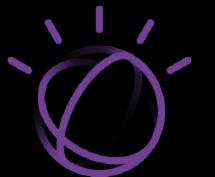


The Future of AI: Transforming Our World Over the Next 5 Years

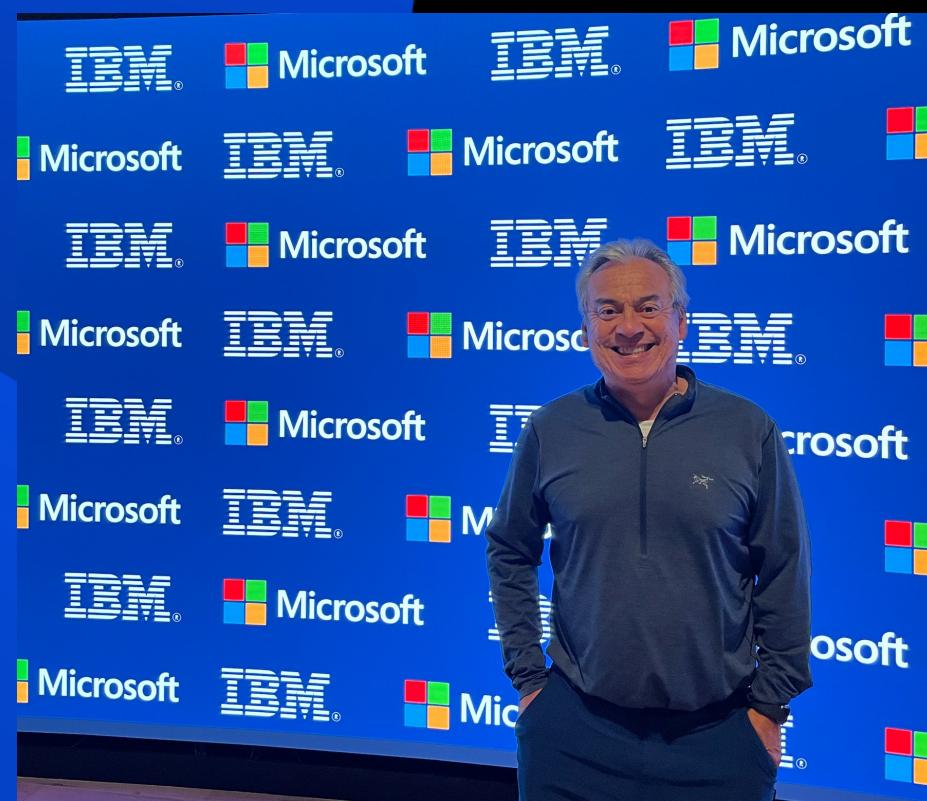
AI Fundamentals



Ivan Portilla
Portilla@gmail.com
github.com/jiportilla/giveback



RICOH



Objectives of This Talk

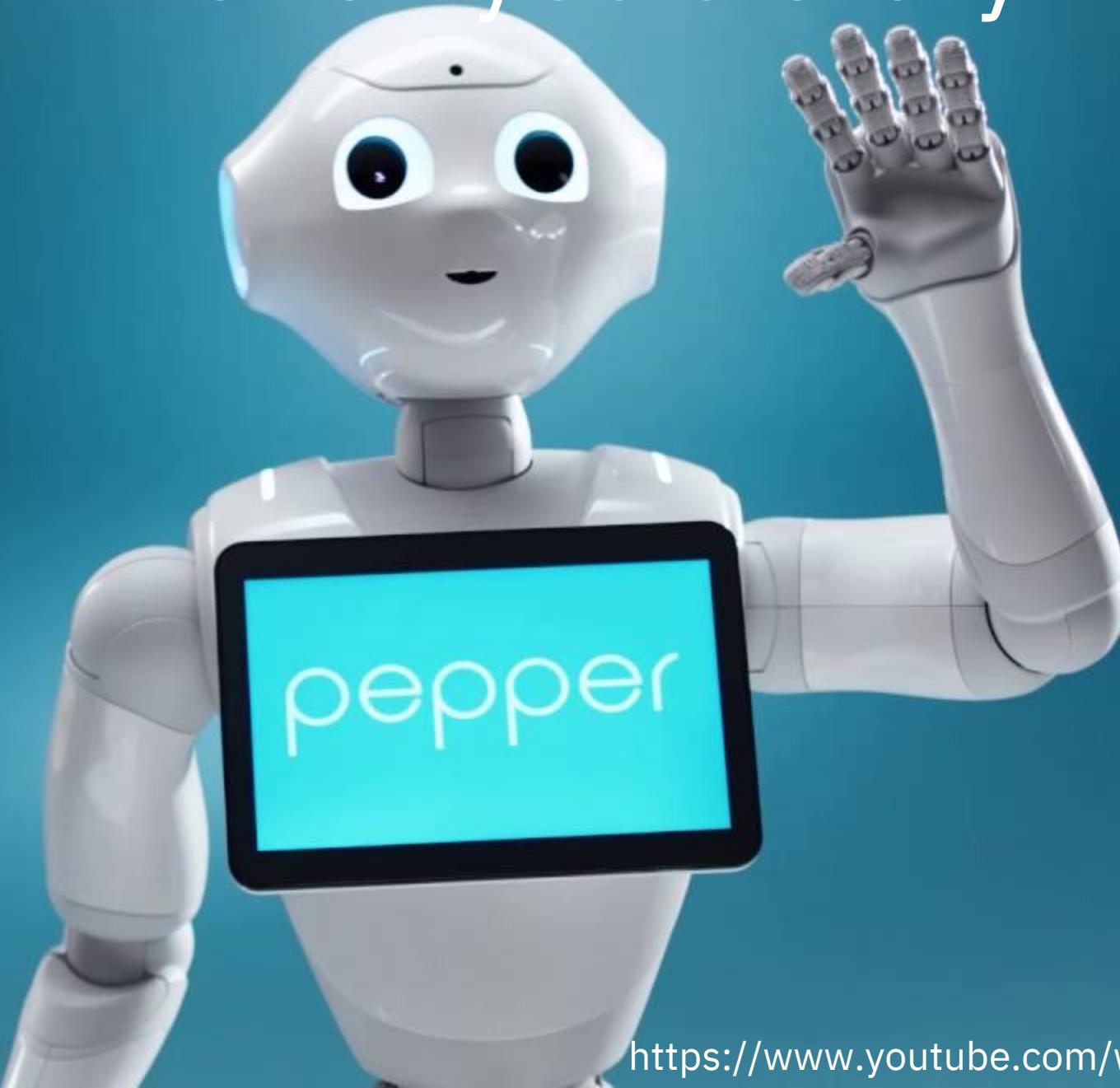
Upon completion of this lecture, you will understand:

- Origins of Modern Artificial Intelligence (AI)
 - ✓ Primer on AI, Machine Learning (ML), Deep Learning (DL)
 - ✓ Generative AI & Large Language Models (ChatGPT)
- Current Landscape
- Long-term Vision: Where is AI headed next

Agenda

1. Artificial Intelligence
 - GenAI (ChatGPT)
2. Current & Next AI use cases
3. Closing Remarks & Q&A

Let me tell you a story



<https://www.youtube.com/watch?v=i9ZF9EYHyDE>



Robo del siglo

<https://www.bbc.com/news/world-latin-america-28783027>

Entity Resolution

Solution at Degrees of Difficulty

<https://senzing.com>

Exactly
Same

Bob Jones
123455

Bob Jones
123455

Fuzzy

Bob Jones
123455

Robert T Jonnes
000123455

Incompatible
Features

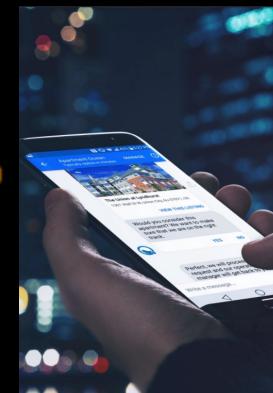
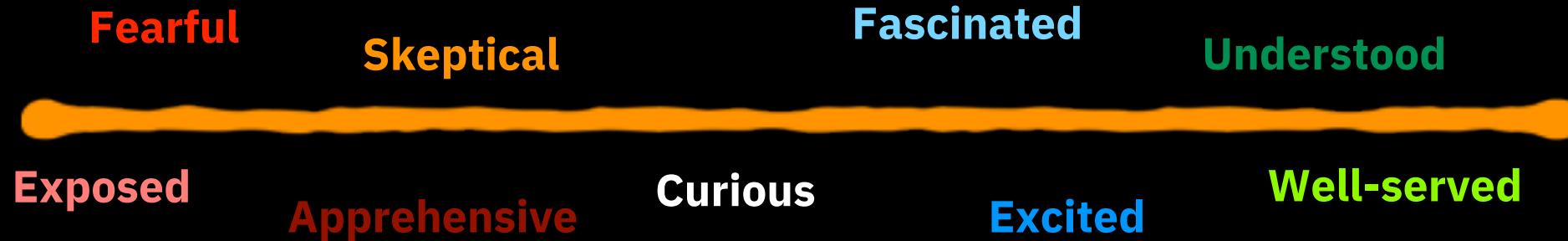
Bob Jones
123455

What is AI?

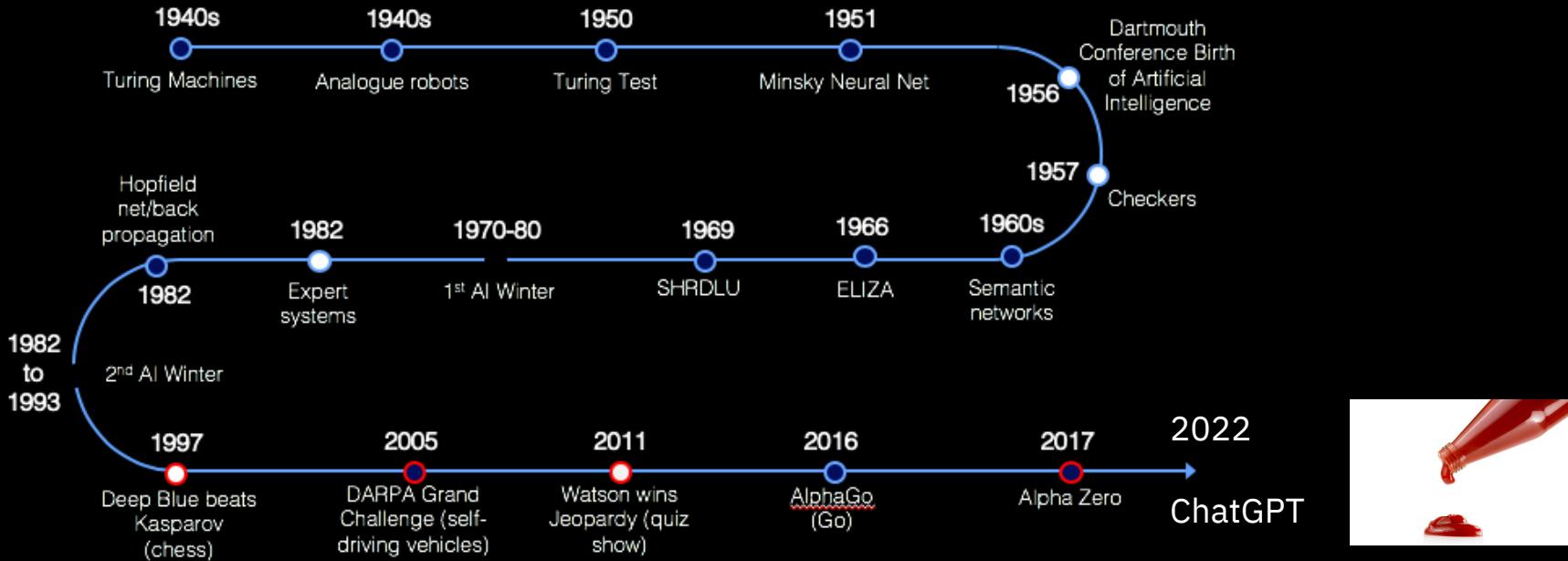
poll

AI Perception

What do people feel about AI?



