

Generative AI in Organisations: Challenges and Opportunities

ODSC Europe 2023 - Heiko Hotz

About myself



Heiko Hotz

- Senior Solutions Architect for Generative AI at AWS
- Founder of not-for-profit Meetup group NLP London
- Data Ambassador at DataKind UK
- Independent consultant at AI/ML Consulting
- More than 20 years of experience in technology
- YouTuber, Writer, Mentor, ...

Agenda

- What is Generative AI & how does it work?
- Challenges with Large Language Models (LLMs)
- Demo: Document Chatbot
- Bias in Generative AI
- Q&A

Agenda

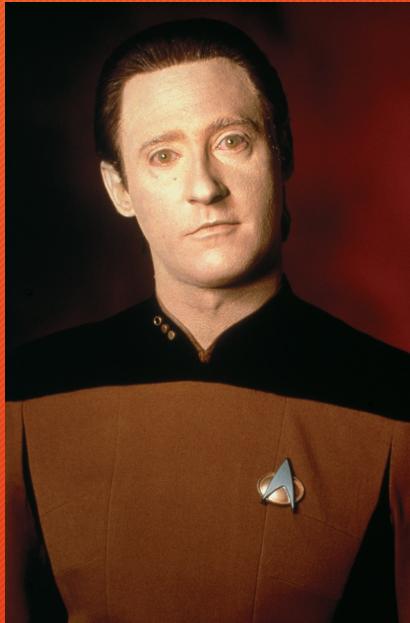
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What is Generative AI?

Generative AI - I grew up with it 😊



Source: <https://theconversation.com/star-treks-holodeck-from-science-fiction-to-a-new-reality-74839>



Source: <https://www.fanpop.com/clubs/star-trek-the-next-generation/images/9406565/title/lt-commander-data-photo>

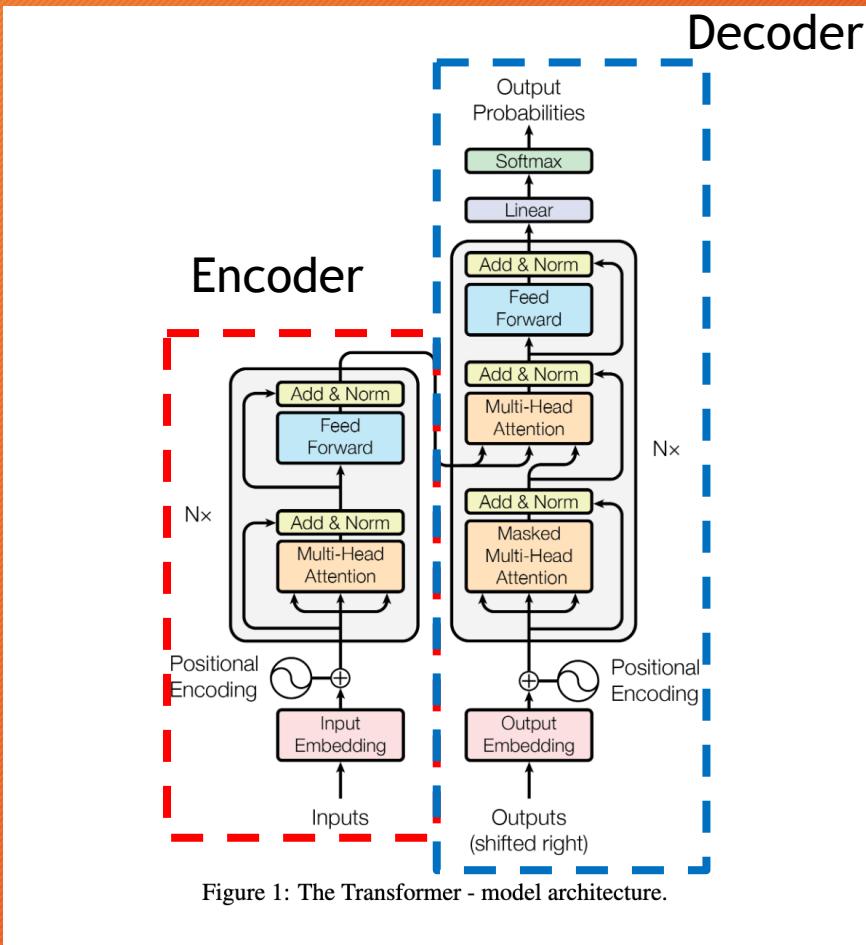
Generative AI - What is it?



AI that can produce original content close enough to human generated content for real-world tasks

How does it work?

Transformer Architecture



Source:
<https://arxiv.org/pdf/1706.03762.pdf>
(Attention is all you need)

Encoder-only models

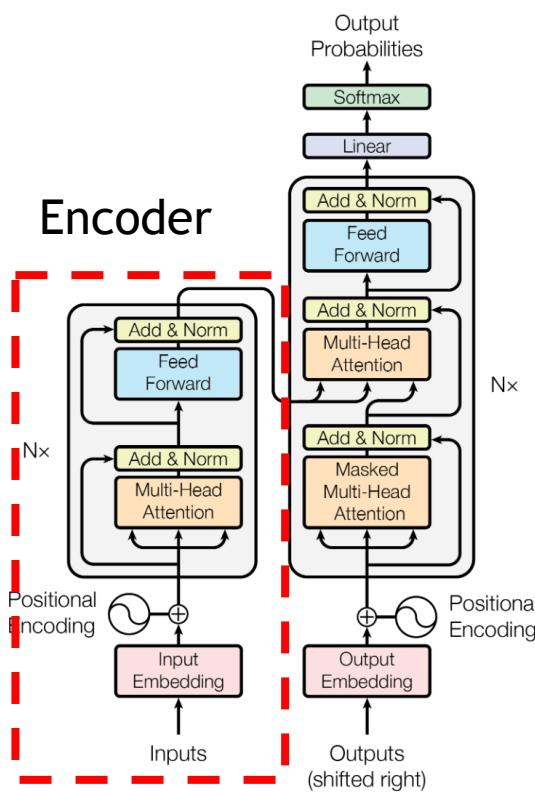


Figure 1: The Transformer - model architecture.

