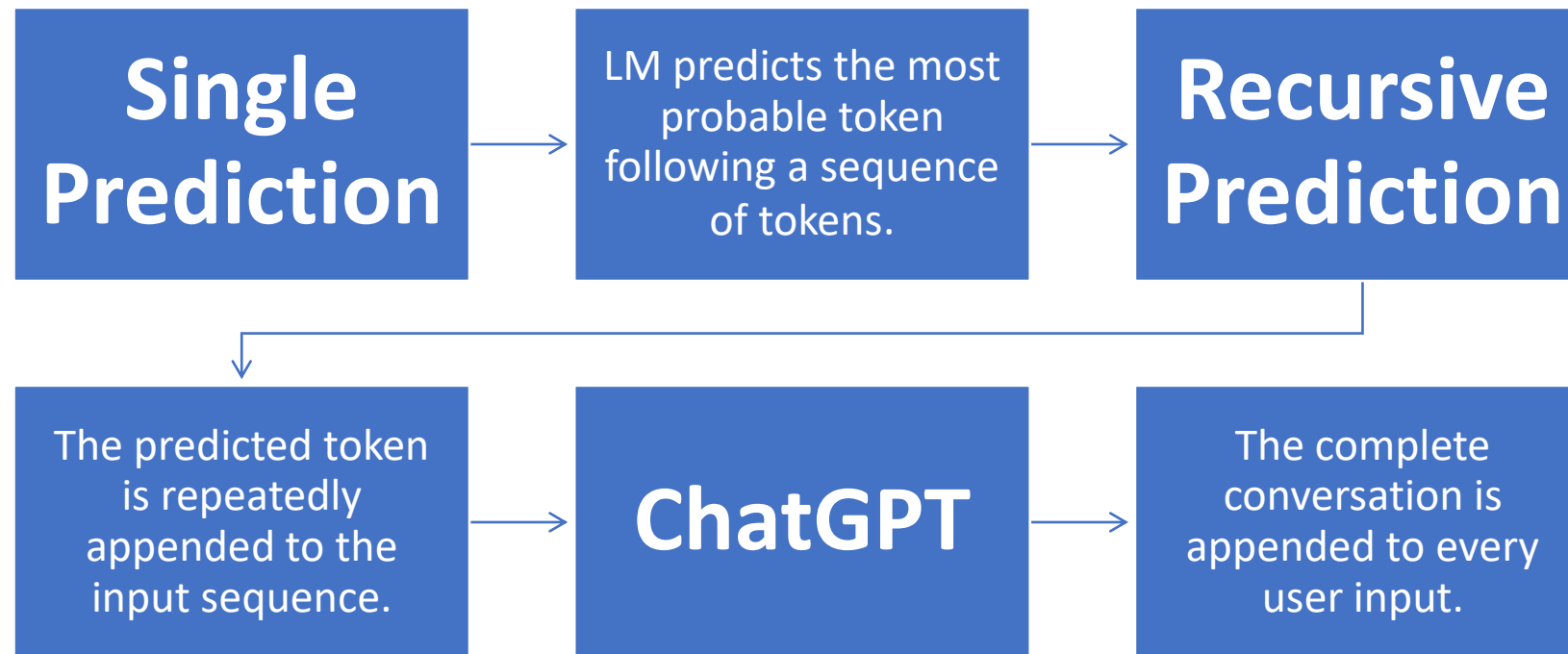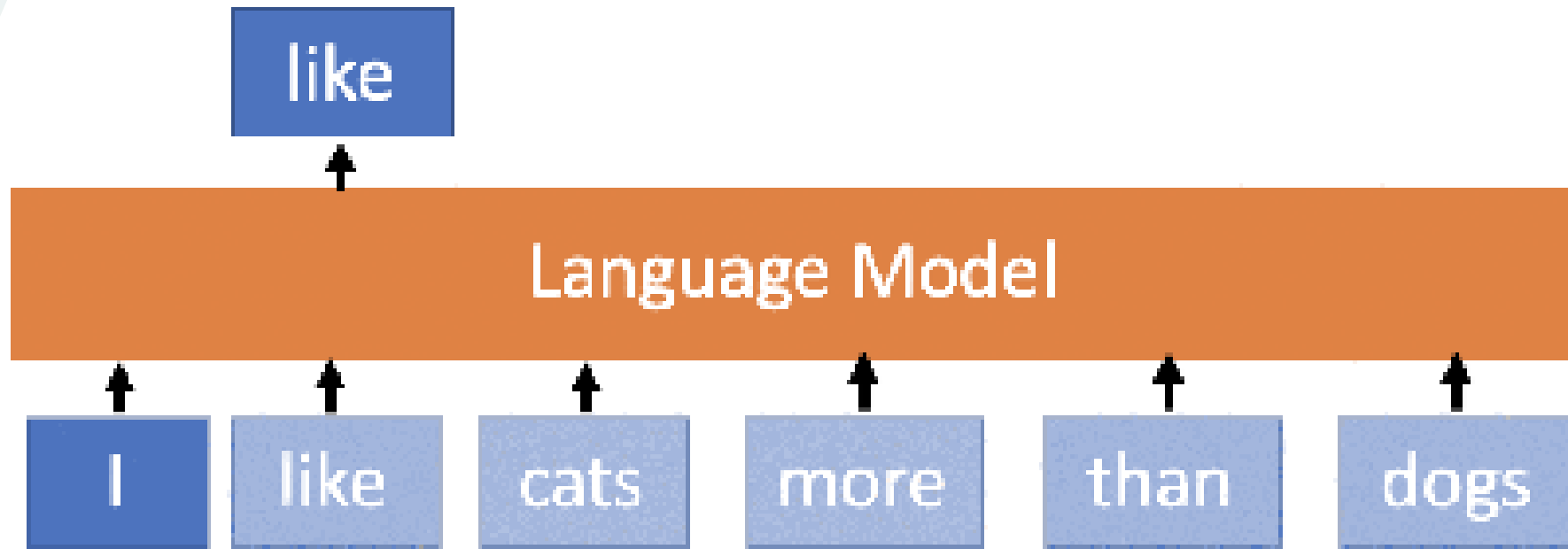