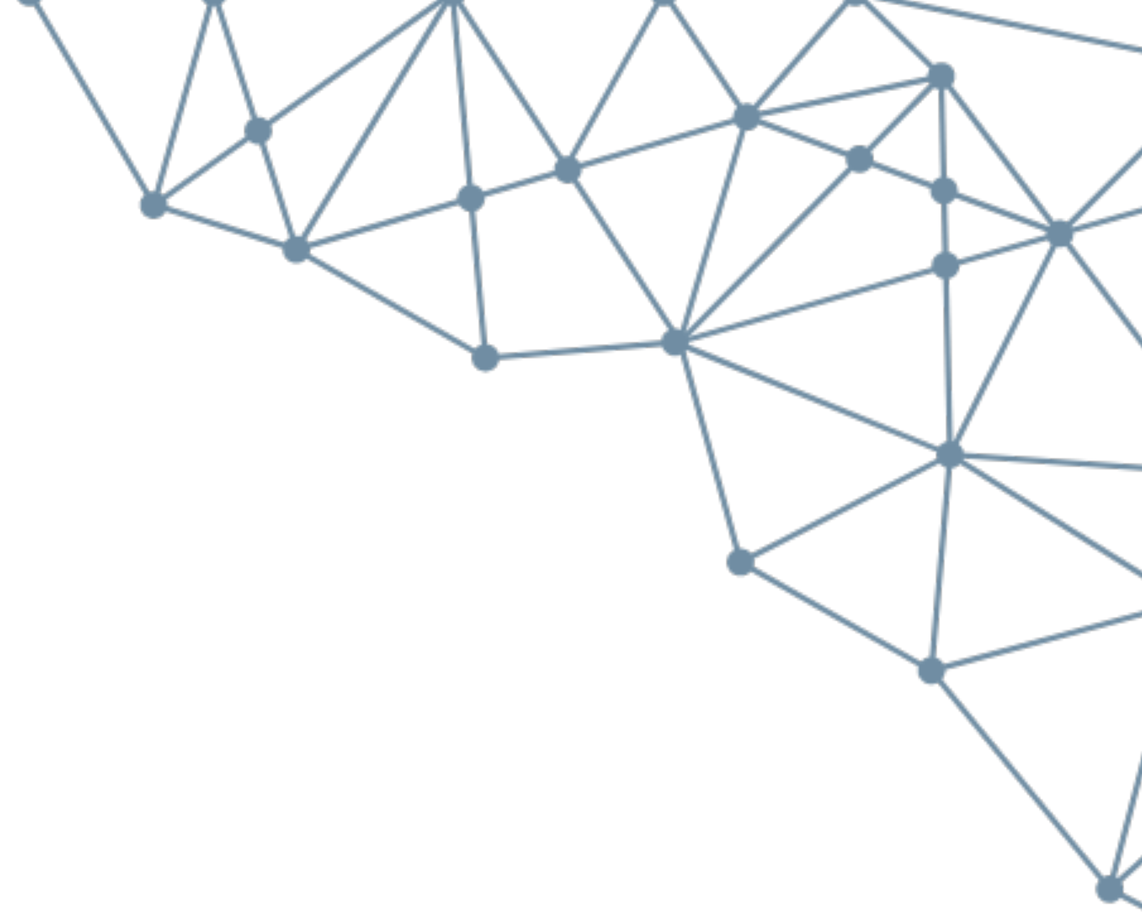
ABB - Session 3

Software 3.0, LLMs, Prompt Engineering

Shaw Talebi

Today's Session



1. **Housekeeping**
    1.1. Announcements
    1.2. Homework 2
2. **Software 3.0**
    2.1. Large Language Models (LLMs)
    2.2. Two Levels of LLM Development
    2.3. Prompt Engineering
3. **Examples**
    3.1. Summarizing Research Papers with GPT-4o
    3.2. Text Classification with GPT-4o-mini
    3.3. Local (Visual) QA with Ollama

Announcements

Homework 2

Shoutouts 🎉

Stock Price Prediction
Saijai Osika

Stock Price Prediction
Sangeeta Bahri

iPhone Price Predictor
Rakesh Bidhar

Email Inbox Organizer
Divya Mani

Catering Menu Creator
Adam Rosenkoetter

Transcript Cleaner
Bryce Klein

Churn/Fake News Classifiers
Rod Morrison

Stock Report Generator
Christopher Briggs

The Problem with Software 2.0

Getting *good* data is hard

14M images

49k human labelers

Millions of dollars invested

(deduping, quality control, remove copyrighted content)

AlexNet

ImageNet Classification with Deep Convolutional Neural Networks

Alex Krizhevsky
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1.2M Images

2 Consumer GPUs trained for 5-6 days

… still wrong 15% of the time.

But what if there's another way?