Encoder:

- Reads the entire input sequence & encodes the information
- Bidirectional: It has access to all the words in the input sequence
- Useful for tasks where the entire context needs to be taken into account
- Example: Text classification with BERT (Bidirectional Encoder Representation from Transformers)

Decoder-only models

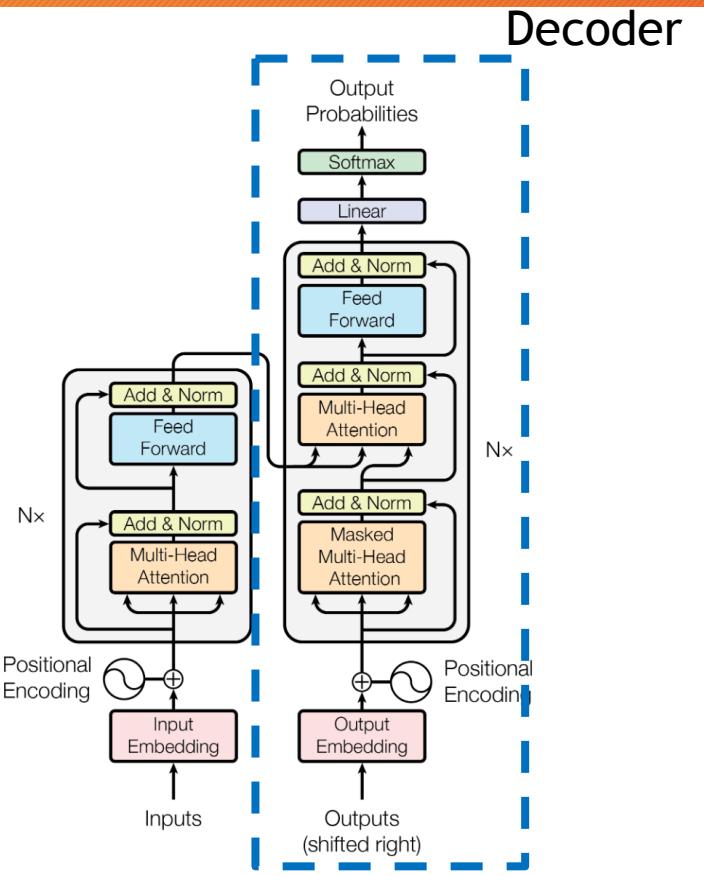
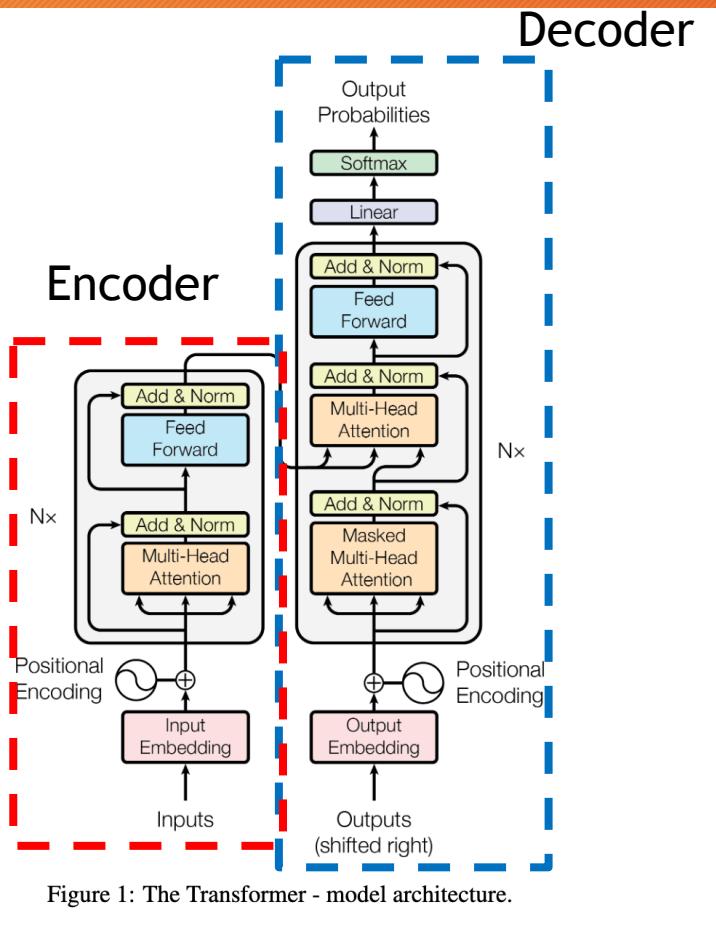


Figure 1: The Transformer - model architecture.

Decoder:

- Generates output sequence one token at a time
- Unidirectional: It has access only to the words to the left
- Autoregressive: Each next token is predicted based on the tokens that came before
- Example: Text generation (All GPT models are decoder-only)

Encoder-decoder models



Encoder-Decoder:

- Combines both abilities: Reading and understanding an input sequence and generating an output sequence
- Sequence-to-sequence models (T5, BART)
- Example: Translation

