



Seminar Microsoft Azure Design

DZ-Bank Hamburg, 23. -26. Februar 2026

Tag 1 Einführung

- Einführung Azure
- Einführung Künstliche Intelligenz

<https://github.com/www42/Hamburg>

Tag 2 Architektur

- Azure Well-Architected Framework
- Cloud Adoption Framework

Tag 3 Azure Services

- Compute, Applications, Network, Migrations
- Storage, Databases, Data Integration

Tag 4 Deep Dive

- Governance, Authentication, Authorization, Monitoring
- Backup, Disaster Recovery, High Availability

Thomas Jäkel



Lead Trainer Cloud Infrastructure

Microsoft Certified Trainer since 1999

<https://github.com/www42/Hamburg>



Let's have a great time together

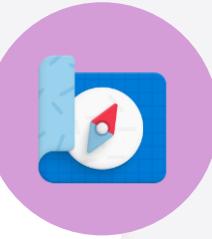
We all contribute to a great class

$$9^{\circ\circ} - 17^{\circ\circ}$$

$$12^{\circ\circ} - 12^{45}$$



What you should know about our facilities

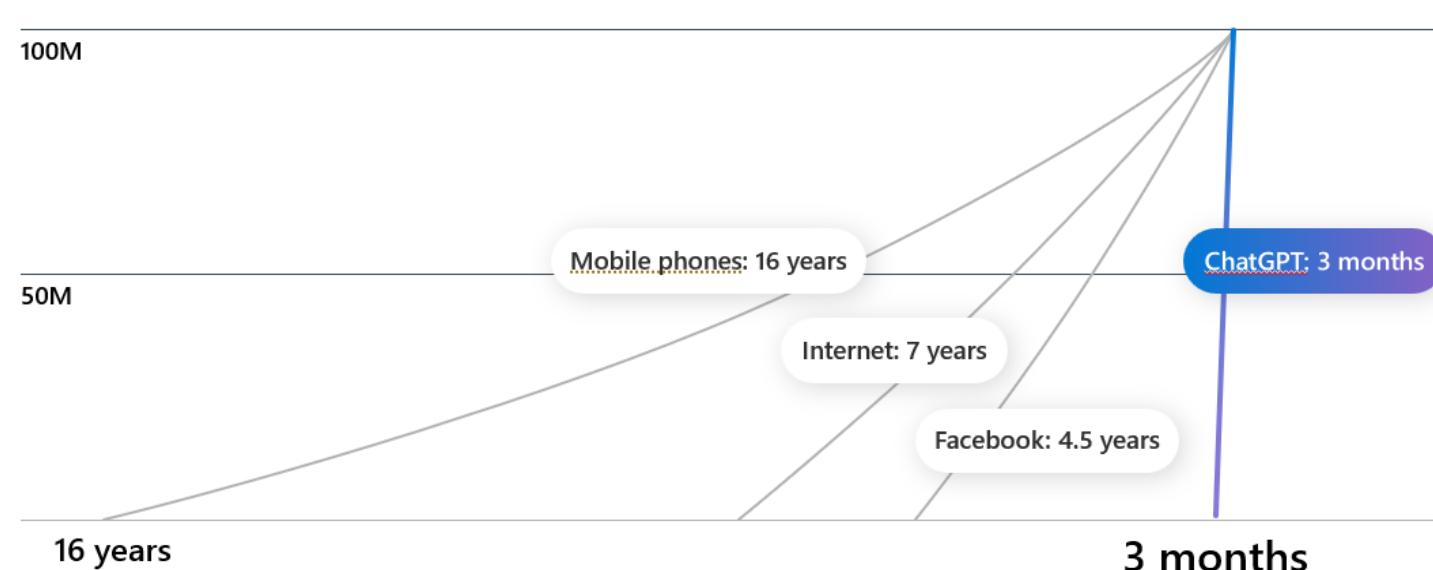


📢 "ChatGPT is now available. Try talking with it here: <https://chat.openai.com/>"

30. November 2022 Sam Altman on Twitter

The AI technology is here

Time to reach 100M users



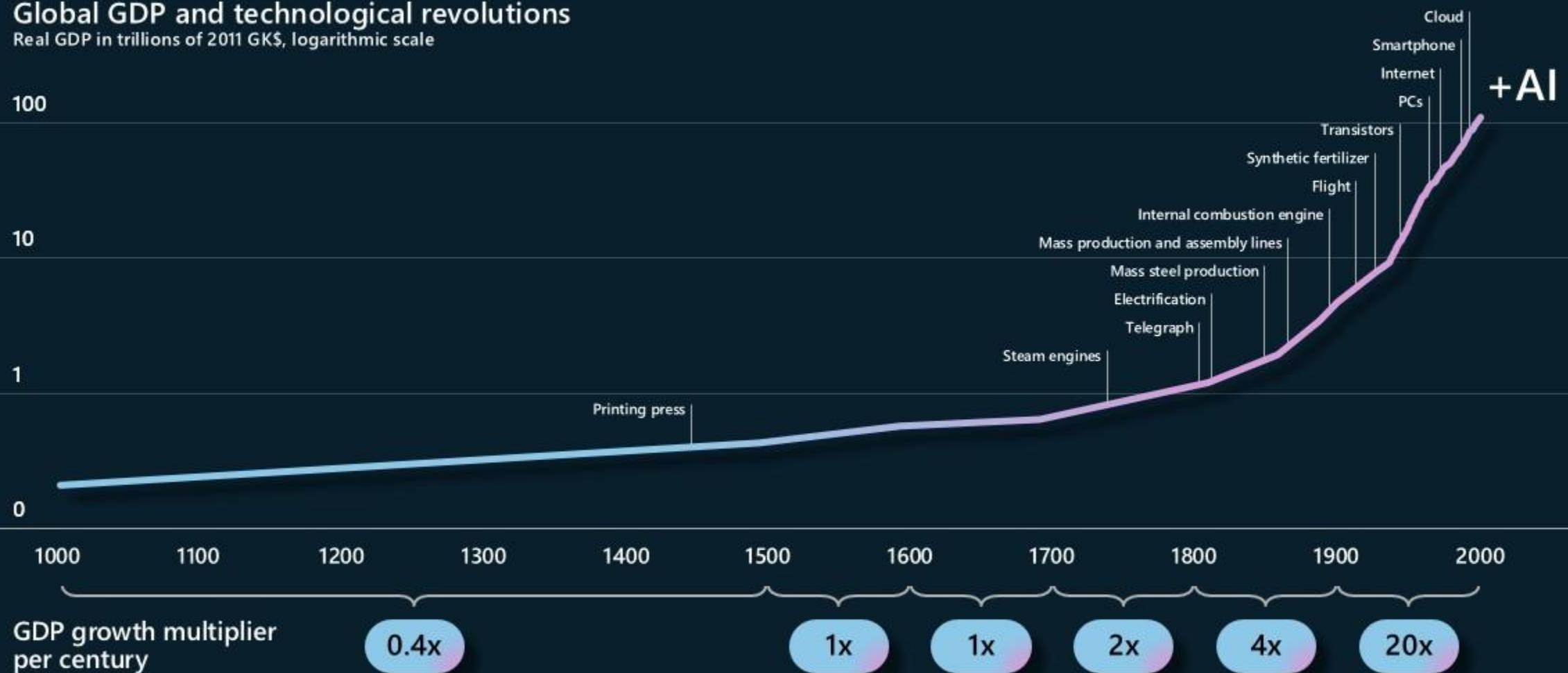
World as a prompt



Technology drives GDP growth, and the pace of change is accelerating

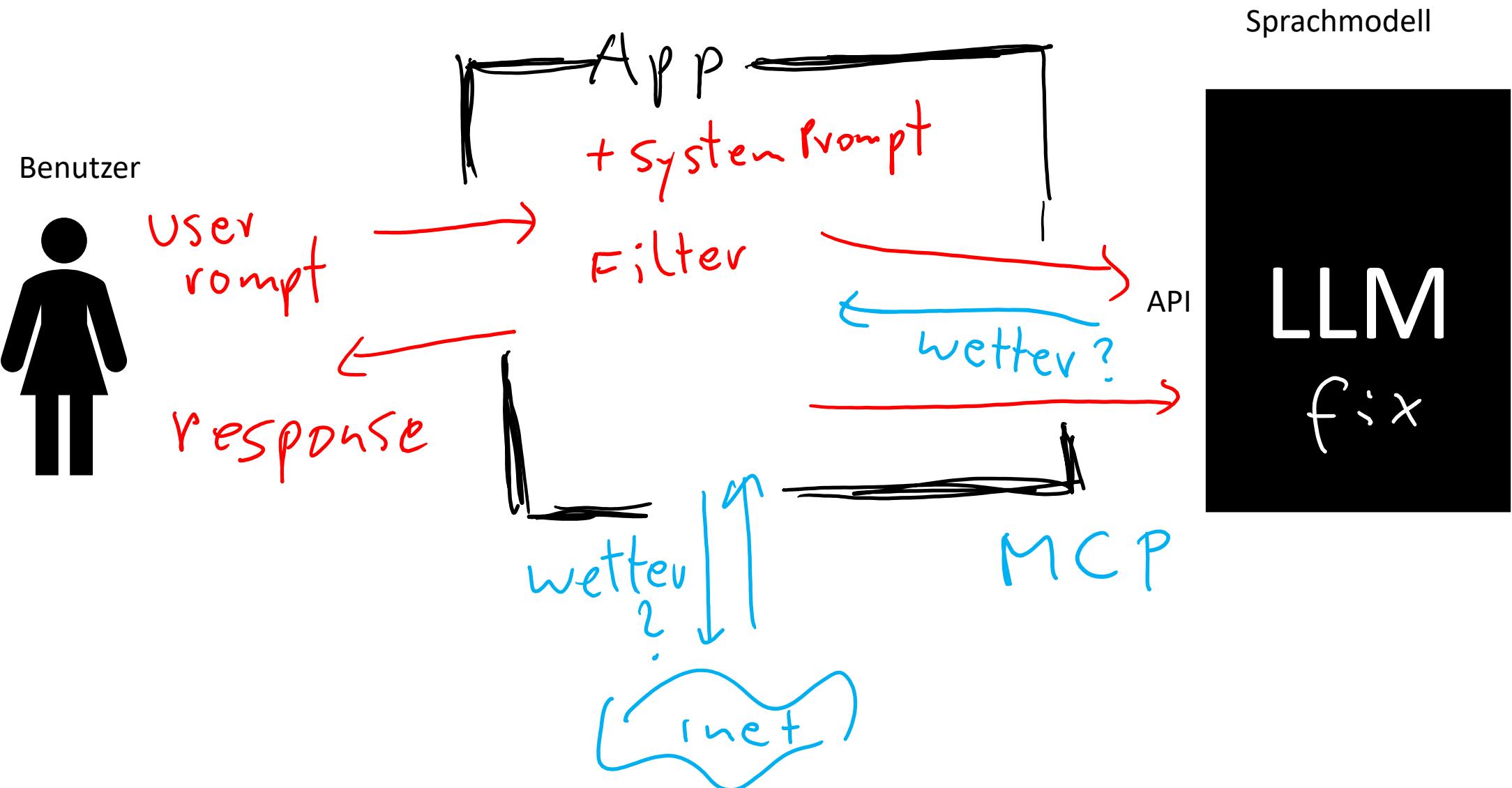
Global GDP and technological revolutions

Real GDP in trillions of 2011 GK\$, logarithmic scale



Source: Maddison Project, Our world in data

Architektur



A brief history of AI

Artificial Intelligence

Machine Learning

Deep Learning

Generative AI

1950s

Artificial Intelligence

The field of computer science that seeks to create intelligent machines that can replicate or exceed human intelligence.

1959

Machine Learning

A subset of AI that enables machines to learn from existing data and improve upon that data to make decisions or predictions.

2017

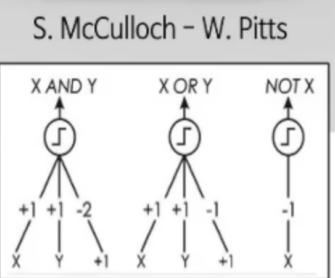
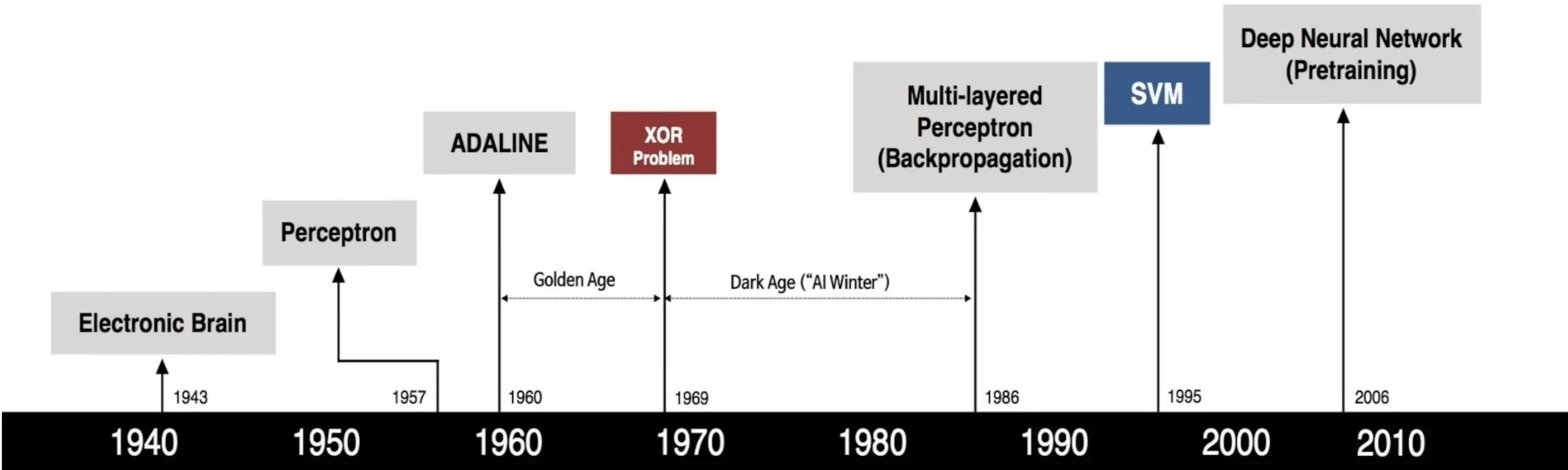
Deep Learning

A machine learning technique in which layers of neural networks are used to process data and make decisions.

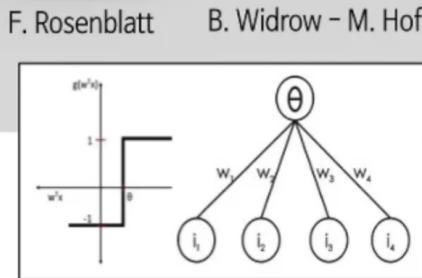
2021

Generative AI

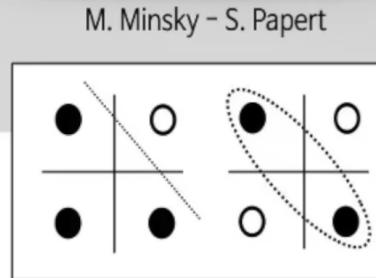
Create new written, visual, and auditory content given prompts or existing data.



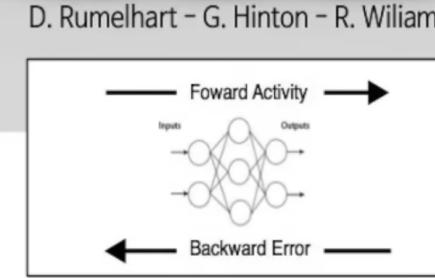
- Adjustable Weights
- Weights are not Learned



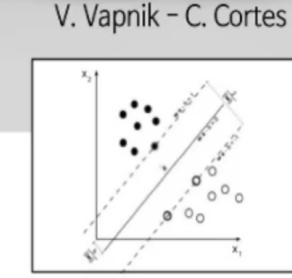
- Learnable Weights and Threshold



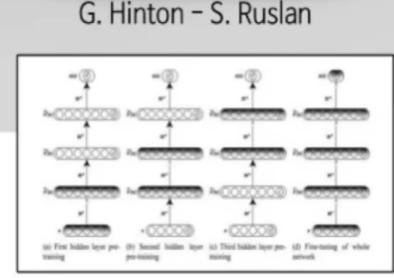
- XOR Problem



- Solution to non-linearly separable problems
- Big computation, local optima and overfitting



- Limitations of learning prior knowledge
- Kernel function: Human Intervention



- Hierarchical feature Learning

AI Shared Responsibility Model

Illustrates which responsibilities are typically performed by an organization and which are performed by their AI provider (such as Microsoft)

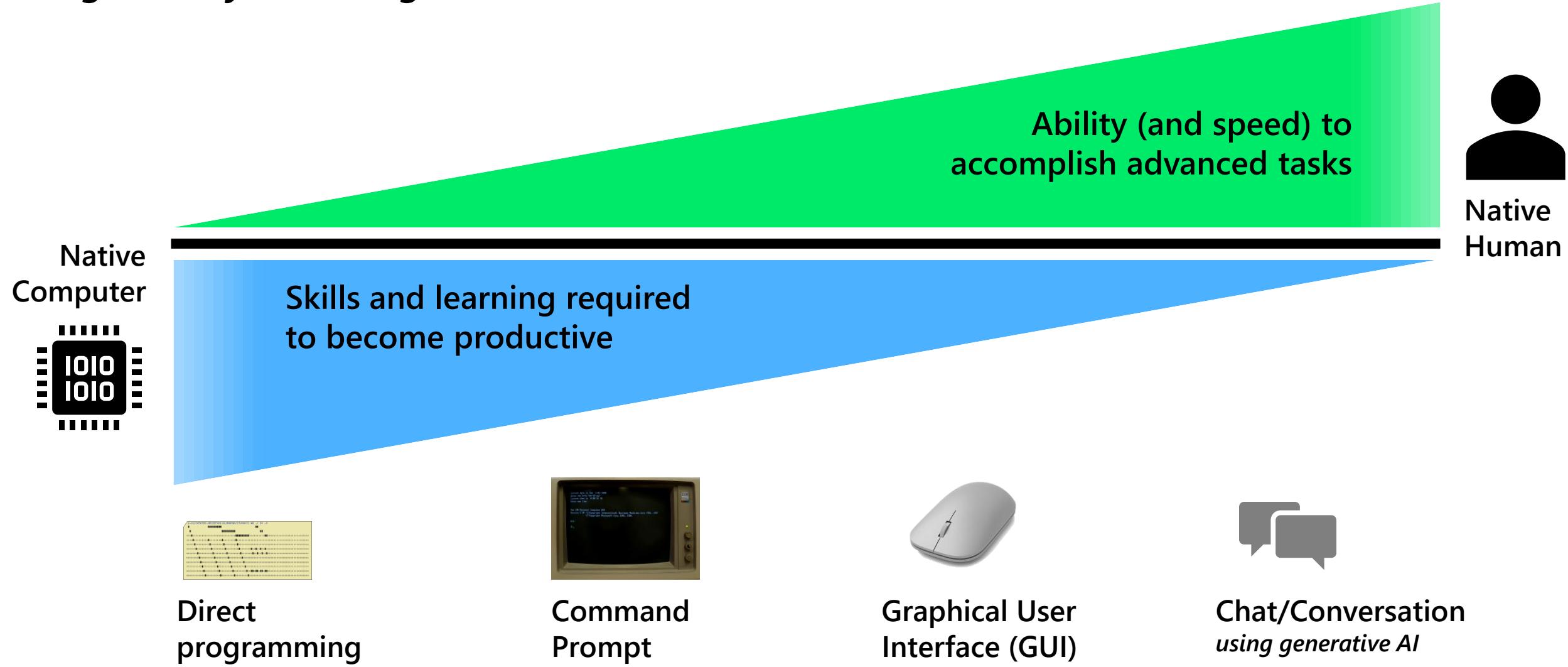
		IaaS (BYO Model)	PaaS (Azure AI)	SaaS (Copilot)
AI Usage	User Training and Accountability	Customer	Customer	Customer
	Usage Policy, Admin Controls	Customer	Customer	Customer
	Identity, Device, and Access Management	Customer	Customer	Customer
	Data Governance	Customer	Customer	Customer
AI Application	AI Plugins and Data Connections	Customer	Customer	Customer
	Application Design and Implementation	Customer	Customer	Microsoft
	Application Infrastructure	Customer	Customer	Microsoft
	Application Safety Systems	Customer	Customer	Microsoft
AI Platform	Model Safety & Security Systems	Customer	Customer	Microsoft
	Model Accountability	Customer	Model Dependent	Microsoft
	Model Tuning	Customer	Model Dependent	Microsoft
	Model Design & Implementation	Customer	Model Dependent	Microsoft
	Model Training Data Governance	Customer	Model Dependent	Microsoft
	AI Compute Infrastructure	Customer	Microsoft	Microsoft

Legend:

- Microsoft (Dark Blue)
- Model Dependent (Yellow-Gold)
- Shared (Blue/Yellow Gradient)
- Customer (Light Blue)