Software 3.0

Software 3.0

Adapting pre-trained (general-purpose) models for specific use cases

What object would this be classified as in the image net dataset?

GPT-4o

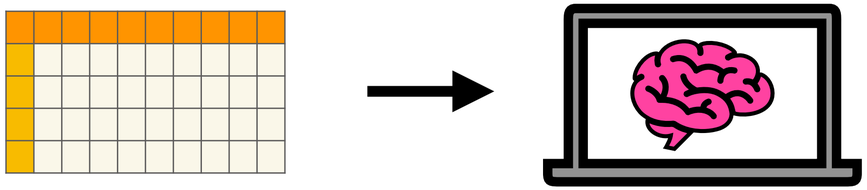
"giant panda"

n02510455

What's so different about this?

Upgrading from 2.0 to 3.0

Old Way

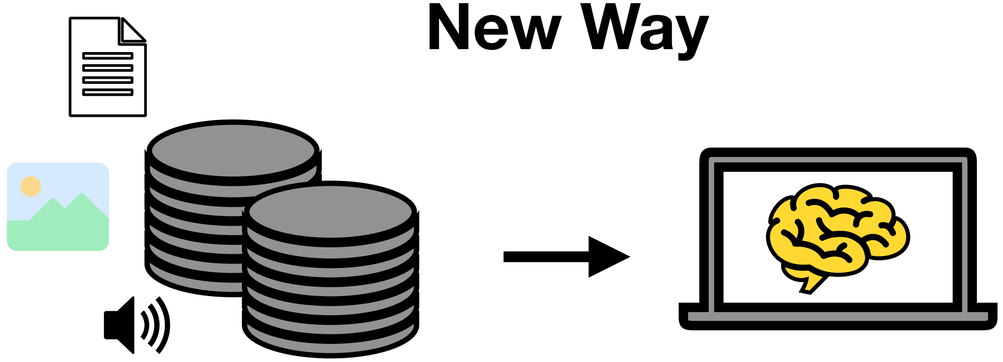


Task-specific Data → Task-specific Model

***Data**: 1K-1M Rows*

***Strong** performance on **narrow** set of tasks*

New Way



Non-specific Data → Foundation Model

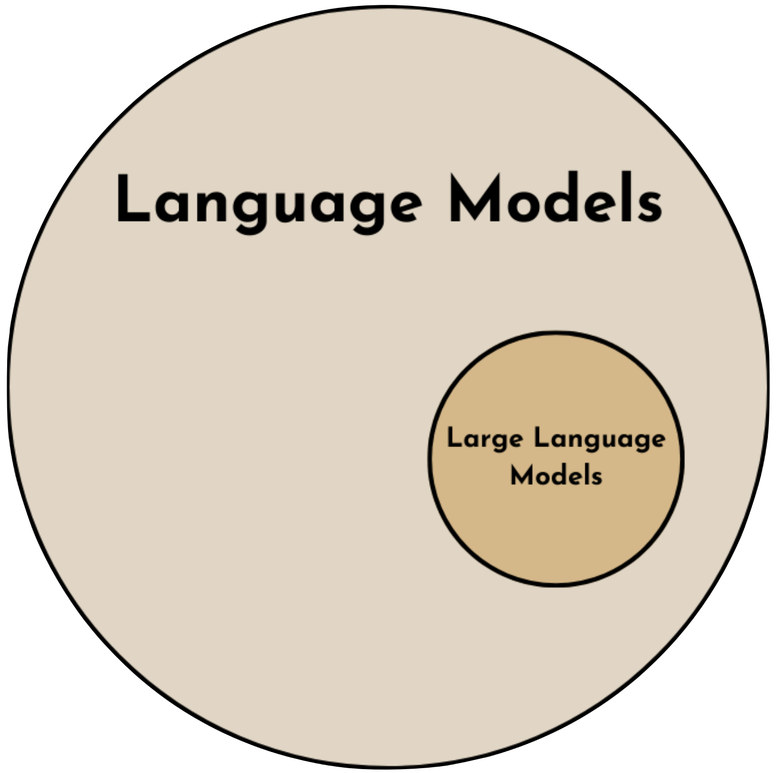
***Data**: 10B-10T Tokens*

***Decent** performance on **wide** set of tasks (0-shot and in-context learning)*

*Strong performance on narrow set of tasks via **fine-tuning** (50-5k examples)*

Large Language Models (LLMs)