Examples

Encoder-only models

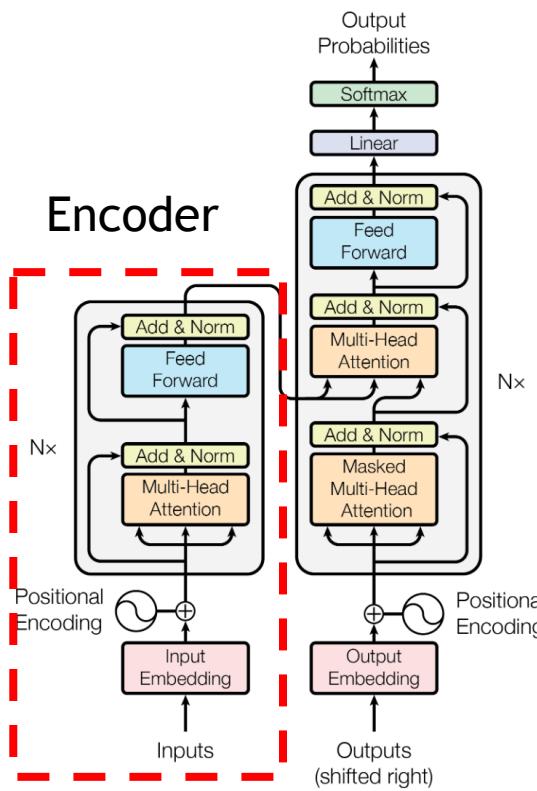


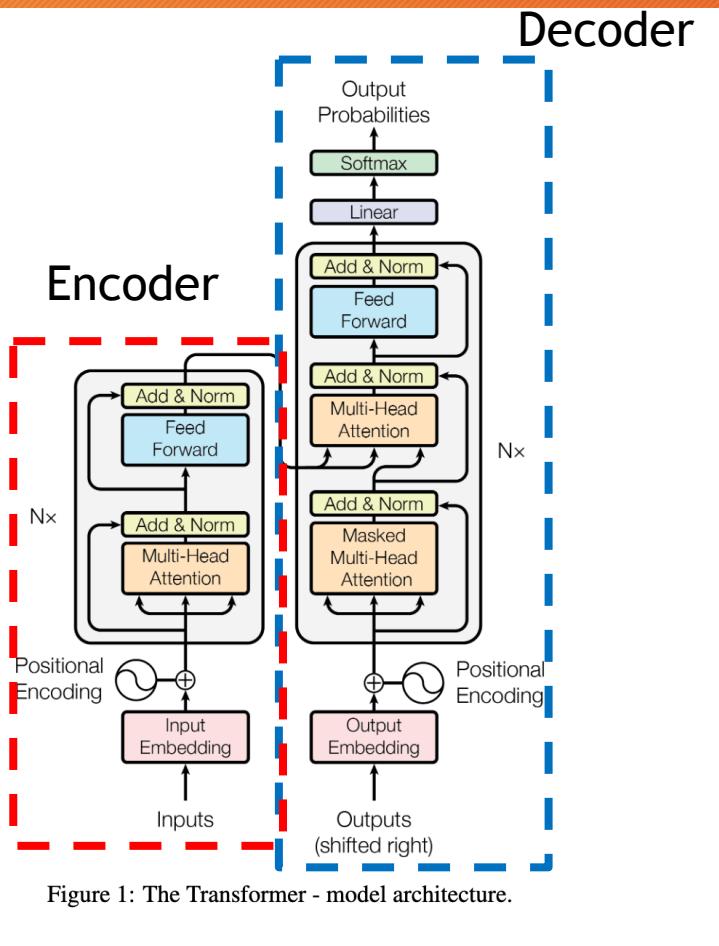
Figure 1: The Transformer - model architecture.

Example:

"She was preparing dinner for her friends who never arrived."



Encoder-decoder models

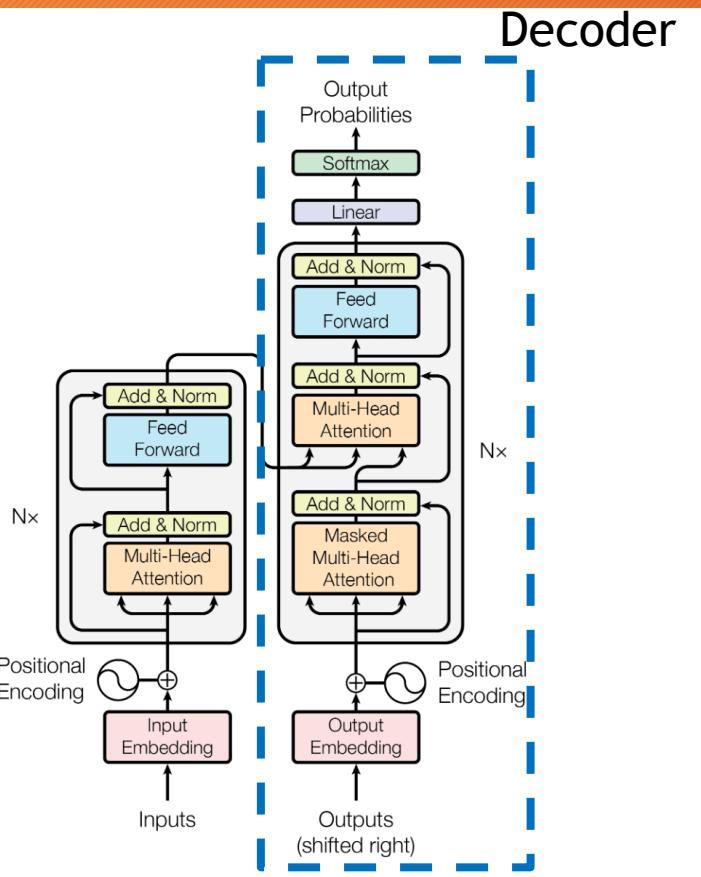


Example:

English: "I have given the book to John."

German: "Ich habe John das Buch gegeben."

Decoder-only models



Example:

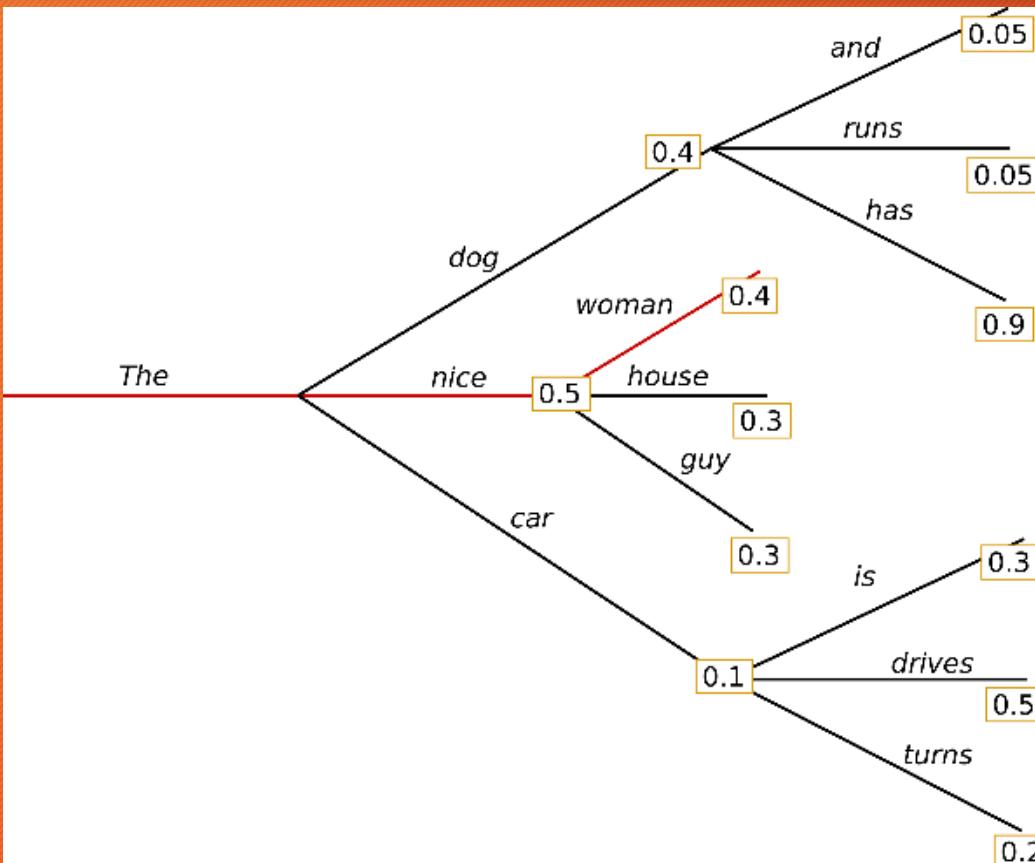
English: "I went to the bakery and bought ..."