Evolution of Computer Interfaces

Progressively becoming more natural/native human models



Timeline

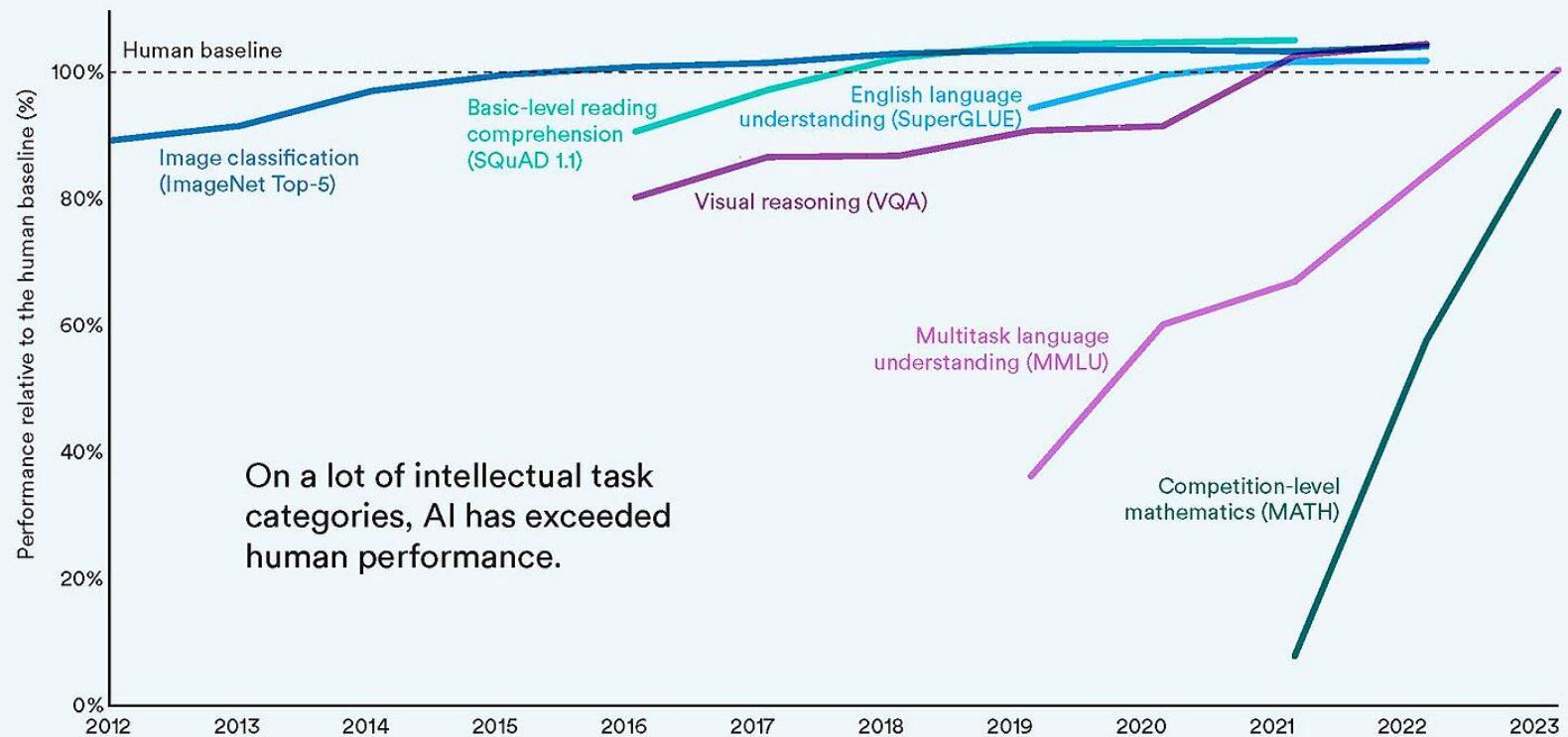
Artificial Super Intelligence
ASI

Artificial General Intelligence
AGI

Artificial Narrow Intelligence
ANI

Select AI Index technical performance benchmarks vs. human performance

Source: AI Index, 2024 | Chart: 2024 AI Index report





Sam Altman

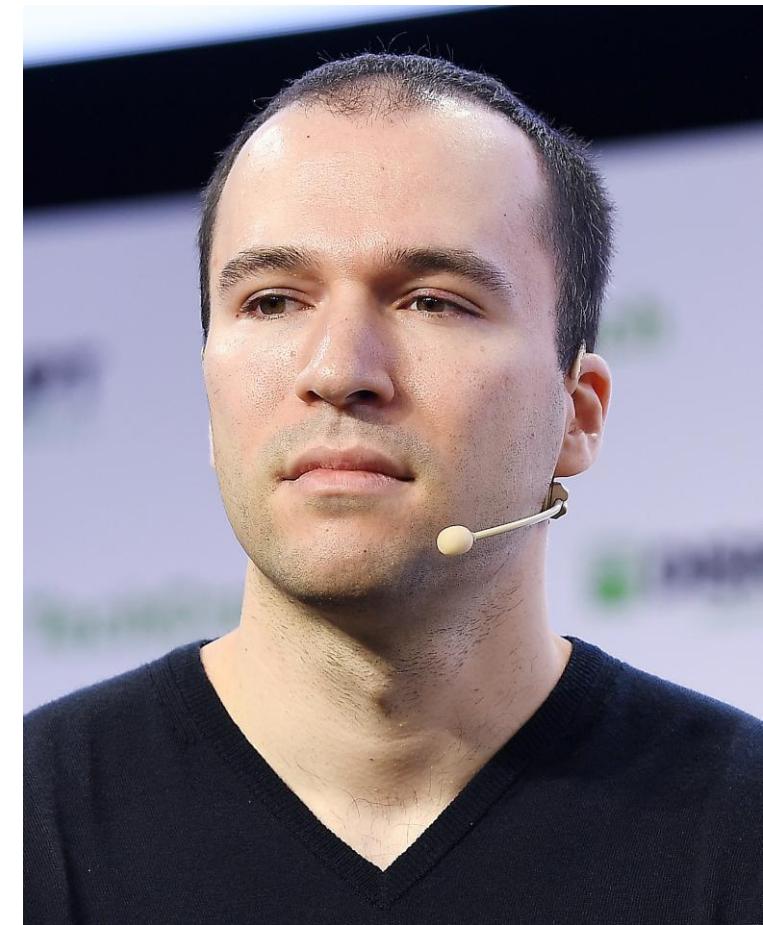
1 billion = 10^9

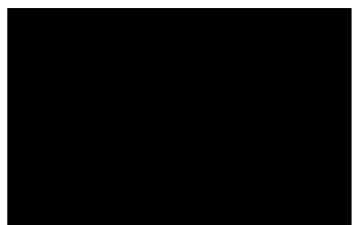
brainymotion

OpenAI Inc.

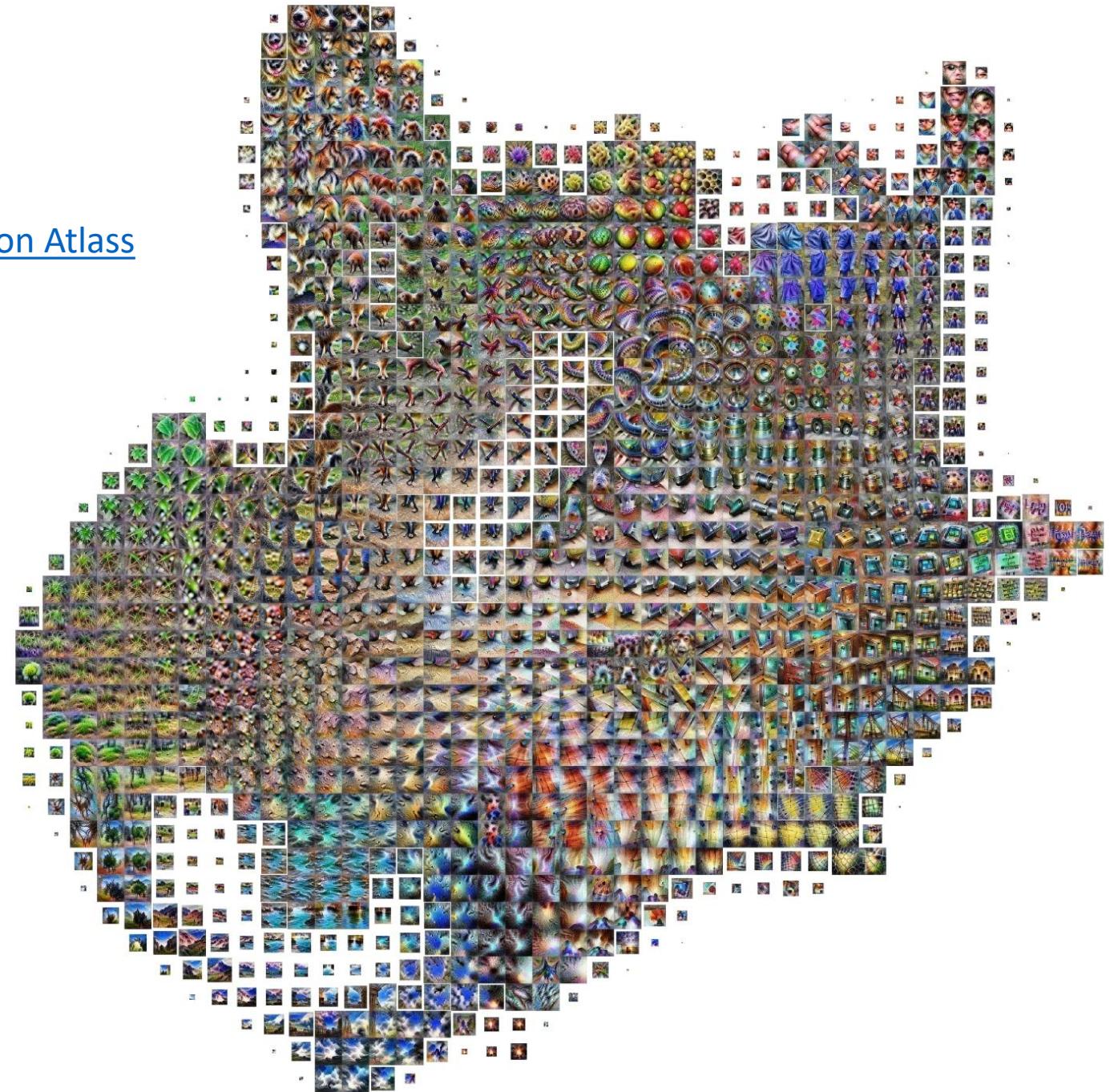
- 2015 -2018 Non-profit
- 2019 Capped profit
- 2020 GPT-3
- 2022 December ChatGPT
- 2023 Microsoft \$10 billion
- 2024 March GPT-4

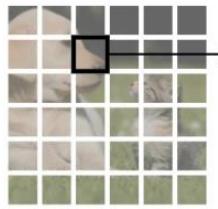
Greg Brockman



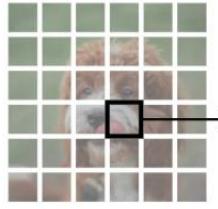
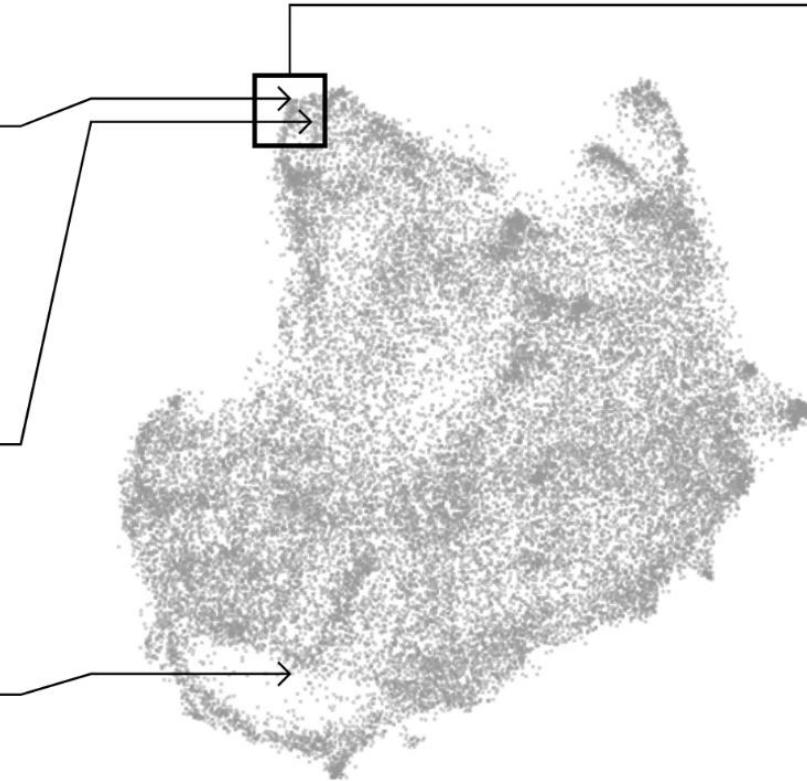


Activation Atlass

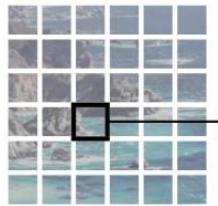




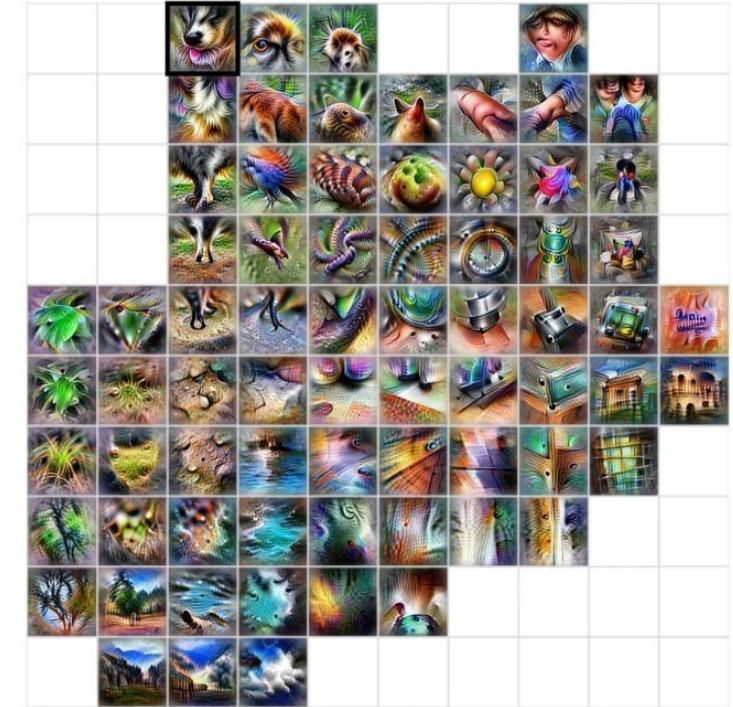
[0.370, 0.698, ...]



[0.012, 0.540, ...]



[0.034, 0.678, ...]



The Rise and Rise of A.I. Large Language Models (LLMs)

& their associated bots like ChatGPT

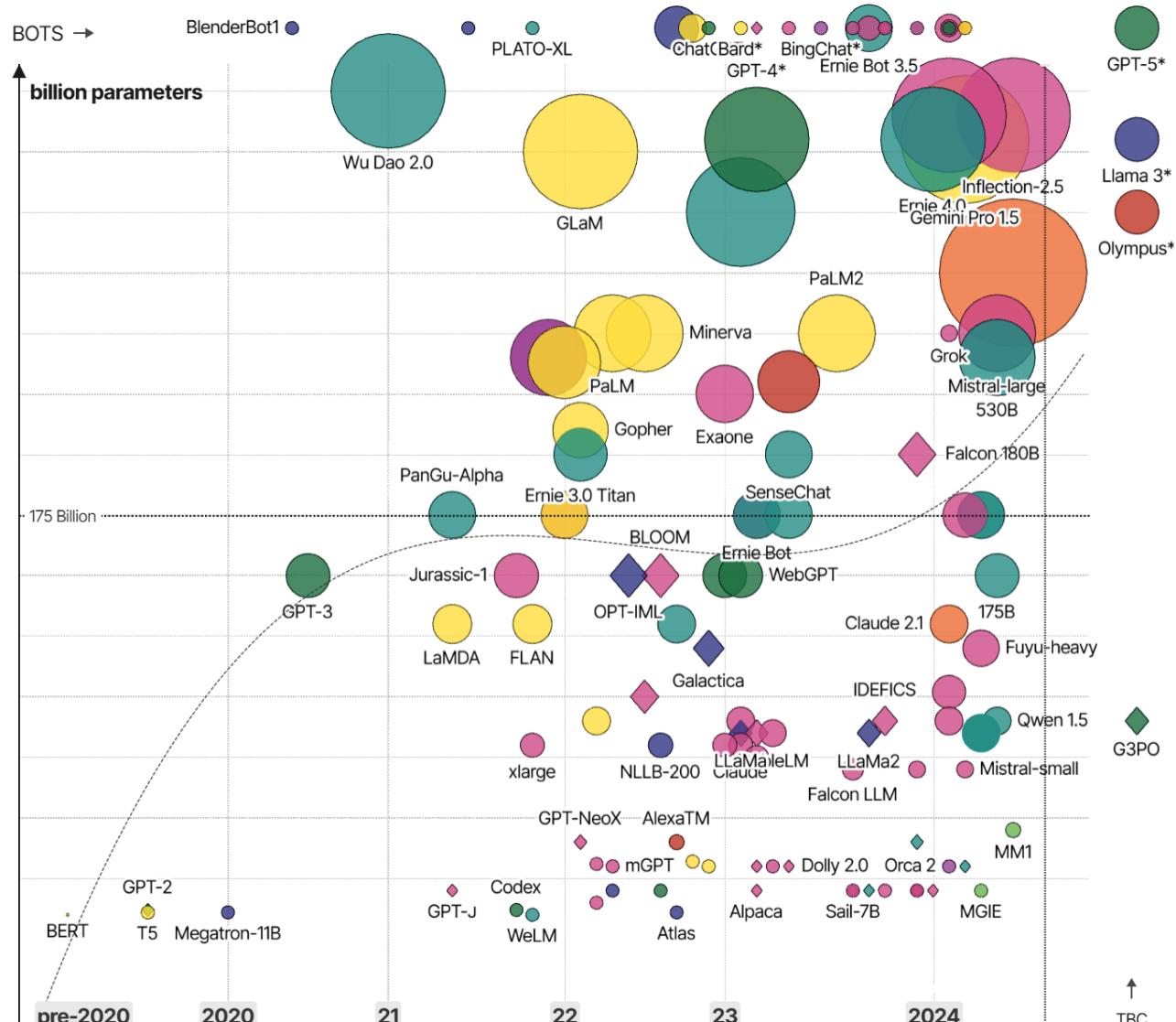


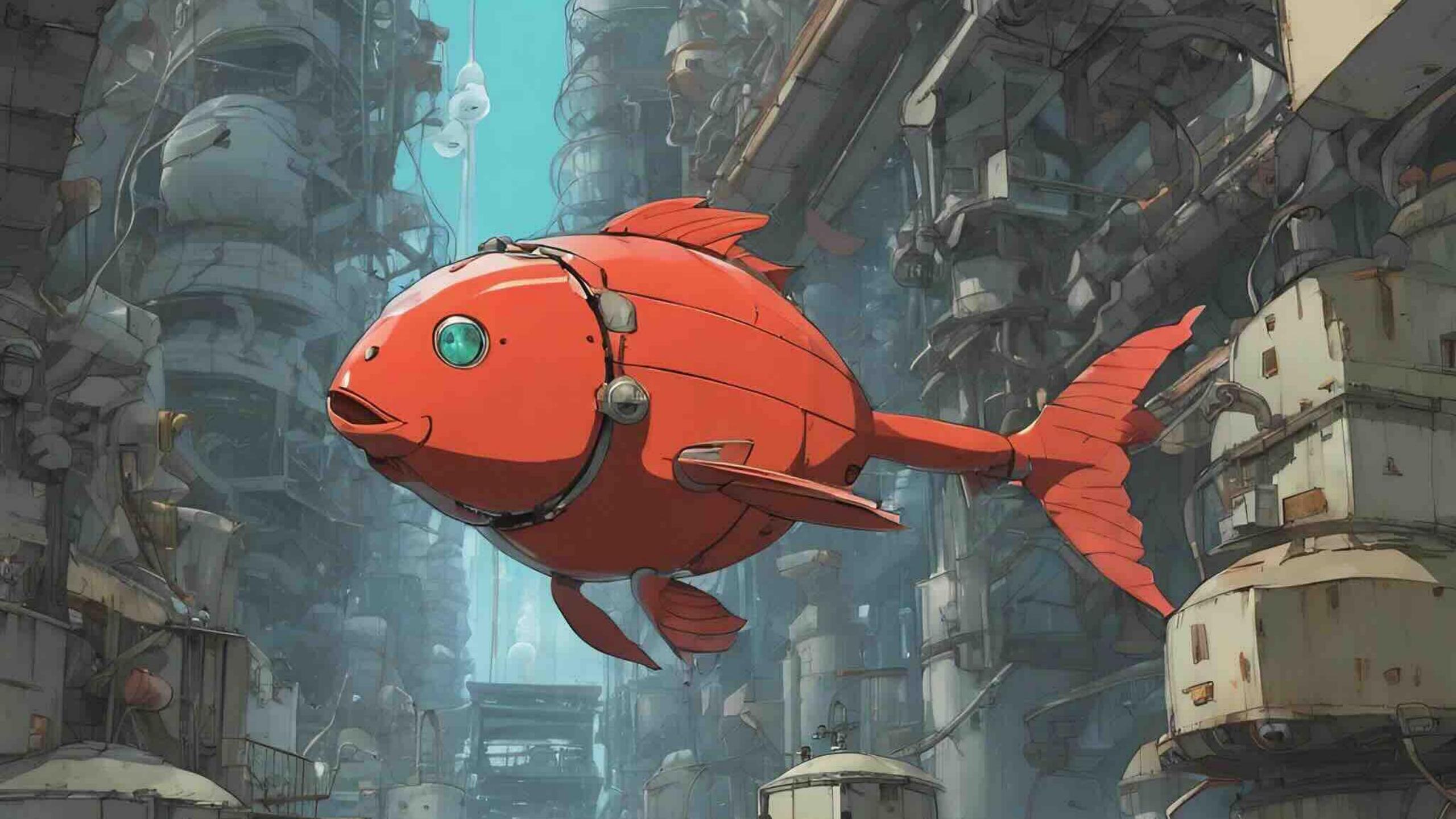
size = no. of parameters



open-access

● Amazon-owned ● Anthropic ● Apple ● Chinese ● Google ● Meta / Facebook ● Microsoft ● OpenAI ● Other