(Very) big models that can perform wide range of NLP tasks



Quantitatively

Number of model parameters

i.e. 1-100+ Billion

Qualitatively

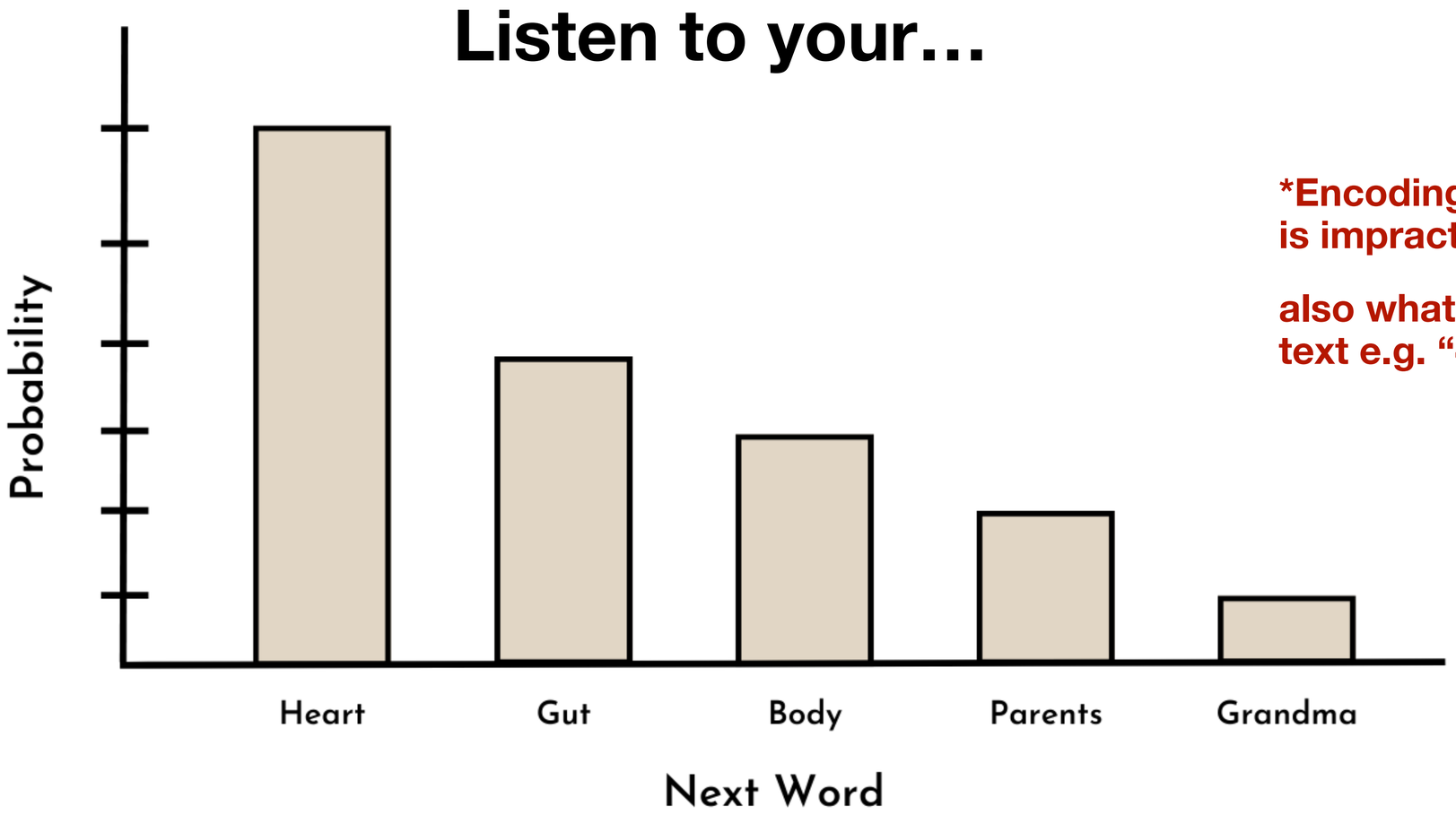
Emergent properties

e.g. Zero-shot learning

[1] [2]

How do LLMs work?

Basic idea: Next-word prediction



***Encoding individual words is impractical…**

also what about non-word text e.g. “4%`?.<&*@#/>|

[1] [3]