How do decoder-only models work?

How the decoder produces text

$$P(w_{1:T}|W_0) = \prod_{t=1}^T P(w_t|w_{1:t-1}, W_0) \text{, with } w_{1:0} = \emptyset,$$

How the decoder produces text



Source: <https://huggingface.co/blog/how-to-generate>

Demo in GPT Playground

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How to use LLMs?

There are different ways to use LLMs

Public facing API



co:here

AI21labs

ANTHROPIC

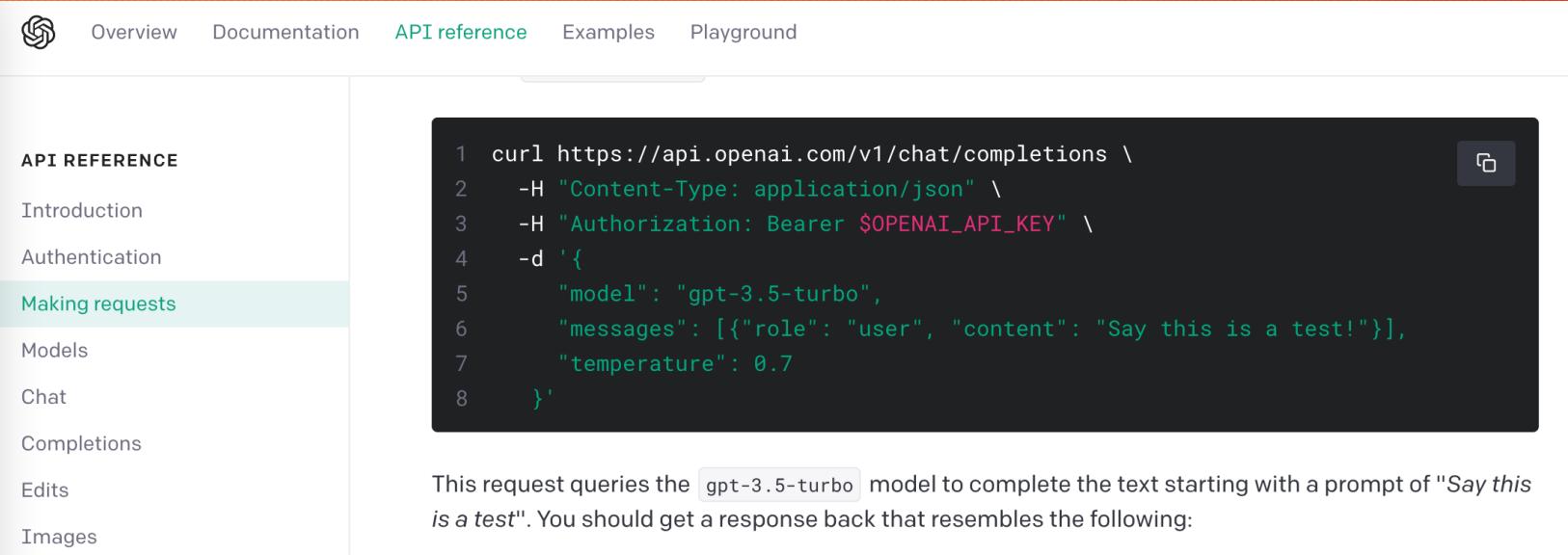
Self-hosted (locally or cloud)



Google Cloud Platform



Public facing APIs



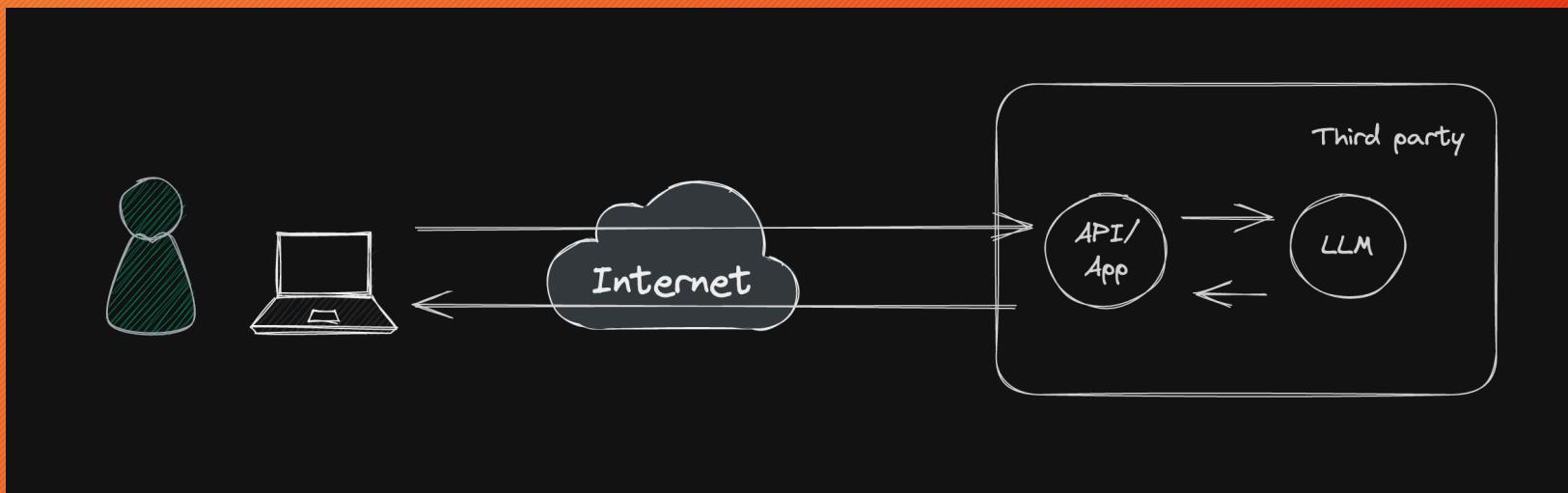
The screenshot shows a web browser displaying the OpenAI API reference documentation. The top navigation bar includes links for Overview, Documentation, API reference (which is highlighted in green), Examples, and Playground. On the left, a sidebar titled 'API REFERENCE' lists several categories: Introduction, Authentication, Making requests (which is highlighted in green), Models, Chat, Completions, Edits, and Images. The main content area shows a 'curl' command for making a request to the 'chat/completions' endpoint. The command is as follows:

```
1 curl https://api.openai.com/v1/chat/completions \
2   -H "Content-Type: application/json" \
3   -H "Authorization: Bearer $OPENAI_API_KEY" \
4   -d '{
5     "model": "gpt-3.5-turbo",
6     "messages": [{"role": "user", "content": "Say this is a test!"}],
7     "temperature": 0.7
8   }'
```