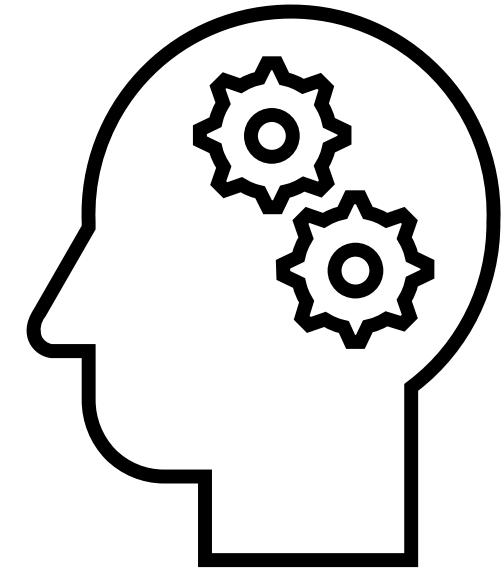
Introduction to AI concepts

<https://aka.ms/mslearn-ai-concepts>

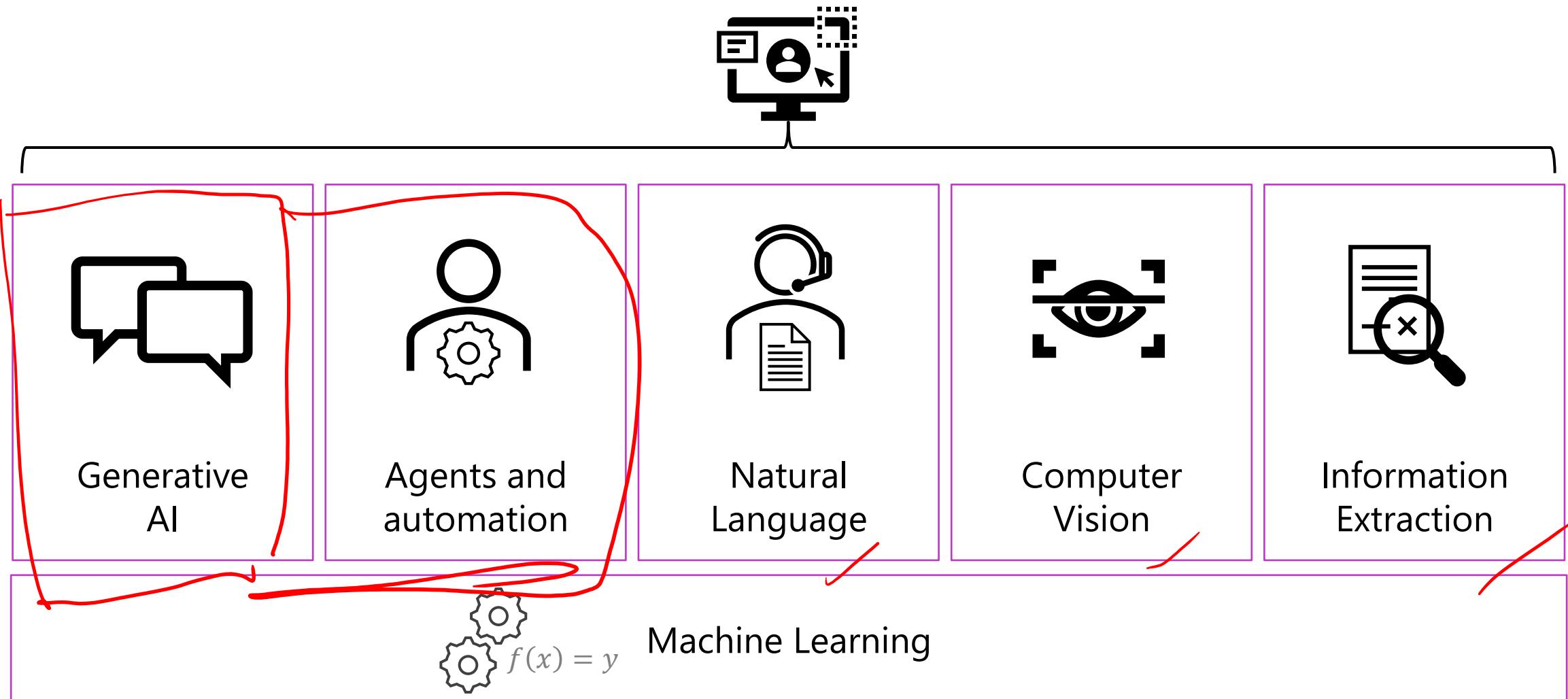
What is Artificial Intelligence?

Software that imitates human capabilities

- Predicting outcomes and recognizing patterns based on historic data.
- Recognizing abnormal events, making decisions, and taking appropriate action.
- Interpreting visual input.
- Understanding language and engaging in conversations.
- Extracting information from sources to gain knowledge.



What is Artificial Intelligence?



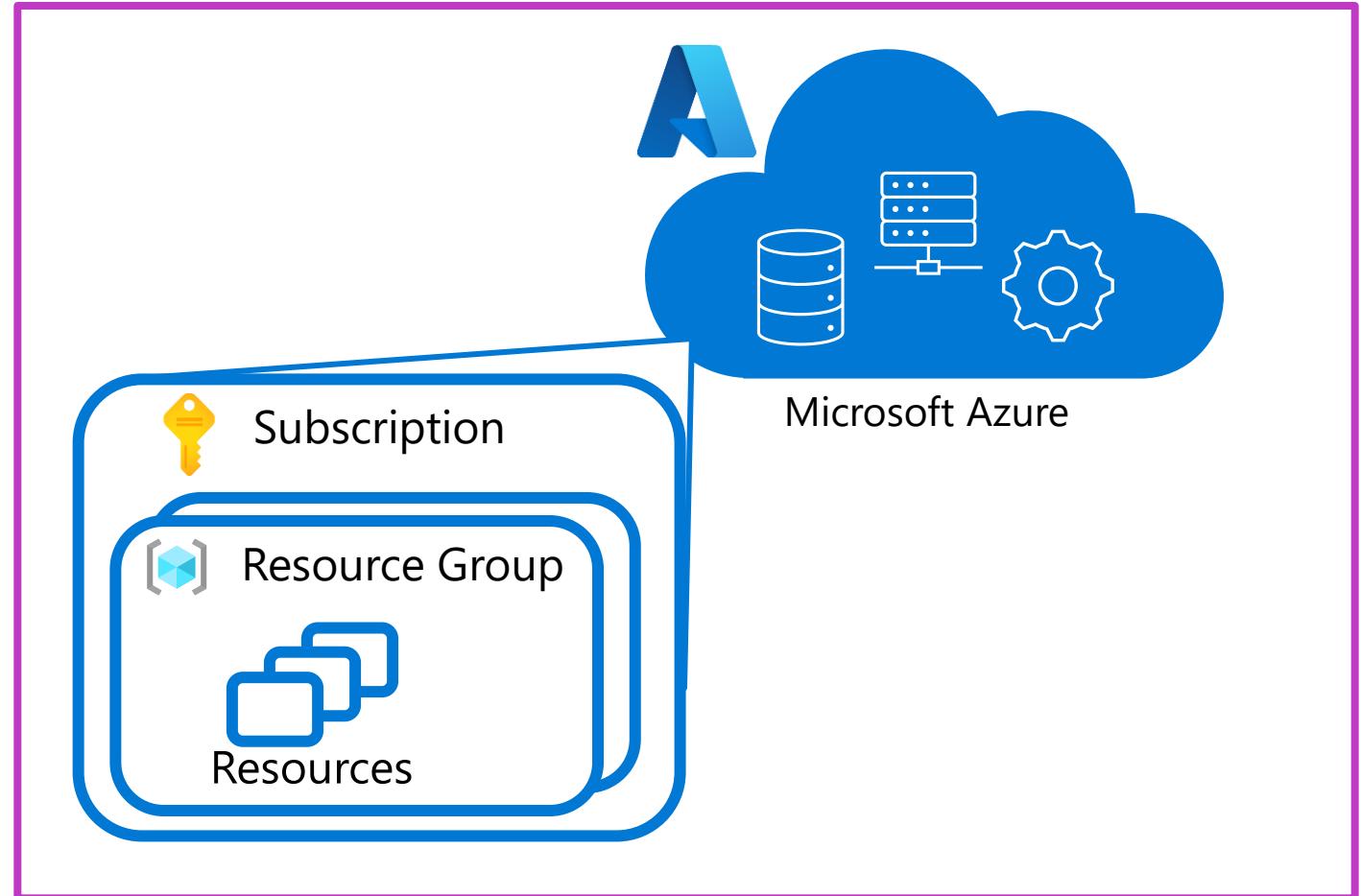
Principles of responsible AI

	Challenge or Risk	Example
 Fairness	Bias can affect results.	A loan-approval model discriminates by gender due to bias in the data with which it was trained.
 Reliability & safety	Errors may cause harm.	An autonomous vehicle experiences a system failure and causes a collision.
 Privacy & security	Private data could be exposed.	A medical diagnostic agent is trained using sensitive patient data, which is stored insecurely.
 Inclusiveness	Solutions may not work for everyone.	A predictive app provides no audio output for visually impaired users.
 Transparency	Users must trust a complex system.	An AI-based financial tool makes investment recommendations – what are they based on?
 Accountability	Who's liable for AI-driven decisions?	An innocent person is convicted of a crime based on evidence from facial recognition – who's responsible?

Microsoft Azure basics

Microsoft's Azure cloud platform provides scalable and reliable:

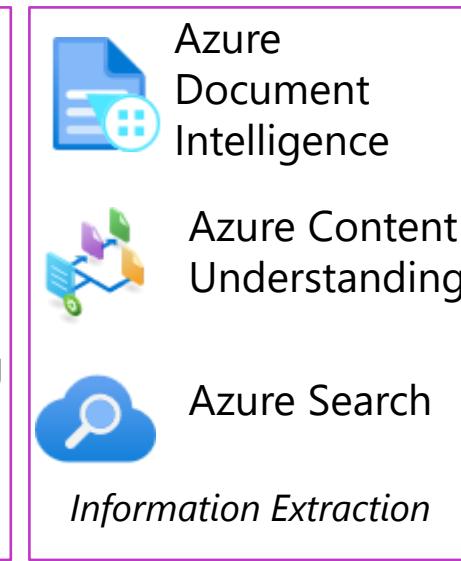
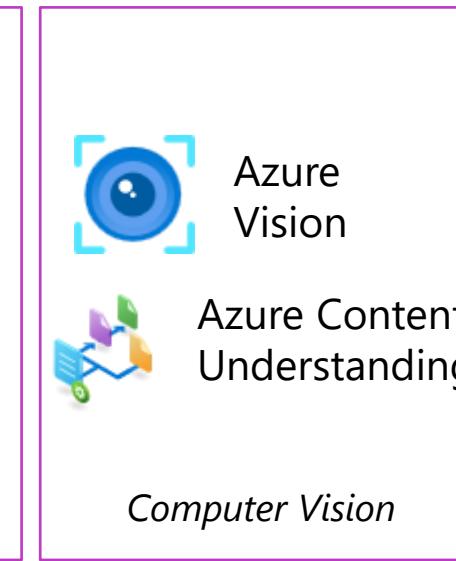
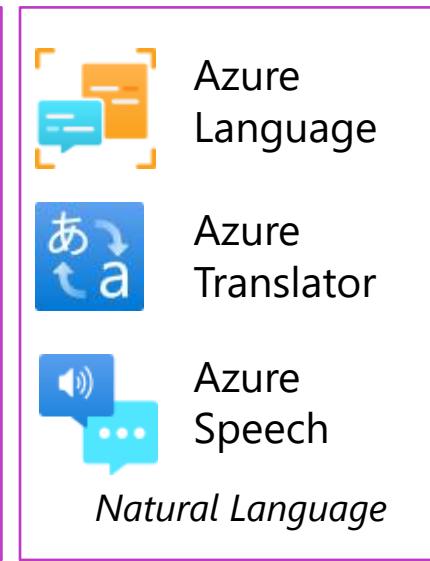
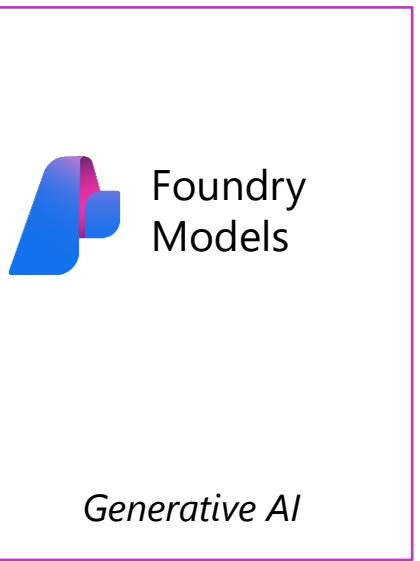
- Data storage
- Compute
- Tools



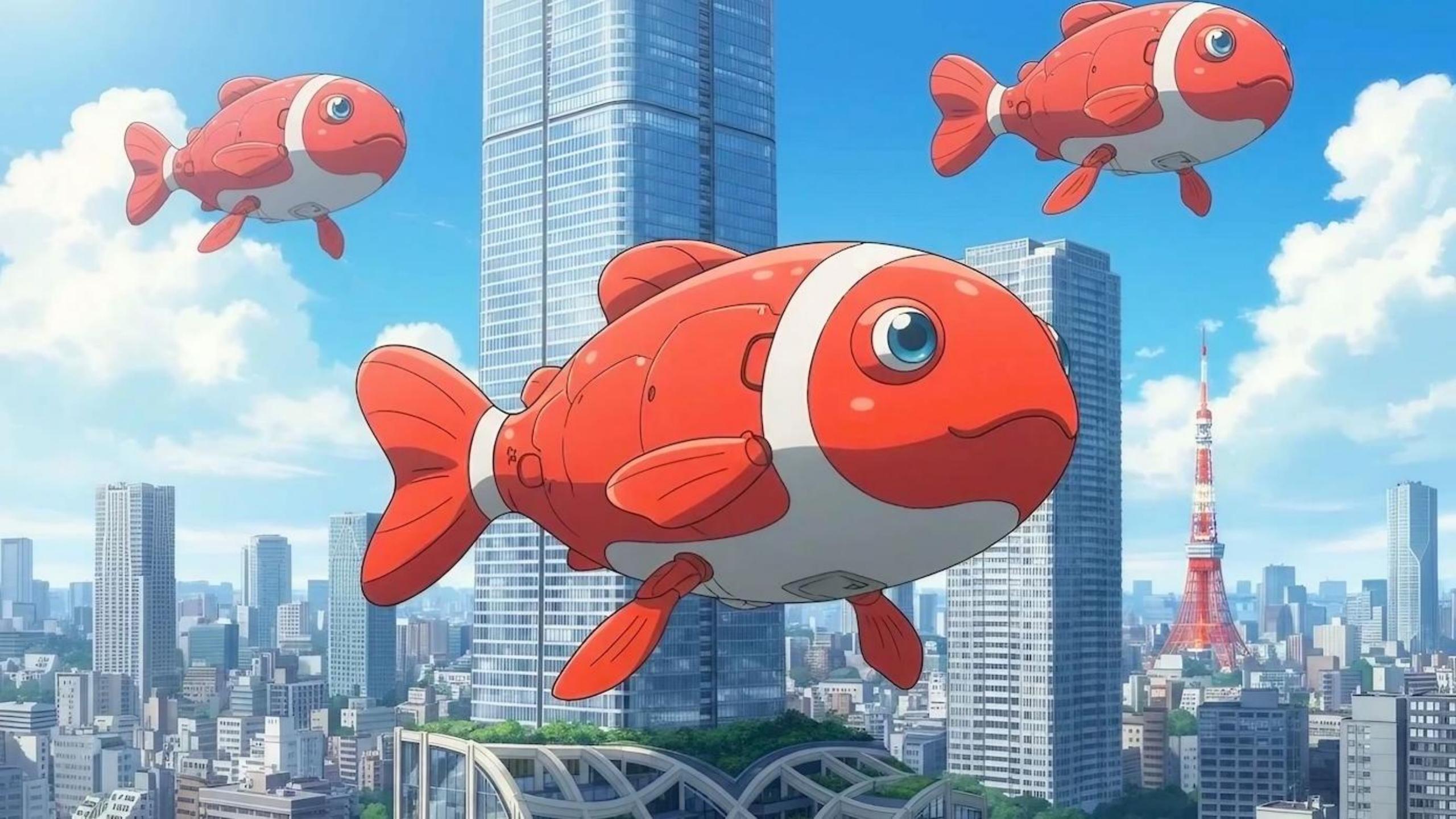
Microsoft Foundry Tools



Microsoft Foundry



Azure Machine Learning



Introduction to machine learning concepts

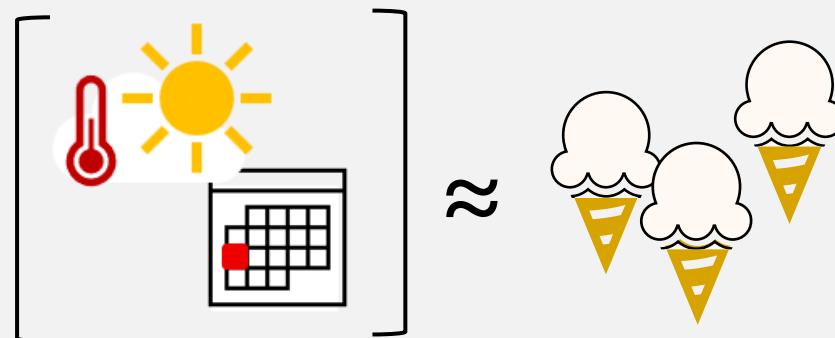
<https://aka.ms/mslearn-ml-concepts>

What is machine learning?

Predictive models that encapsulate relationships between:

- **Features** (known characteristics of something)
- **Label** (the thing we want to predict)

Example: Predicting ice cream sales for a given day



- Features
- Day of week
 - Month
 - Temperature
 - ...