Tokens

Character strings serving as basis of LLM inputs/outputs

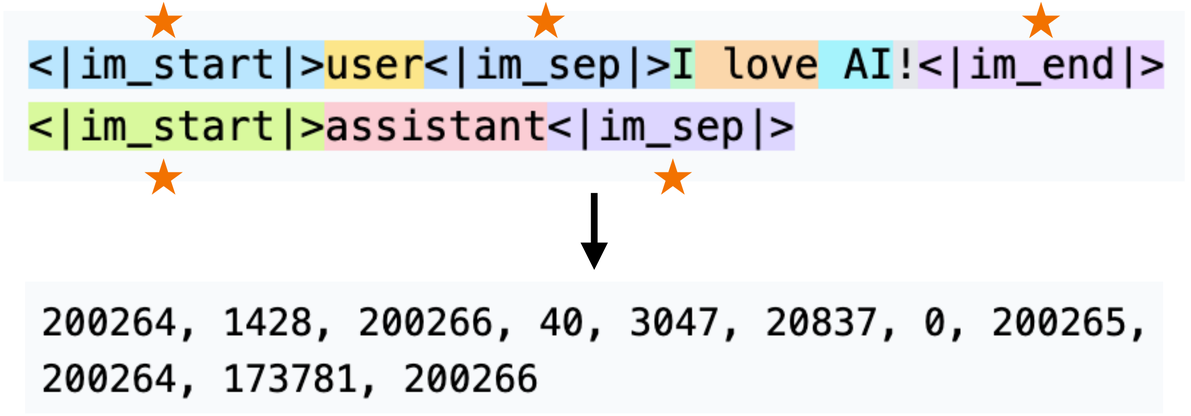
GPT-2

I love AI! —*Tokenization*→ I | love | AI | ! → 40, 1842, 9552, 0

GPT-4o

I love AI! —*Tokenization*→

Special tokens ★



Vocabulary = the set of all tokens used for a particular LLM

2 Levels of LLM Development

How to get LLMs to do what you want…

Level 1

Adapting models via prompts and tools

Prompt Engineering 

RAG 

Tool-use 

Level 2

Adapting models via additional training

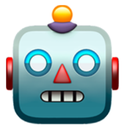
Fine-tuning 

Post-training 

Prompt Engineering

Adapting model behavior through (natural language) inputs

Can you write me a simple and concise definition of Prompt Engineering?

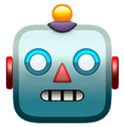


Prompt Engineering is the process of designing and optimizing input prompts to guide AI models, like ChatGPT, in producing desired and accurate outputs. It involves crafting specific instructions, context, and examples to achieve effective and reliable results.

Prompt Engineering

Adapting model behavior through (natural language) inputs

What is the tone of sentiment of the following message?
"I love prompt engineering. It's much easier than writing code :P"



The tone of the sentiment in the message is **positive** and playful. The use of "I love" conveys enthusiasm, and the emoticon ":P" adds a lighthearted and humorous touch.

Prompt Engineering

A few tricks to improve model performance

Trick 1: Clear Instructions

Summarize this paper.

Your task is to act as an academic summarizer, condensing research papers into concise, clear, and accessible summaries.

Follow these guidelines:
{Guidelines here}

Hint: using an LLM is a great starting point for prompt writing

Trick 2: Give Examples

Here are some examples of sentiment analysis:

Input: "I love the new design of this app!"
Sentiment: Positive

Input: "This service is okay, but it could be better."
Sentiment: Neutral

Input: "I'm extremely disappointed with the support team."
Sentiment: Negative

Now, analyze the sentiment of this statement:
Input: {New example}

Trick 3: Use Structured Text

Here are some examples of sentiment analysis:

1. **Input**: "I love the new design of this app!"
Sentiment: Positive

2. **Input**: "This service is okay, but it could be better."
Sentiment: Neutral

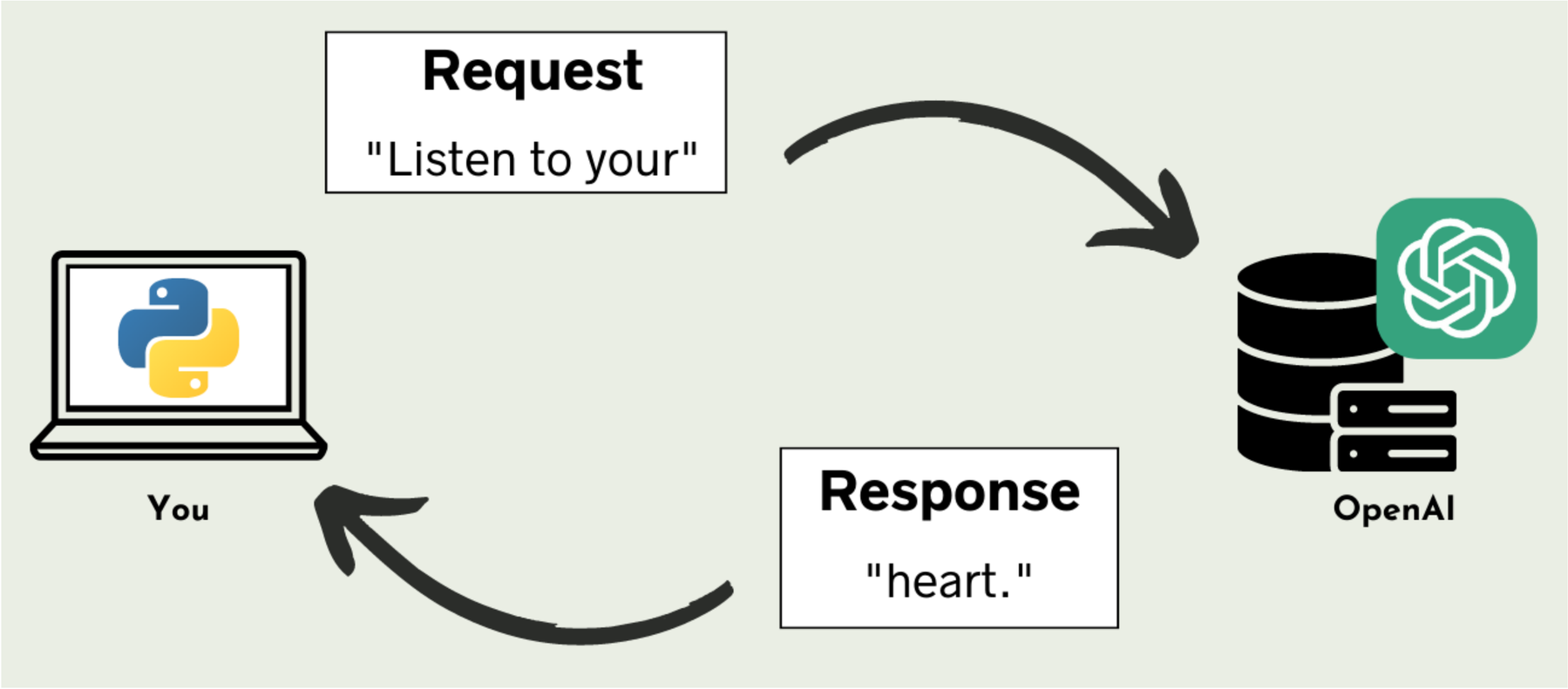
3. **Input**: "I'm extremely disappointed with the support team."
Sentiment: Negative

Now, analyze the sentiment of this statement:
Input: {New example}

Often better prompts are the best way to improve an LLM system

Using LLM APIs

Running model inference without GPUs



***Pricing** based on token count and model size*

Examples

Example 1

Summarizing Research Papers with GPT-4o (Overview)

Attention Is All You Need

Ashish Vaswani* Google Brain avaswani@google.com

Noam Shazeer* Google Brain noam@google.com

Niki Parmar* Google Research nikip@google.com

Jakob Uszkoreit* Google Research usz@google.com

Llion Jones* Google Research llion@google.com

Aidan N. Gomez* † University of Toronto aidan@cs.toronto.edu

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Abstract

The dominant sequence transduction models are based on complex recurrent or convolutional neural networks that include an encoder and a decoder. The best performing models also connect the encoder and decoder through an attention mechanism. We propose a new simple network architecture, the Transformer, based solely on attention mechanisms, dispensing with recurrence and convolutions entirely. Experiments on two machine translation tasks show these models to be superior in quality while being more parallelizable and requiring significantly less time to train. Our model achieves 28.4 BLEU on the WMT 2014 English-to-German translation task, improving over the existing best results, including ensembles, by over 2 BLEU. On the WMT 2014 English-to-French translation task, our model establishes a new single-model state-of-the-art BLEU score of 41.8 after training for 3.5 days on eight GPUs, a small fraction of the training costs of the best models from the literature. We show that the Transformer generalizes well to other tasks by applying it successfully to English constituency parsing both with large and limited training data.