A brief history of AI



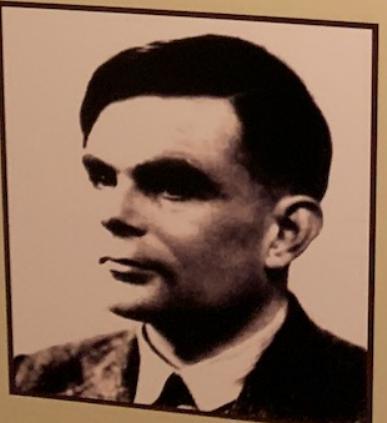
ALAN TURING'S OFFICE

Here at his desk in Hut 8, Turing took the lead on breaking naval Enigma ciphers – something few thought could ever be done. His mathematical skills also enabled him to break other ciphers, including the complex Lorenz cipher where he used a method that became known as Turingery. Together with his fellow Codebreaker Gordon Welchman, he developed the Bombe machine to help speed up the codebreaking process.

IN THEIR WORDS

If anyone was indispensable to Hut 8 it was Turing. The pioneer work always tends to be forgotten when experience and routine later make everything seem easy, and many of us in Hut 8 felt that the magnitude of Turing's contribution was never fully realised by the outside world.

Hugh Alexander, Codebreaker, Hut 8



What is AI?

Artificial Intelligence | noun

An area of computer science that emphasizes the creation of intelligent machines that work and react like humans.

What led to the prominence of AI?

- ✓ Data explosion
- ✓ Computing power
- ✓ Deep learning algorithms

What is AI?

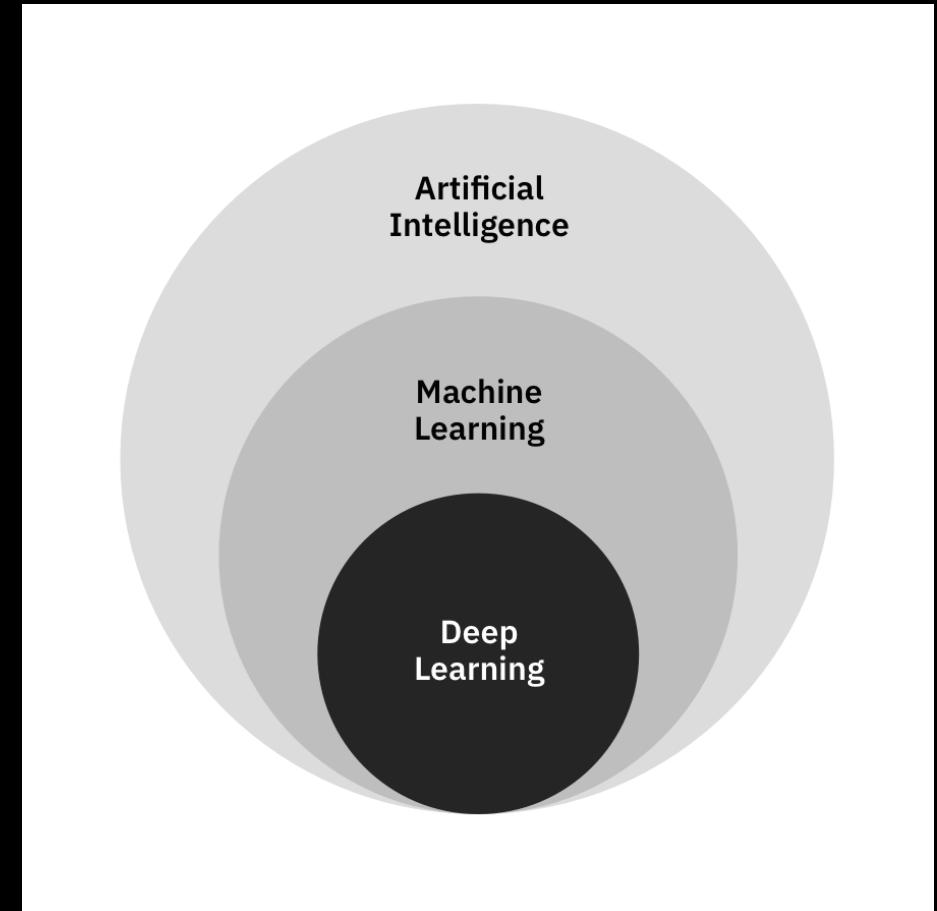
Artificial Intelligence | noun

An area of computer science that emphasizes the creation of intelligent machines that work and react like humans.

Intelligence demonstrated
by machines

Definitions

- AI: Intelligence demonstrated by machines
- ML: Set of algorithms that allow computers to learn from (big) data
- DL: Set of learning techniques focused on models and neural networks

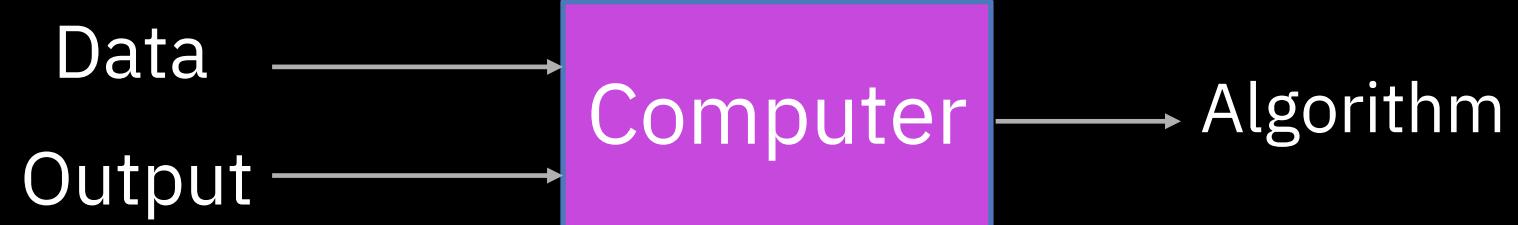


Why Machine Learning?

Traditional Programming



AI-Machine Learning



ML provides systems the ability to automatically learn from experience
(without being explicitly programmed)

Intelligence demonstrated
by architects

Exercise 2

Lab 1

Create a rule-based system that evaluates the **suitability** of a building design for **different** climates (e.g., tropical, arid temperate)

1. Rule Development:

1. In groups, develop a set of rules that evaluate building designs. For instance, consider aspects such as material choices, window placements, insulation, and orientation.
2. Example Rule: If the building is in a tropical climate and has large windows facing west, then suggest adding shades to reduce heat gain.

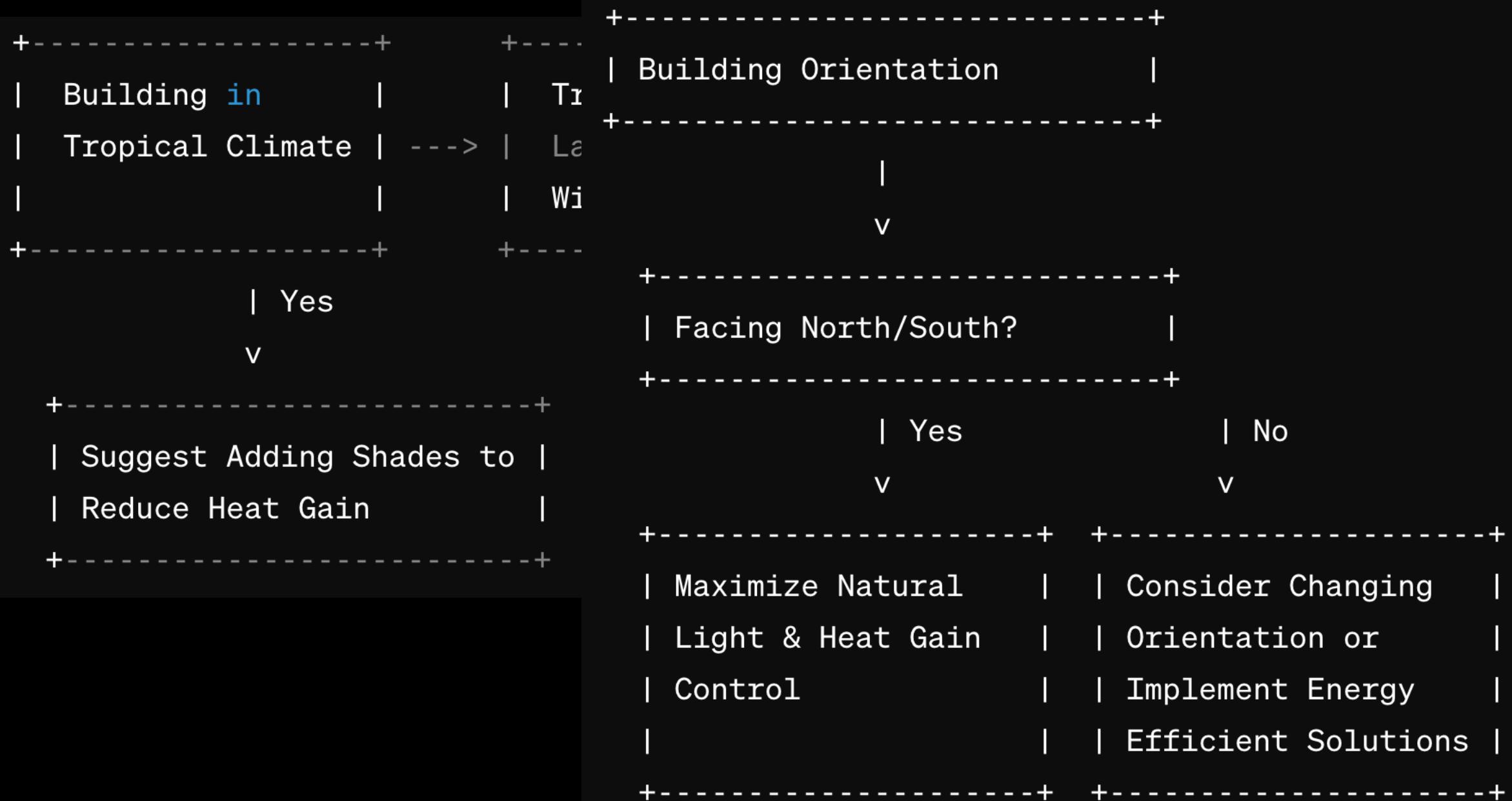
2. Implement Rules with Flowcharts:

1. Draw flowcharts to represent how your rules interact and lead to design evaluations. This helps visualize the decision-making process.