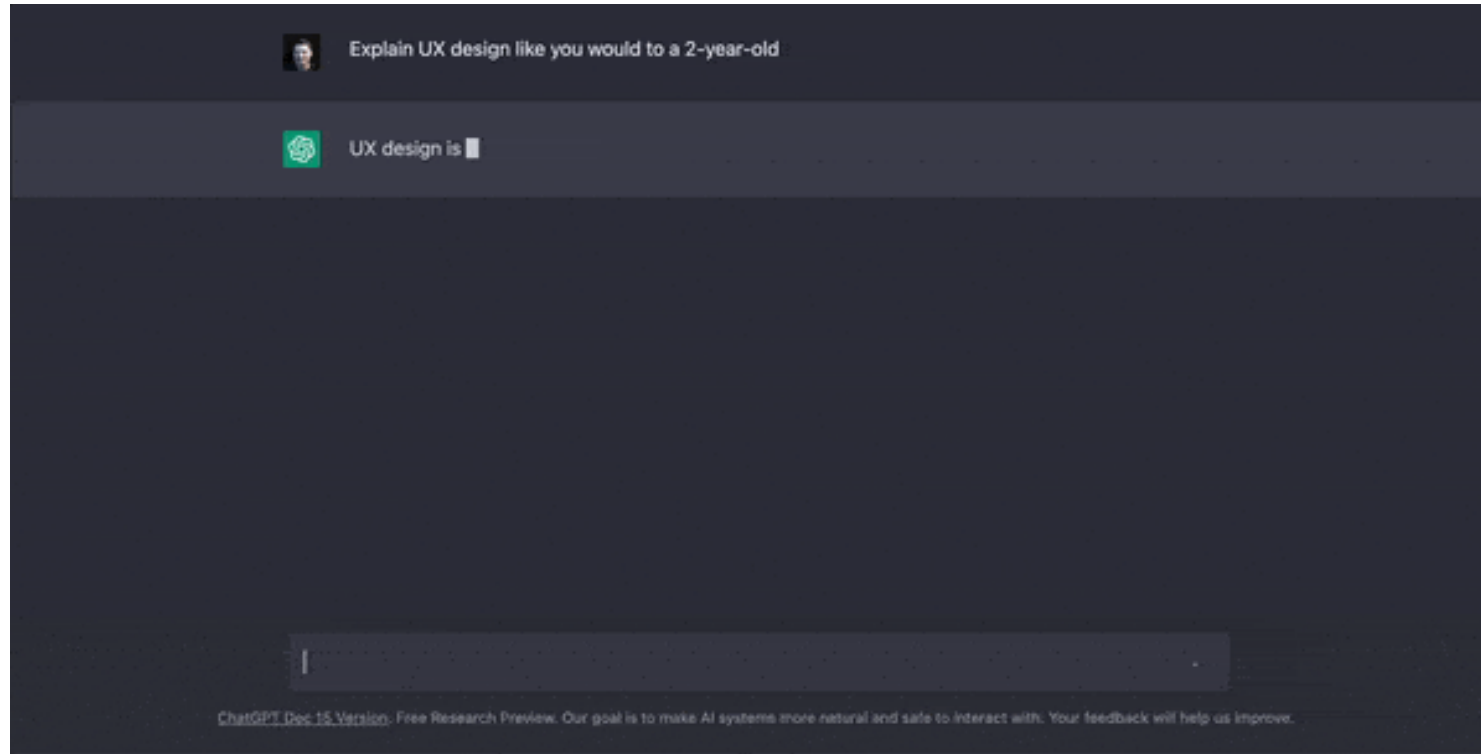# Language Models