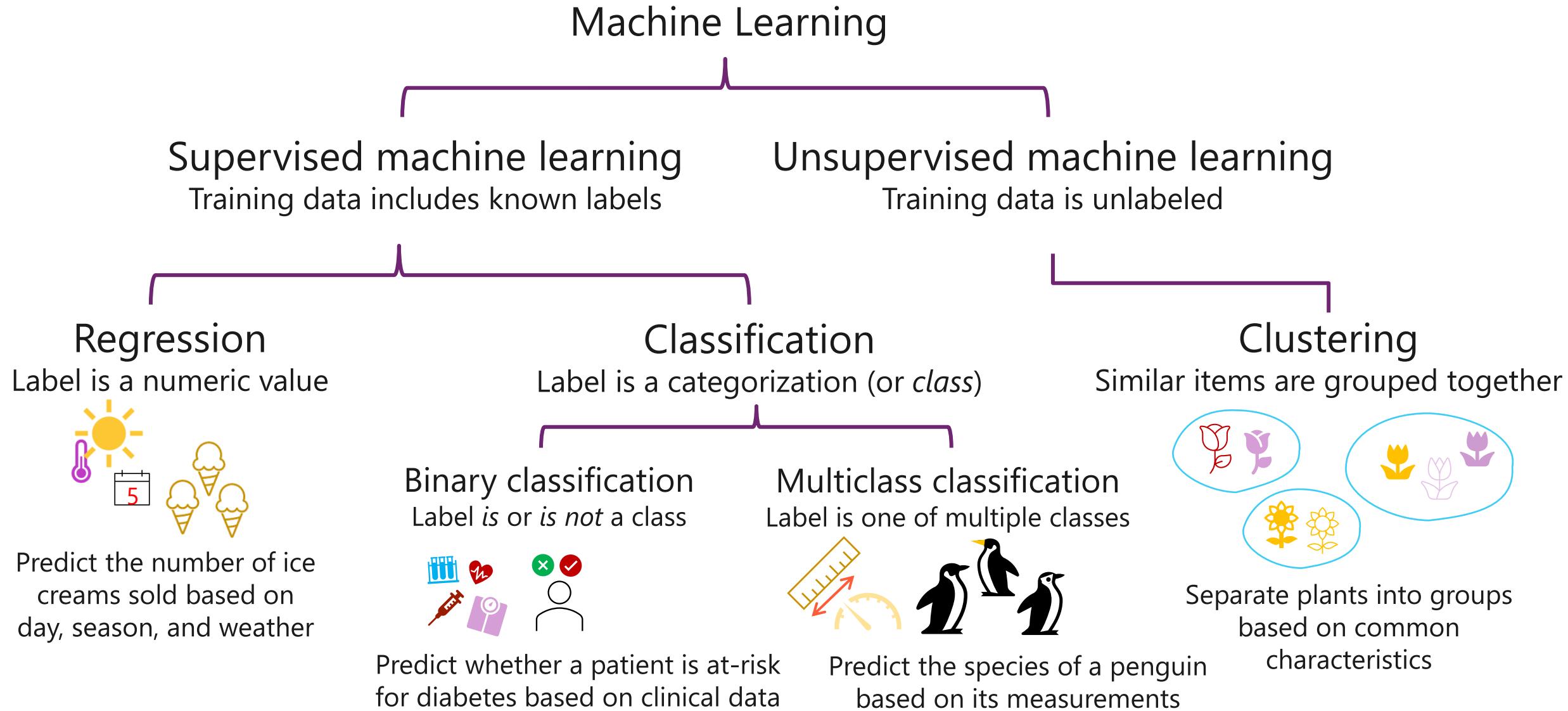
- Label
- Number of ice creams sold

Generalized function

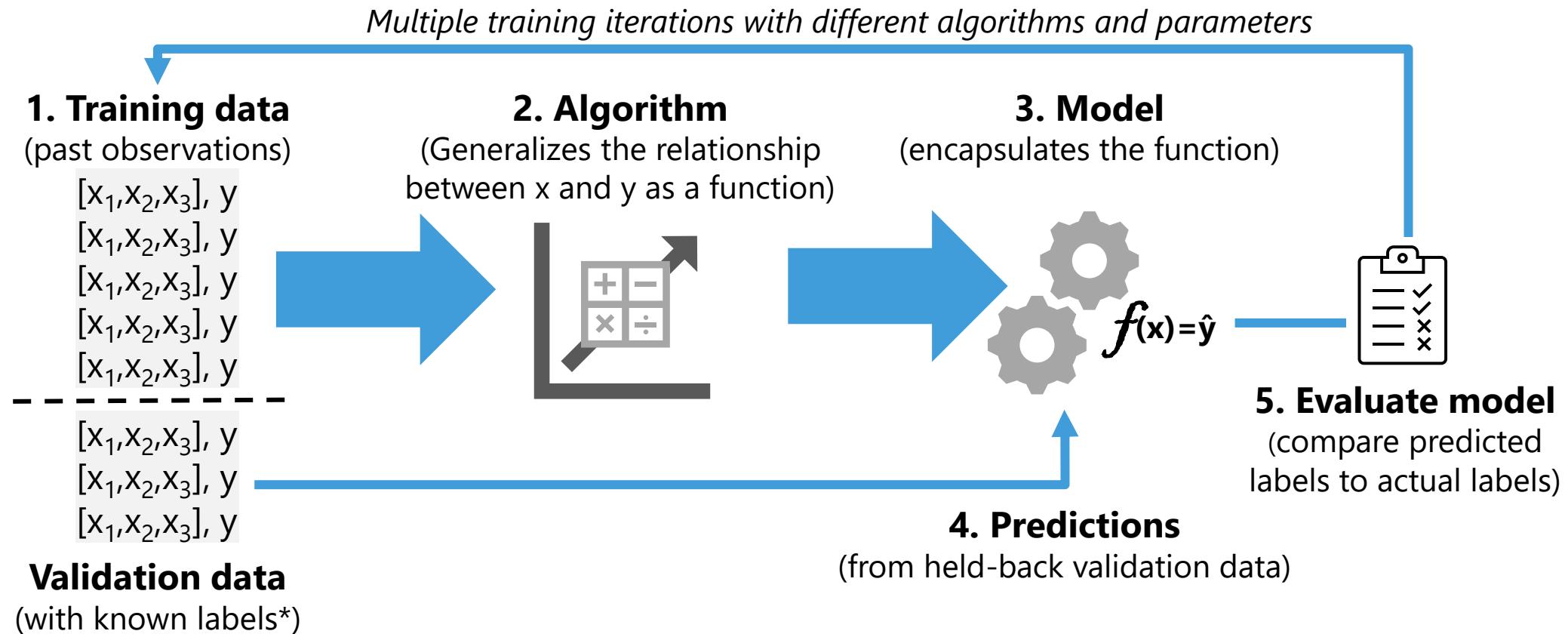
$$f(\underbrace{x_1, x_2, x_3}_{\text{Features}}) = \hat{y} \quad \text{Label}$$

(typically, an array of multiple features)

Types of machine learning

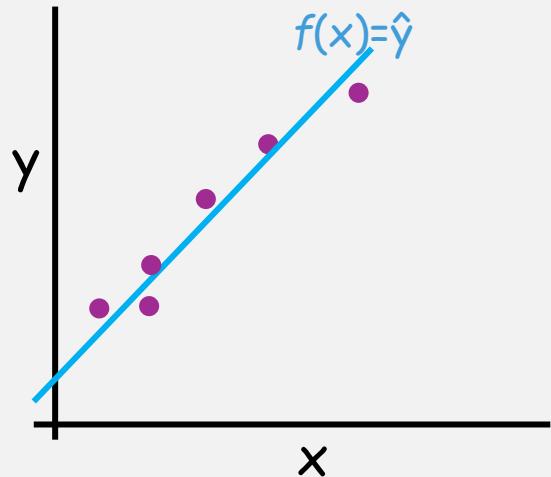


Model training and evaluation



Model algorithms and evaluation metrics

Regression

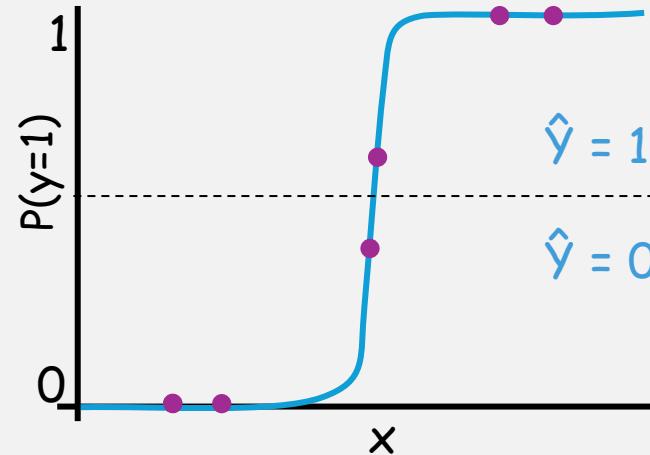


Example, *Linear Regression*

Evaluation metrics:

- *Mean absolute error (MAE)*
- *Mean squared error (MSE)*
- *Root mean squared error (RMSE)*
- *Coefficient of determination (R^2)*

Classification

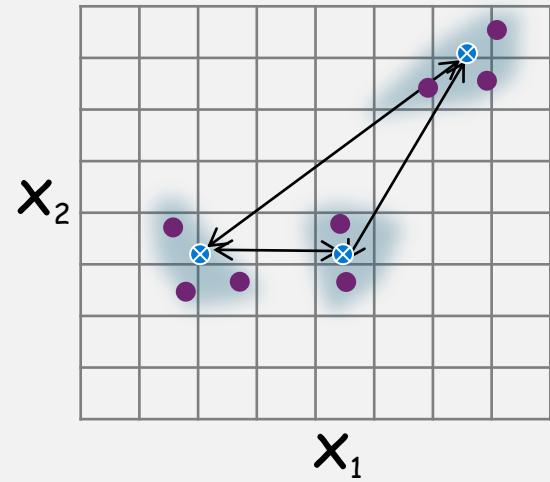


Example, *Logistic Regression*

Evaluation metrics (per class and overall):

- *Accuracy*
- *Recall*
- *Precision*
- *F1 Score*

Clustering



Example, *K-Means*

Evaluation metrics:

- *Cluster centroid distance*
- *Mean distance to centroid within cluster*
- *Silhouette score*

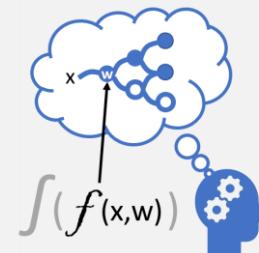
Deep learning

Human neural network

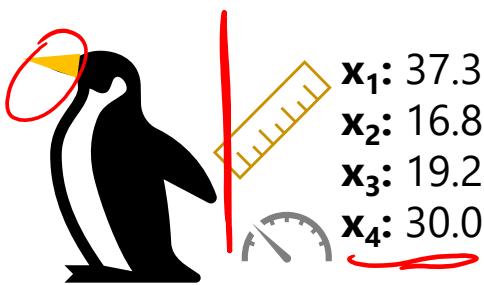


- Neurons fire in response to electrochemical stimuli
- When fired, the signal is passed to connected neurons

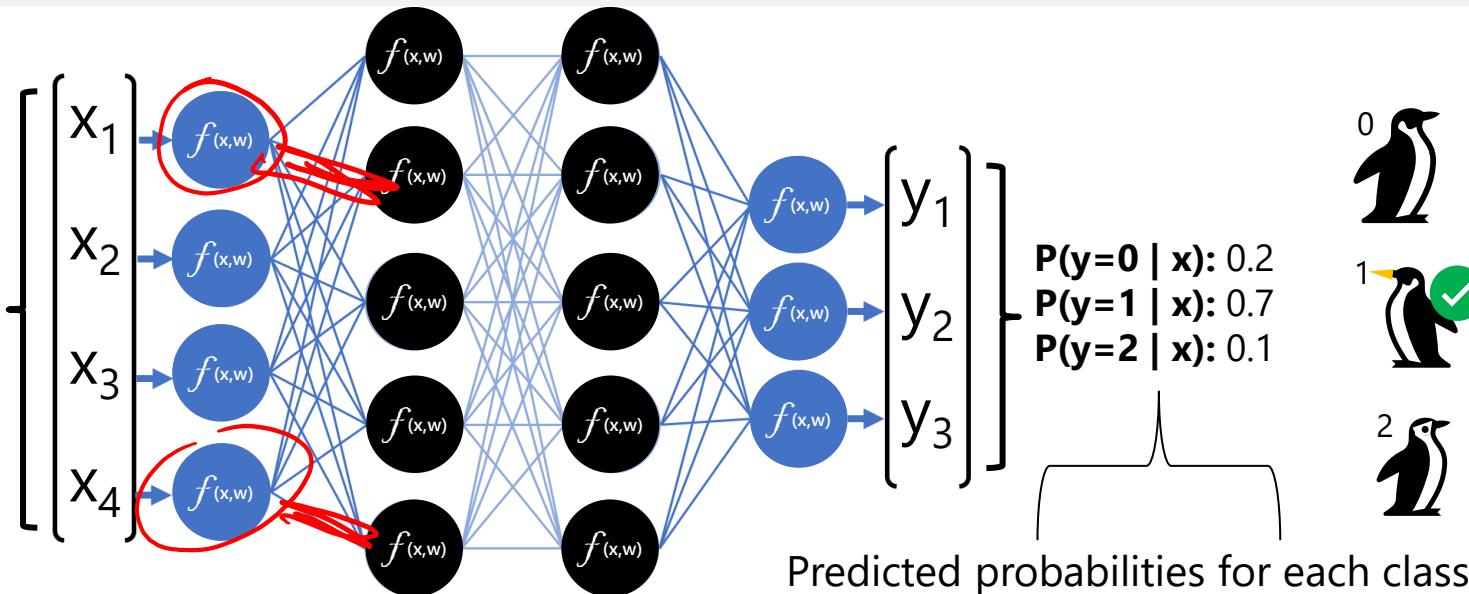
Artificial neural network



- Each neuron is a function that operates on an *input* value (x) and a *weight* (w)
- The function is wrapped in an *activation function* that determines whether to pass the output on to the next layer



$x_1: 37.3$
 $x_2: 16.8$
 $x_3: 19.2$
 $x_4: 30.0$



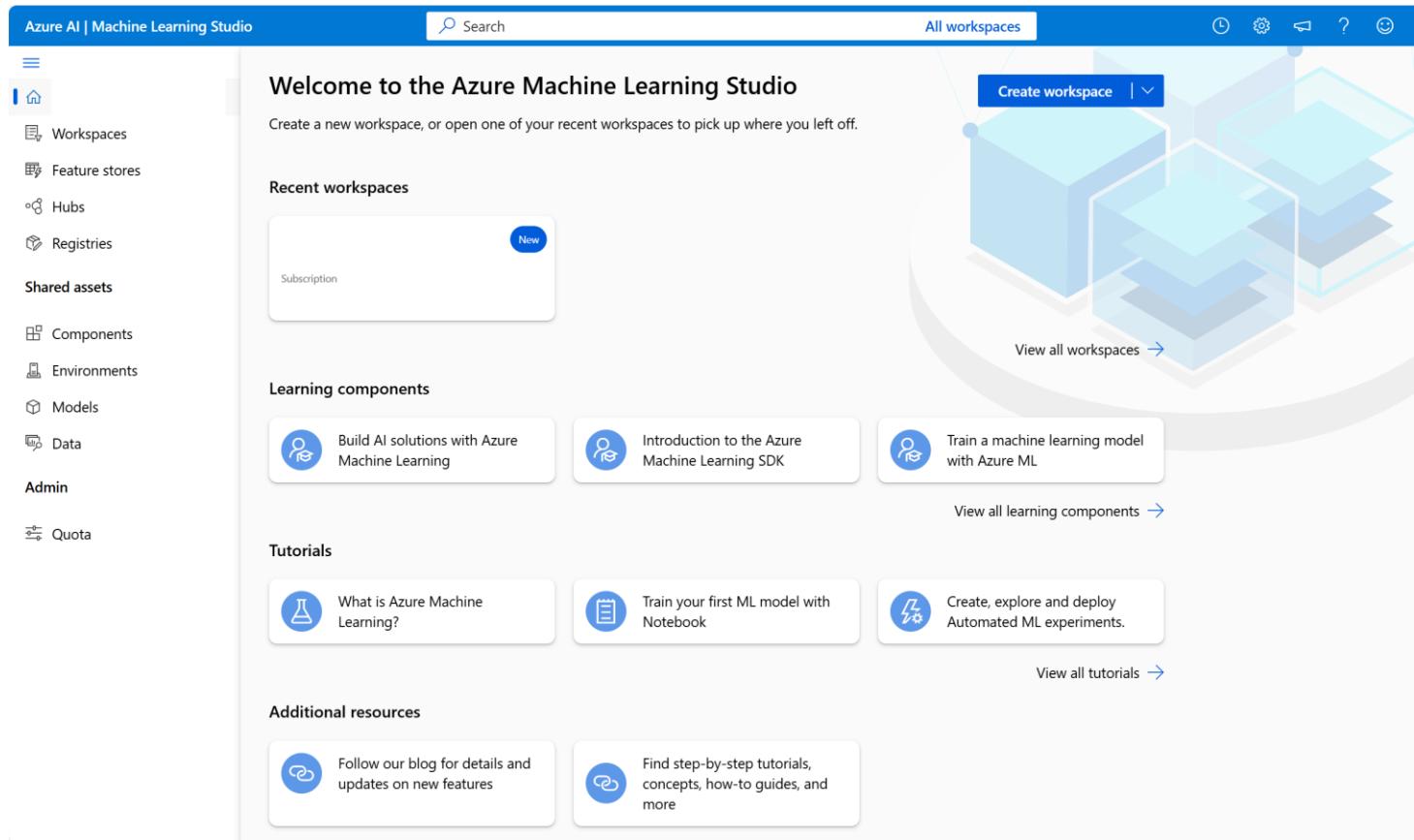
- The difference between predicted probabilities and actual label (0 or 1) is the **loss**.
- During training, weights are iteratively adjusted to minimize the loss

Get started with machine learning in Azure

<https://aka.ms/mslearn-azure-ml-intro>

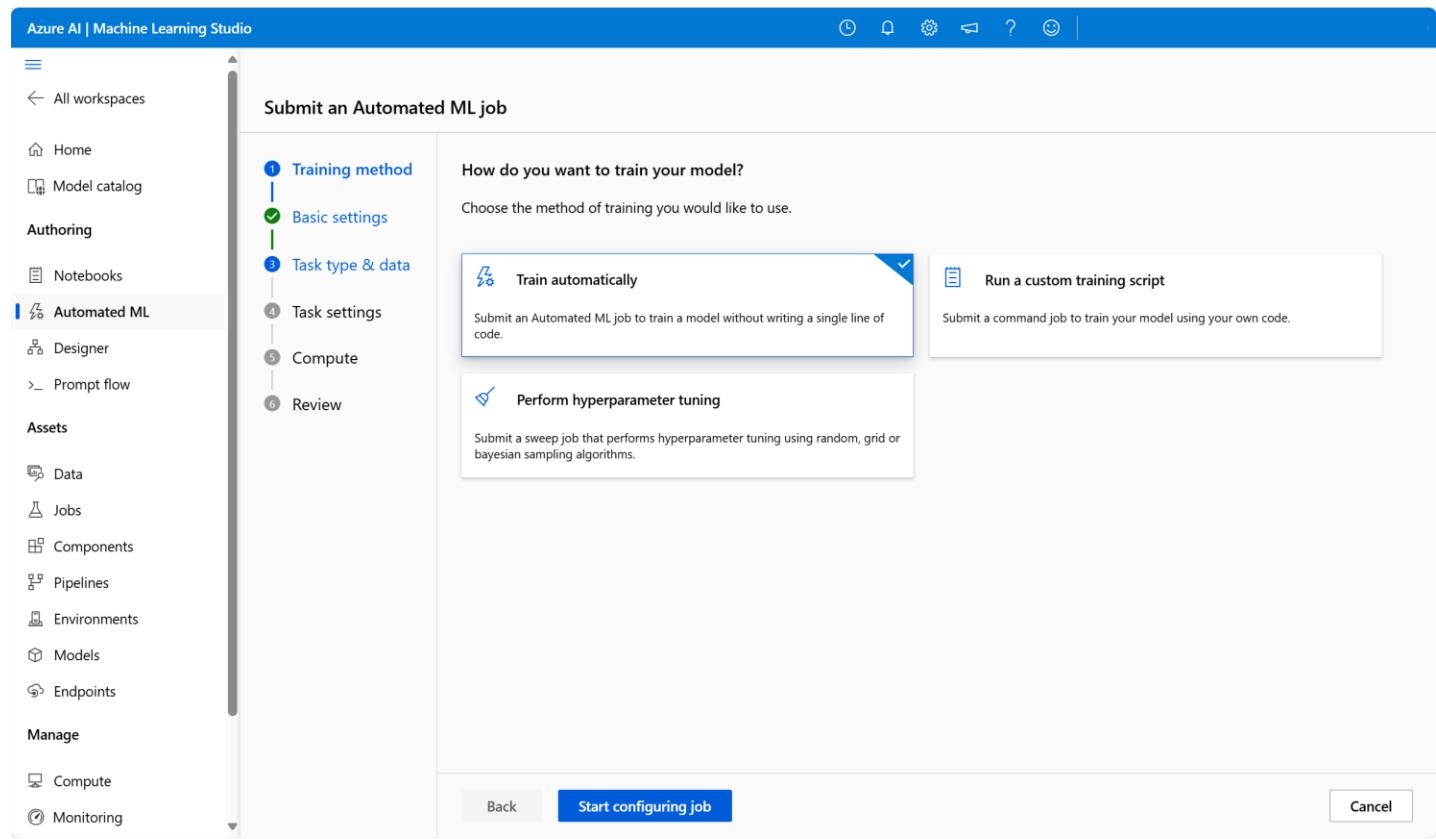
What is Azure Machine Learning?

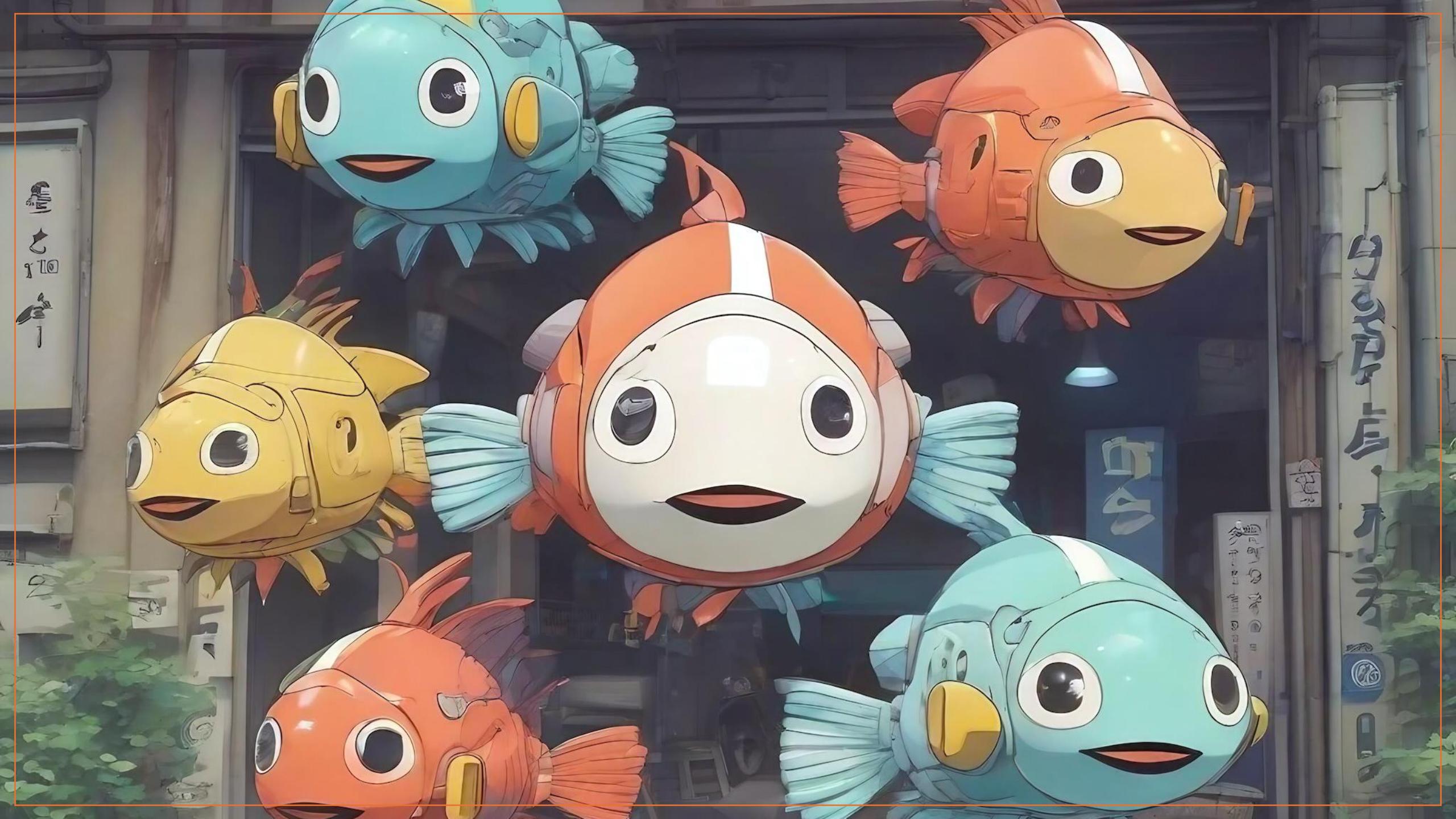
- Azure Machine Learning is a cloud-based platform for machine learning
- Azure Machine Learning Studio is a user interface for accessing Azure Machine Learning capabilities
- Machine learning models trained with Azure Machine Learning can be published as services and consumed by applications



What is Automated Machine Learning?