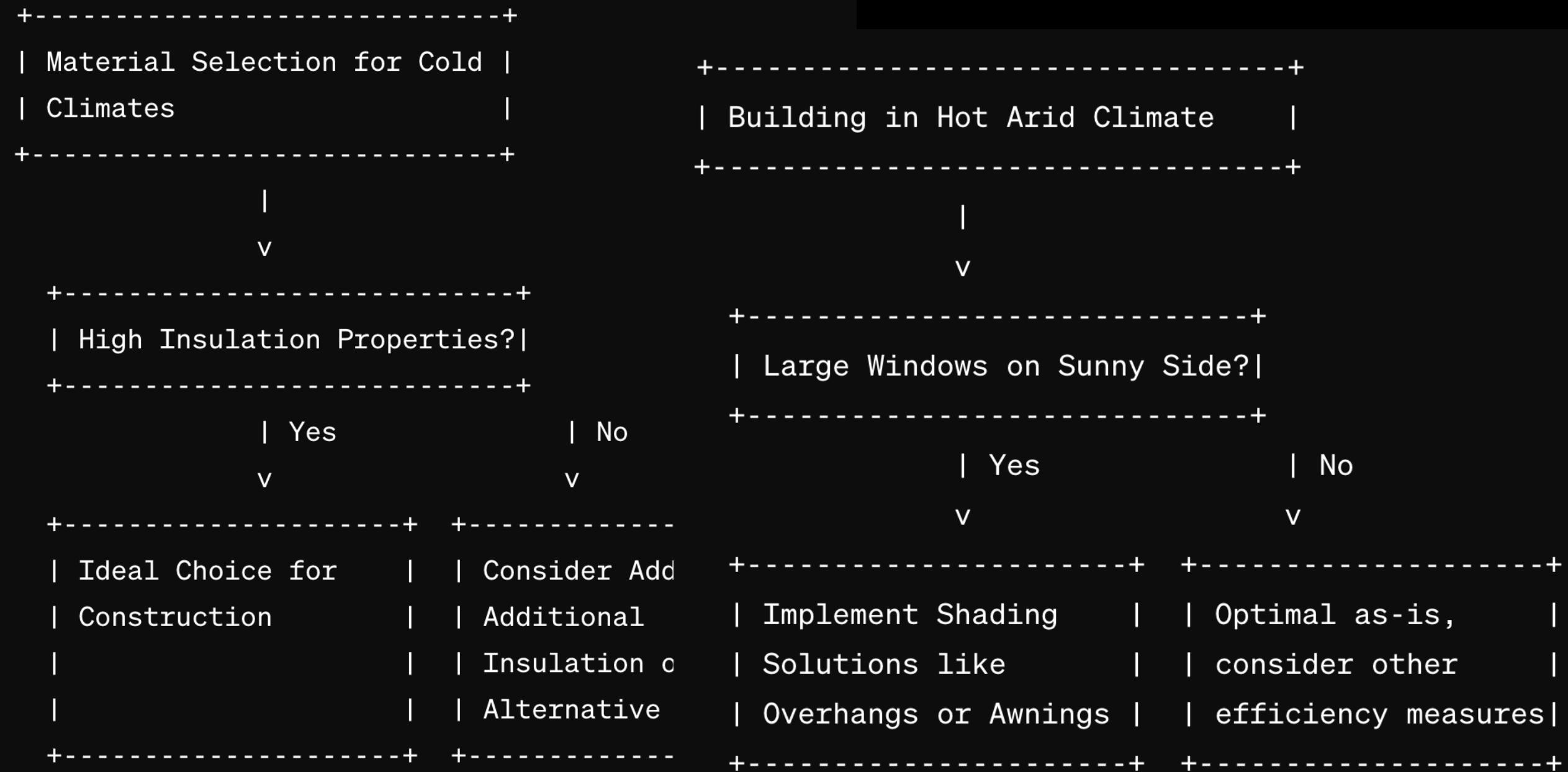
3. Discussion and Feedback:

1. Present your flowcharts and rule sets. Discuss how different rules affect the outcomes and how such a system could be implemented in software.

Example



Example



PB&J Recipe

Exercise 1

Program how to make a Peanut Butter & Jelly sandwich

1. Get ingredients (PB, Jelly, Bread)
2. Get cooking utensils (plate, knives)
3. Get two slices of bread
4. Open PB, Jelly jars
5. With a knife spread 2 Tablespoons of peanut butter on one piece of bread
6. With a different knife, spread 2 Tablespoons of jelly on the other slice of bread
7. Put the slices together
8. Toddler adaptation: cut off crusts before serving.
9. Place on plate & serve



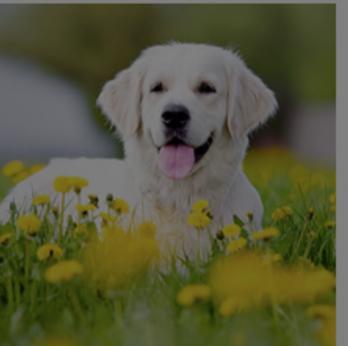
Exercise 3

Machine Learning.

Sample



Label



dog



cat



horse

Human Learning:

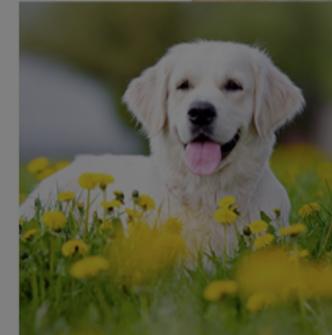
We learn through



Cat or Dogs

Long Ear Black nose

dog



Machine Learning:

Sample



Label



dog



cat



horse

Human Learning:

We learn through



Long Ear Black nose

dog



Examples

Diagrams

Comparisons

Exercise 4

A photograph of a highway scene. In the foreground, the side of a white semi-truck is visible, showing its trailer and rear wheels. The road is a two-lane highway with a solid yellow line on the left and a dashed white line on the right. In the distance, another truck and a car are visible on the road. To the left, there is a yellow diamond-shaped road sign with a black silhouette of a car on a winding road. The background consists of a dense forest of green trees under a clear sky.

Passing truck in
highway

Passing truck in highway

Don't Follow Closely Behind Prior to Passing

- As you prepare to pass, keep a healthy distance between your car and the truck in front of you. At minimum, 30 feet should separate the two vehicles. Signal clearly to indicate your next move.

Pass in the Left Lane

- The left lane is referred to as the 'passing lane' for a reason; it's the safest place to pass any vehicle, but particularly trucks and buses. It's frustrating to be stuck behind a slow truck in the left lane, but resist the urge to pass on the right side.

Don't Linger in the Truck's Blind Spot

- Trucks have huge blind spots on both sides. Pass promptly while still abiding by the speed limit. Don't hang out in the blind spot area, which, in the left (passing) lane, constitutes the truck's entire front half.

Recognition

- With GPS navigation, HiRes cameras, Laser-radar cameras: Location, speed of trucks, road conditions, emergency lane
- With Image Recognition: Turn signal (!lamp), paper or debris on the road

Insights

- Data is fed into multiple CPUs + collected data + rules
- Manufacturer knows who has the right of the way, when trucks can pass + MM miles driven have feedback on different driving style

Action (Cognitive Decision)

- Assist (alerts driver)
- Act (Pass or Not pass, Measure decision effects, feedback loop, and share w other cars)

Where is AI going?

poll

AI is Everywhere

Everyone working with information technology is already relying on AI, and if not, will be soon.

AI is Everywhere

AUTOMATION



Automating actions, processes, and alerts

CONVERSATION



Understanding text and answering questions in natural language

OPTIMIZATION



Analyzing data for patterns and outliers and deriving insights

RECOMMENDING AND INSIGHTS



Understanding needs and recommending solutions

PERSONALIZING



Personalizing experiences

VISUAL RECOGNITION



Recognizing objects in images and videos

Let's look at some interesting trends.

AI Means Business Across All Industries

E-COMMERCE:
Recommender
Systems

EDUCATION:
Research Insight

FINANCE:
Fraud Detection

GOVERNMENT:
Smarter Services

HEALTHCARE:
Patient Diagnosis

- **Opportunity Identification**
- **Competitive Advantage**
- **Intelligent Content**
- **Sales Growth**

MANUFACTURING:
Anomaly Detection

MEDIA:
Interaction & Speed

NETWORKS:
Intrusion Detection

RETAIL:
Inventory
Optimization

TRANSPORTATION:
Demand
Forescating

The GenAI Software Market Will Grow To \$79 Billion Globally By 2030

Explosive Growth: Generative AI is set to dominate 55% of the AI market by 2030, growing at an annual rate of 36%.

Sector-Specific Investments: \$79 billion will be spent annually on specialized AI applications in security, health, and marketing by 2030.

Broad Applications: General use cases like chatbots will see \$42 billion in annual spending by 2030.

Emerging Opportunities: New revenue streams will open, including paid access to data and increased sales of AI-related hardware.

Current Challenges: Growth is hampered by unresolved regulatory, ethical, and technical issues.

Pre LLMs Demonstration

Future of AI Example (Semantic Analysis)

The Wining Shot

The soccer game was nearly over. The two teams were tied, one to one.

Alice kicked the ball. Oops! She kicked it the wrong way.

"What a bad kick," Alice thought.

But wait!. Her teammate John jumped to stop the ball. The ball went off John into the goal!.

Alice's team won the game. Hooray! It was not a bad kick, after all.

Who won the game?

Why?

Future of AI Example

The Wining Shot

The soccer game was nearly over. **The two teams were tied, one to one.**

Alice kicked the ball. Oops! She kicked it the wrong way.

"What a bad kick," Alice thought.

But wait!. **Her teammate John** jumped to stop the ball. **The ball went off John into the goal!!**

Alice's team won the game. Hooray! It was not a bad kick, after all.

Who won the game?

Answer: Alice's team
✓ **Correct**

Explanation: Alice's team won the game because Alice's team had more points than the other team

✓ **Correct**

Conversational AI

This is a **natural** conversation.



Milena



Lawrence

hey!



hiya



it was okay



the weather kind of ruined some plans I had



ah that's annoying I'm sorry



what time are you thinking?



We can link up at 7 and head out after



alright, sounds good! i'll text you



sick, see you then



This is a **designed** conversation.



Bot



Lawrence

hey! 🙌



how was your weekend bud?



ah that's annoying I'm sorry



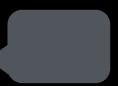
If you're free we should go to a couple of free shows downtown tonight



We can link up at 7 and head out after



sick, see you then

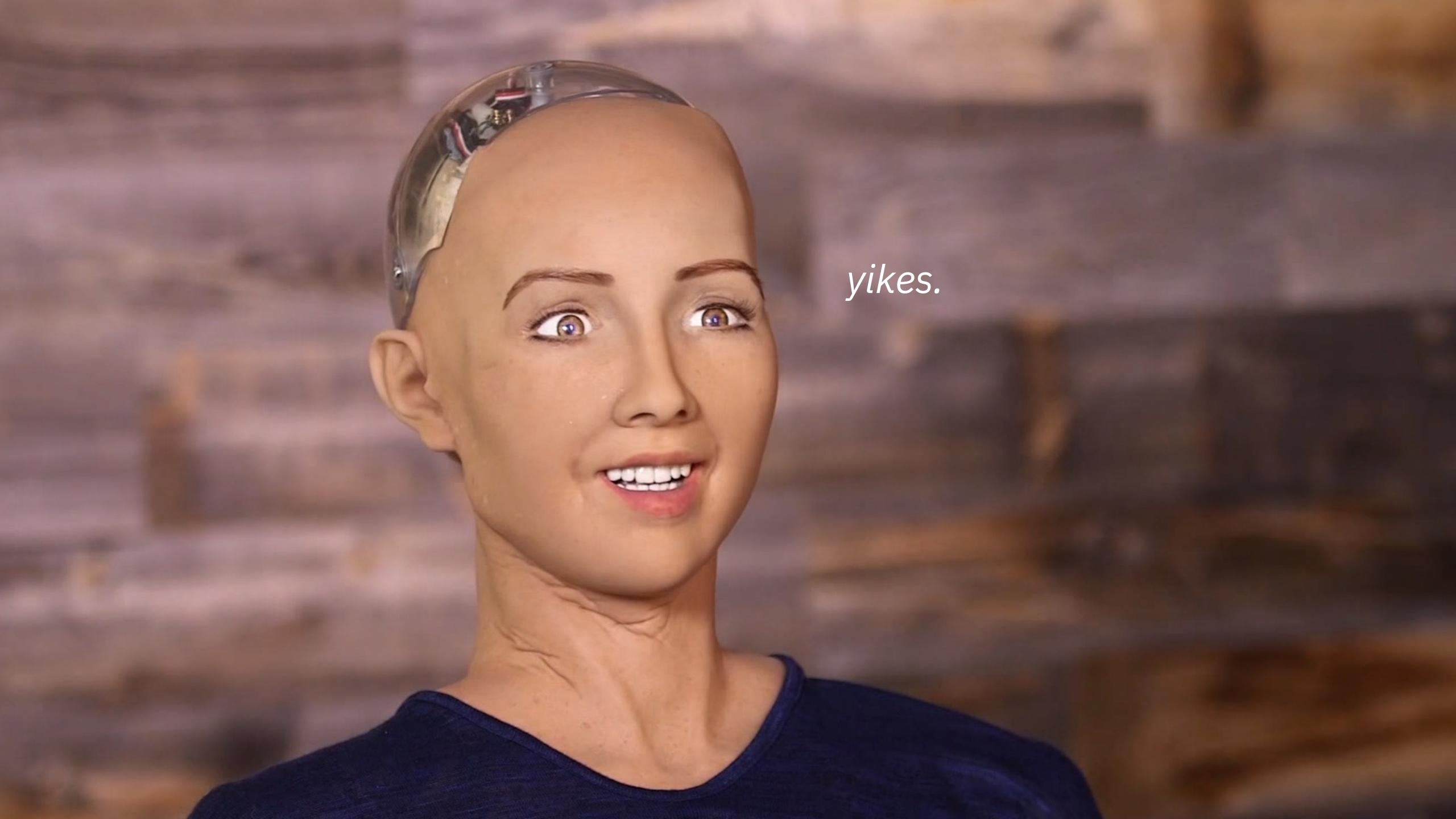




life partner

Our expectations
are out of sync
with reality





yikes.