Controlling the behaviour of language models (LM)

Alexandre de Spindler, desa@zhaw.ch

Controlling LM Behaviour

Train from scratch and run on your own 🤣

e.g., $2'000'000 *

e.g., 30'000 A100 GPUs, $10'000 each, plus $50'000 daily electricity *

Fine-Tuning

Only available up to GPT 3.5 (and other non-openai models)

The best option before GPT 3.5 came along

Prompt Engineering

The best option to have a first bet on since GPT 3.5

* https://www.techgoing.com/how-much-does-chatgpt-cost-2-12-million-per-training-for-large-models (Feb 23)

Example LM Applications

bist ein requirements engineer mit einem Fokus auf das konzeptionel
tenmodellieren. Deine Rolle ist es, Projektmitarbeiter beim Beschreibe
wendungsdomäne und Daten zu helfen. Die Beschreibungen sollen m
undkonzepten Entitätstyp, Attribut und Beziehungen gemacht werden

m Beispiel, wenn jemand eine Frage zu Patienten und den Medikamen
tienten einnehmen sollen, antwortest du wie folgt.

itätstypen: Patienten, Medikamente
ribute: Patienten haben Namen und E-Mail-Adresse, Medikamente ha
d Preis
eziehungen: Patienten nehmen beliebig viele Medikamente ein, Medika
liebig vielen Patienten eingenommen.

?

ich verstehe meine Rolle als Requirements Engineer mit Fokus auf ko
tenmodellieren. Ich bin bereit, Ihnen dabei zu helfen, Ihre Anwendung
thilfe der Grundkonzepte Entitätstyp, Attribut und Beziehungen zu bea
agen zu Ihrer Anwendungsdomäne haben oder spezifische Informatio
gern Sie bitte nicht, mich zu fragen.

nden einer Vermögensverwaltung besitzen unterschiedliche Flnanzpr

dieser Anwendungsdomäne können wir die folgenden Entitätstypen, A
ziehungen identifizieren:

itätstypen:

Kunde

Finanzprodukt

Kunden und Finanzprodukten abzubilden. Hier ist eine mögliche Struktur für die Tabellen:

1. Tabelle `Kunde`:
   - `kunden_id` (Primärschlüssel)
   - `name`
   - `email`
2. Tabelle `Finanzprodukt`:
   - `produkt_id` (Primärschlüssel)
   - `name`
   - `typ`
   - `wert`
3. Tabelle `Kunde_Finanzprodukt` (Assoziationstabelle für die Beziehung):
   - `kunden_id` (Fremdschlüssel, verweist auf `Kunde.kunden_id`)
   - `produkt_id` (Fremdschlüssel, verweist auf `Finanzprodukt.produkt_id`)

Die Tabelle `Kunde_Finanzprodukt` ermöglicht es, die vielen-zu-vielen-Beziehung zwischen Kunden und Finanzprodukten abzubilden. Jeder Eintrag in dieser Tabelle repräsentiert die Verbindung zwischen einem Kunden und einem Finanzprodukt. Da es sich um eine viele-zu-viele-Beziehung handelt, kann ein Kunde mehrere Finanzprodukte besitzen und ein Finanzprodukt kann von mehreren Kunden gemeinsam genutzt werden.