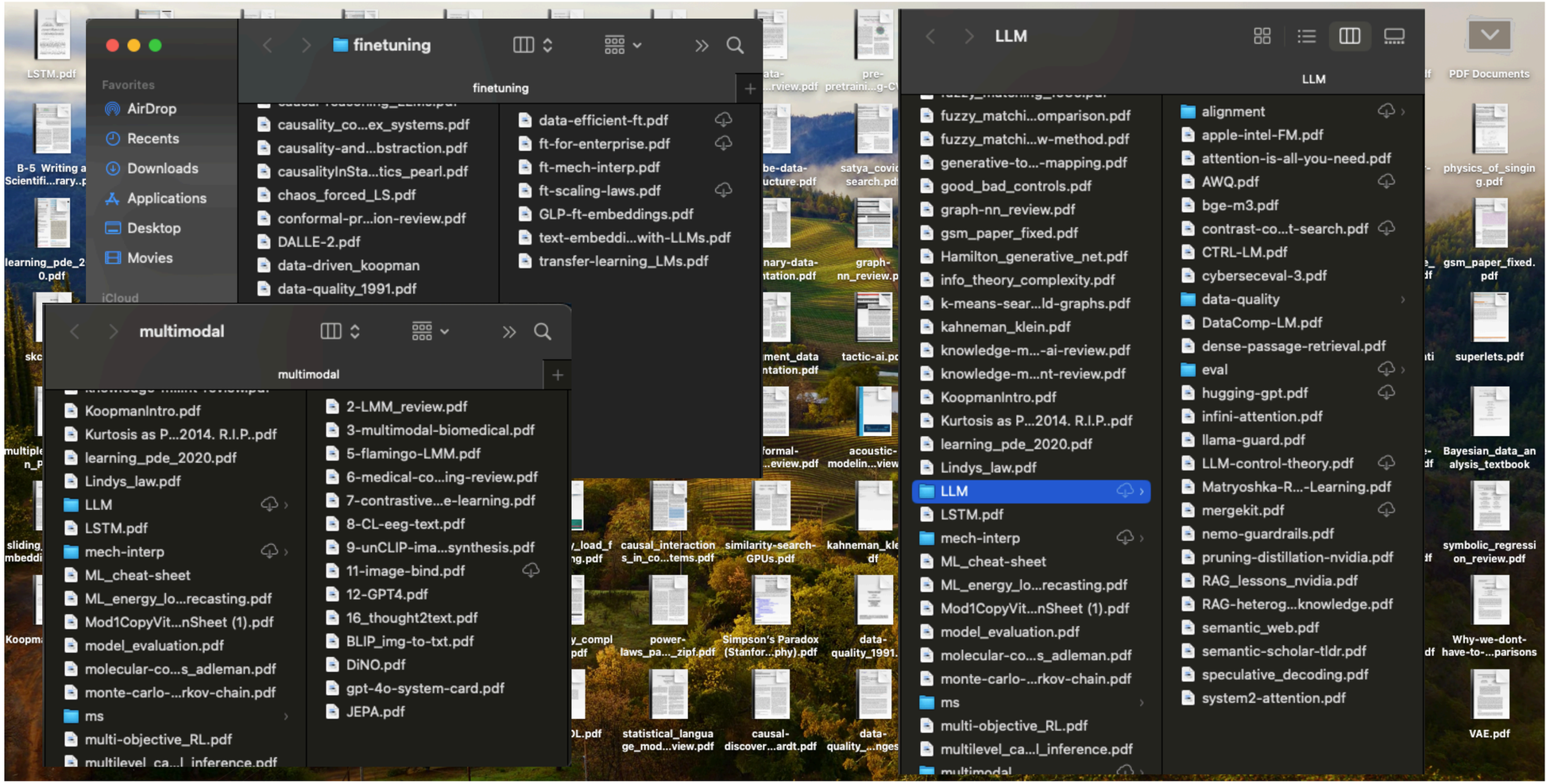
→

Lit Review:

Title
Authors/Affiliations
Key Concepts
Contributions

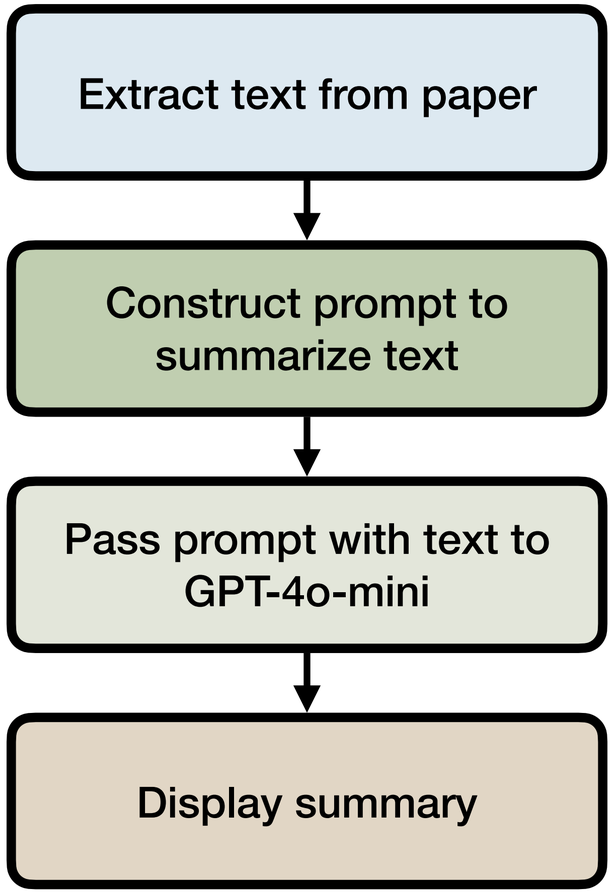
Example 1

Summarizing Research Papers with GPT-4o (Overview)



Example 1

Summarizing Research Papers with GPT-4o (Flowchart)



(From Example 1 - Session 2)