Conversation fundamentals

Since conversation is the bedrock of meaningful relationships, a bot must be capable of holding an intelligent, two-way conversation.

Conversations
consist of:



Milena



Lawrence

Utterances

The individual statements that are articulated.



hiya

it was okay

the weather kind of ruined some plans I had

ah that's annoying I'm sorry

If you're free we should go to a couple of
free shows downtown tonight

what time are you thinking?

We can link up at 7 and head out after

alright, sounds good! i'll text you

sick, see you then



Conversations consist of:

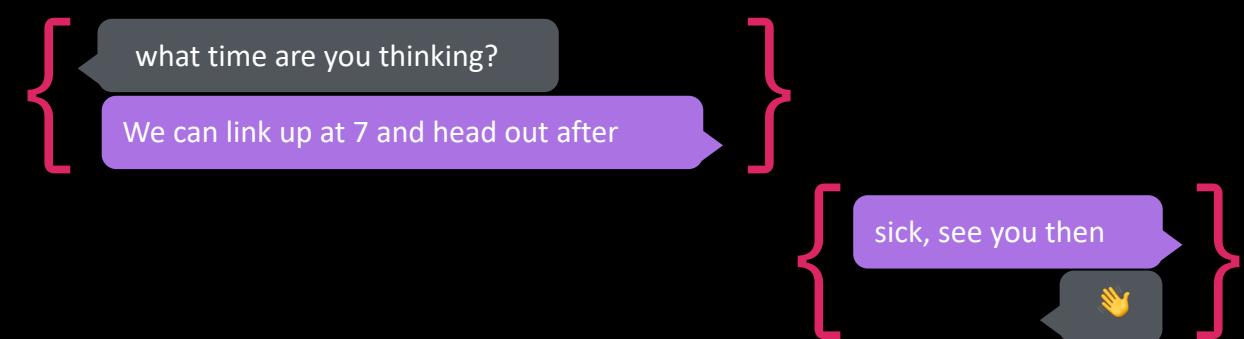
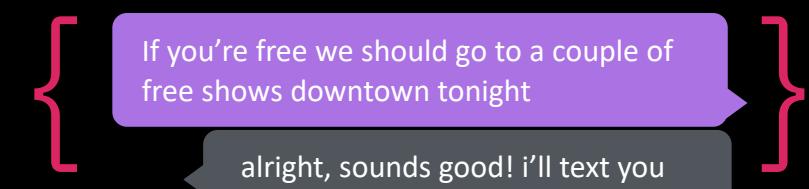
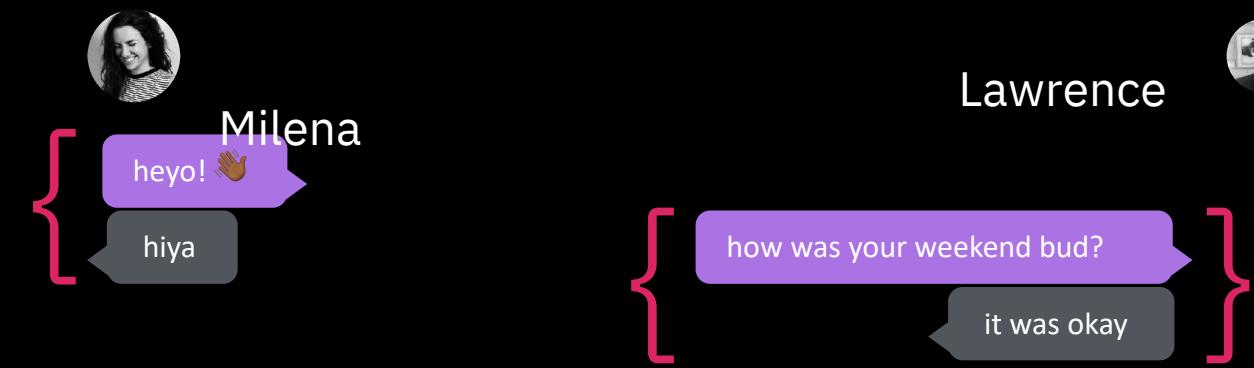
Utterances

The individual statements that are articulated.



Exchanges

Two or more utterances that exchange information.



Conversations consist of:

Utterances

The individual statements that are articulated.



Exchanges

Two or more utterances that exchange information.



Topics

One or more exchanges that provide conversation context.



Milena

hey!

hiya

the weather kind of ruined some plans I had

ah that's annoying I'm sorry

Lawrence



Topic: weekend

how was your weekend bud?

it was okay

If you're free we should go to a couple of free shows downtown tonight

alright, sounds good! i'll text you

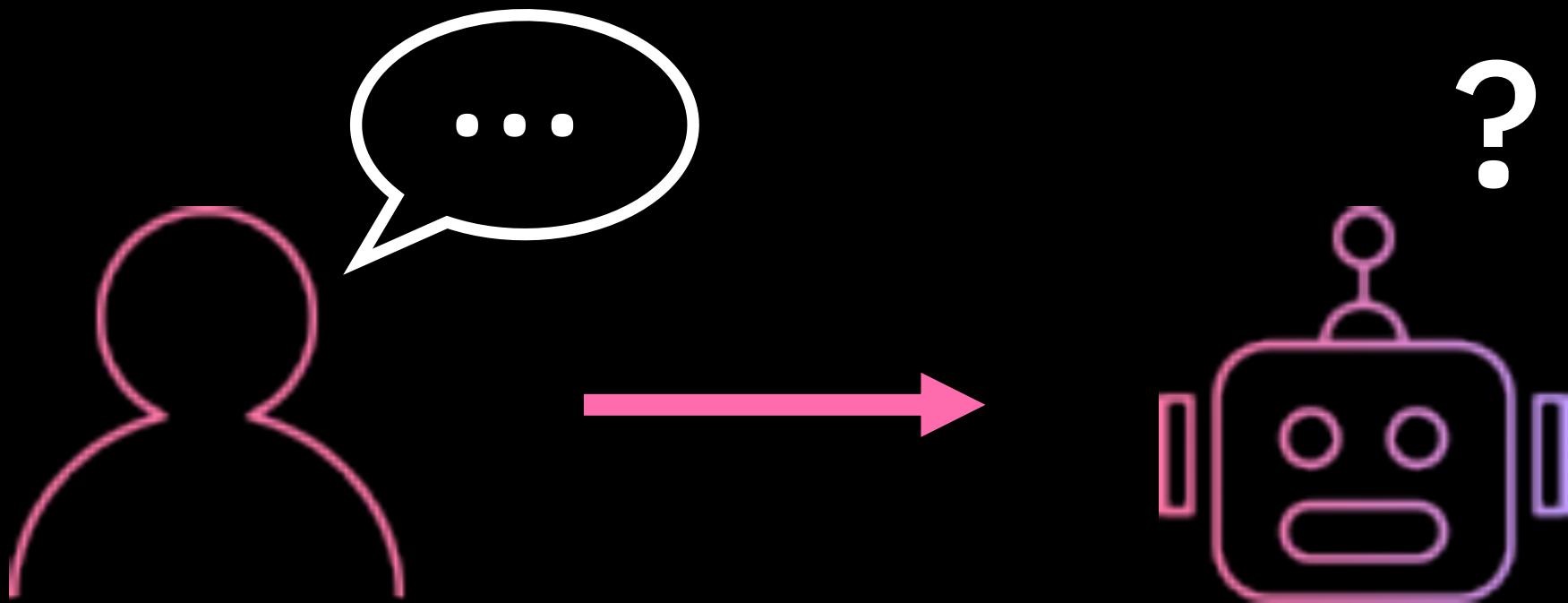
what time are you thinking?

We can link up at 7 and head out after

sick, see you then



Topic: see some shows



GenAI

Artificial Intelligence

Machine Learning

Deep Learning

Generative AI



Artificial Intelligence

Intelligence demonstrated by machines



Machine Learning

Learn from data



Deep Learning

Model after the human brain (Neural Networks)



Generative AI

Create new written, visual, and auditory content

Generative AI

The best thing about AI is its ability to ...

Adapt = 30%

Process = 22%

Analyze = 7%



GTP-4

Why is the sky blue?

OpenAI GPTx Answer:

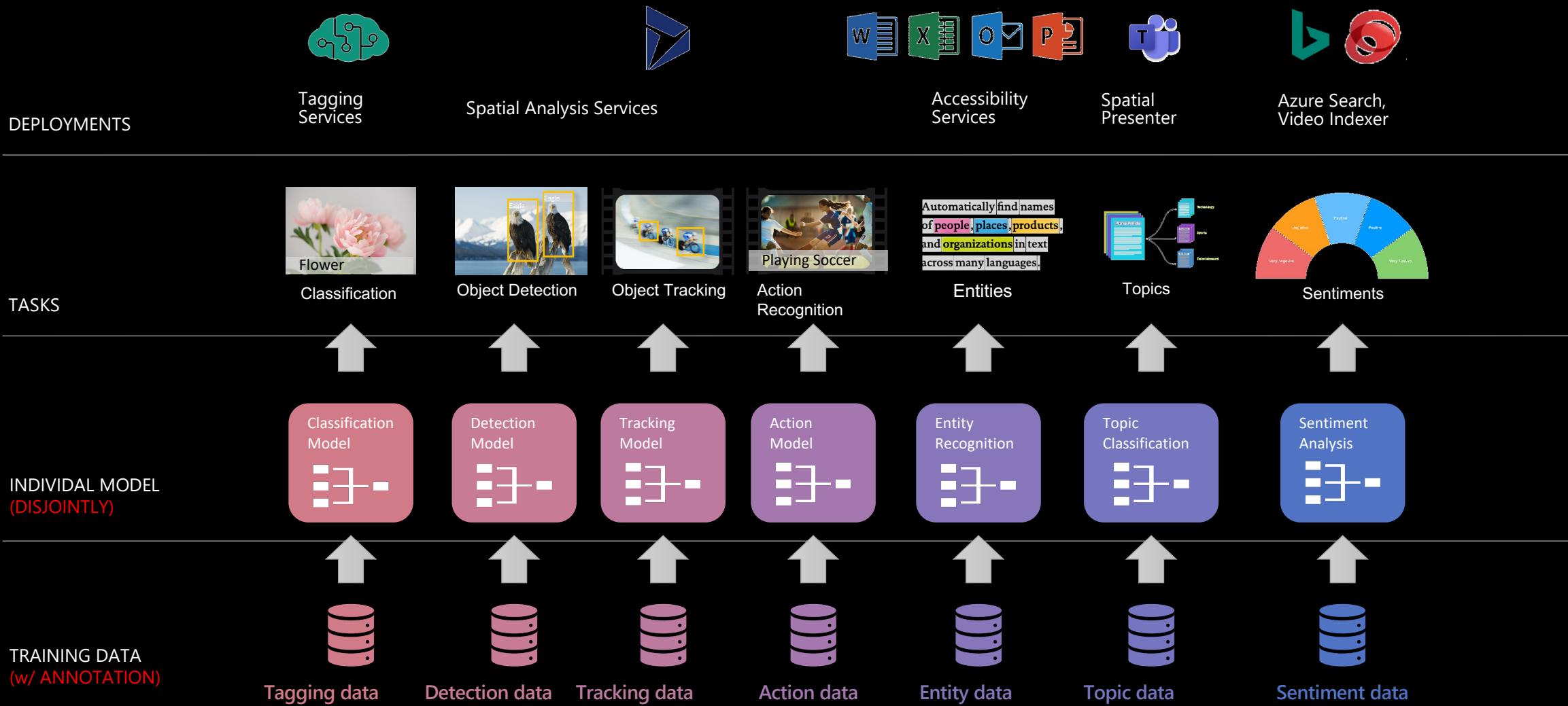
The screenshot shows the OpenAI Playground interface. At the top, it says "Playground" and has a "Your presets" dropdown and a "Save" button. The conversation is as follows:

SYSTEM	USER	ASSISTANT
you are a science professor	why is the sky blue	The sky appears blue because of a phenomenon called Rayleigh scattering. Essentially, when sunlight enters Earth's atmosphere, the shorter blue wavelengths are scattered more effectively by the gases and particles in the air compared to the longer red wavelengths. This scattering causes the blue light to be diffused in all directions, giving the sky its blue appearance to our eyes.

