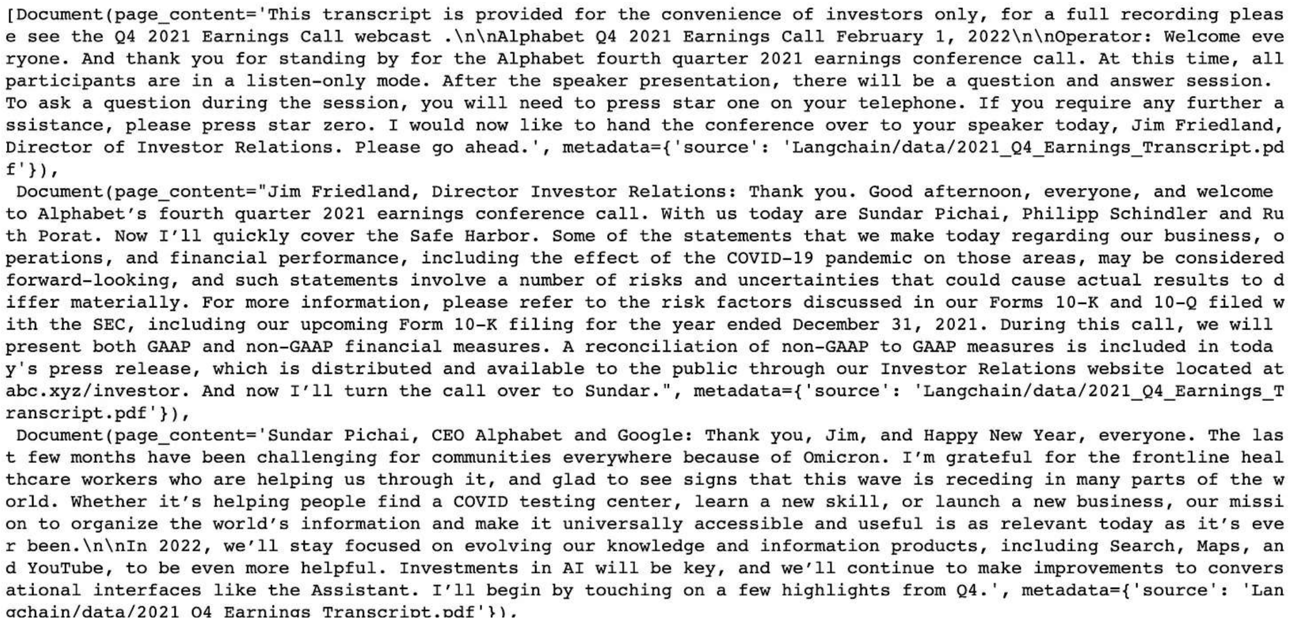
e see the Q4 2021 Earnings Call webcast .\n\nAlphabet Q4 2021 Earnings Call February 1, 2022\n\nOperator: Welcome eve
ryone. And thank you for standing by for the Alphabet fourth quarter 2021 earnings conference call. At this time, all
participants are in a listen-only mode. After the speaker presentation, there will be a question and answer session.
To ask a question during the session, you will need to press star one on your telephone. If you require any further a
ssistance, please press star zero. I would now like to hand the conference over to your speaker today, Jim Friedland,
Director of Investor Relations. Please go ahead.\n\nJim Friedland, Director Investor Relations: Thank you. Good after
noon, everyone, and welcome to Alphabet's fourth quarter 2021 earnings conference call. With us today are Sundar Pich
ai, Philipp Schindler and Ruth Porat. Now I'll quickly cover the Safe Harbor. Some of the statements that we make tod
ay regarding our business, operations, and financial performance, including the effect of the COVID-19 pandemic on th
ose areas, may be considered forward-looking, and such statements involve a number of risks and uncertainties that co
uld cause actual results to differ materially. For more information, please refer to the risk factors discussed in ou
r Forms 10-K and 10-Q filed with the SEC, including our upcoming Form 10-K filing for the year ended December 31, 202
1. During this call, we will present both GAAP and non-GAAP financial measures. A reconciliation of non-GAAP to GAAP
measures is included in today's press release, which is distributed and available to the public through our Investor
Relations website located at abc.xyz/investor. And now I'll turn the call over to Sundar.\n\nSundar Pichai, CEO Alpha
bet and Google: Thank you, Jim, and Happy New Year, everyone. The last few months have been challenging for communiti
es everywhere because of Omicron. I'm grateful for the frontline healthcare workers who are helping us through it, an
d glad to see signs that this wave is receding in many parts of the world. Whether it's helping people find a COVID t
esting center, learn a new skill, or launch a new business, our mission to organize the world's information and make
it universally accessible and useful is as relevant today as it's ever been.\n\nIn 2022, we'll stay focused on evolvi
ng our knowledge and information products, including Search, Maps, and YouTube, to be even more helpful. Investments
in AI will be key, and we'll continue to make improvements to conversational interfaces like the Assistant. I'll begi
n by touching on a few highlights from Q4.\n\nOur new AI models are helping to create information experiences that ar
e truly conversational, multimodal, and personal. For example, Multitask Unified Model -- or MUM for short -- has imp
roved searches for vaccine information. And soon, we'll introduce new ways to search with images and words simultaneo
usly. In October, we introduced a new AI architecture, called Pathways. AI models are typically trained to do only on
e thing. With Pathways a single model can be trained to do thousands, even millions, of things.\n\nFrom MUM to Pathwa
ys, to BERT and more, these deep AI investments are helping us lead in search quality. They're also powering innovati
```

And we split them into chunks. Each chunk will correspond to an embedding vector