- A step-by-step wizard that helps you run machine learning training jobs
- Supports multiple machine learning types, including regression, time-series forecasting, classification, computer vision, and natural language processing tasks
- Connect to your data, define the training job and target metrics, and deploy the best resulting model



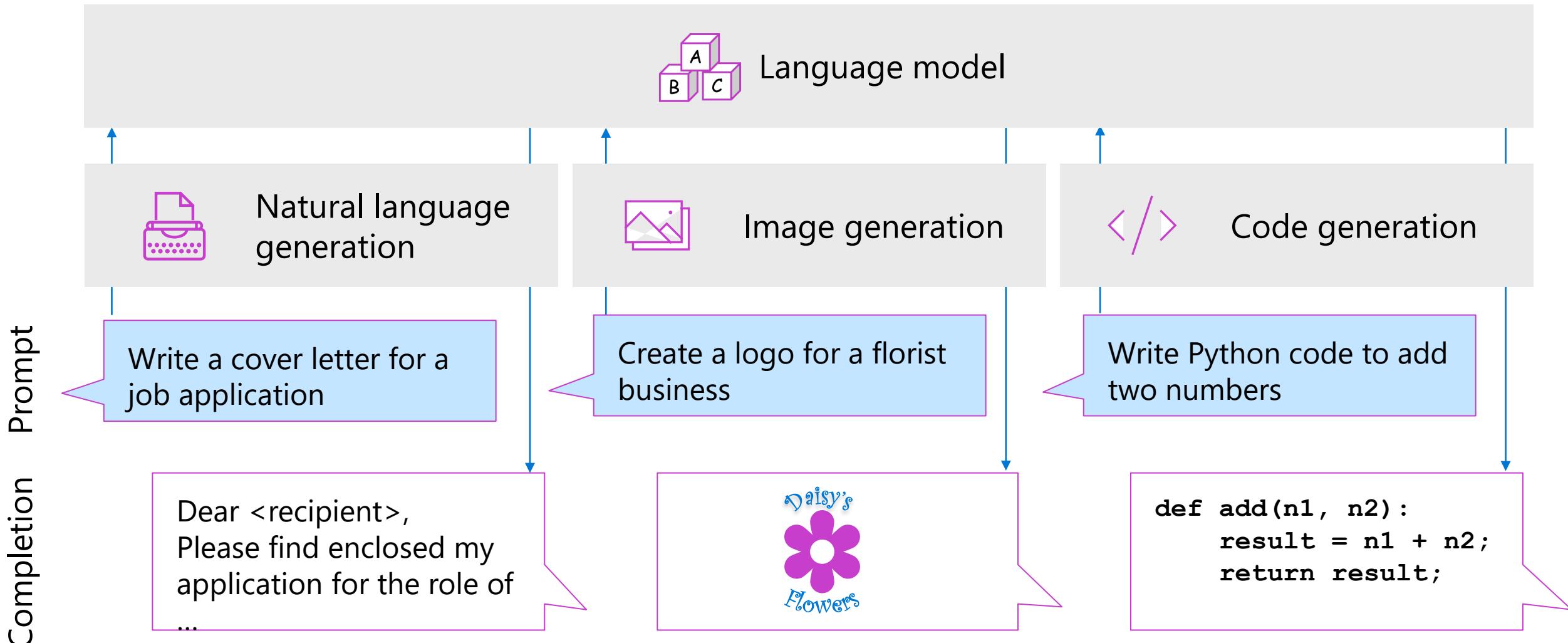


Introduction to generative AI concepts

<https://aka.ms/mslearn-intro-gen-ai>

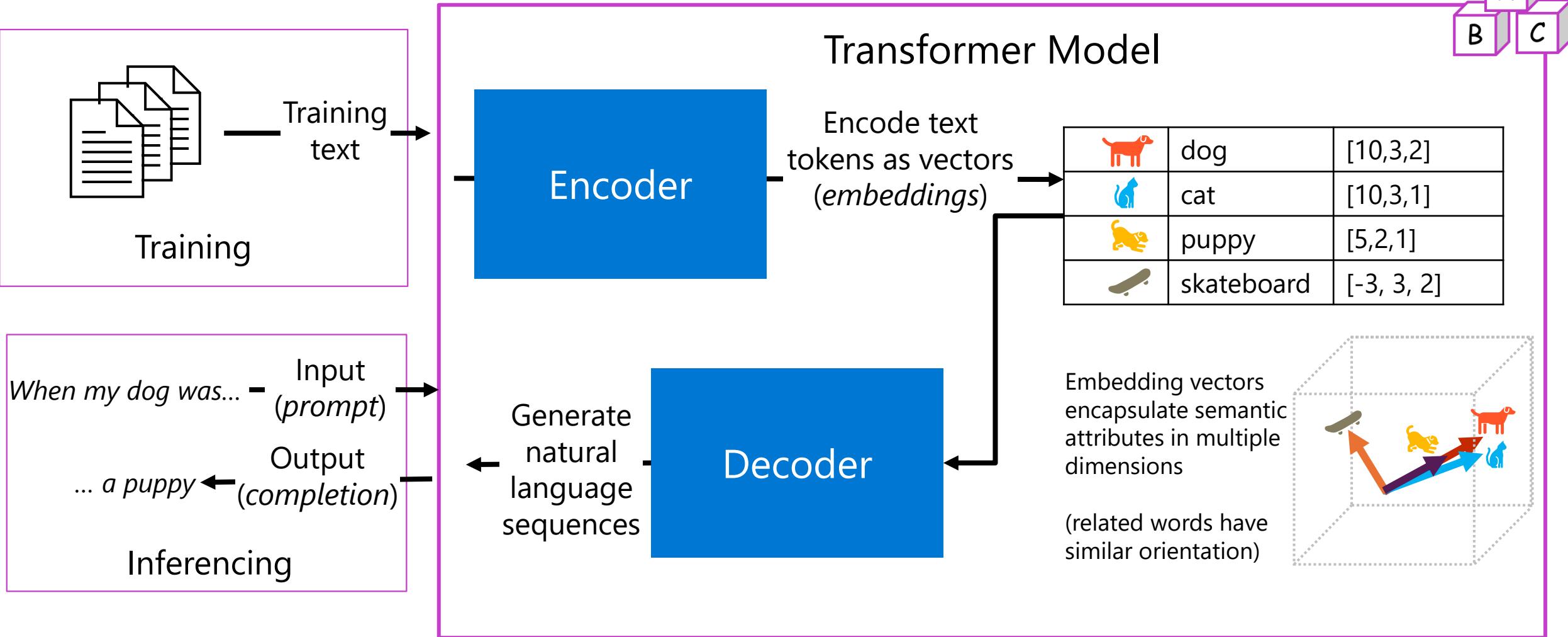


What is Generative AI?



Language models

A (very) high-level overview



Language models – tokenization

Step one: tokenization

The first step in training a transformer model is to decompose the training text into *tokens*.

Example sentence: *I heard a dog bark loudly at a cat.*

"I"=1

"heard"=2

"a"=3

"dog"=4

"bark"=5

"loudly"=6

"at"=7

"cat"=8

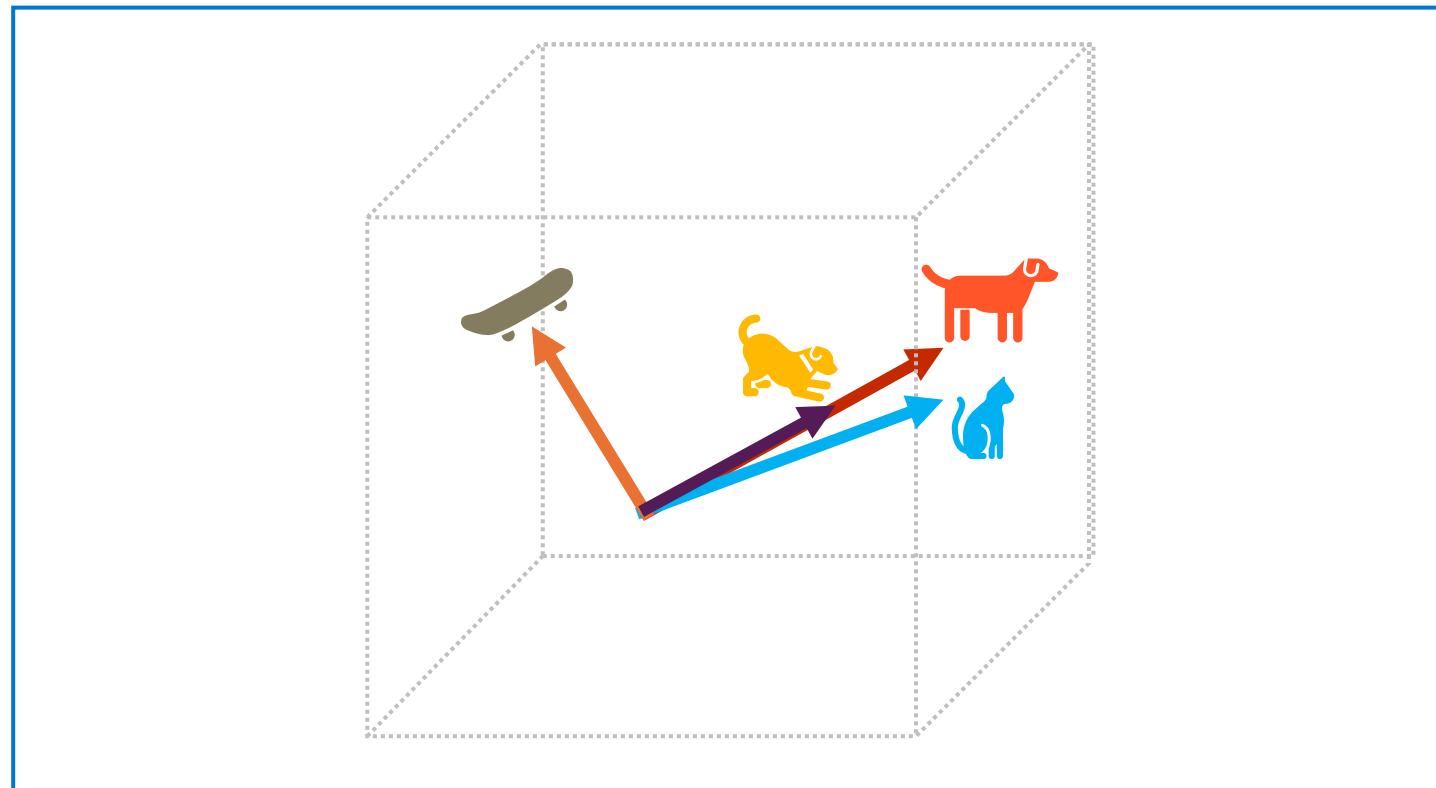
- The sentence is now represented with the tokens: [1 2 3 4 5 6 7 3 8].
- Note "a" is tokenized as 3 only once.
- Similarly, the sentence "I heard a cat" could be represented with the tokens [1 2 3 8].

R A G L
Retrieval
Augmented Generation

Language models – embeddings

Step two: embeddings

The semantic relationship between tokens is encoded in vectors, known as embeddings.



Token	Word	Embedding
	4 dog	[10,3,2]
	8 cat	[10,3,1]
	9 puppy	[5,2,1]
	10 skateboard	[-3, 3, 2]

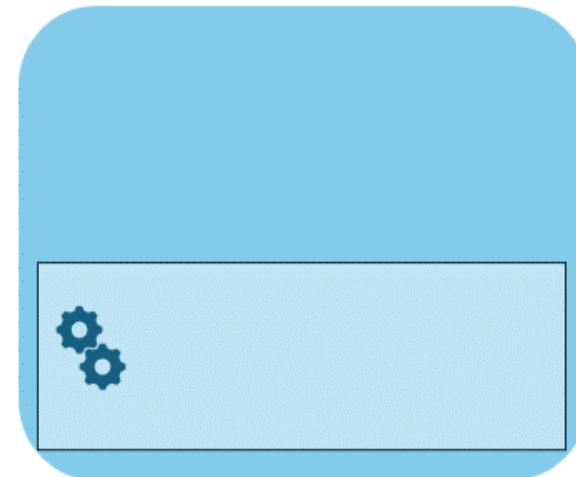
Language models – attention

Step three: attention

Capture the strength of relationships between tokens using the attention technique.

Example:

- Goal: predict token after “**dog**.”
- Represent “**I heard a dog**” as vectors.
- Assign “**heard**” and “**dog**” more weight.
- Several possible tokens can come after dog.
- The most probable token is added to the sequence, in this case “**bark**.”



Language models

Large and small language models

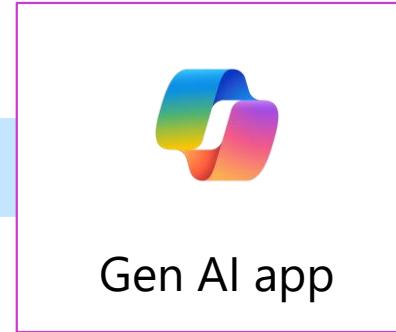
Large language models (LLMs)	Small language models (SLMs)
Trained with large volumes of general text data	Trained with focused text data
Many billions of parameters	Fewer parameters
Comprehensive language generation capabilities in multiple contexts	Focused language generation capabilities in specialized contexts
Large size can impact performance and portability	Fast and portable
Time-consuming (and expensive) to fine-tune with your own training data	Faster (and less expensive) to fine-tune with your own training data
Examples include: Azure OpenAI in Microsoft Foundry GPT 5 Mistral 7B Meta Llama 3	Examples include: Microsoft Phi 4 Microsoft Orca 2 Hugging Face GPT Neo

Considerations for prompts



Example:

Summarize the key considerations for adopting Copilot¹ described in this document² for a corporate executive³. Format the summary as no more than six bullet points with a professional tone⁴.



System Message:

You are a helpful assistant...

+

Conversation history⁵:

User: Hello

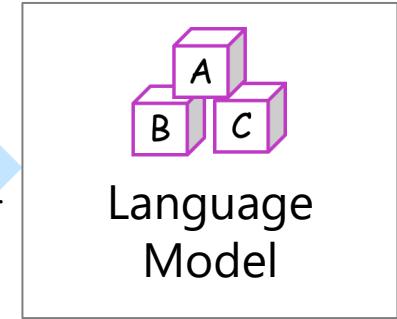
Assistant: Hi. How can I help?...

+

Current prompt:

User: Summarize the key ...

(May be further optimized by Copilot)



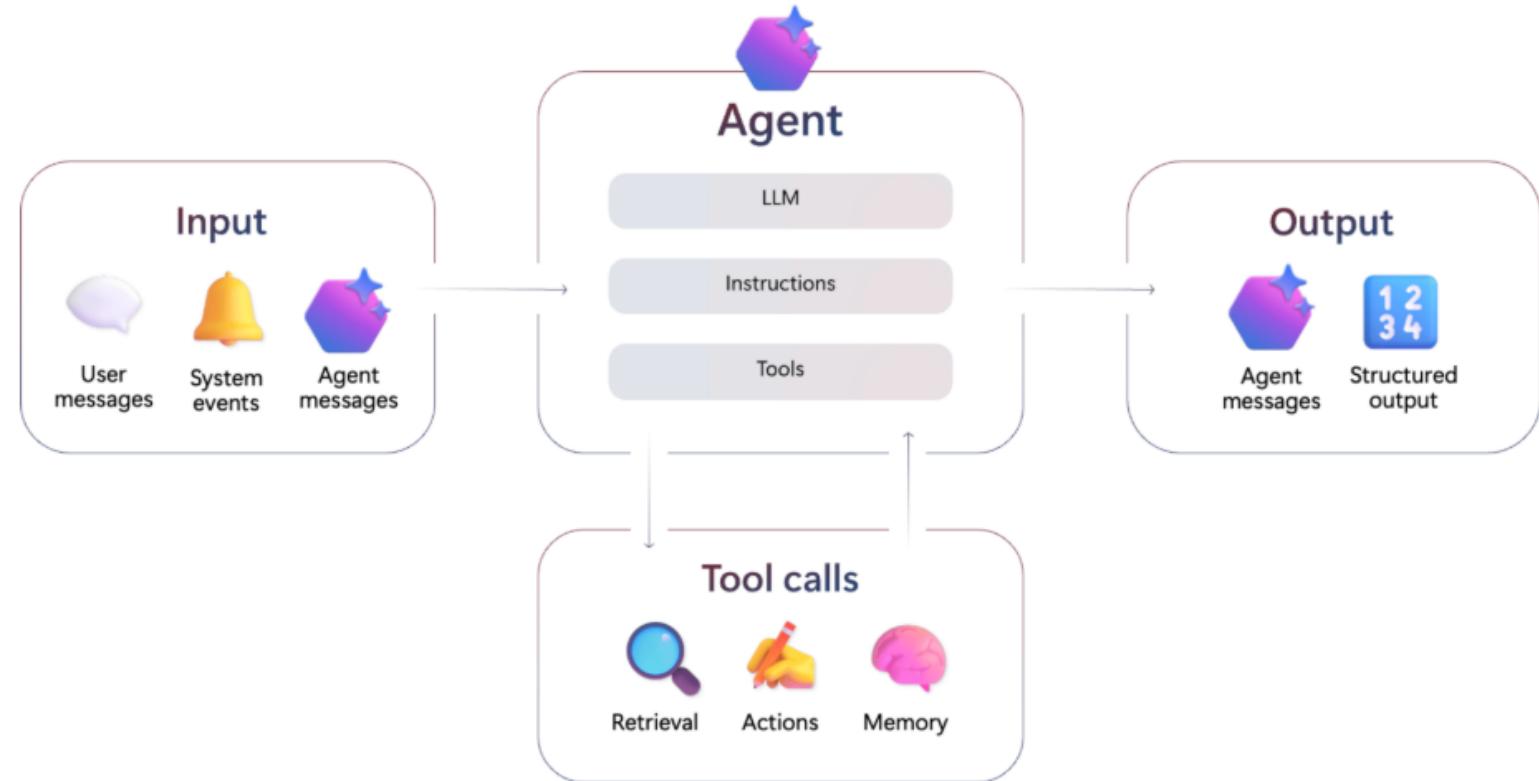
1. Start with a specific goal for what you want the output to be
2. Provide a source to *ground* the response in a specific scope of information
3. Add context to maximize response appropriateness and relevance
4. Set clear expectations for the response
5. Iterate based on previous prompts and responses to refine the result

What are agents?

Agents are generative AI applications that can respond to user input or assess situations *autonomously* and take appropriate *actions*.

Agents have three core components:

- **Model (LLM)**: Powers reasoning and language understanding
- **Instructions**: Define the agent's goals, behavior, and constraints
- **Tools**: Let the agent retrieve knowledge or take action



Responsible AI



Microsoft 365 Copilot



Copilot feature comparison

	For Individuals		For Organizations	
	Copilot	Copilot Pro	Copilot	Copilot for Microsoft 365
Foundational Capabilities	Free	\$20	Free	\$30
Web Grounding	●	●	●	●
Commercial Data Protection	●	?	●	●
Priority Model Access		●	●	●
Copilot in Outlook, Word, Excel, PowerPoint, and OneNote		●		●
Copilot in Teams			●	●
Microsoft Graph Grounding			●	●
Enterprise-Grade Data Protection				●
Customization			Copilot GPT Builder	Copilot Studio

Commercial Data Protection applies when users are signed into their work account using their organization's Entra ID.

Microsoft 365 Copilot



Grounded in
your business data

Microsoft 365 Copilot has real-time access to both your content and context in Microsoft Graph.



Comprehensive **security, compliance, and privacy**

Copilot inherits your security, compliance, and privacy policies set up in Microsoft 365.



Architected to protect data

Your data never leaves its secure partition, and it is never used for training purposes.



Integrated into the
apps you use every day

Word, Excel, PowerPoint, Outlook, Teams, and more.



Individual user and admin
always in control

User decides what to use, modify, or discard.



Designed to
learn new skills

As Copilot learns about processes, it can perform more sophisticated tasks and queries.