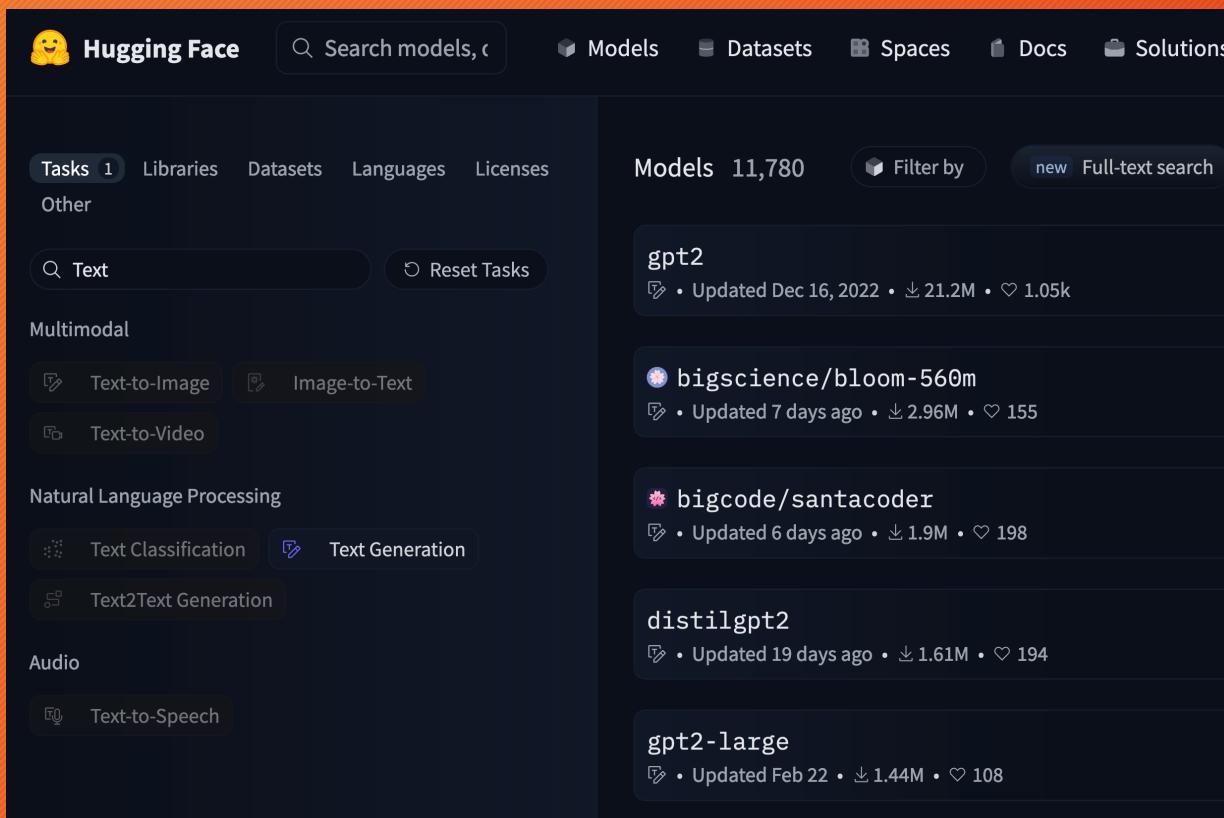
Below the command, a text block explains: 'This request queries the `gpt-3.5-turbo` model to complete the text starting with a prompt of "Say this is a test". You should get a response back that resembles the following:'.

Public facing APIs

Easy to use, but ...