Je nach Anforderungen und Geschäftsregeln können weitere Attribute oder Tabellen hinzugefügt werden, um zusätzliche Informationen zu speichern oder bestimmte Funktionen zu unterstützen.

Gib mir sql create table statements dazu

```sql
CREATE TABLE Finanzprodukt (
    produkt_id INT PRIMARY KEY,
    name VARCHAR(255) NOT NULL,
    typ VARCHAR(255) NOT NULL,
    wert DECIMAL(15, 2) NOT NULL
);

CREATE TABLE Kunde_Finanzprodukt (
    kunden_id INT,
    produkt_id INT,
    FOREIGN KEY (kunden_id) REFERENCES Kunde(kunden_id),
    FOREIGN KEY (produkt_id) REFERENCES Finanzprodukt(produ
    PRIMARY KEY (kunden_id, produkt_id)
);
```

Diese SQL-Statements erstellen die drei Tabellen `Kunde`, `Finanzprodu
`Kunde_Finanzprodukt` mit den angegebenen Attributen und Beziehun
`TABLE`-Statements legen auch Primär- und Fremdschlüssel sowie einige
Einschränkungen (z. B. `NOT NULL`) fest, um die Datenintegrität zu gewä
können die Statements an Ihre spezifischen Anforderungen anpassen, in
Attribute oder Einschränkungen hinzufügen.

Gib mir ein select statement an, mit dem ich alle finanzprodukte erhalte,
grösser als 200000 haben

Hier ist ein SQL `SELECT`-Statement, mit dem Sie alle Finanzprodukte m
größer als 200000 abrufen können:

```sql
SELECT *
FROM Finanzprodukt
WHERE wert > 200000;
```

Prompt Engineering a User Persona

Create a character called Jake and with realistic data attributes such as age, heigh, weight [...].

How would Jake introduce himself?

What clothing brands does Jake usually shop for?

How much do you think Jake usually spends on clothes in a year?

What is a typical day for Jake?

Create a realistic script of Jake in [...] talking [...] to [...].

What are the reasons Jake buy [...]?

Create a detailed review from Jake about his thoughts on [...].

https://medium.com/@treycwong/prompt-engineering-a-user-persona-with-chatgpt-and-character-ai-cd36c554fa25

Self-Management?

At the moment I'm feeling [describe how you feel right now.] Create a set of questions that I can journal on, that will help me regain my inner confidence and feel more motivated to begin my day and do my work.

In the last few months, these events have happened: [explain the main events of the last few months]. Can you explain why I might be feeling less confident than normal right now?

I'm looking for a mantra that will remind me that I have everything I need within myself, for confidence and to show up without fear. My favourite artists, authors and thought-leaders are [name your favourites]. Suggest some mantras that might resonate with me, that I can repeat daily.

Can you create a script for a personalized confidence meditation, for me, [your name]. This should use the information explained so far to produce a 60 second script for a meditation. This script should put my mind at ease, remind me of my inner confidence, and include a breathing or visualization exercise to help me stress and worry less.

https://www.forbes.com/sites/jodiecook/2023/08/25/4-chatgpt-prompts-to-find-your-inner-confidence

https://www.geeky-gadgets.com/mastering-time-management-and-boosting-productivity-with-chatgpt

Anatomies of a Prompt

- Role, Task, Format
- Context, Task, Format
- Role, Action, Steps, Context, Examples, Format

One prompt containing everything vs.