The sky blue because the Earth's atmosphere scatters sunlight in all directions and blue light is scattered more than the other colors because it travels as shorter, smaller waves

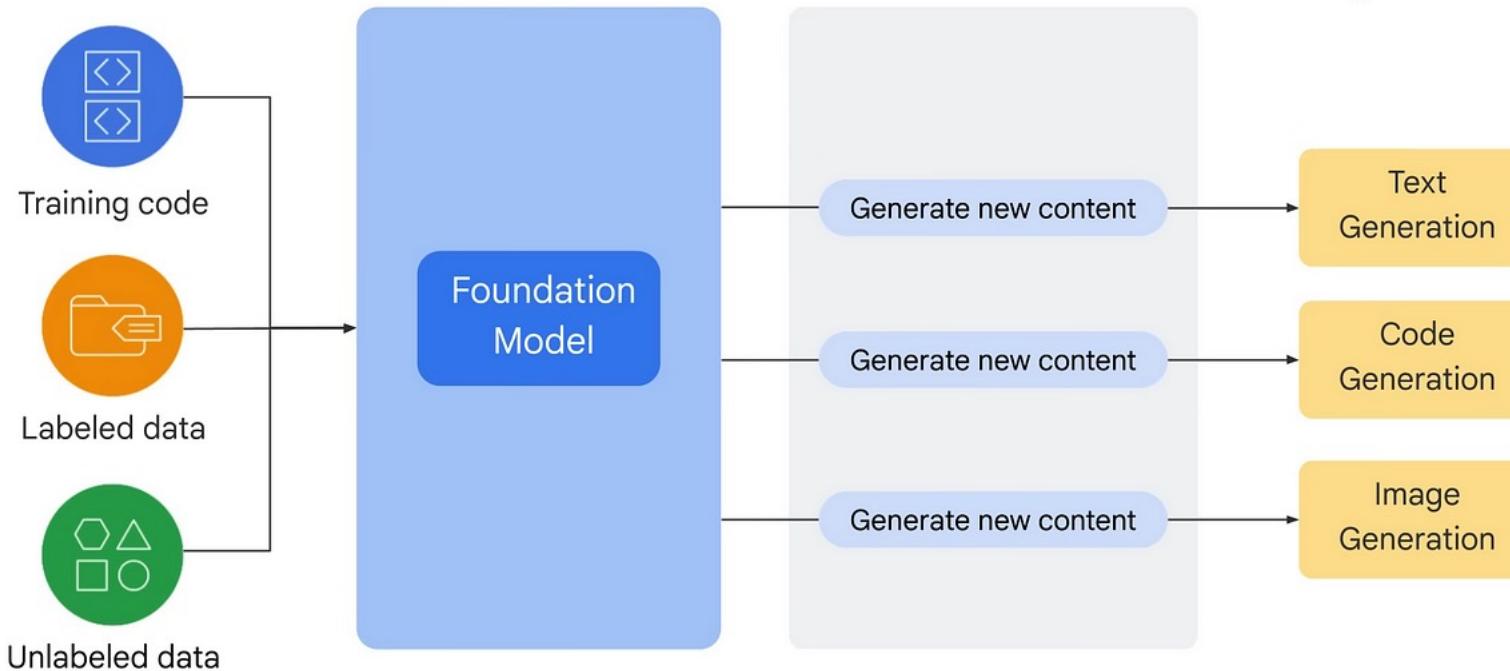
Traditional model development

High cost & slow deployment - Each service is trained disjointly



Foundation Models

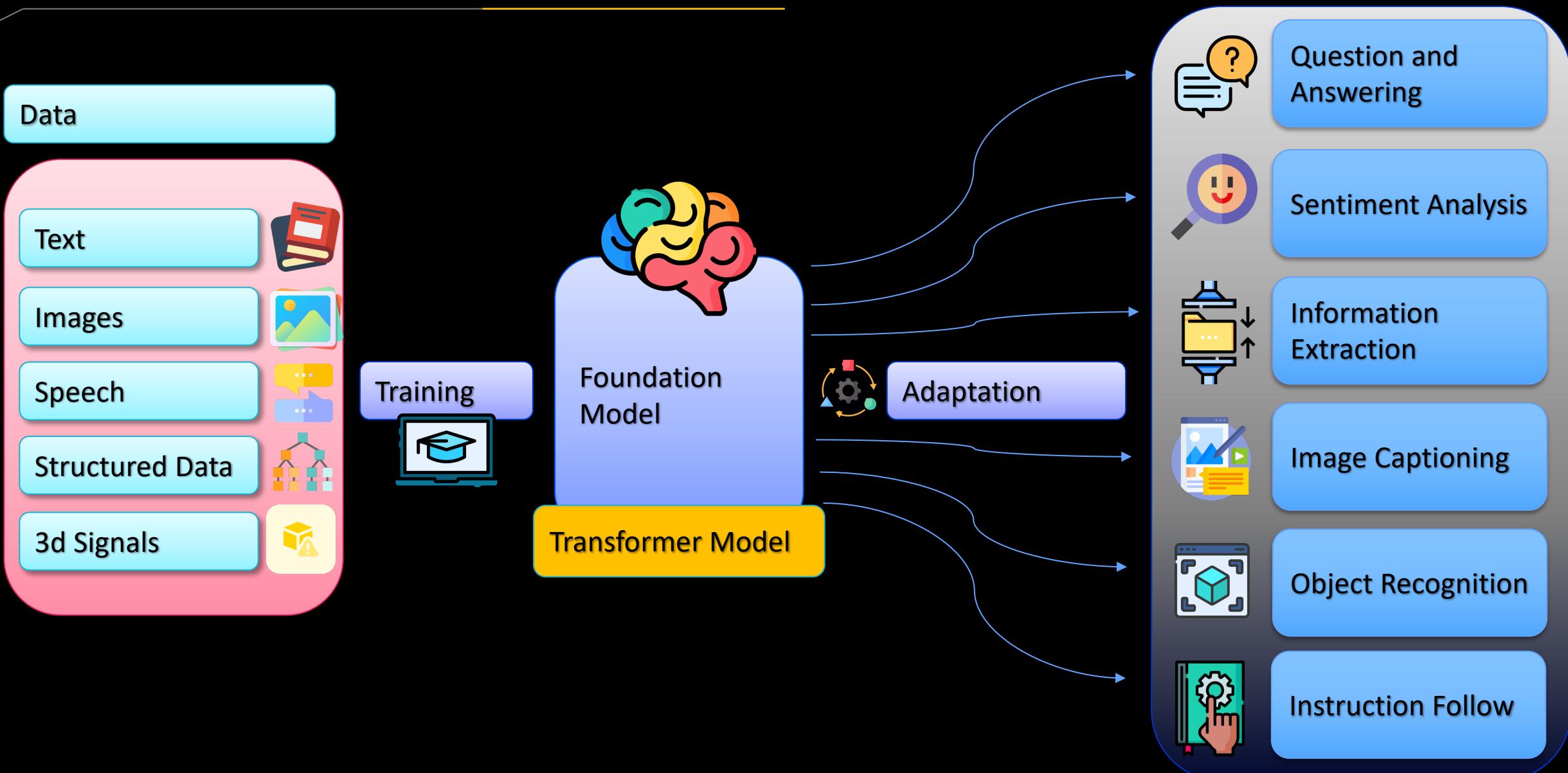
Gen AI Supervised, Semi-Supervised & Unsupervised Learning



Attention is all you need-> <https://arxiv.org/abs/1706.03762>



Foundation Models



[https://platform.openai.com/playground?
mode=complete](https://platform.openai.com/playground?mode=complete)

Prompt
Engineering

Text Classification

Named Entity Recognition (Zero-Shot)

Extract the name and mailing address from this email:

Dear Kaylee,

It was great to talk to you at the seminar. I thought Jane's talk
was quite good.

Thank you for the book. Here's my address 2111 Ash Lane,
Boulder, CO 80301

Best,
Marilú

Name: Marilú

Mailing Address: 2111 Ash Lane, Boulder, CO 80301

Text Classification

Custom Named Entities (Few-Shot)

Extract job titles from the following sentences.

Sentence: Jane Doe has been working for Microsoft for 20 years as a Linux Engineer.

Job title: **Linux Engineer**

###

Sentence: Jane Doe has been working for Microsoft for 20 years and she loved it.

Job title: **none**

###

Sentence: Marc Simoncini | Director | Meetic

Job title: **Director**

###

Sentence: Damien is the CTO of Platform.sh, he was previously the CTO of Commerce Guys, a leading ecommerce provider.

Job title: **CTO**

Text Classification

Multi-Label Text Classification (Few-Shot)

The following is a list of movies and the **categories** they fall into:

Topgun: As students at the United States Navy's elite fighter weapons school compete to be best in the class, one daring young pilot learns a few things from a civilian instructor that are not taught in the classroom.

Category: **Drama, Action**

Hustle: A basketball scout discovers a phenomenal street ball player while in Spain and sees the prospect as his opportunity to get back into the NBA.

Category: **Comedy, Drama, Sport**

The Northman: From visionary director Robert Eggers comes The Northman, an action-filled epic that follows a young Viking prince on his quest to avenge his father's murder.

Category: **Action, Adventure, Drama**

Abstractive Summarization

Contact Center Summarization

Summarize this for a call center agent:

Agent: Thank you for calling ADM. Who am I am speaking to?

Customer: Hello, my name is Peter Smith. I own a small business and have some questions regarding payroll processing.

Agent: Good morning, Peter, before we get started may I ask you a few questions so that I better answer your questions today?

Customer: Thank you that is quite helpful. Are there specific regulations that I need to follow?

Agent: Certain aspects of payroll processing are regulated by the Internal Revenue Service (IRS) and the Department of Labor (DOL)

The agent is speaking to a customer named Peter Smith. Peter is asking for tips on manual payroll processing. The agent also informs Peter that certain aspects of payroll processing are regulated by the Internal Revenue Service (IRS) and the Department of Labor (DOL).

Business Examples

Text – to - Text

Generation, Summarization,
Extraction, Translation,
(Re)Search, Editing, Rewriting

Text – to – Image/Video

Image generation, Image
editing, Video generation and
editing, Game assets.

Text – to - Task

Software agents, Virtual
assistants, Automation

Text – to - Audio

Text-to-Speech, Audio
generation.