Self-hosting

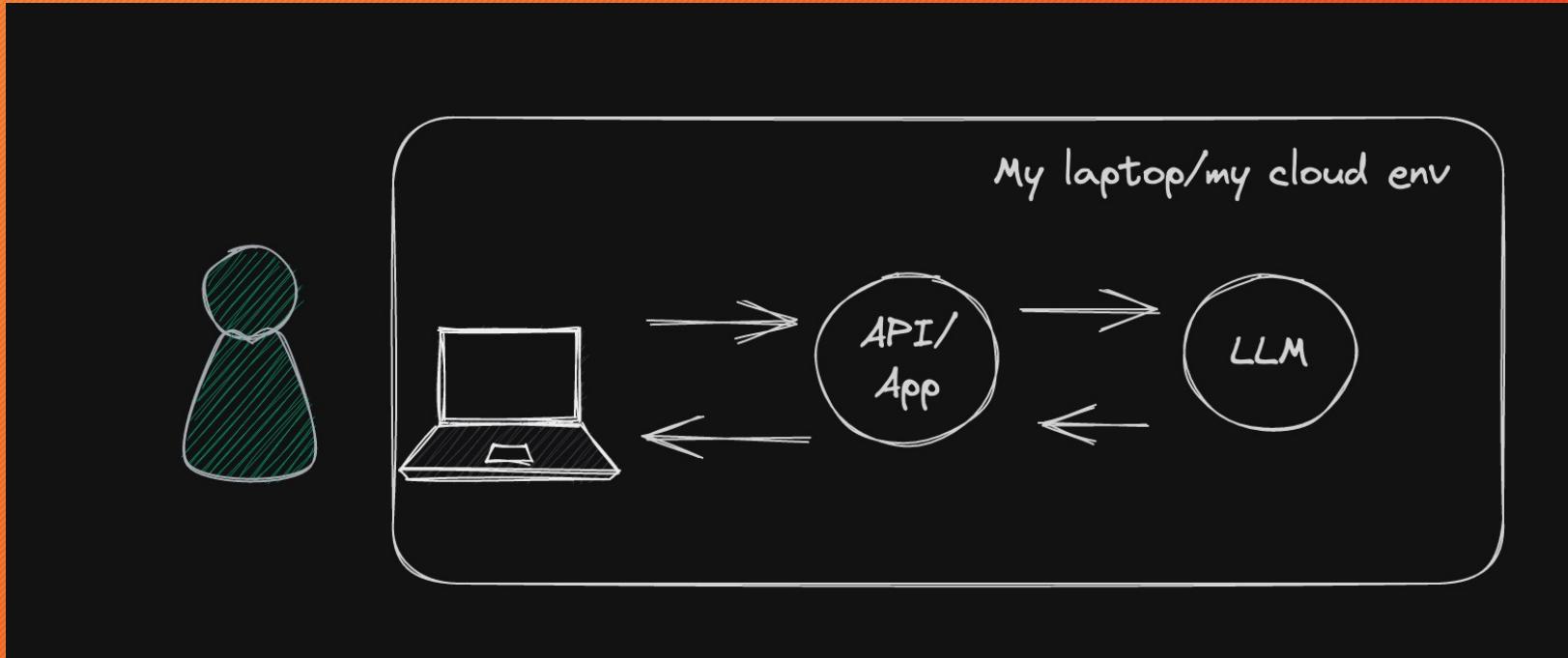


The screenshot shows the Hugging Face website interface. The top navigation bar includes a logo, a search bar, and links for Models, Datasets, Spaces, Docs, and Solutions. The left sidebar features a 'Tasks' section with 1 item, and categories for Libraries, Datasets, Languages, Licenses, and Other. It also lists Multimodal tasks: Text-to-Image, Image-to-Text, and Text-to-Video. Under Natural Language Processing, it lists Text Classification, Text Generation, and Text2Text Generation. Under Audio, it lists Text-to-Speech. The main content area is titled 'Models 11,780' and includes a 'Filter by' button and a 'new Full-text search' button. It displays a list of models with their names, last updated date, size, and star count. The models listed are: gpt2 (updated Dec 16, 2022, 21.2M, 1.05k stars), bigscience/bloom-560m (updated 7 days ago, 2.96M, 155 stars), bigcode/santacoder (updated 6 days ago, 1.9M, 198 stars), distilgpt2 (updated 19 days ago, 1.61M, 194 stars), and gpt2-large (updated Feb 22, 1.44M, 108 stars).

Model	Last Updated	Size	Stars
gpt2	Dec 16, 2022	21.2M	1.05k
bigscience/bloom-560m	7 days ago	2.96M	155
bigcode/santacoder	6 days ago	1.9M	198
distilgpt2	19 days ago	1.61M	194
gpt2-large	Feb 22	1.44M	108

<https://huggingface.co/models>

Self-hosting



Private, but ...

Challenge with self-hosting

junyanz/pytorch-CycleGAN-and-pix2pix

#422 **CUDA Error: Out of Memory**

20 comments

 **brian1986** opened on November 4, 2018



Easy-to-use solutions

How 😊 Accelerate runs very large models thanks to PyTorch

<https://huggingface.co/blog/accelerate-large-models>

bitsandbytes

The bitsandbytes is a lightweight wrapper around CUDA custom functions, in particular 8-bit optimizers, matrix multiplication (LLM.int8()), and quantization functions.

Resources:

- 8-bit Optimizer Paper -- Video -- Docs
- LLM.int8() Paper -- LLM.int8() Software Blog Post -- LLM.int8() Emergent Features Blog Post

<https://github.com/TimDettmers/bitsandbytes>

Demo in Notebook

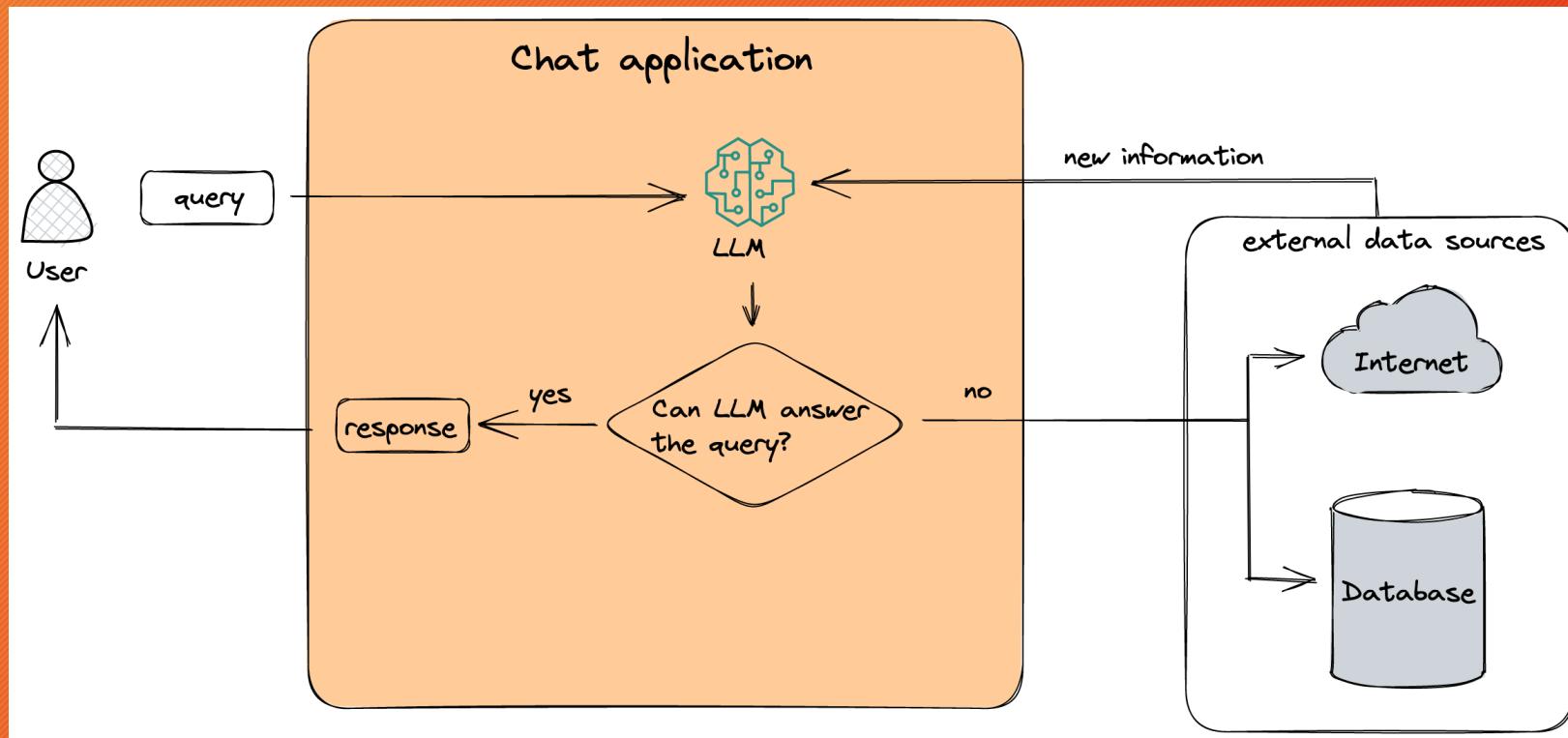
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Knowledge Cut-off