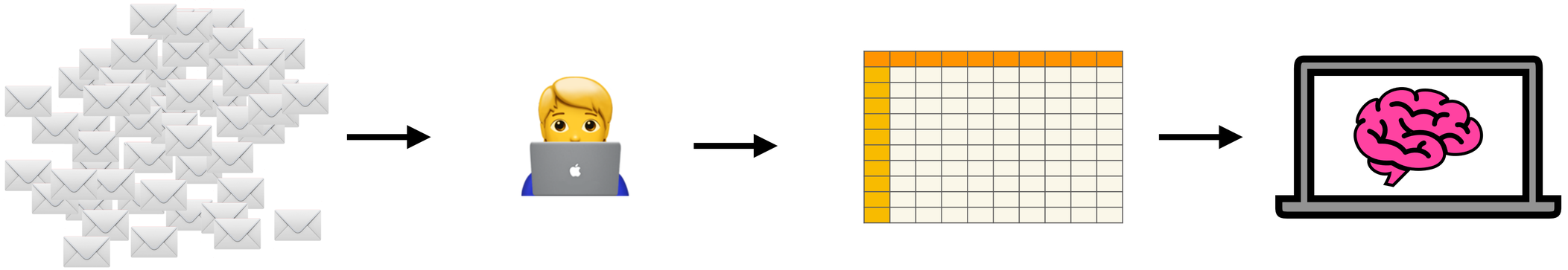
Example 1

Summarizing Research Papers with GPT-4o (Code)

Example 2

Text Classification with GPT-4o-mini (Overview)

Cohort 1, Session 2 - Examples



Extract emails

Transform into features

Store in DataFrame

Train ML model

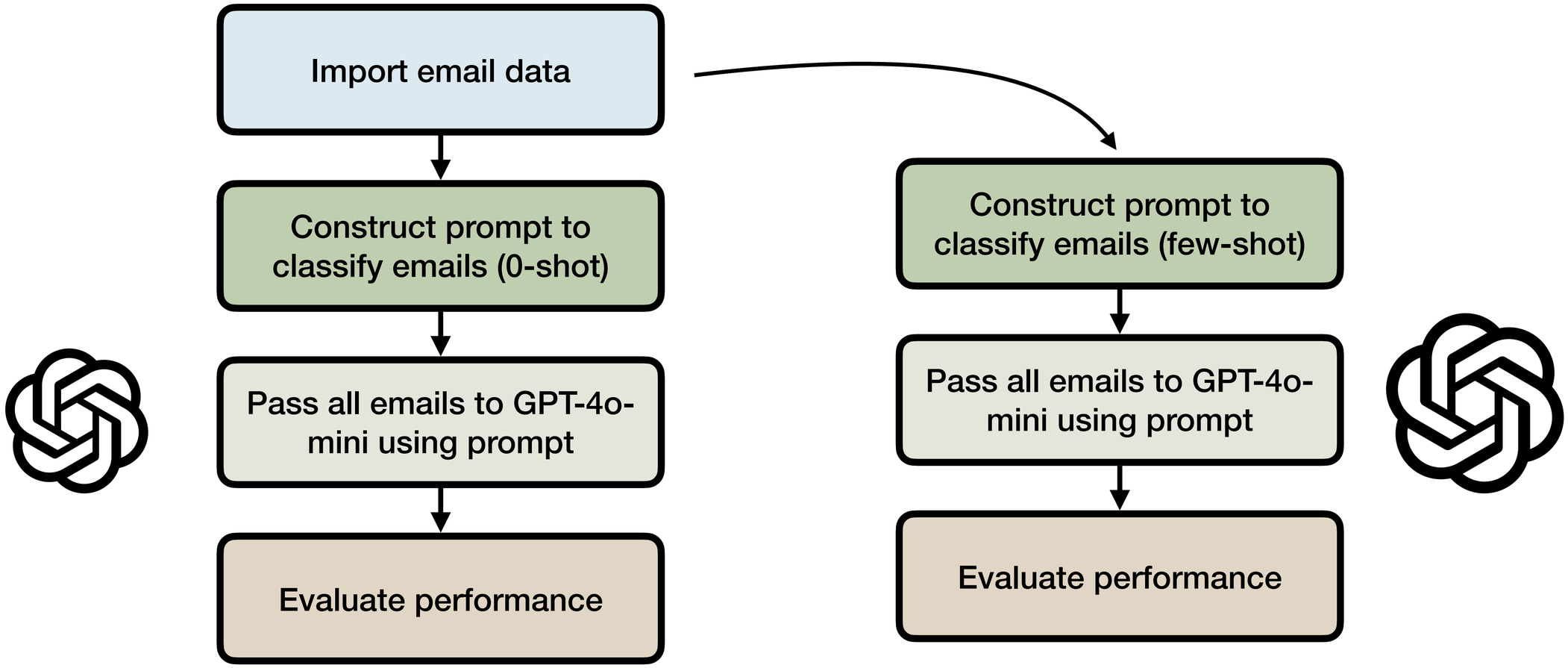
Example 2

Text Classification with GPT-4o-mini (Overview)