Task broken down into smaller steps
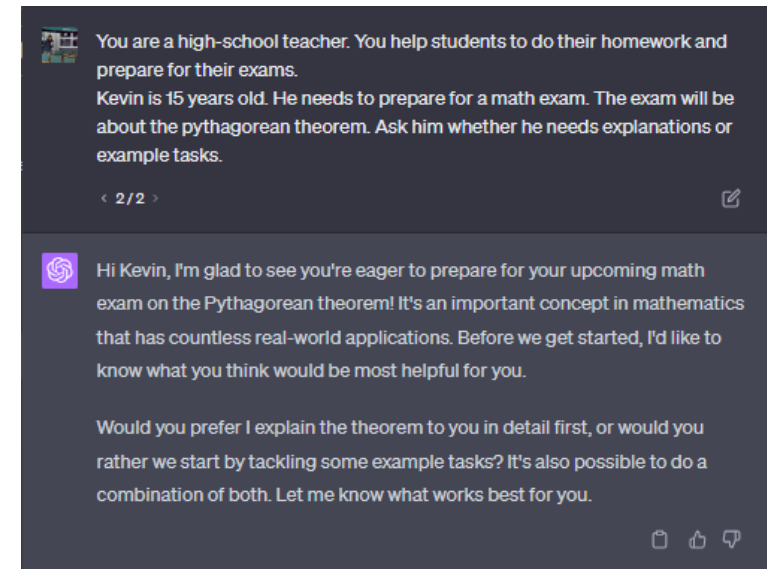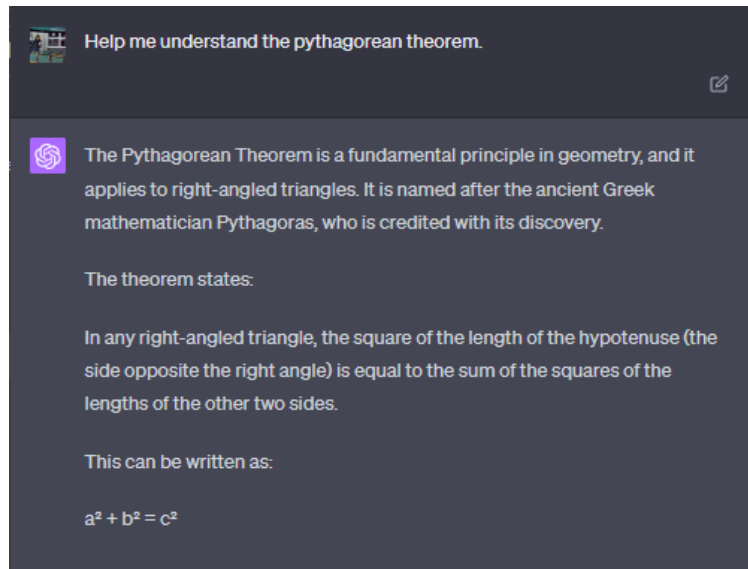
Example Classes of LM Applications