Demo in ChatGPT

If only LLMs could tell us what they need ...



LangChain Demo

If only LLMs could tell us what they needed ...

Supercharging Large Language Models With  Langchain

Building a Modular Reasoning, Knowledge and Language (MRKL) system using prompt chaining

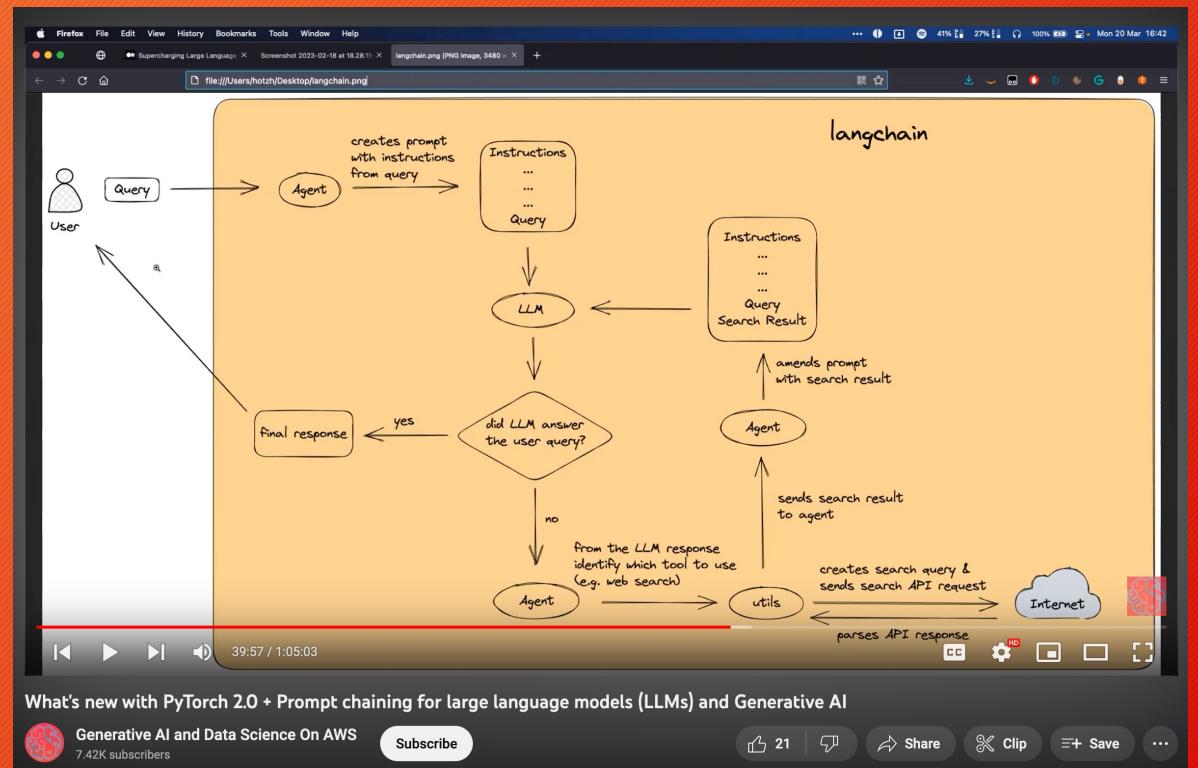
Heiko Hotz
Published in MLearning.ai · 8 min read · Feb 21