Microsoft 365 Copilot

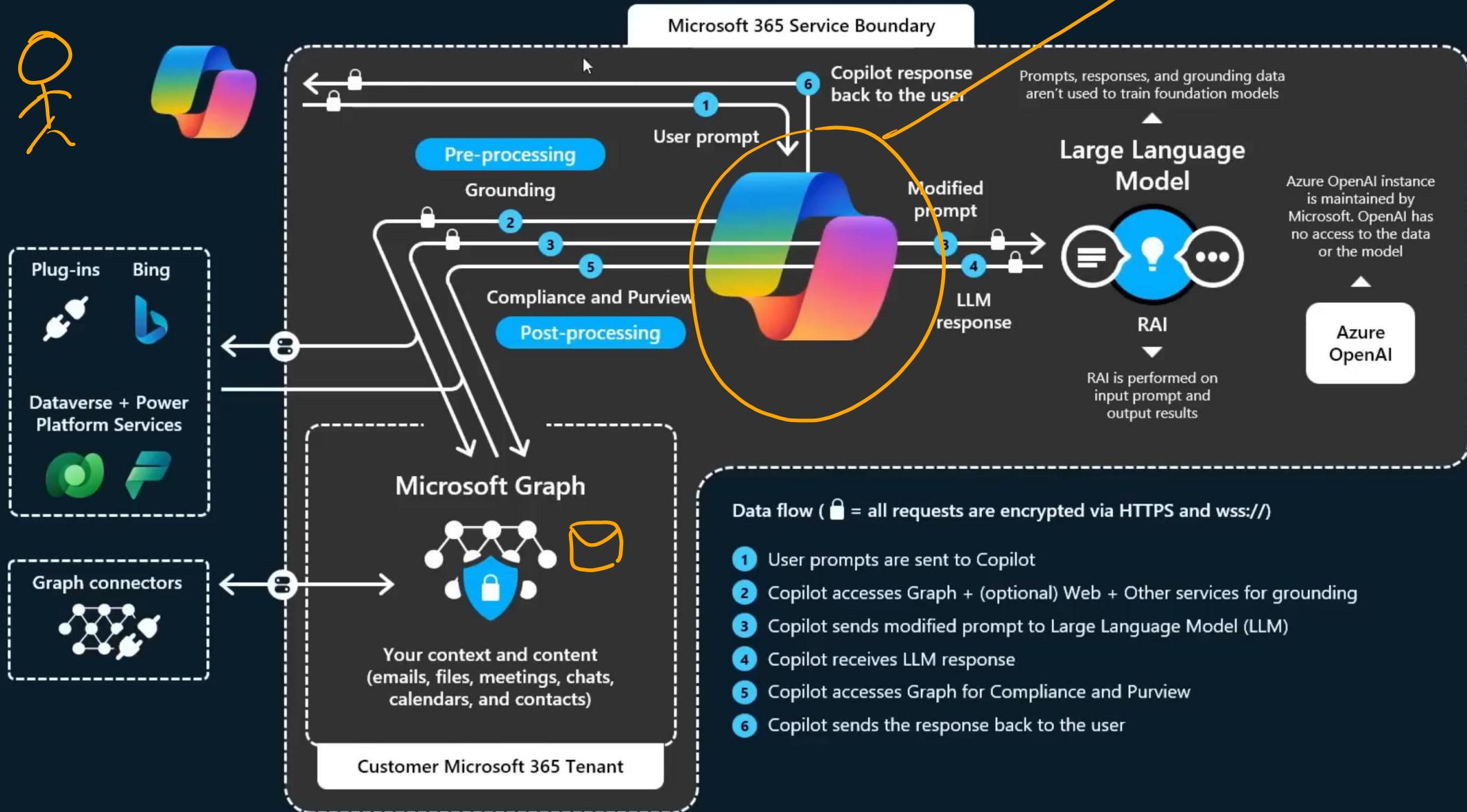
Embedded across Microsoft 365 apps



User

Copilot for Microsoft 365 architecture

user impersonation



Get started with generative AI in Microsoft Foundry

<https://aka.ms/mslearn-get-started-gen-ai>

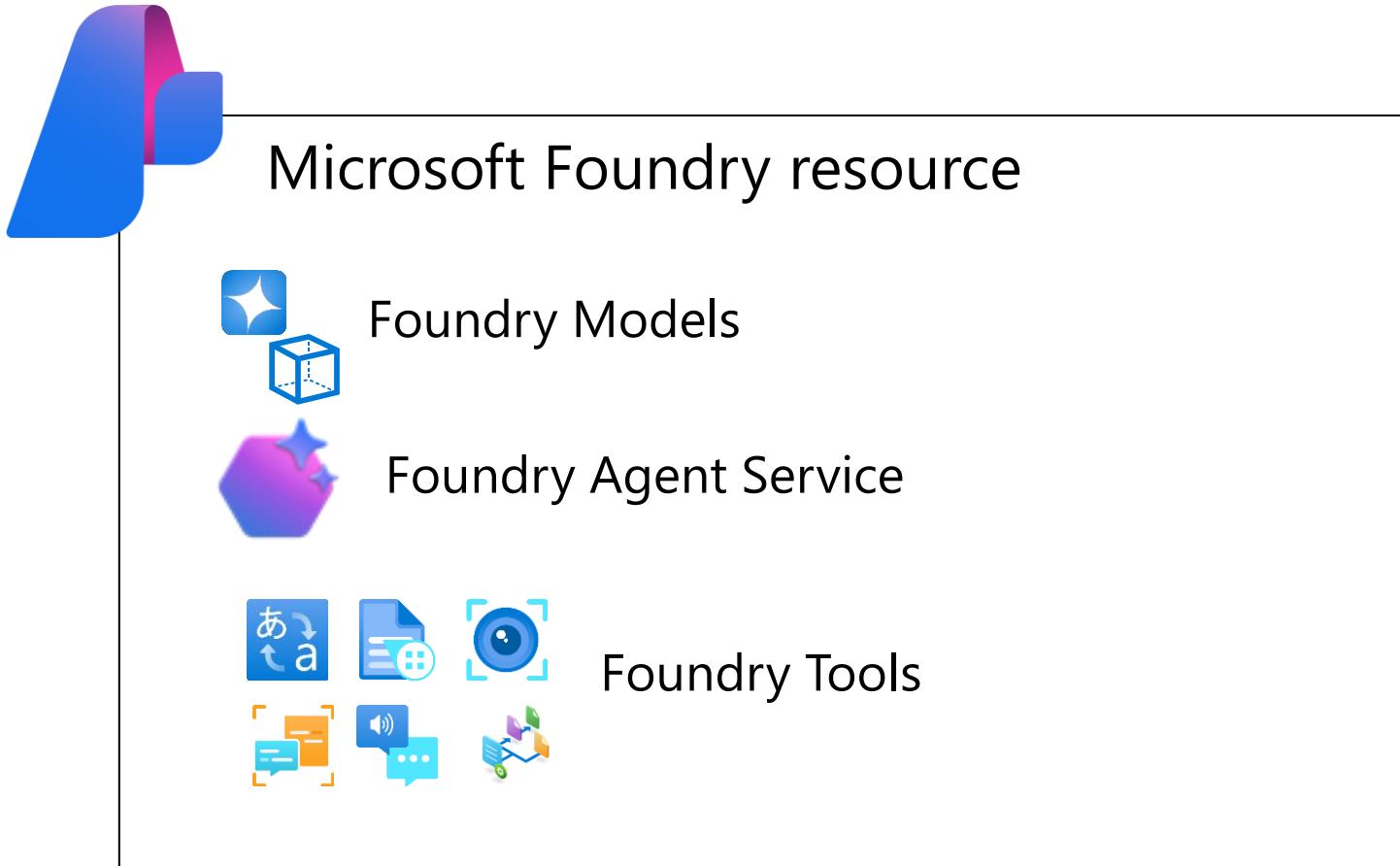


What is Microsoft Foundry?

- A cloud-based platform for AI development
- Provides a collaborative pro-code environment with enterprise-grade security for AI innovation
- Use to explore, build, test, and deploy AI solutions that are reliable, scalable, and secure

The screenshot displays the Microsoft Foundry web interface. At the top, there's a navigation bar with icons for 'New Foundry', 'Docs', and settings. Below the header, a main title 'Explore models and capabilities' is centered. On the left, a large callout box contains the heading 'Create smarter agents with Microsoft Foundry' and a subtext about designing, customizing, and managing AI agents. It features a prominent blue 'Create an agent' button. To the right of this box is a detailed view of an AI agent's interface, showing a 'Model deployment' dropdown set to 'GPT-4o mini', a 'System message' input field with placeholder text 'You are a helpful chatbot...', and a 'Knowledge' section with a '+ Add' button. A status bar at the bottom of this panel shows '5.8s', 'Groundedness 0.4', 'Fluency 0.4', and a 'View run trace' link. Below the main title is a search bar with the placeholder 'Search for a model'. Underneath it, a section titled 'Latest models' lists six AI models in a grid: 'gpt-5.1-codex-max' (Responses), 'claude-opus-4-5' (messages), 'claude-sonnet-4-5' (messages), 'gpt-5.1' (Chat completion, Responses), 'gpt-5.1-codex' (Responses), and 'DeepSeek-V3.1' (Chat completion). Each model card includes a small icon and a 'View' button. To the right of the latest models is a link 'Go to full model catalog'. At the bottom, a section titled 'Explore more capabilities' features a large, close-up image of a cat's face.

Microsoft Foundry projects



Foundry models

- Find the model that best suits your needs in the Foundry model catalog:
 - OpenAI (e.g. GPT 5)
 - Microsoft (e.g. Phi 4)
 - Popular third-party models
- Deploy the model(s) you want to use in your apps

The screenshot shows the Microsoft Foundry Model catalog interface. At the top, there's a header with the Microsoft Foundry logo and a 'Model catalog' link. On the right side of the header are buttons for 'New Foundry', 'Docs', 'Help', and other settings.

The main content area has a title 'Find the right model to build your custom AI solution'. Below it, there's a section for 'Announcements' featuring cards for 'Introducing GPT-5.1-codex-max', 'Introducing Mistral Large 3', 'Introducing claude-opus-4-5', 'Introducing claude-opus-4-1', and 'Introducing claude-sonnet-4-5'. Each card includes a 'Check out model' button and a 'Read blog' link.

Below the announcements, there's a section for 'Model leaderboards'. It includes four boxes: 'Quality' (top 3: claude-sonnet-4-5, grok-4, gpt-5-pro), 'Safety' (top 3: gpt-5-pro, claude-haiku-4-5, gpt-5-mini), 'Cost' (top 3: gpt-5-nano, mistral-small-2503, gpt-4.1-nano), and 'Throughput' (top 3: gpt-oss-120b, gpt-5-nano, grok-code-fast-1). Each box has a 'Browse leaderboards' button.

At the bottom of the page, there's a search bar and a 'Compare models' button. The footer indicates there are 'Models 11257' available.

Some specific model cards shown at the bottom include:

- gpt-5.1-codex-max Responses
- claude-opus-4-5 messages
- claude-sonnet-4-5 messages
- gpt-5.1 Chat completion, Responses
- gpt-5.1-codex Responses
- DeepSeek-V3.1 Chat completion
- Mistral-Large-3 Chat completion
- gpt-5-chat Chat completion, Responses
- claude-haiku-4-5 messages
- model-router Chat completion

Chat playground

- Test Foundry model deployments in the *Chat playground*
- Experiment with questions, instructions, your own data, and parameters
- Deploy your customization as a web app

The screenshot shows the Microsoft Foundry Chat Playground interface. At the top, there are navigation links: 'View code' (highlighted in blue), 'Deploy', 'Import', 'Export', 'Prompt samples', and 'Filters feedback'. Below this is a 'Help' button.

The main area is divided into two sections: 'Setup' on the left and 'Chat history' on the right.

Setup: This section includes a 'Deployment' dropdown set to 'gpt-4o (version:2024-11-20)', a text input for 'Give the model instructions and context' containing the placeholder 'You are an AI assistant that helps people find information.', and buttons for 'Apply changes', 'Generate system prompt', and '+ Add section'.

Chat history: This section displays a message from 'Azure AI Foundry | gpt-4o-2024-11-20' stating: 'Microsoft Foundry's Chat Playground is a tool designed to experiment with and build conversational AI experiences. Although specific features might vary depending on updates, here are some typical capabilities and uses of a chat playground:' followed by a numbered list of six items.

User Query: A large input field at the bottom left contains the placeholder 'Type user query here. (Shift + Enter for new line)'. At the bottom right, it says '358/128000 tokens to be sent' with icons for copy, paste, and send.

Message Content:

What can you do with Microsoft Foundry's chat playground?

AI-generated content may be incorrect

Azure AI Foundry | gpt-4o-2024-11-20

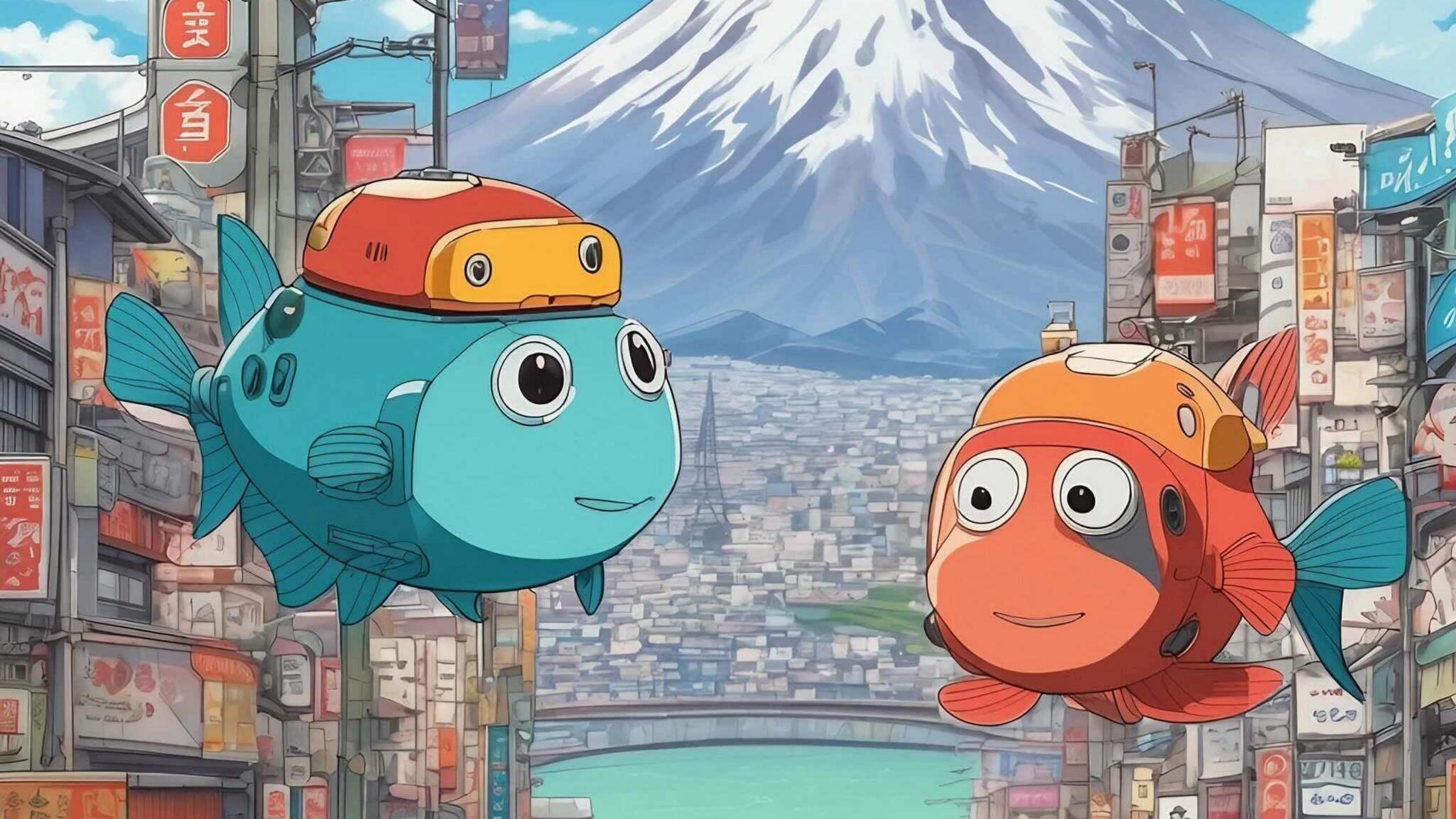
Microsoft Foundry's Chat Playground is a tool designed to experiment with and build conversational AI experiences. Although specific features might vary depending on updates, here are some typical capabilities and uses of a chat playground:

- 1. Prototype Conversational AI Bots:**
 - Create and test chatbot flows without needing extensive coding.
 - Simulate conversations to understand user interactions.
- 2. Experiment with Chatbot Features:**
 - Test AI models for natural language understanding (NLU).
 - Try out different intents, entities, and responses.
 - Explore conversational design principles, such as fallback handling or multi-turn dialogue.
- 3. Integrate APIs and Services:**
 - Connect external APIs or databases to enhance chatbot functionality.
 - Test how bots interact with backend systems for dynamic data retrieval or updates.
- 4. Analyze User Behavior and Responses:**
 - Use logs or analytics to study user interactions.
 - Identify areas for improvement in bot responses or flow design.
- 5. Collaborative Design:**
 - Work with teams to refine conversational AI experiences.
 - Share prototypes and gather feedback.
- 6. Deploy and Test Scenarios:**
 - Simulate real-world use cases to ensure robust performance.

Foundry Agents

- Create agents in Foundry specifying:
 - Agent name
 - Model deployment
 - Instructions
 - Knowledge tools
 - Action tools
 - Connected agents
- Test agents in the *Agents playground*

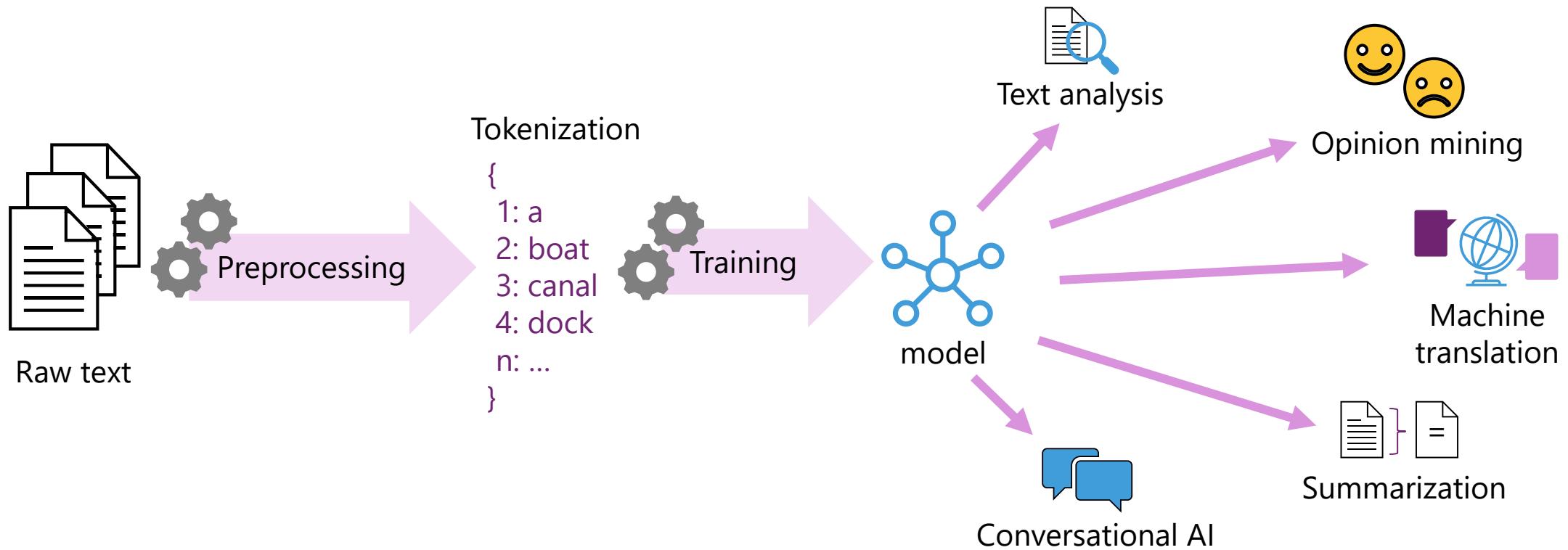
The screenshot shows the Microsoft Foundry web interface with the 'Agents' page selected. The left sidebar includes links for Overview, Model catalog, Playgrounds, Agents (selected), Templates, Fine-tuning, Content Understanding, Observe and optimize, Tracing, Monitoring, Protect and govern, Evaluation, Guardrails + controls, Risks + alerts, Governance, Azure OpenAI, Stored completions, and Batch jobs. The main area is titled 'Create and debug your agents' and shows a list of 'My agents' with one entry: 'Agent998'. A red box highlights the '+ New agent' button. To the right, the 'Setup' section is detailed, with fields for 'Agent ID' (set to 'asst_OY9Mz9eXqTGqVLsOCbC1n50p'), 'Agent name' (set to 'Agent998'), 'Deployment' (set to 'gpt-4o (version:2024-11-20)'), and 'Instructions' (a large text area with placeholder text). A red box highlights the 'Try in playground' button in the top right. Another red box highlights the 'Actions (0)' section at the bottom right.



Introduction to natural language processing concepts

<https://aka.ms/mslearn-nlp>

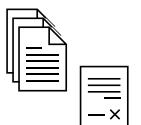
What is natural language processing?



Techniques for language modeling and text analysis

Statistical techniques

- **Classification:** Use algorithms like Naïve Bayes and Logistic Regression to classify text based on the presence of specific tokens (words). For example, implementing an email spam filter based on terms that often appear in junk mail but not in “regular” email.
- **Term Frequency / Inverse Document Frequency:** A statistical technique that compares the frequency of a specific term in individual documents with its frequency across a full *corpus* of documents. Used to determine the core *subject* of an individual document



Semantic modeling techniques

- **Transformer models:** Represent language tokens as vector-based *embeddings* that encapsulate semantic relationships. Related terms have similar vector directions. Used for tasks like *translation* and *next-word-completion*.
- **Attention:** A technique used in transformer models to improve next-word prediction based on token context. Weights are applied to tokens to reflect their influence on the next word.