```
from langchain.text_splitter import CharacterTextSplitter

text_splitter = CharacterTextSplitter(
    chunk_size=1000,
    chunk_overlap=0
)
docs_split = text_splitter.split_documents(docs)
docs_split
```



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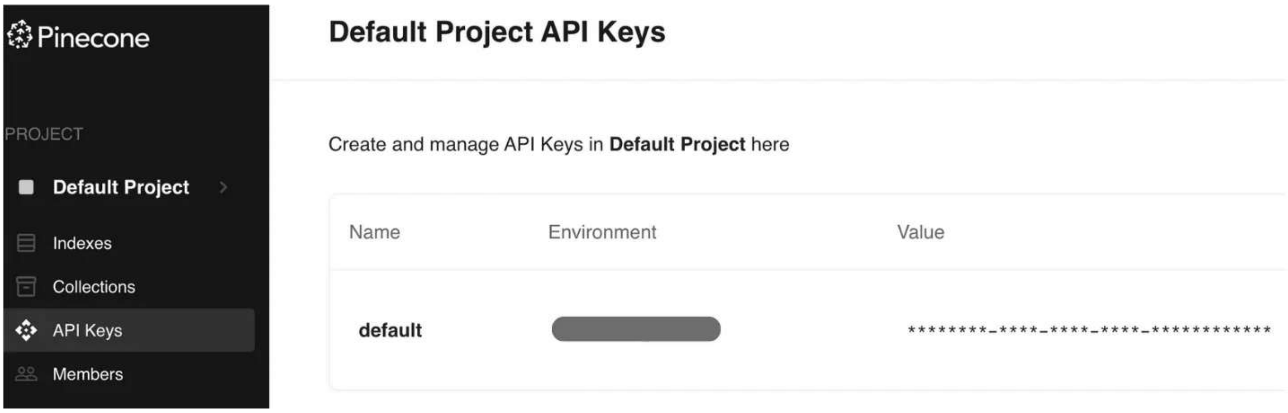
ational interfaces like the Assistant. I'll begin by touching on a few highlights from Q4.', metadata={'source': 'Lan
gchain/data/2021_Q4_Earnings_Transcript.pdf'}),
```

As a result, we will need to convert that data into embeddings and store those in a database.