178 Q 5



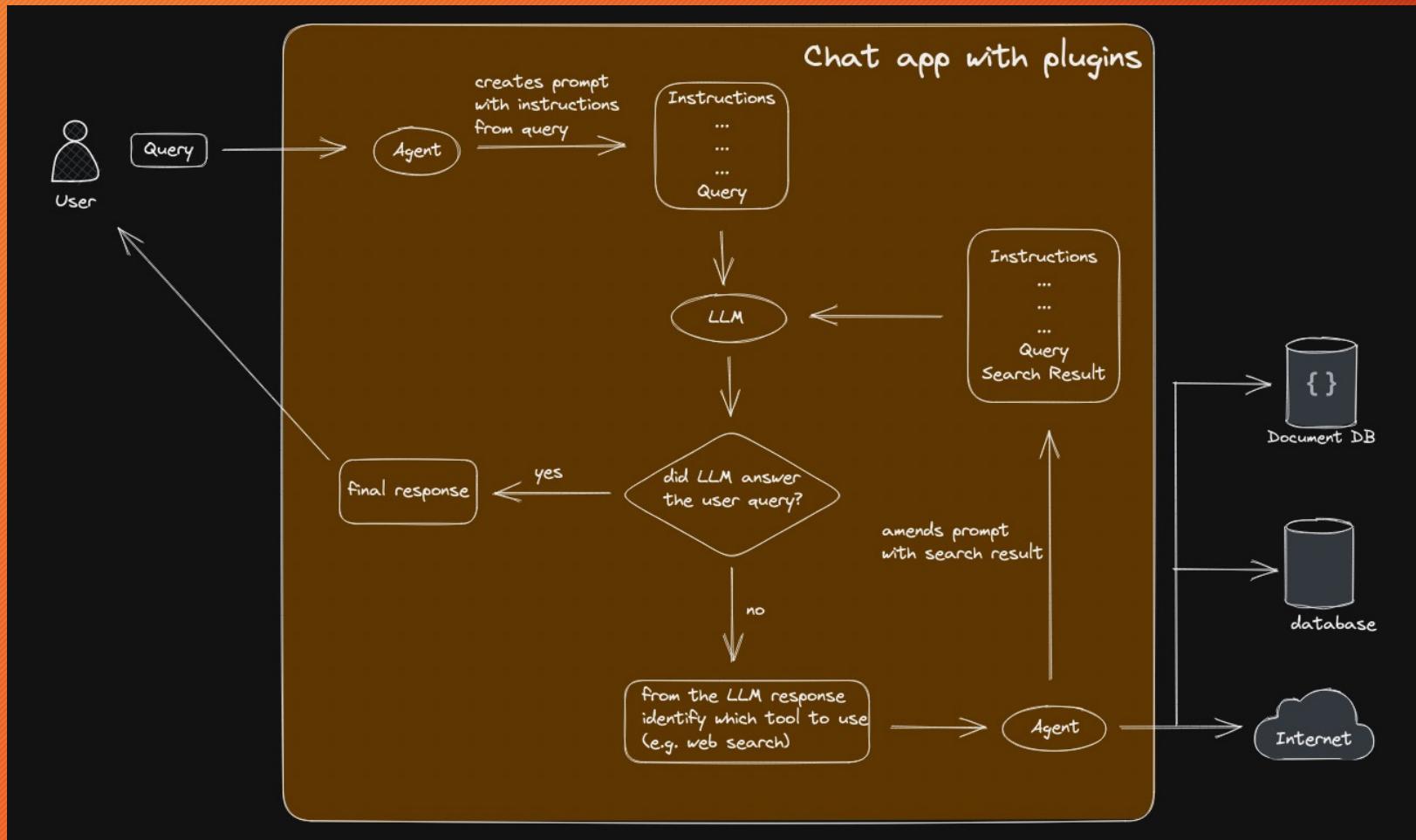
Image by author

[https://medium.com/mlarning-ai/supercharging-large-language-models-with-langchain-1cac3c103b52](https://medium.com/mlearning-ai/supercharging-large-language-models-with-langchain-1cac3c103b52)



https://www.youtube.com/watch?v=25dcCFvb4o4&list=PL7pBcJ870QHeNRBXdKirc4fdtbtbB5Xy-&index=4&ab_channel=GenerativeAlandDataScienceOnAWS&t=2055s

If only LLMs could tell us what they needed ...



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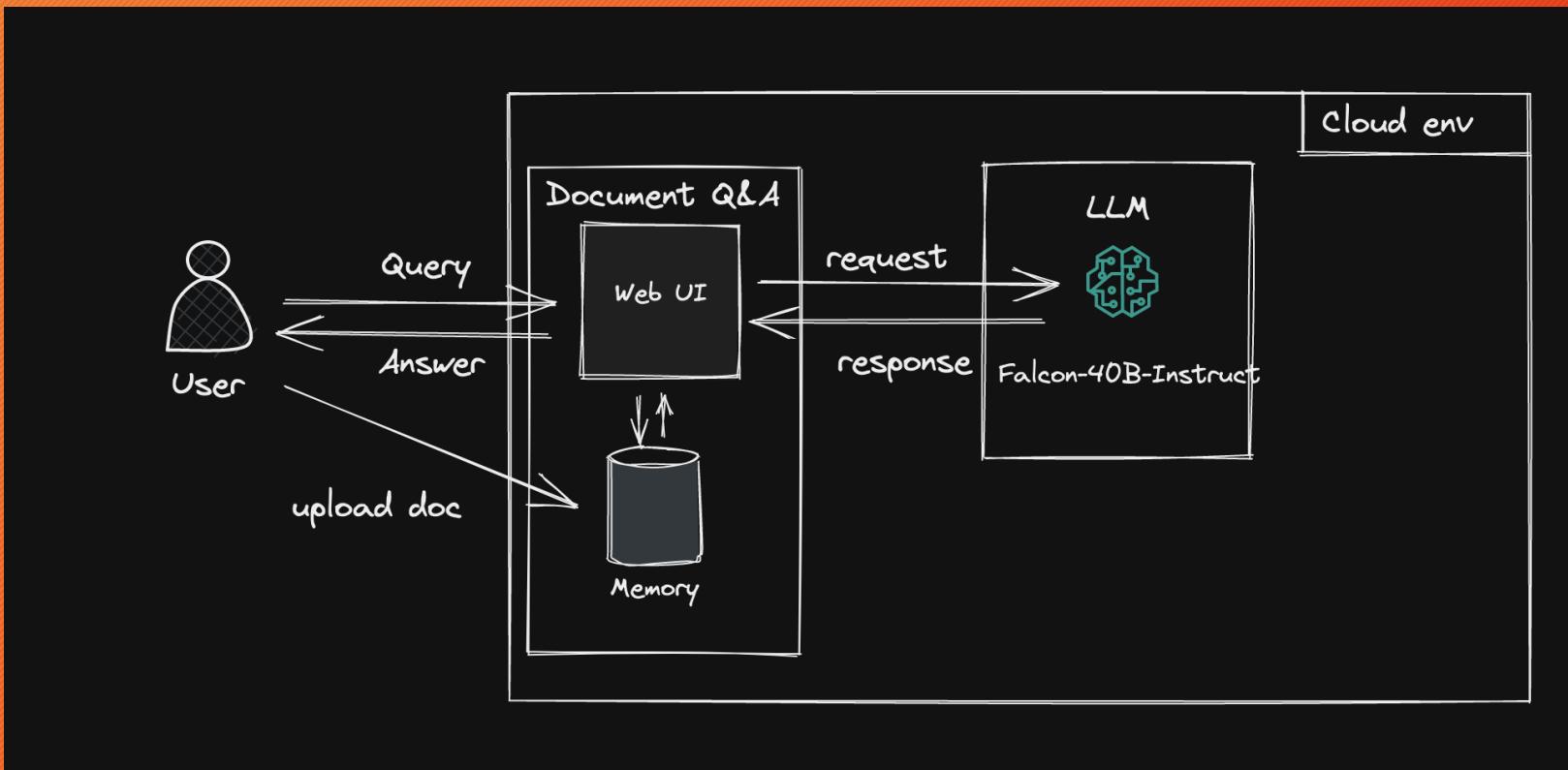
How to build applications with LLMs?

Open source!



Introducing Falcon LLM

Architecture



Demo

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Bias: Demo in Playground

Questions?

Connect with me on LinkedIn:

<https://www.linkedin.com/in/heikohotz/>