Education

The screenshot shows a digital education platform interface. On the left, there's a sidebar with icons for TA (Teaching Assistant), Modules (selected), New Chat, and Conversations. The main area displays a "Welcome to CSCI-128 2024 Spring!" message. Below it is a search bar labeled "Search lessons". The main content area is a vertical timeline of four weeks:

- Week 00: Intro** (2 LESSONS)
 - Slides - Introductions
 - Runestone Book
- Week 1: Variables & Operators** (4 LESSONS, 9 HOMEWORK)
 - Week 1: Variables & Operators
- Week 2: Types & Binary Representations** (7 LESSONS, 8 HOMEWORK)
 - Week 2: Types & Binary Representations
- Week 3: Branching, Algorithmic Thinking, & Basic Debugging** (6 LESSONS, 8 HOMEWORK)
 - Week 3: Branching, Algorithmic Thinking, & Basic Debugging

<https://www.aiedu.org/teach-ai>

Healthcare

Gensilico



Healthcare



Reimagining target assessment in drug discovery using generative AI

Drug discov

Target assess

Lead genera

Novel bioma
discovery

Protein fold
and desig



Use large language model (LLM) tools to quickly analyze vast amounts of scientific literature and databases



Identify relevant research related to potential drug targets



Significantly speed up the initial stages of target identification and validation

Law

Copilot

10:01 AM

How can I help you today?

Search options

Case Law Research

Summarize

Correct Grammar

Draft Email or Letter

Brainstorm Content

Emotional Support

Translate

Citation Check

Prompt Creator

Freeform Prompt

Feedback

Tech Support



Case Law Research

Research case law, brief cases, summarize and query them.

Case Law Research



Summarize text. Just copy and paste what you would like to summarize.

Summarize



Correct grammar. Just copy and paste what you would like to grammar check.

Grammar Check



Draft email or letter. Guided drafting of emails or letters.

Draft Email or Letter



Brainstorm content ideas with this guided prompt.

Brainstorm



Emotional Support

Emotional support. Having a stressful day? Let's talk.

Emotional Support



Translate

Translate. Copy and paste text to translate into multiple languages.

Translate



Citation Checker. Citation Checker. Check your legal citations using the Indigo Book.

Citation Checker



Freeform Prompt. Freeform Prompt. Enter your freeform prompt into GPT-4 directly.

Freeform Prompt



Prompt Creator. Assisted custom prompt creation tool.

Prompt Creator

Prepare a case demo

Finance

Ask David



Transportation



moralmachine

Software Engineering

Technical preview

Your AI pair programmer

The screenshot shows a dark-themed code editor interface. At the top, there's a tab bar with files: 'fetch_pic.js' (active), 'push_to_git.py', 'JS d3_scale.js', 'JS fetch_stock.js', and 'JS material_ui.js'. Below the tabs, a code editor displays the following JavaScript code:

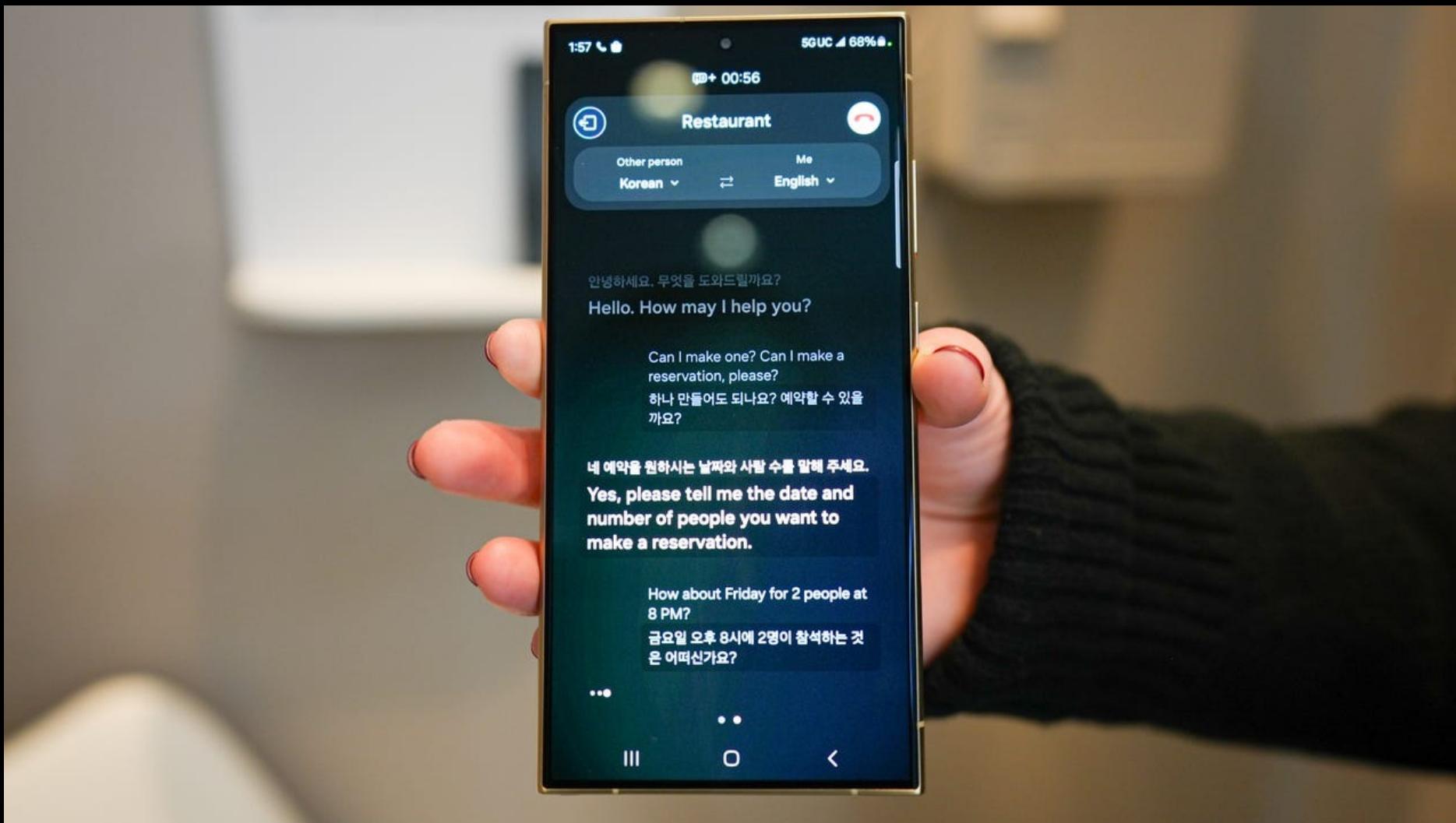
```
1 const fetchNASAPictureOfTheDay = () => {
2   return fetch('https://api.nasa.gov/planetary/apod?api_key=DEMO_KEY', {
3     method: 'GET',
4     headers: {
5       'Content-Type': 'application/json',
6     },
7   })
8     .then(response => response.json())
9     .then(json => {
10       return json;
11     });
12 }
```

A small 'Copilot' button is visible at the bottom left of the code editor. Below the code editor, the GitHub Copilot logo (a white icon with two people) and the text 'GitHub Copilot' are displayed.

Local AI
Ollama
LM Studio
Jan

Some interesting trends

Live Translate



<https://youtu.be/3hPoEmIBQdY?si=y0w6Qj9POCZnbc8w&t=51>

Rabbit.tech (LAM)



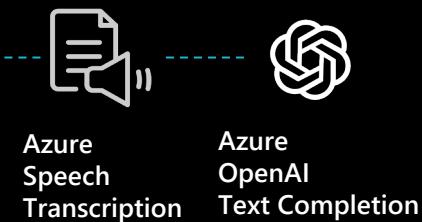
<https://www.youtube.com/watch?v=22wlLy7hKP4>

Media Example

News Analyses & Article Creations



News Broadcast (Global Warming)



Search
SEO
Virtual Agent
Analytics
Reporting
Knowledge Mining

Content Analysis

Topic Classification

Global warming, Deforestation,
Carbon footprint

Entity Extraction

Organizations: IPCC, UNFCCC, Green Peace
Geography: Canada, USA

Key Word Extraction

Human activities, fossil fuels,
earth atmosphere

Question and Answer

What is the Intergovernmental Panel on Climate Change (IPCC)?

The IPCC is an international organization that studies climate change and the effectiveness ...

Content Creation

Ideation
Productivity
Personalization
Accessibility
A/B Testing

Video summarization

The article discusses about global warming and its effects on the Earth's atmosphere, wildlife, and human communities. It states that the primary cause of global warming is

News article generation (or blogs, social media)

Global warming is the gradual increase in the overall temperature of the Earth's atmosphere, primarily caused ...

Script Generation

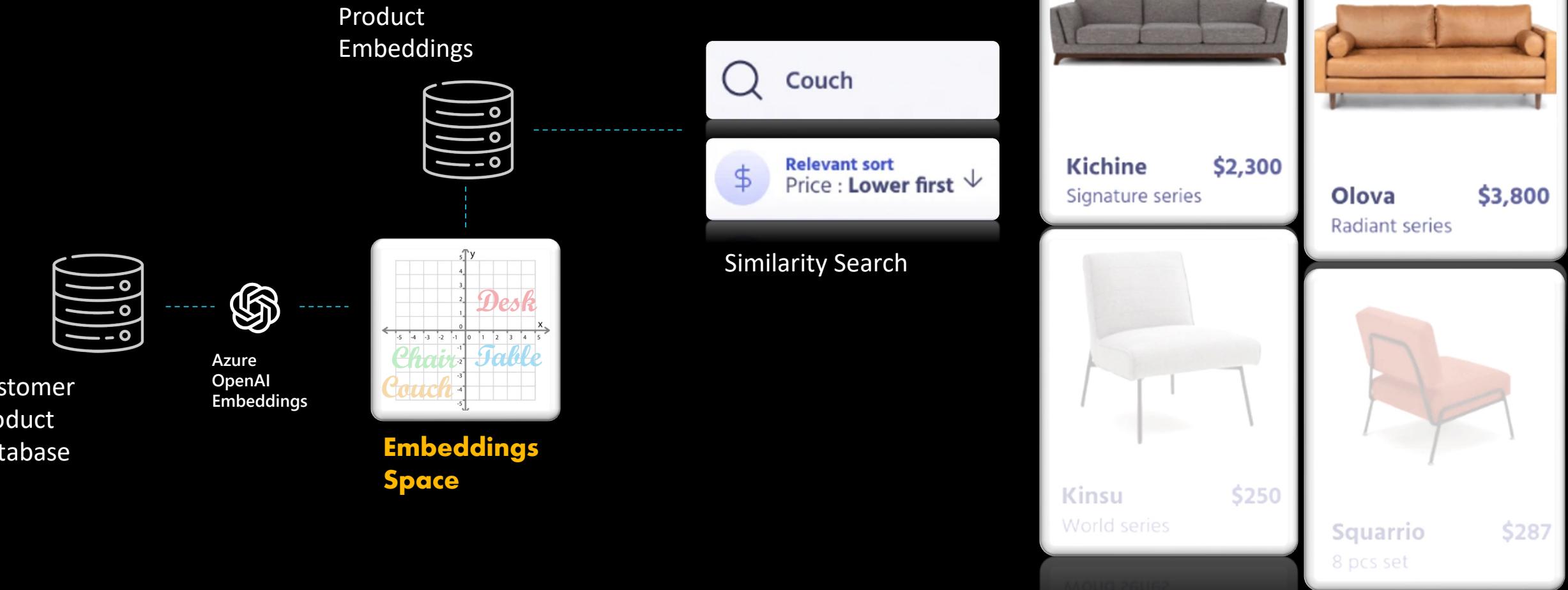
Act 1: The show opens with a shot of a beautiful coastal town
Act 2: As the town struggles to cope with the crisis ...

Personalized Content generation (or Advertising)

Simon, as someone passionate about global warming, you are aware of the urgent threat it poses to our planet ...