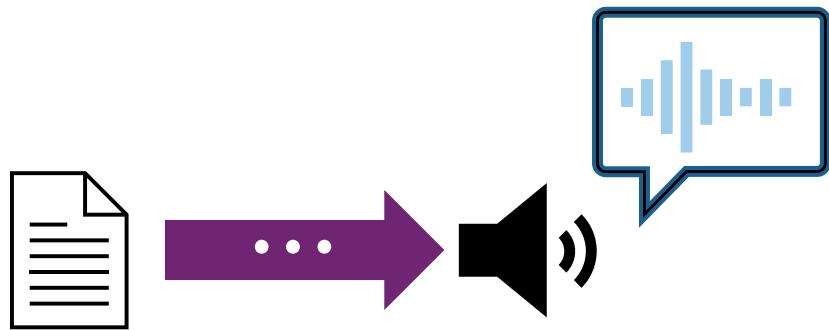
Using attention in the transformer architecture enables the latest advances in generative AI models

[1,3,5]
[2,3,4]
[1,2,4]

[1,3,5, 1]
[2,3,4, 2]
[1,2,4, 1]



Speech processing



Speech Synthesis

(Text to speech)

1. Tokenize text
2. Map tokens to *phonemes*
3. Generate audio signal



Speech Recognition

(Speech to text)

1. Capture audio signal
2. Break into *phonemes*
3. Map *phonemes* to text *tokens*

Get started with natural language processing in Microsoft Foundry

<https://aka.ms/mslearn-azure-language>

Language tools in Foundry



Azure Language in Foundry Tools

- Language detection
- Key phrase extraction
- Named entity detection
- Sentiment analysis and opinion mining
- Personal information detection
- Summarization
- ...



Azure Translator in Foundry Tools

- Text translation
- Document translation
- Custom translation
- ...

Analyzing text

"It was so exciting to watch Noah Lyles win a gold medal at the 2024 Olympic Games in Paris on Sunday, August 4, 2024."

- **Language:** English
- **Sentiment:** Positive
- **Key Phrases:**
 - 2024 Olympic Games
 - gold medal
 - Noah Lyles
 - Paris
 - ...
- **Entities:**
 - *Person:* Noah Lyles
 - *Event:* Olympic Games
 - *City:* Paris
 - *Date:* Sunday, August 4, 2024
 - ...

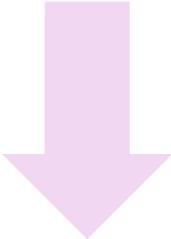
The screenshot shows the Microsoft Foundry Language Playground interface. At the top, there are tabs: All, Extract Information (which is selected), Summarize Information, Classify Text, and Fine-tune models. Below these are five cards representing different text analysis functions:

- Extract health information: Extract and label relevant health information from unstructured text.
- Extract key phrases: Identify the most important points in a piece of text. This card is highlighted with a blue border.
- Extract named entities: Identify different entities in text and categorize them into pre-defined types.
- Extract PII from conversation: Identify sensitive entities in text that are associated with an individual.
- Extract PII from text: Identify sensitive entities in text that are associated with an individual.

The configuration sidebar on the left includes dropdowns for API version (2025-05-15-preview), model version (latest ("GA")), and text language (English). The sample text area contains the quote provided at the top of the slide. The details panel on the right lists the extracted key phrases: 2024 Olympic Games, August, gold medal, Noah Lyles, Paris, and Sunday. A "Run" button is located at the bottom right of the main workspace.

Translating text

"It was so exciting to watch Noah Lyles win a gold medal at the 2024 Olympic Games in Paris on Sunday, August 4, 2024."



"C'était tellement excitant de voir Noah Lyles remporter une médaille d'or aux Jeux olympiques de 2024 à Paris le dimanche 4 août 2024."

The screenshot shows the Microsoft Foundry Translator Playground interface. At the top, there's a navigation bar with the Microsoft Foundry logo, 'Playgrounds / Translator Playground', a 'New Foundry' toggle, and various icons for 'Docs', 'All resources', and settings.

The main area has a title 'Translator Playground' with a back arrow. Below it are two cards: 'Text translation' (selected) and 'Document translation (sync)'. The 'Text translation' card shows an icon of a document with three speech bubbles containing letters A, N, and E. It describes translating text from one language to another using Azure AI Translator, supporting 130+ languages. The 'Document translation (sync)' card shows an icon of a document with a gear and a speech bubble containing the letter A. It describes translating documents from source language to target language from file types such as .docx, .pptx, .xlsx, etc.

On the left side, there's a vertical toolbar with various icons for file operations like copy, paste, search, and refresh.

The central workspace is divided into three sections: 'Configure', 'Original', and 'Translation'.

- Configure:** Contains dropdown menus for 'Translate from' (set to 'Auto detect') and 'Translate to' (set to 'French'), along with a 'Show Advanced settings' link.
- Original:** Displays the English text: "It was so exciting to watch Noah Lyles win a gold medal at the 2024 Olympic Games in Paris on Sunday, August 4, 2024".
- Translation:** Displays the French translation: "C'était tellement excitant de voir Noah Lyles remporter une médaille d'or aux Jeux Olympiques de 2024 à Paris, le dimanche 4 août 2024".

At the bottom, there's a character counter '116 / 1000 Characters' and a 'Translate' button.

Get started with speech in Microsoft Foundry

<https://aka.ms/mslearn-azure-speech>

Azure Speech in Foundry Tools



- Speech to text transcription (real-time and batch)
- Text to speech synthesis
- Speech translation
- Custom speech models
- Built-in and custom voices
- Audio content creation
- Video translation
- Voice Live: real-time voice agents
- Built-in and custom avatars
- ...

Speech in Foundry

- Use the *Speech playground* to:
 - Transcribe recorded or live speech
 - Synthesize speech with built-in voices
 - Create custom voices
 - Create custom speech models
 - Add live voice capabilities to an agent
 - Translate audio and video
 - Create avatar-presented videos
 - Create custom avatars
 - ...

The screenshot shows the Microsoft Foundry Speech Playground interface. At the top, there's a navigation bar with the Microsoft Foundry logo, a 'Speech Playground' link, a 'New Foundry' toggle switch, and various icons for 'Docs', 'All resources', and user settings. Below the navigation is a header titled 'Speech Playground' with a back arrow. A sidebar on the left contains a vertical stack of icons, some of which are highlighted in blue. The main content area has tabs for 'All', 'Speech capabilities by scenario', 'Speech to text', and 'Text to speech'. Under 'Speech capabilities by scenario', there are cards for 'Voice live' (which is selected and highlighted in blue), 'Video translation', 'Real-time transcription', 'Fast transcription', 'Batch transcription', and 'Speech'. Below these are buttons for 'View code' and 'View documentation', and a 'Full Screen' button. The central part of the screen features a large circular icon with a stylized robot head and the text 'Just say the word'. Below this is a call-to-action: 'Try speaking out loud, just like you would converse with a real person, and hear the responses you get back.' To the right is a 'Configuration' panel with sections for 'GenAI' (set to 'GPT Realtime'), 'Response instruction' (containing an objective for an English teacher), 'Response temperature' (set to 0.8), and 'Proactive engagement' (set to 'Speech input').

Exercise – If time permits

Explore Speech in Microsoft Foundry

In this exercise, you'll use Microsoft Foundry's speech playground to see speech capabilities in action.

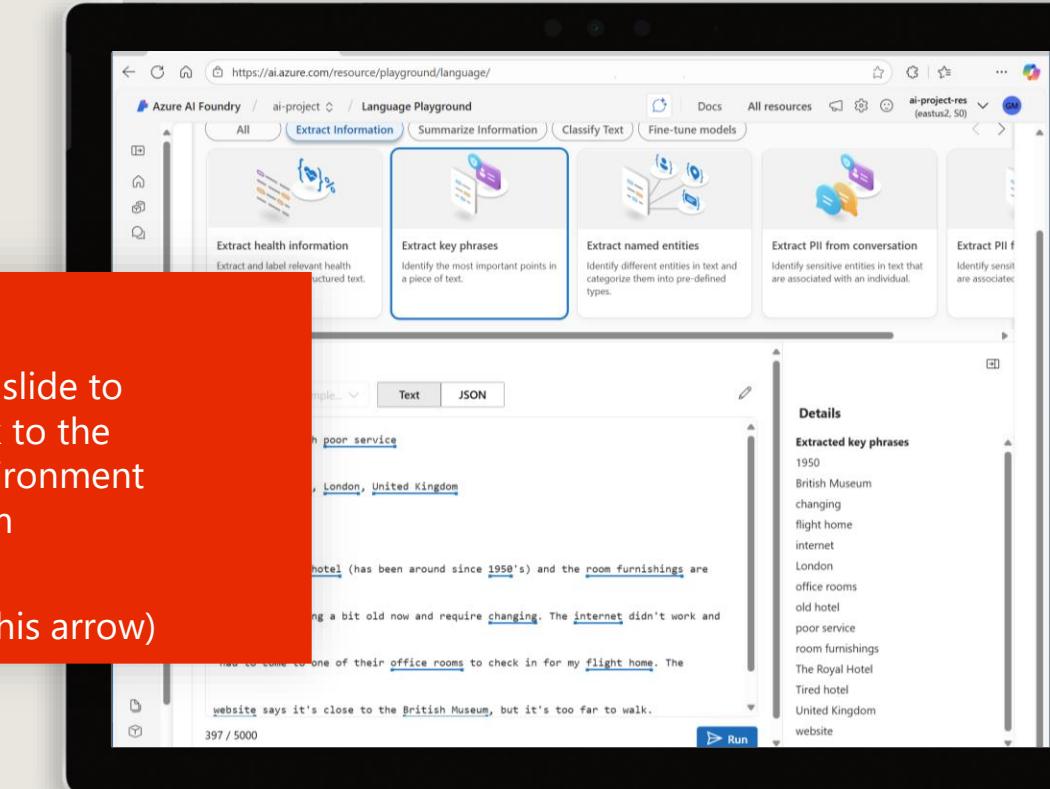
Start the exercise at:

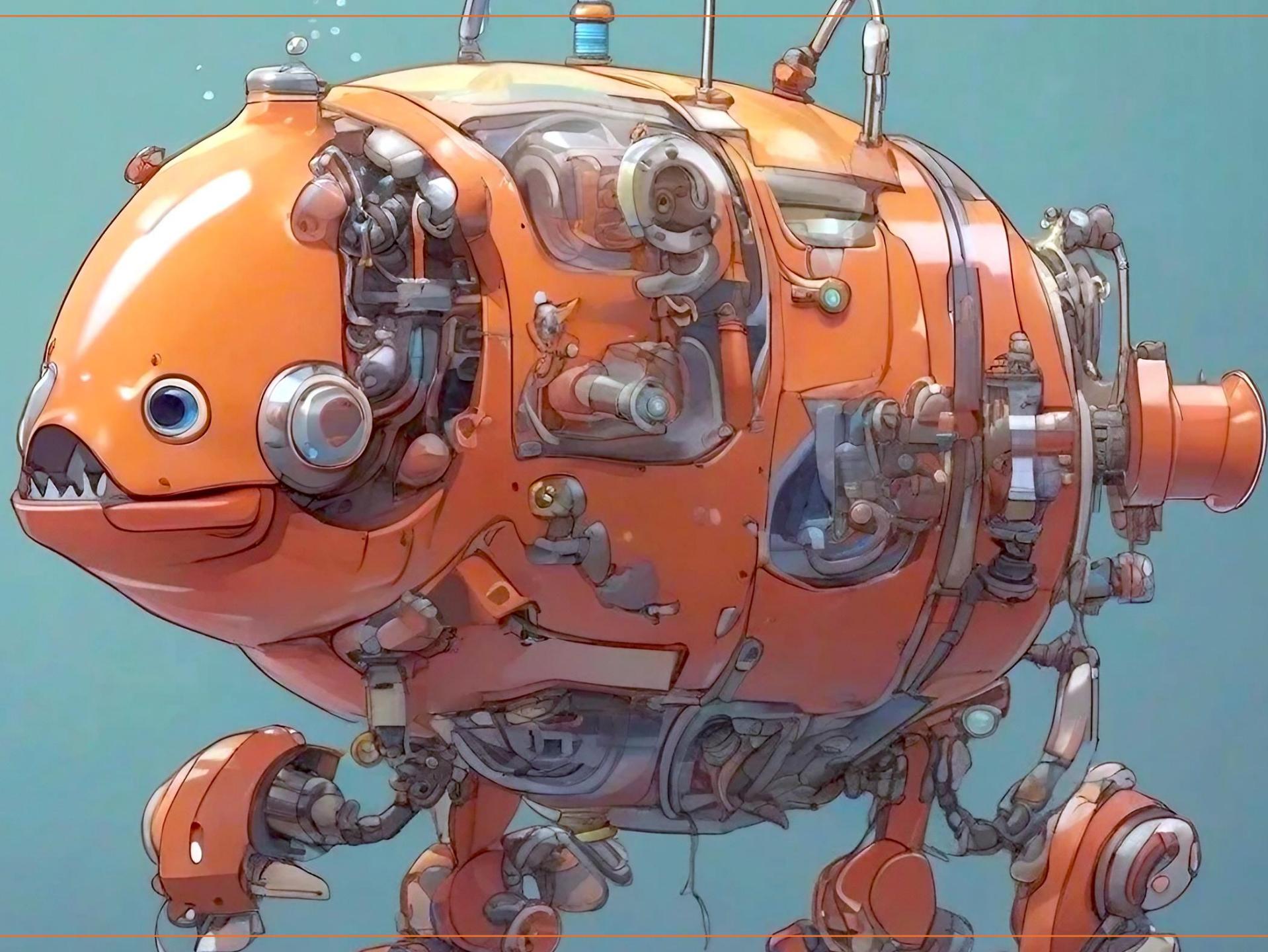
<https://go.microsoft.com/fwlink/?LinkId=2250148>

Trainers:

Customize this slide to include the link to the hosted lab environment and any custom instructions.

(then remove this arrow)





Introduction to computer vision concepts

<https://aka.ms/mslearn-vision>

Images and image processing

An image is an array of pixel values

Single-channel (monochrome) or multi-channel (color)

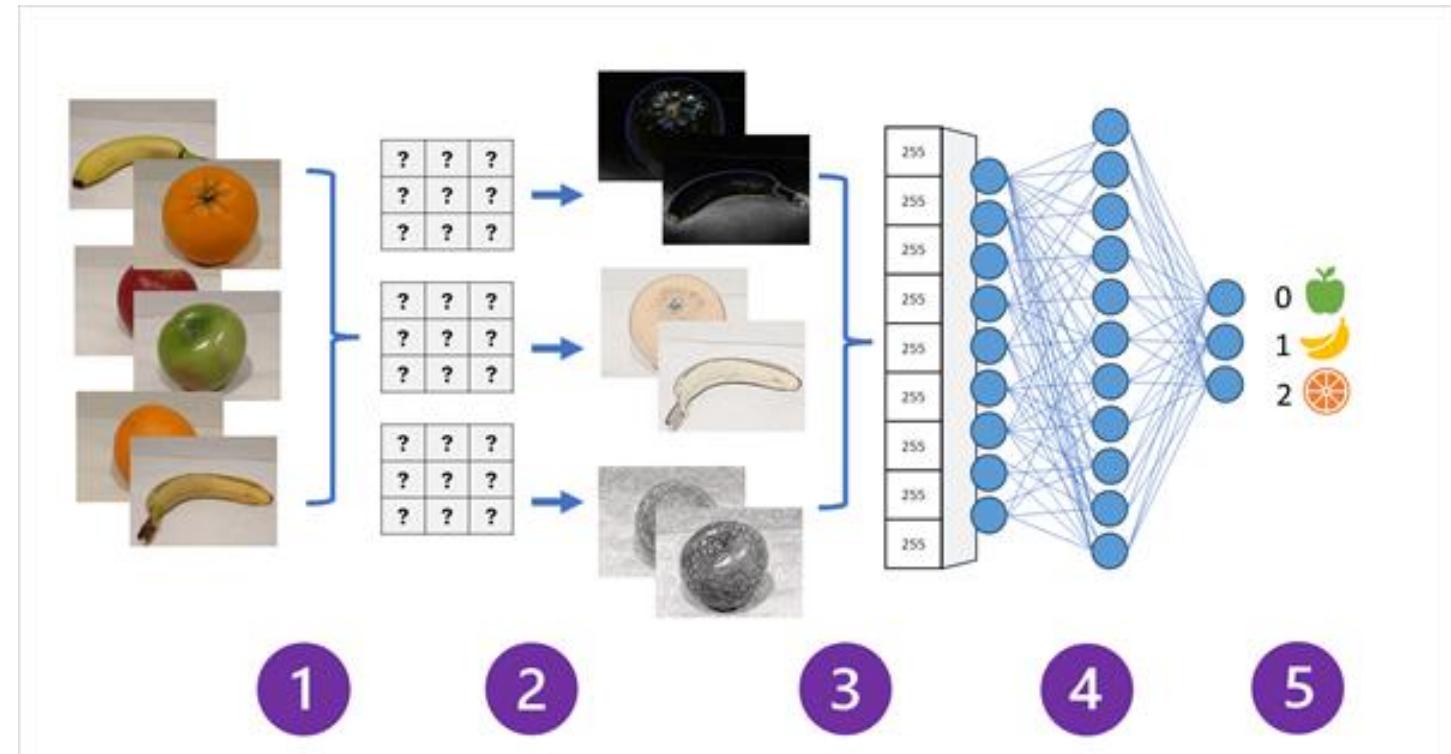
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	255	255	255	0	0
0	0	255	255	255	0	0
0	0	255	255	255	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0

Filters are applied based on a *kernel*
Creating structure and extracting features

-1	-1	-1	0	0	0	0
-1	8	-1	0	0	0	0
-1	-1	255	255	255	0	0
0	0	255	0	255	0	0
0	0	255	255	255	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0

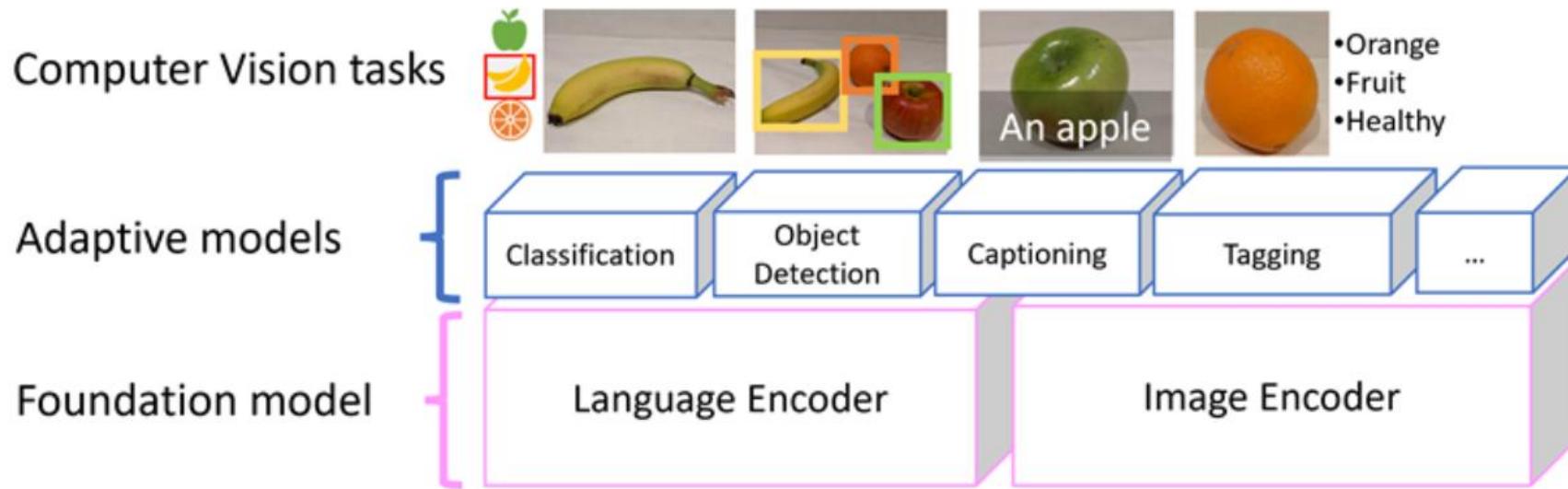
Convolutional Neural Networks

1. Labeled mages are used to train the model
2. Filter layers extract *feature maps* from each image
3. The feature maps are flattened
4. The feature values are fed into a fully connected neural network
5. The output layer produces a probability value for each possible class label



- During training, the filter kernels start with random weights. These weights are iteratively adjusted to improve the accuracy of the predictions based on the known labels.
- The trained model uses learned weights to extract features from new images and predict their class.

Multi-modal models



- A newer approach to modeling involves combining language and vision models that encode image and text data
- The model encapsulates semantic relationships between features extracted from the images and text extracted from related captions.
- A multi-modal model can be used as a *foundation* model for more specialized *adaptive* models.