Cohort 1, Session 2 - Examples

Example 2

Text Classification with GPT-4o-mini (Flowchart)



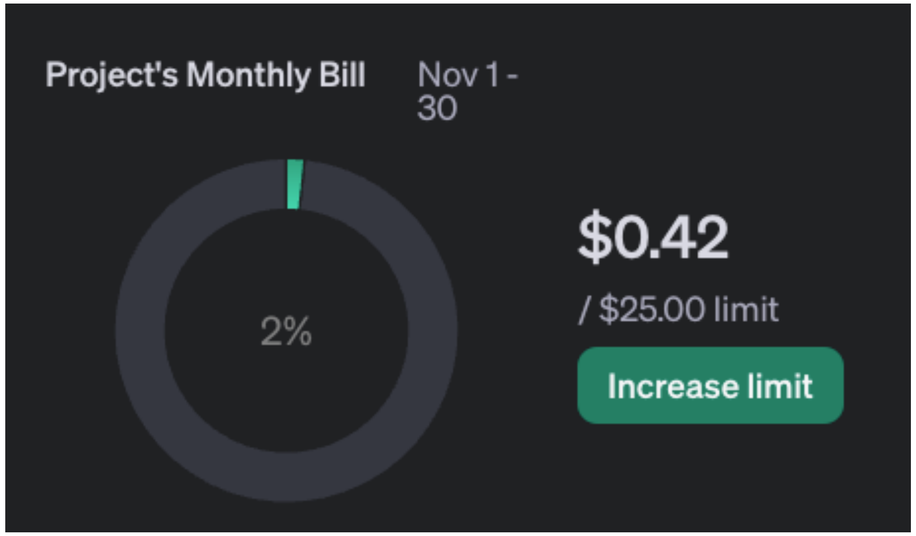
Example 2

Text Classification with GPT-4o-mini (Code)

Example 3

Local (Visual) QA Bot with Ollama (Overview)

API Costs



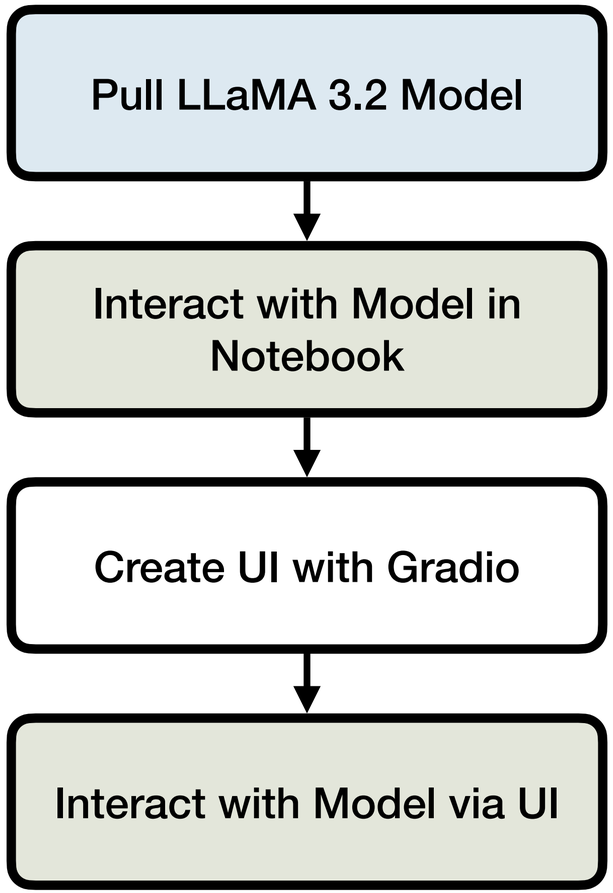
API Limits

Error Code 429 - Rate limit reached for requests

Restricted Data

Example 3

Local (Visual) Question Answering with Ollama (Flowchart)



Example 3

Local (Visual) Question Answering with Ollama (Code)

Homework 3

Project 💻

Build an Automation with an LLM

Pre-work ✍️

Session 4: Embedding Models

Session 4: RAG

No session next week!

References

[1] Survey of Large Language Models. arXiv:2303.18223 [cs.CL]

[2] A Practical Introduction to Large Language Models (LLMs)

[3] Radford, A., & Narasimhan, K. (2018). Improving Language Understanding by Generative Pre-Training.

[4] LLM Tokenizer Demo

[5] Prompt Engineering: How to Trick AI into Solving Your Problems

[6] OpenAI’s Prompt Engineering Guide

[7] Anthropic's Prompt Engineering Guide