Pinecone: A vector database

To store the data, I use Pinecone. You can create an account for free and you are automatically given API keys to access the database::

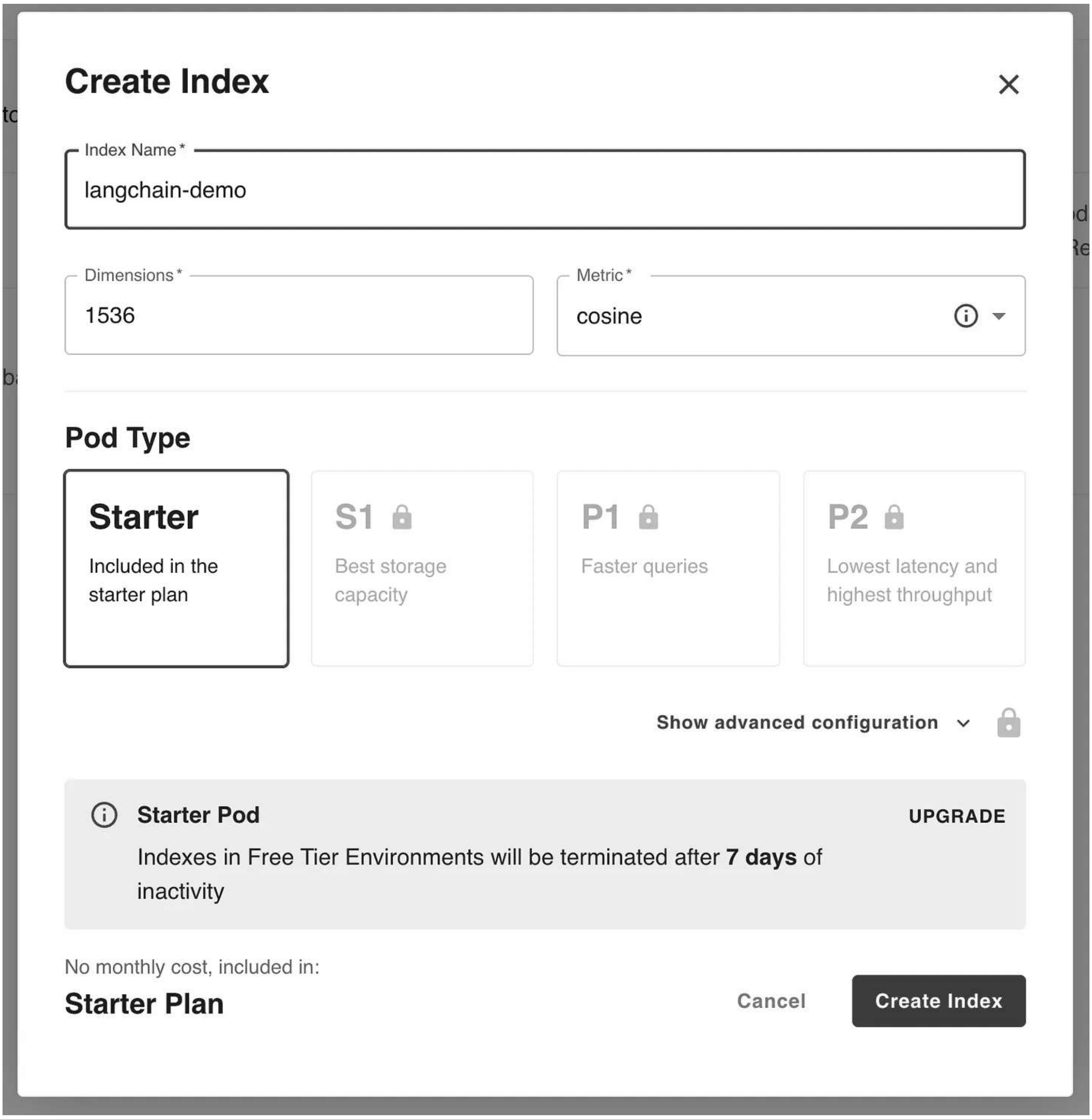


Default Project API Keys

Create and manage API Keys in **Default Project** here

Name	Environment	Value
default	[redacted]	********-****-****-****-************

In the “indexes” tab click on “create index“. Give it a name and a dimension. I use 1536 for the dimension as it is the size of the embedding from the OpenAI embedding model I will use. I use the cosine similarity metric to search for similar documents:



Create Index

Index Name*: langchain-demo

Dimensions*: 1536

Metric*: cosine

Pod Type

Starter — Included in the starter plan

S1 — Best storage capacity

P1 — Faster queries

P2 — Lowest latency and highest throughput

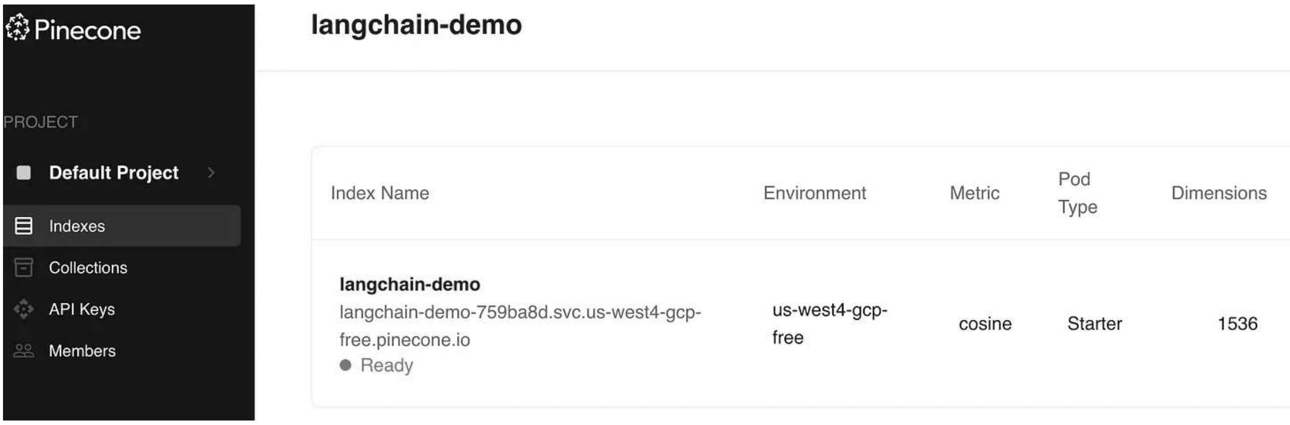
Starter Pod

Indexes in Free Tier Environments will be terminated after **7 days** of inactivity

No monthly cost, included in:

Starter Plan

This is going to create a vector table:

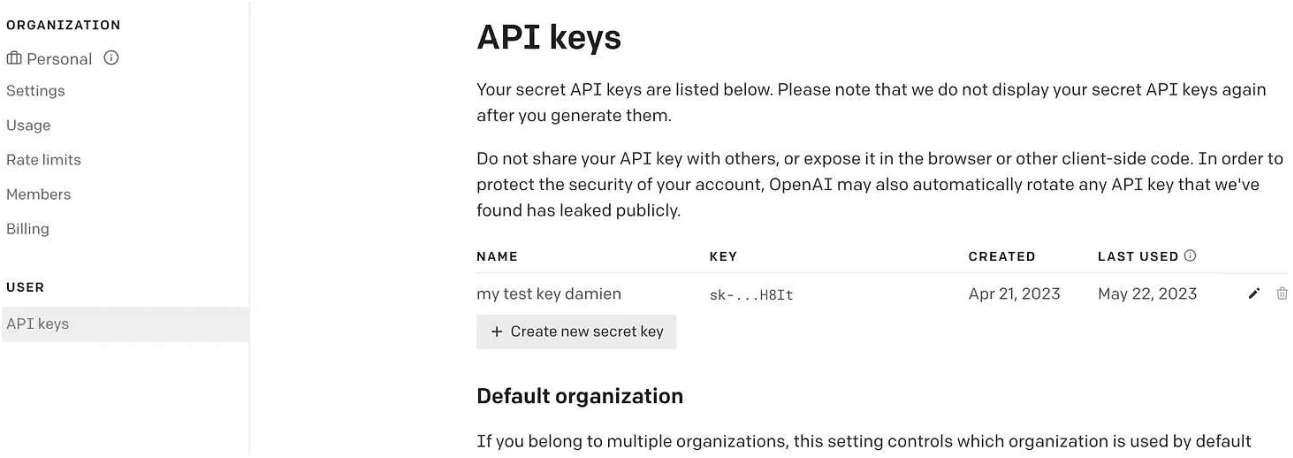


langchain-demo

Index Name	Environment	Metric	Pod Type	Dimensions
langchain-demo langchain-demo-759ba8d.svc.us-west4-gcp-free.pinecone.io ● Ready	us-west4-gcp-free	cosine	Starter	1536