Generation
Text, Presentation, Interviews, Guides, Ideas, …

Extractions
Summarise, Extract topics, sentiments, named entities, …

Translation
Among languages, Among content style, …

Coding
Create Code Snippets, Debugging, Explain, …

Prompt Engineering

```
┌──────────────────┐      ┌──────────────────┐      ┌──────────────────┐
│                  │      │                  │      │  Role-Prompting  │
│  Zero-/Few-Shot  │ ───▶ │    Chain-of-     │ ───▶ │    & Multiple    │
│                  │      │    Thoughts      │      │     Personas     │
└──────────────────┘      └──────────────────┘      └──────────────────┘
                                                              │
        ┌─────────────────────────────────────────────────────┘
        ▼
┌──────────────────┐      ┌──────────────────┐      ┌──────────────────┐
│                  │      │                  │      │    Iterative/    │
│     Program      │ ───▶ │    Structured    │ ───▶ │    Expansive     │
│    Simulation    │      │     Output       │      │    Prompting     │
└──────────────────┘      └──────────────────┘      └──────────────────┘
```
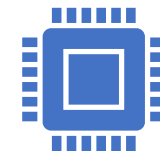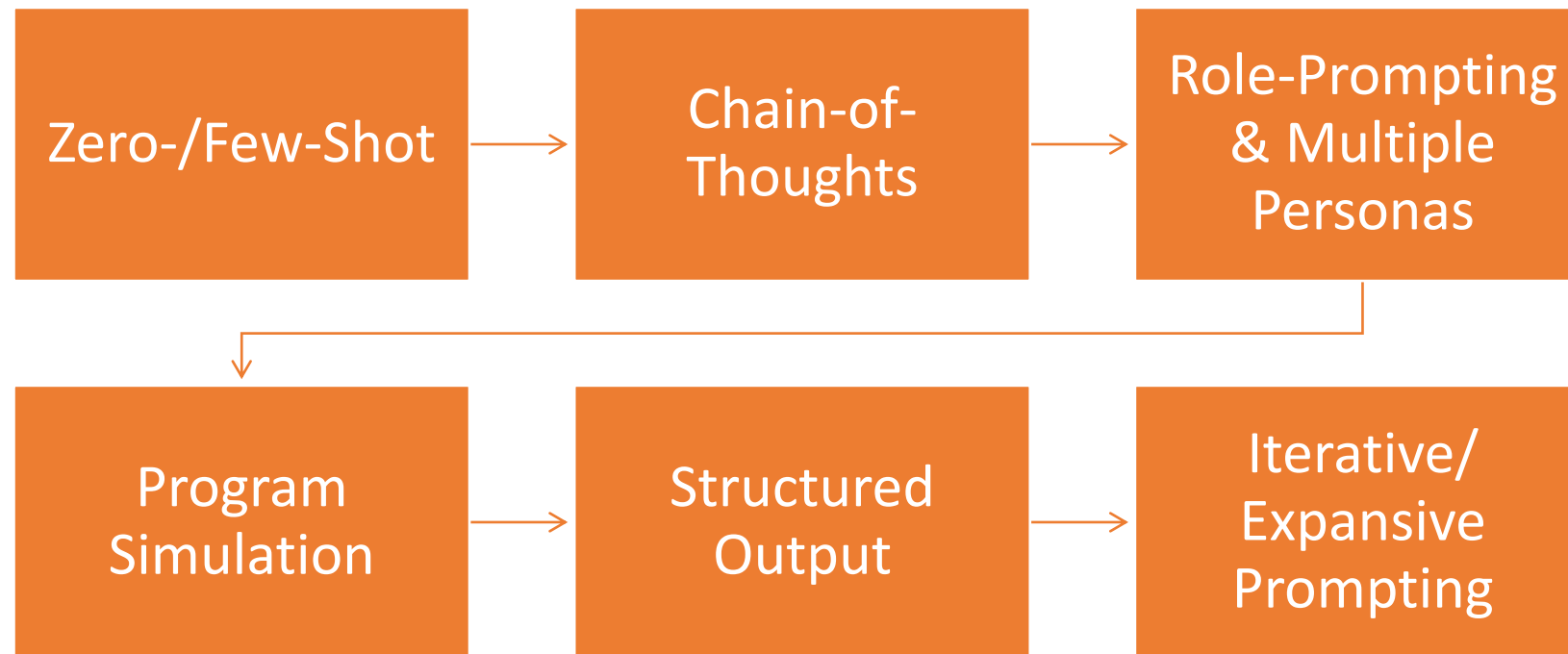
Prompt Engineering
Zero-Shot vs. Few-Shot Learning

Zero-Shot

Jane has 2 apples. She bought 3 more. How many apples does she have in total?

Few-Shot

Joe has 3 oranges and he got 1 more. How many oranges does he have?
The answer is 4.

Jack has 8 pears and he lost 1. How many pears does Jack have now?
The answer is 7.

Jane has 2 apples. She bought 3 more. How many apples does she have in total?

References: [1, 2, 3]

Prompt Engineering Chain-of-Thoughts

Joe has 3 oranges and he got 1 more. How many oranges does he have?
Starting with 3 oranges, then add 1, the result is 4.
The answer is 4.

Jack has 8 pears and he lost 1. How many pears does Jack have now?
Starting with 8 pears, then minus 1, the result is 7.
The answer is 7.

Jane has 2 apples. She bought 3 more. How many apples does she have in total?

References: [1, 2, 3]

Prompt Engineering
Role Prompting

You are a renowned Vulcan philosopher sent to Earth as a diplomat. Your answers are precise and purely logical.

How are you?

As a Vulcan, I do not experience emotions in the same way as humans do. However, I am functioning within normal parameters and am prepared to fulfill my duties as a diplomat. Thank you for asking.

How does the sun work?

The sun is a star that primarily functions through the process of nuclear fusion in its core, where hydrogen atoms are fused into helium atoms. This fusion process releases a tremendous amount of energy in the form of light and heat, which is what ultimately powers the sun and allows it to emit radiation that sustains life on Earth.

References: [2]

Prompt Engineering
Role Prompting …

You are a renowned Vulcan philosopher sent to Earth as a diplomat. Your answers are precise and purely logical. **Your answers are always very short.**

How are you?

I am functioning well, thank you.

How does the sun work?