Retail Example

Similarity Search

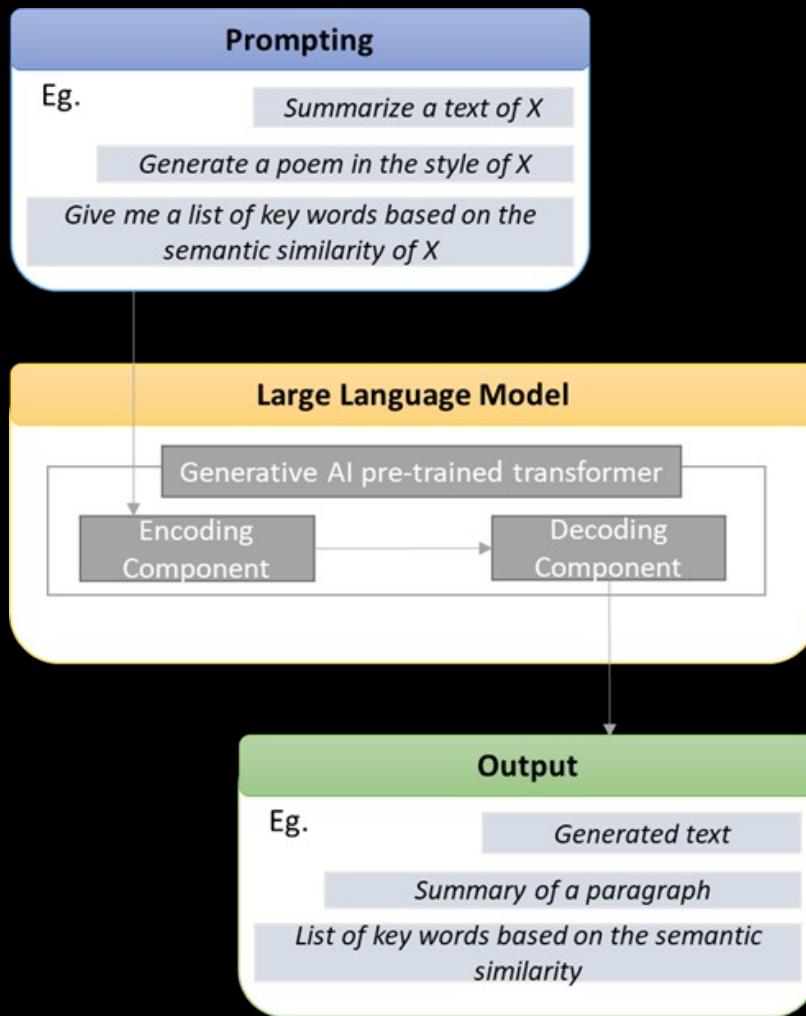


Lab exercise

IBM watsonx studio

<https://dataplatform.cloud.ibm.com/>

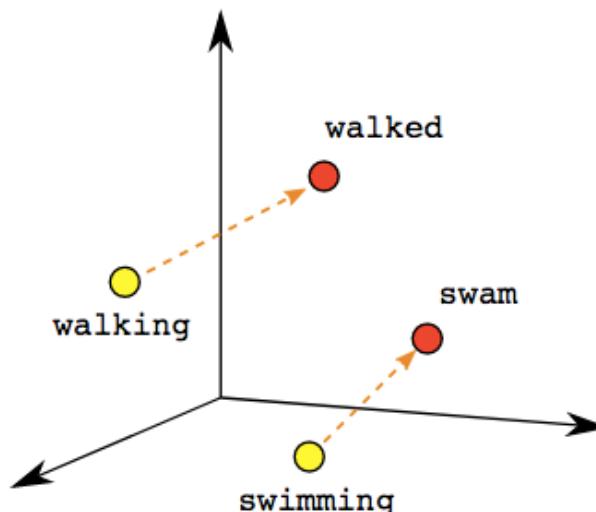
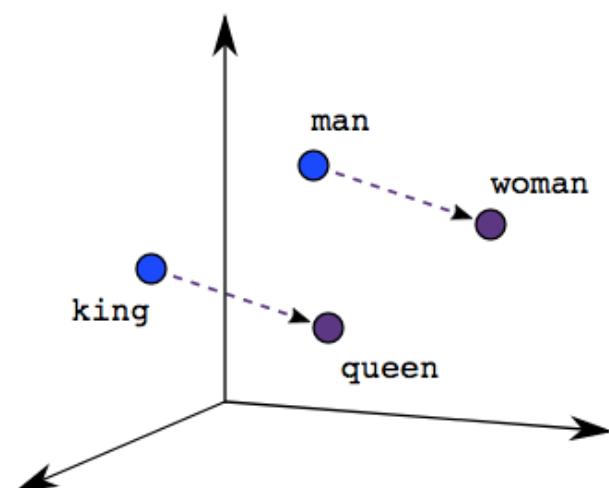
GenAI



Lab 2

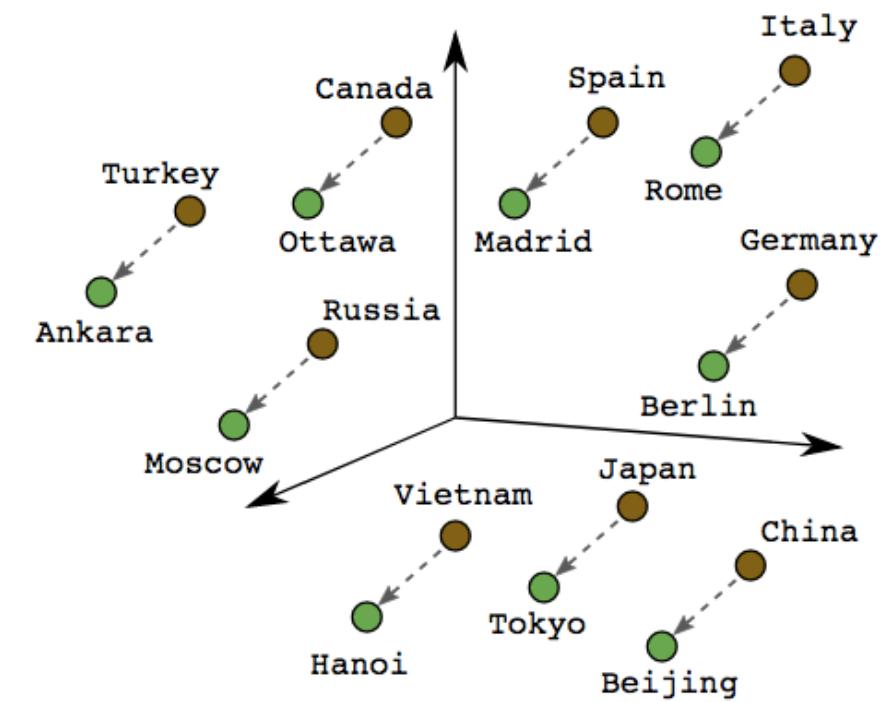
English – Code Translation

Lab Vector Search



Male-Female

Verb Tense



Country-Capital

Sports & Entertainment Example

Natural language to SQL to surface stats data (Fan Engagement)



Azure
OpenAI
Codex

"How many points did LeBron James score in 2023?"

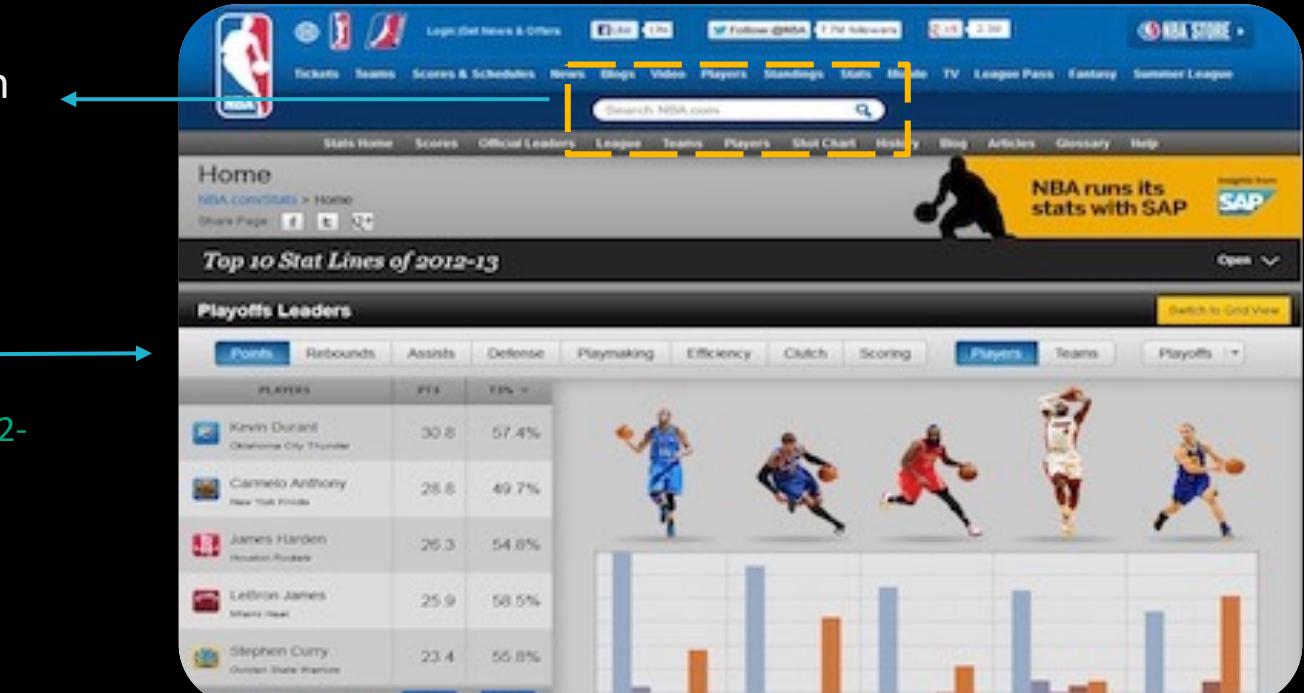
```
SELECT SUM(points) FROM basketball_stats WHERE player = 'LeBron James' AND game_date BETWEEN '2023-01-01' AND '2023-12-31';
```

basketball_stats (player, team, points, rebounds, assists, steals, blocks, turnovers, games_played)

("LeBron James", "Los Angeles Lakers", 25, 7, 10, 1, 0, 3, 82), ("Kevin Durant", "Phoenix Suns", 30, 7, 4, 1, 2, 3, 72)

basketball_games (home_team, away_team, home_score, away_score, game_date)