Storing the data

Before continuing, make sure to get your OpenAI API key by signing up in the OpenAI platform:



API keys

Your secret API keys are listed below. Please note that we do not display your secret API keys again after you generate them.

Do not share your API key with others, or expose it in the browser or other client-side code. In order to protect the security of your account, OpenAI may also automatically rotate any API key that we've found has leaked publicly.

NAME	KEY	CREATED	LAST USED
my test key damien	sk-...H8It	Apr 21, 2023	May 22, 2023

Default organization

If you belong to multiple organizations, this setting controls which organization is used by default

Let’s first write down our API keys

```
import os

PINECONE_API_KEY = ... # find at app.pinecone.io
PINECONE_ENV = ...     # next to api key in console
OPENAI_API_KEY = ...   # found at platform.openai.com/account/api-
keys

os.environ['OPENAI_API_KEY'] = OPENAI_API_KEY
```

We upload the data to the vector database. The default OpenAI embedding model used in Langchain is `'text-embedding-ada-002'` (OpenAI embedding models). It is used to convert data into embedding vectors

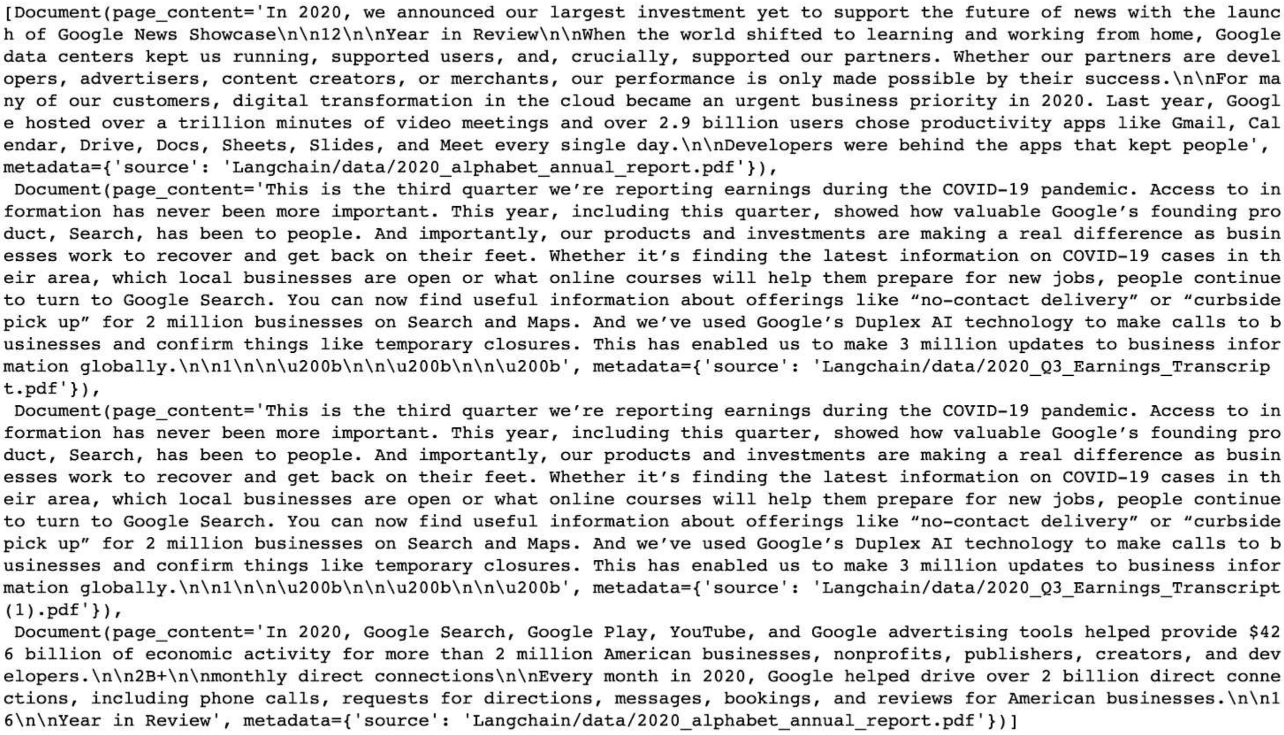
```
import pinecone
from langchain.vectorstores import Pinecone
from langchain.embeddings.openai import OpenAIEmbeddings

# we use the openAI embedding model
embeddings = OpenAIEmbeddings()
pinecone.init(
    api_key=PINECONE_API_KEY,
    environment=PINECONE_ENV
)

doc_db = Pinecone.from_documents(
    docs_split,
    embeddings,
    index_name='langchain-demo'
)
```