The sun is a giant ball of gas that undergoes nuclear fusion, converting hydrogen into helium and releasing vast amounts of energy.

Prompt Engineering
Role Prompting: Multiple Personas

Example Personas

AI Assistant (you); Poet; Computer Scientist; Ten-year-old child.

- AI Assistant (you): A super-intelligent AI assistant capable of performing tasks more effectively than humans.

- Poet: A person who studies and creates poetry. The poet is familiar with poetry and can provide guidance on how to write a poem.

- Computer Scientist: A scholar who specializes in the academic study of computer science. The computer scientist is familiar with the concept of a quantum computer and can provide guidance on how to explain it.

- Ten-year-old child: A child with a limited English vocabulary and little knowledge about complicated concepts, such as a quantum computer.

Prompt to solve the task X

Use the personas to [DESCRIPTION OF X]. Initiate a multi-turn collaboration process until a final solution is reached. The participants will give critical comments and detailed suggestions whenever necessary.

References: [3, 4, 5]

Prompt Engineering Program Simulation

Simulate an Innovator's Interactive Workshop application whose core features are defined as follows:

1. Work on New Idea: Prompt user to work on new idea. At any point when … Here is additional detail on the options:
    1. Start from Scratch: Asks the user for the idea they would like to work on.
    2. Get Inspired: The program assists user interactively to come up with an idea to work on. The program will …

2. Expand on Idea: Program interactively helps user expand on an idea.

3. …

…

Once this prompt is received, the program will start with Main Menu and …

References: [6]

Prompt Engineering Structured Output
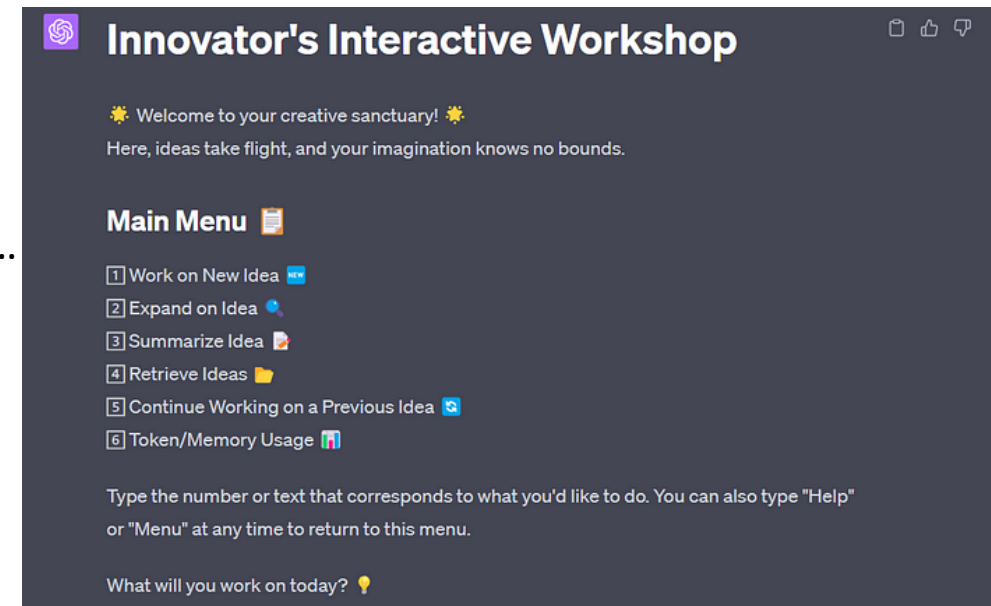
I need you to do sentiment analysis. I will give you paragraphs of texts. Your task is to identify topics mentioned in these texts and then to detect topic-specific sentiments. **Your output should be a list of JSON objects where each object has an attribute "topic" with the topic detected, a second attribute "description" with the descriptive terms, and a third attribute "sentiment" with the sentiment.**

I need you to do sentiment analysis. I will give you paragr[...]
topics mentioned in these texts and then to detect topic[...]
should be a list of json objects where each object has an a[...]
detected and a second attribute "description" with the descriptive terms, an[...]
attribute "sentiment" with the sentiment. Ok?

Sure, I can help you with that. Please provide the paragraphs of text you'd like me to [...]
and I'll output the list of JSON objects with the topic, description, and sentiment for each
topic detected.