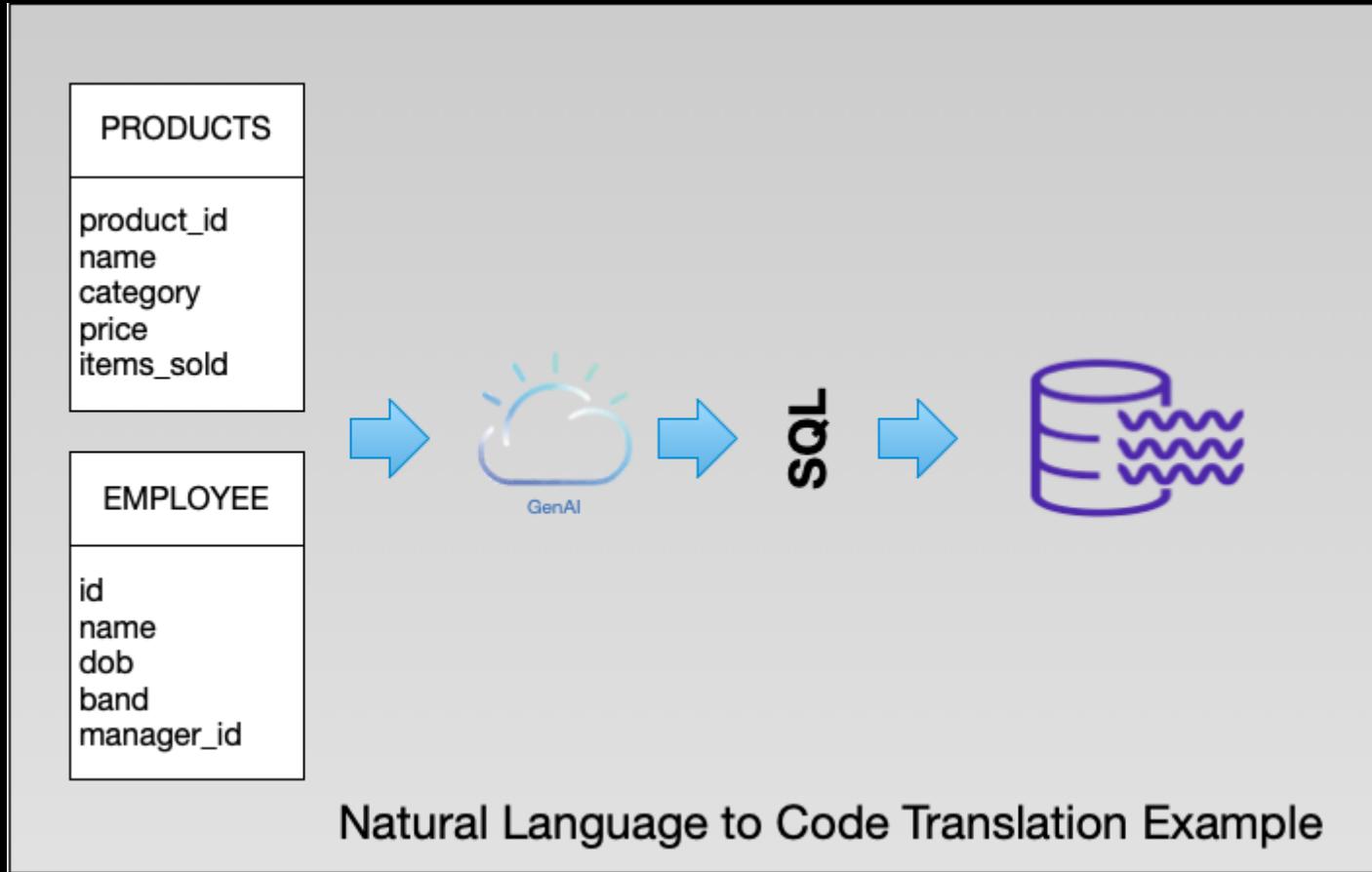
("Los Angeles Lakers", "Brooklyn Nets", 110, 105, '2023-12-01'), ("Milwaukee Bucks", "Golden State Warriors", 120, 115, '2023-12-02')



Query top five products based on the price and items sold

Query the count of employees in band L6 and with manager ID as 23079

Write SQL Query given the table name is {Table} and columns are {Columns} for the question : {question}.



Look ahead

AGI



The Evolution of AI

General AI
Revolutionary

Narrow AI
Emerging

Broad AI
Disruptive and
Pervasive

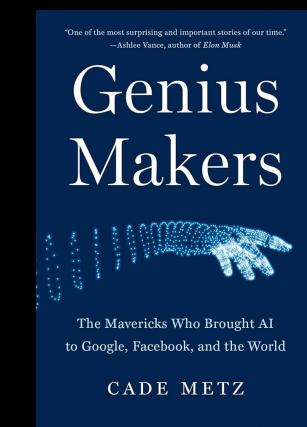
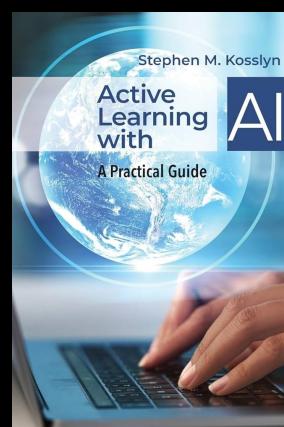
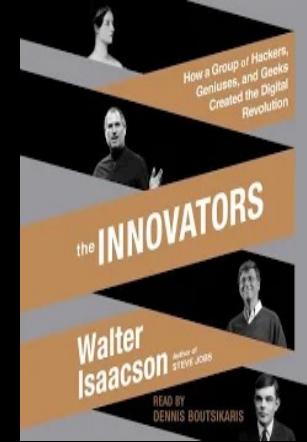
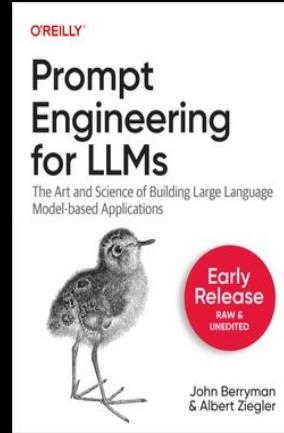
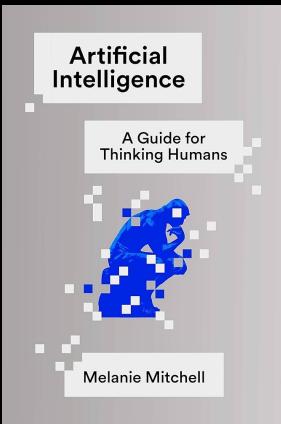
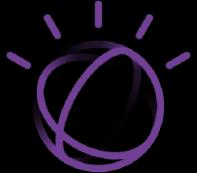
2050 and
beyond

▼ We are
here

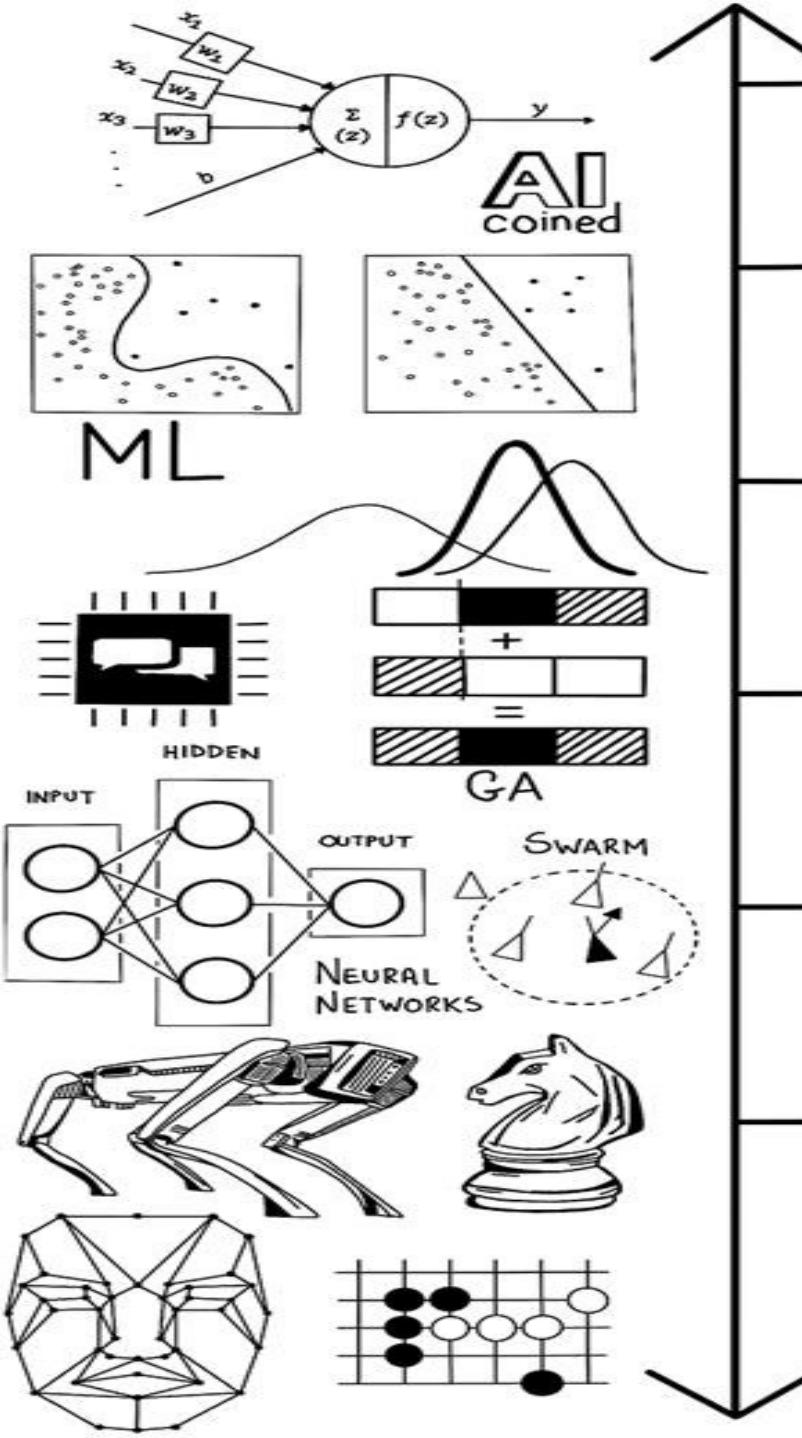
Q & A

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RECAP



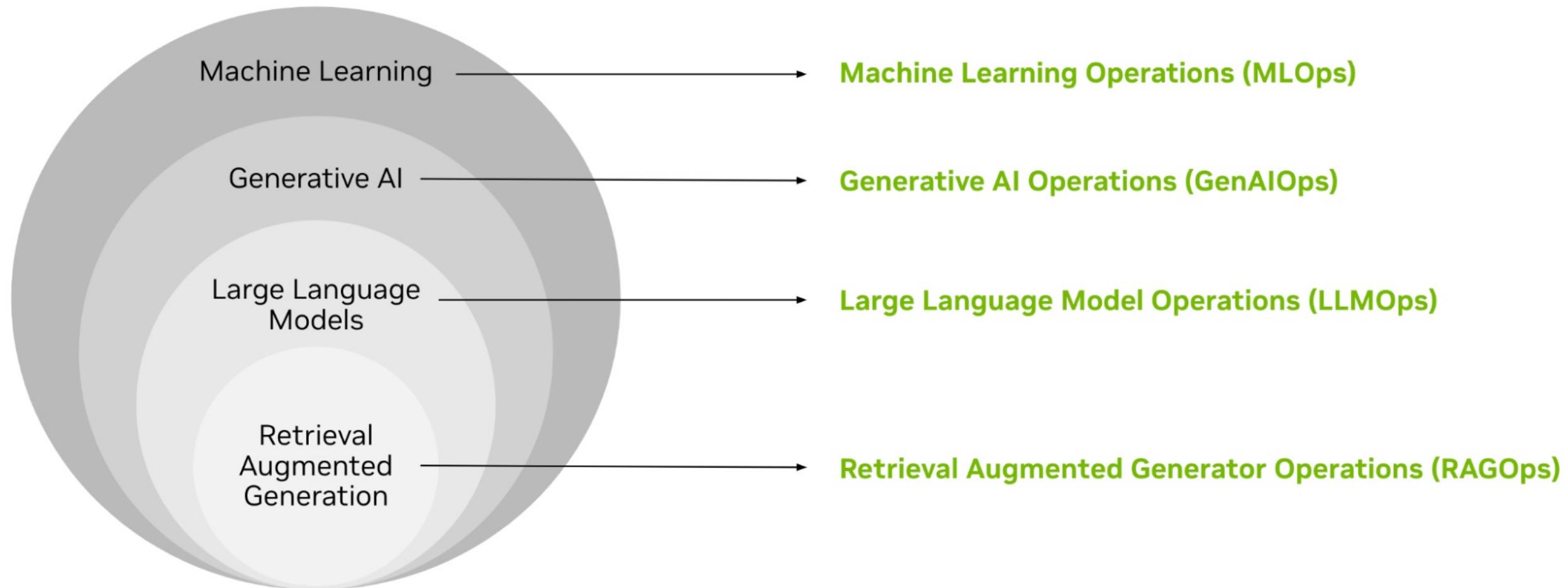
RECAP

Design for Artificial Intelli- gence

LLMOps

<http://github.com/iportilla/mlops>

Understanding GenAIOps, LLMOps, RAGOps



LLMOPS Essentials:

A Practical Guide to Operationalizing Large Language Models

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