We can now search for relevant documents in that database using the cosine similarity metric

```
query = "What were the most important events for Google in 2021?"
search_docs = doc_db.similarity_search(query)
search_docs
```



```
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h of Google News Showcase\n\n12\n\nYear in Review\n\nWhen the world shifted to learning and working from home, Google
data centers kept us running, supported users, and, crucially, supported our partners. Whether our partners are devel
opers, advertisers, content creators, or merchants, our performance is only made possible by their success.\n\nFor ma
ny of our customers, digital transformation in the cloud became an urgent business priority in 2020. Last year, Googl
e hosted over a trillion minutes of video meetings and over 2.9 billion users chose productivity apps like Gmail, Cal
endar, Drive, Docs, Sheets, Slides, and Meet every single day.\n\nDevelopers were behind the apps that kept people',
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formation has never been more important. This year, including this quarter, showed how valuable Google’s founding pro
duct, Search, has been to people. And importantly, our products and investments are making a real difference as busin
esses work to recover and get back on their feet. Whether it’s finding the latest information on COVID-19 cases in th
eir area, which local businesses are open or what online courses will help them prepare for new jobs, people continue
to turn to Google Search. You can now find useful information about offerings like “no-contact delivery” or “curbside
pick up” for 2 million businesses on Search and Maps. And we’ve used Google’s Duplex AI technology to make calls to b
usinesses and confirm things like temporary closures. This has enabled us to make 3 million updates to business infor
mation globally.\n\n1\n\n\u200b\n\n\u200b\n\n\u200b', metadata={'source': 'Langchain/data/2020_Q3_Earnings_Transcrip
t.pdf'}),
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formation has never been more important. This year, including this quarter, showed how valuable Google’s founding pro
duct, Search, has been to people. And importantly, our products and investments are making a real difference as busin
esses work to recover and get back on their feet. Whether it’s finding the latest information on COVID-19 cases in th
eir area, which local businesses are open or what online courses will help them prepare for new jobs, people continue
to turn to Google Search. You can now find useful information about offerings like “no-contact delivery” or “curbside
pick up” for 2 million businesses on Search and Maps. And we’ve used Google’s Duplex AI technology to make calls to b
usinesses and confirm things like temporary closures. This has enabled us to make 3 million updates to business infor
mation globally.\n\n1\n\n\u200b\n\n\u200b\n\n\u200b', metadata={'source': 'Langchain/data/2020_Q3_Earnings_Transcript
(1).pdf'}),
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6 billion of economic activity for more than 2 million American businesses, nonprofits, publishers, creators, and dev
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ctions, including phone calls, requests for directions, messages, bookings, and reviews for American businesses.\n\n1
6\n\nYear in Review', metadata={'source': 'Langchain/data/2020_alphabet_annual_report.pdf'})]
```

Retrieving data with ChatGPT

We can now use a LLM to utilize the database data. Let’s get a LLM. We could get GPT-3 using