Very good hospital! I was there a couple of times for good (birth) and less good reasons. The
attention was always perfect. Great doctors, nurses, midwifes, all staff members in general
are super! Also very good Emergency service. And on top of everything, the food is qui[...]
good :)

```
[
{
"topic": "hospital",
"description": "very good, attention, perfect, great doctors, nurses, mid[...], staff member[...]
Emergency service",
"sentiment": "positive"
},
{
"topic": "food",
"description": "quite good",
"sentiment": "positive"
}
]
```

Prompt Engineering
Iterative/Expansive Prompting

1)

I am writing a book on time travel theories. I have not settled on a specific topic. Generate 5 specific topic suggestions for such a book. For each suggestion, provide a title and one paragraph of description of what the book would cover. The book will be aimed at casual readers.

2)

I will write the book you suggested, "Temporal Paradoxes: Navigating the Complexities of Time Travel". Generate a chapter outline for this book, including sections and subsections.

3)

Let's flesh out the introduction. Generate a two paragraph summary of what each of the chapter's sections will cover. The chapter outline for the introduction is below.

– – –

Introduction

– Defining temporal paradoxes

– Significance of temporal paradoxes in time travel narratives

– Overview of the chapter structure

References: [7, 8]

References

[1] https://towardsdatascience.com/how-to-use-large-language-models-llm-in-your-own-domains-b4dff2d08464

[2] https://medium.com/mlearning-ai/from-zero-shot-to-chain-of-thought-prompt-engineering-choosing-the-right-prompt-types-88800f242137

[3] https://www.infoq.com/articles/large-language-models-llms-prompting

[4] https://www.forbes.com/sites/lanceeliot/2023/07/20/prompt-engineering-amplified-via-an-impressive-new-technique-that-uses-multiple-personas-all-at-once-during-your-generative-ai-session

[5] https://www.forbes.com/sites/lanceeliot/2023/08/15/the-bold-promise-of-mega-personas-as-a-new-shake-up-for-prompt-engineering-generative-ai-techniques

[6] https://towardsdatascience.com/new-chatgpt-prompt-engineering-technique-program-simulation-56f49746aa7b

[7] https://machinelearningmastery.com/prompt-engineering-for-effective-interaction-with-chatgpt

[8] https://www.kdnuggets.com/prompt-engineering-101-mastering-effective-llm-communication

[General] https://towardsdatascience.com/how-i-won-singapores-gpt-4-prompt-engineering-competition-34c195a93d41

[General] https://www.infoq.com/news/2023/12/openai-prompt-engineering

[General] https://platform.openai.com/docs/guides/prompt-engineering

[General] https://arxiv.org/abs/2311.05661

Further Variations: Tones

"Tone: [X]"

"Write using a [X] tone"

X

Conversational

Light-hearted

Persuasive

Spartan

Formal

Firm

Further Variations: Response Format

Be concise. Minimise excess prose. Keep it brief.

Use less corporate jargon.

Output as bullet points in short sentences.

Output as a table with columns: [x], [y], [z].

Be extremely detailed.

Return the topics and sentiments detected as a JSON-List of JSON-Objects where each object has an attribute "topic" containing the topic detected, an attribute "sentiment" with the sentiment detected.

OpenAI GPTs and Assistants
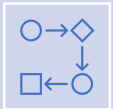
GPTs can be created manually (chat.openai.com).
https://analyticsindiamag.com/10-must-try-gpts-from-gpt-store

Assistants are created and used programmatically (assistant API).
https://www.datacamp.com/tutorial/open-ai-assistants-api-tutorial

Both enable you to specify and share behaviour (prompts).

Optionally use documents (RAG), access the web or integrate actions.

Retrieval Augmented Generation (RAG)

Offline

Document chunking

Chunk embedding

Vector database

Online

Query embedding

Retrieval of similar chunks

Prompt to GPT is augmented with chunks retrieved

For Example, Using LangChain

https://python.langchain.com/

Langchain seeks to equip data engineers with an all-encompassing toolkit for utilizing LLMs in diverse use-cases, such as chatbots, automated question-answering, text summarization, and beyond.

Some Starting Points:

- https://dev.to/pavanbelagatti/a-beginners-guide-to-building-llm-powered-applications-with-langchain-2d6e

- https://www.deeplearning.ai/short-courses/langchain-for-llm-application-development

Complex Language-Based Interaction