Get started with computer vision in Microsoft Foundry

<https://aka.ms/mslearn-azure-vision>

Computer vision in Microsoft Foundry



Azure Vision in Foundry Tools

- Image Analysis:
 - Image tagging, captions, model customization, and more.
- Optical Character Recognition (OCR)
- Video analysis



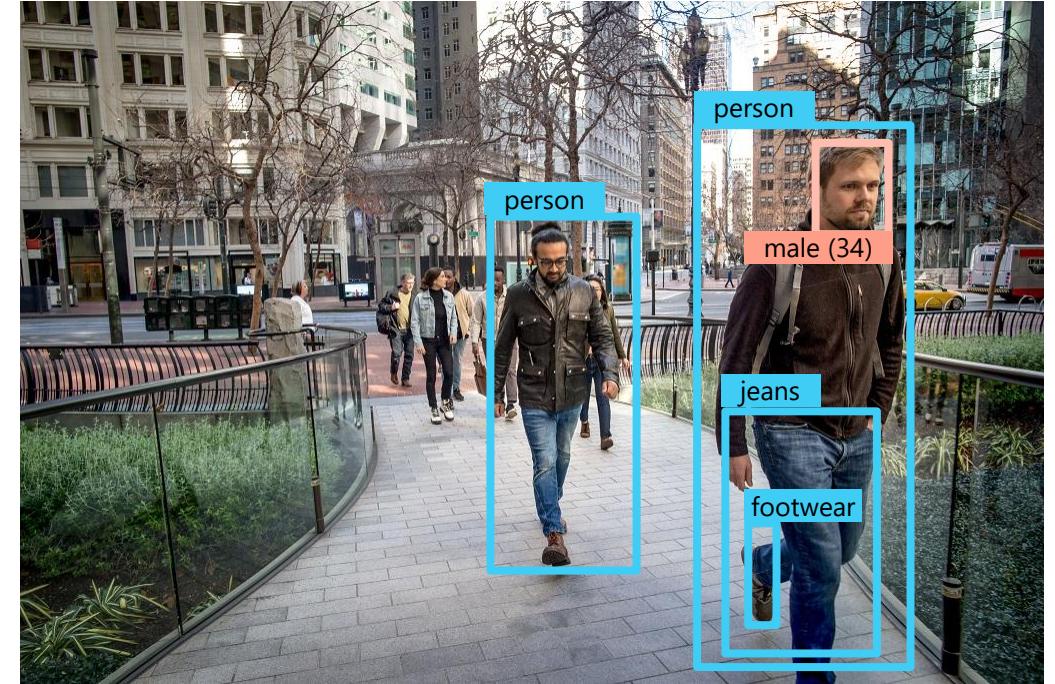
Face API

- Face detection
- Face recognition

Image analysis with *Azure Vision*

Capabilities include:

- Model customization
- Read text from images
- Detect people in images
- Generate image captions
- Detect objects
- Tag visual features
- Smart crop

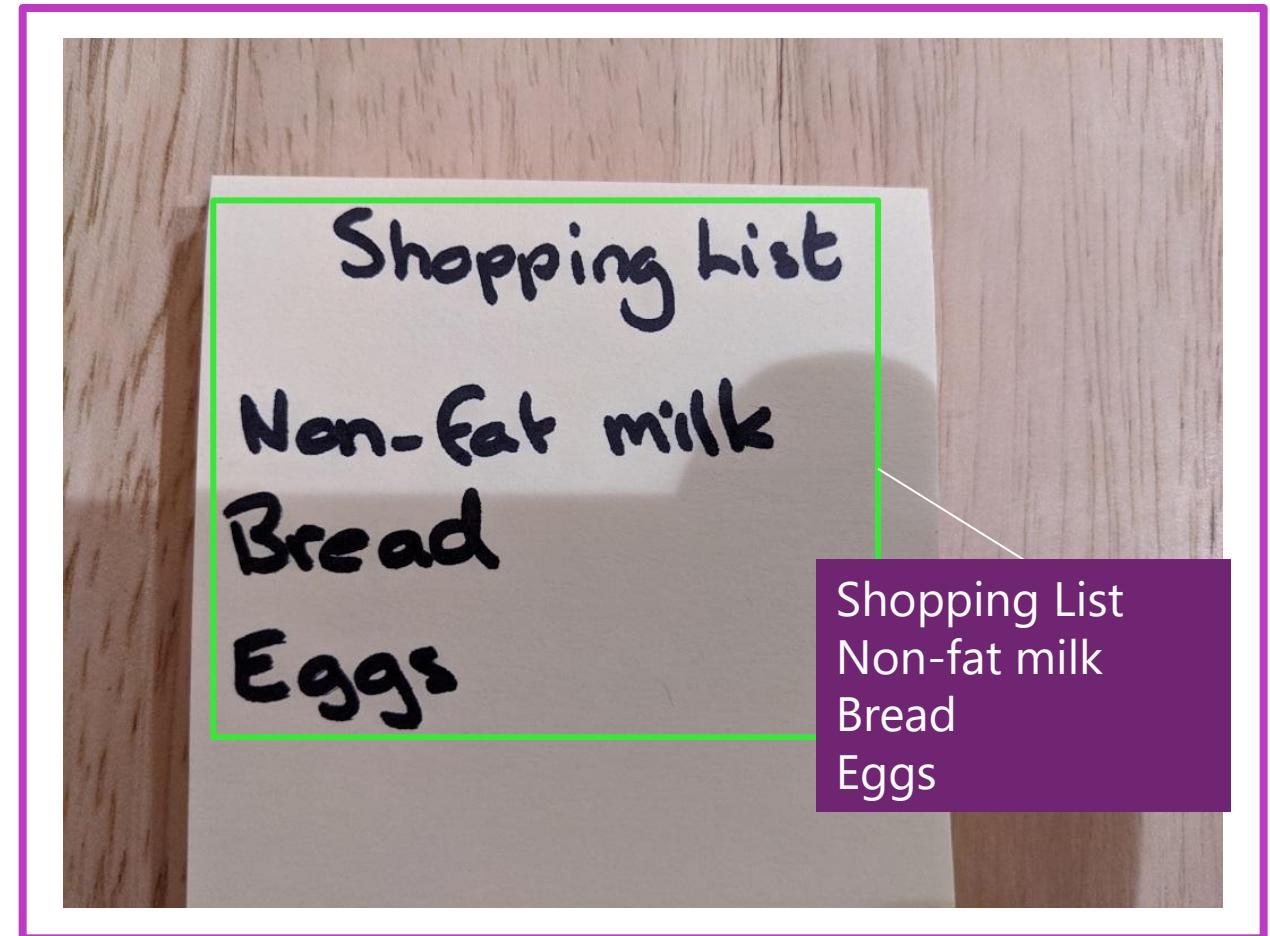


Caption: A group of people walking on a sidewalk

Tags: Building, jeans, street, outdoor, jacket, city, person

Reading text with Optical Character Recognition (OCR)

- Detect the location and characters of **printed** and **handwritten** text
- Options for quick text extraction from images, or asynchronous analysis of larger scanned documents



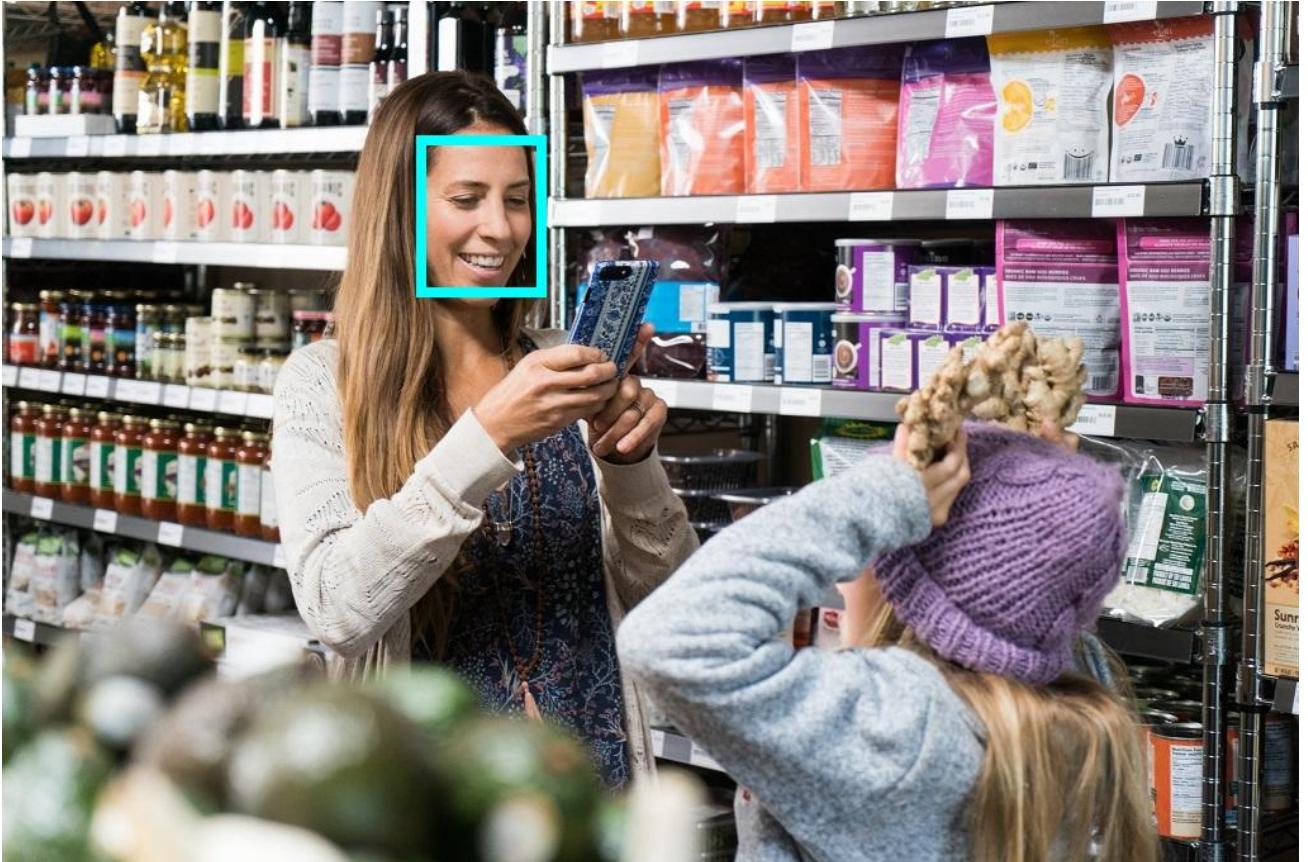
Detecting faces with *Face API*

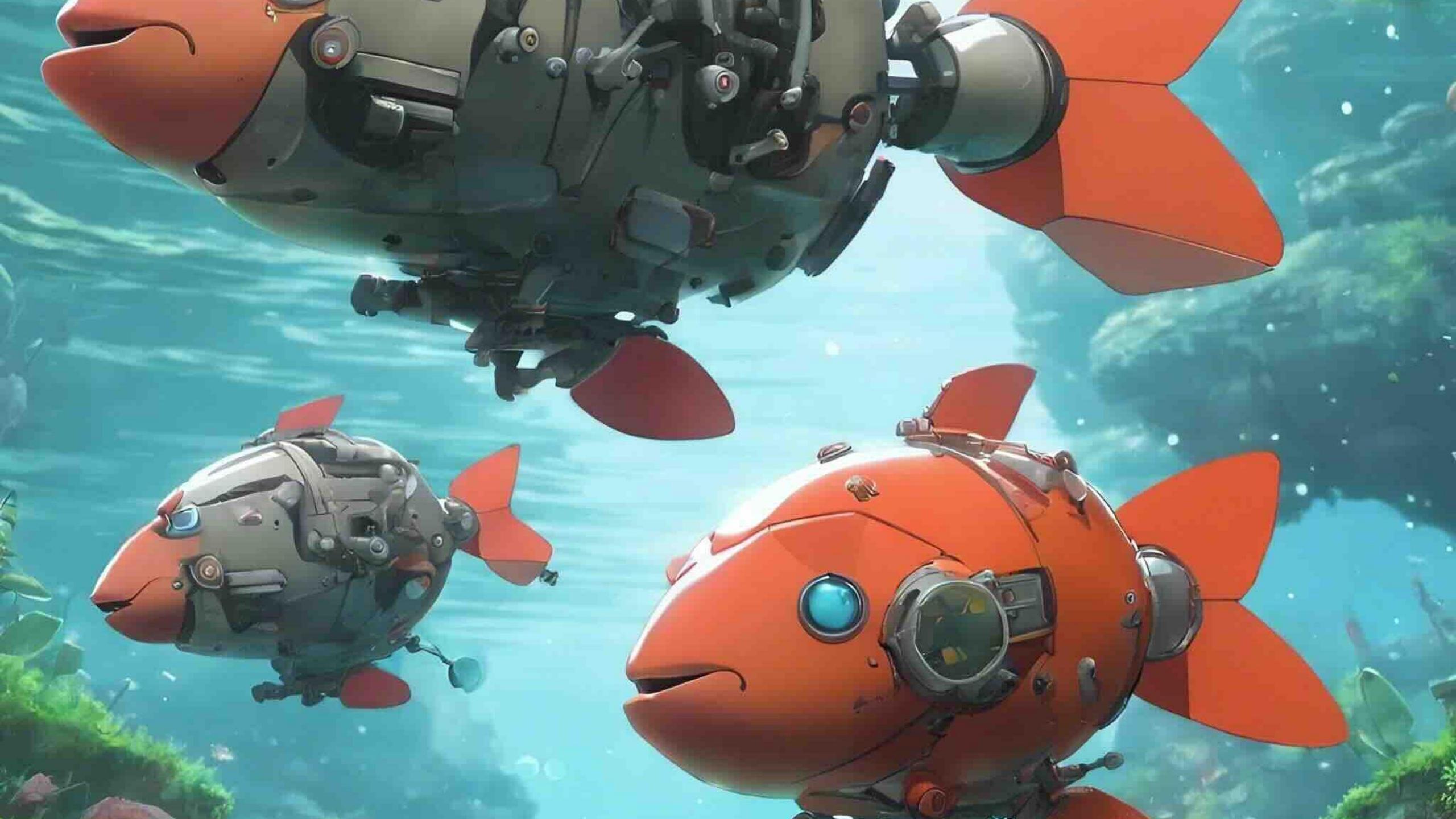
Everyone can use the Face service to detect:

- Blur
- Exposure
- Glasses
- Head pose
- Noise
- Occlusion

Only Managed Microsoft customers can access facial recognition capabilities:

- Similarity matching
- Identity verification

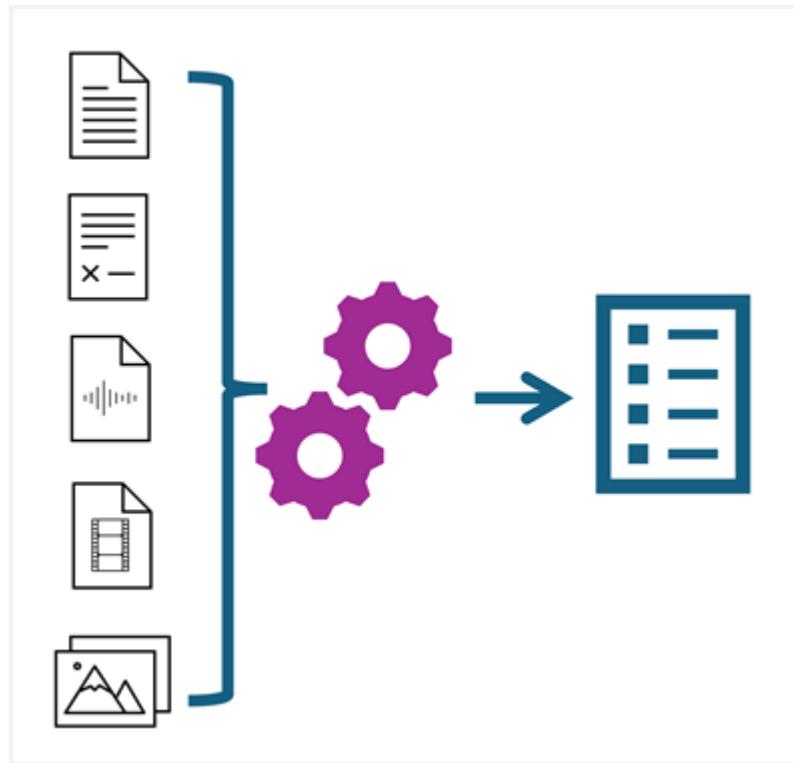




Introduction to AI-powered information extraction concepts

<https://aka.ms/mslearn-ai-info>

Information extraction processes

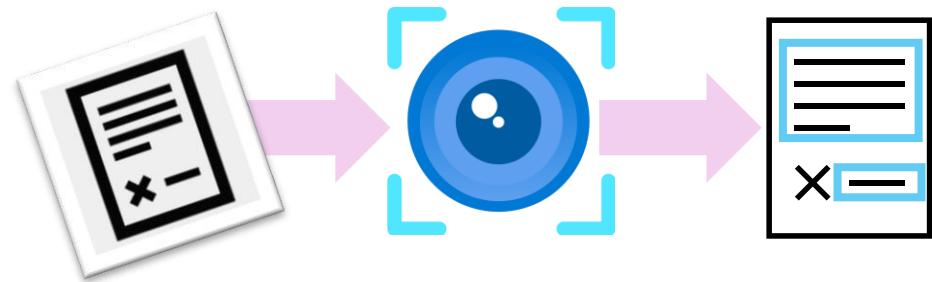


Step	Description
Source Identification	Determine where the information resides and if it needs to be digitized.
Extraction	Leverages many techniques based on machine learning to understand and extract data from digitized content.
Transformation & Structuring	Extracted data is transformed into structured formats like JSON or tables.
Storage & Integration	The processed data is then stored in databases, data lakes, or analytics platforms for further use.

Understand the extraction of data from images

Use optical character recognition (OCR) to:

- Extract contact information from scanned business cards or conference badges
- Capture information from IDs to complete electronic forms
- Scan and store recipes or other text
- Photograph a sign or storefront so you can submit it to a translation service
- Digitize handwritten notes



Understand the extraction of data from forms

- The **field name** is the key or type of data entry.
- The **field description** is the definition of what the field name represents.
- The **value** corresponds with the field name and is the data specific to the content.

The data in forms is recognized with *bounding boxes*.

Adventure Works Cycles

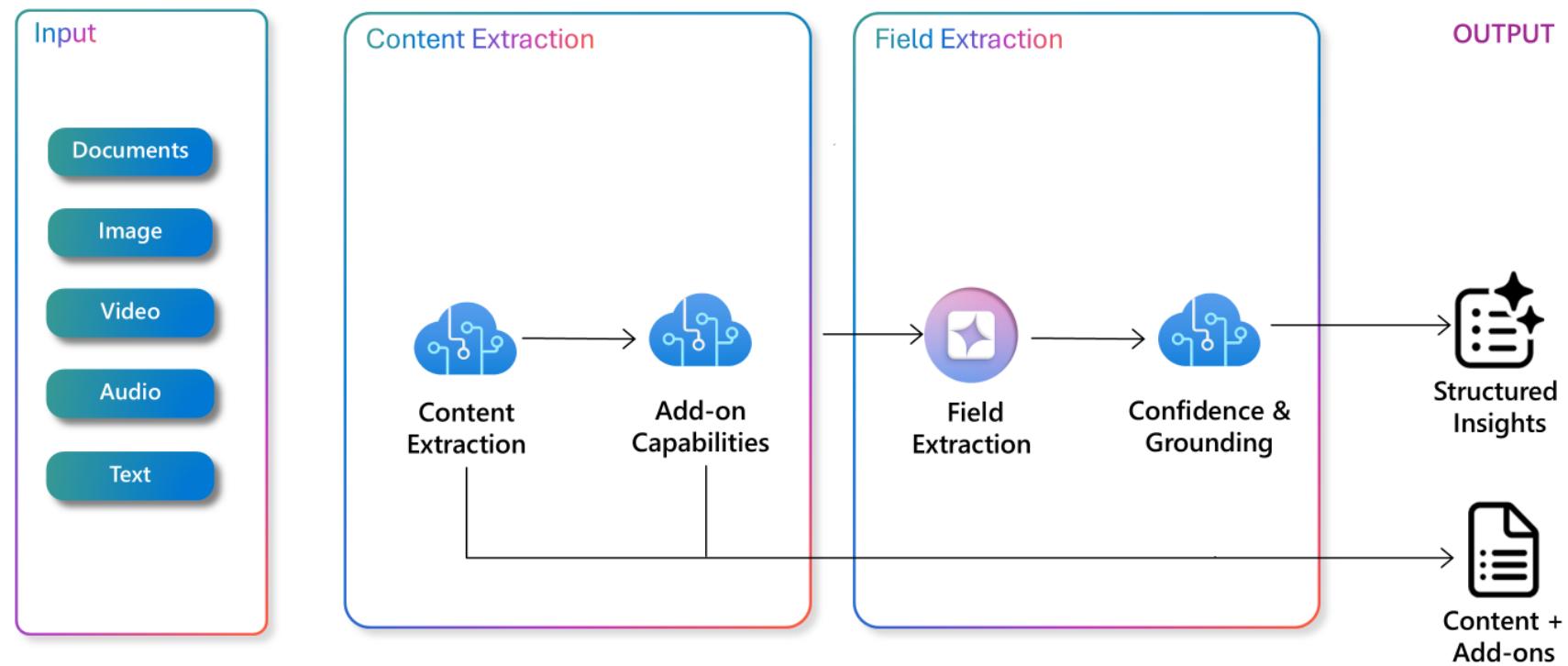
Customer Name: John Smith
Address: 123 River Street, Marshtown, England, GL1 234

Item	Price	Quantity	Item Total
38" Racing Bike (Red)	\$1,299.00	1	\$1,299.00
Cycling helmet (Black)	\$25.99	1	\$25.99
Cycling shirt (L)	\$42.50	2	\$85.00

Subtotal: \$1,409.99
Tax: \$40.99
Shipping: \$35.00
Total Due: \$1,585.98

Understand multimodal data extraction

AI-powered information extraction techniques can be combined to perform data extraction on multiple modalities of content, from documents to video and audio.



Get started with AI-powered information extraction in Microsoft Foundry

<https://aka.ms/mslearn-azure-info-extract>

Foundry options for reading text



Azure Vision Image Analysis

- Identify text and its location in scanned documents
- Find and read text in photographs
- Combine with other image analysis features to implement a digital asset management (DAM) solution



Azure Document Intelligence

- Design to support form processing by extracting fields and associated values from documents
- Use prebuilt models for common document types
- Create custom models for your specific requirements



Azure Content Understanding

- Use multimodal content extraction capabilities to analyze documents, forms audio, video, and images.
- Create custom analyzers to extract specific content or fields tailored to business needs

Azure Document Intelligence service

The screenshot shows the Azure Document Analysis interface. On the left, there's a preview of a document page with several callout boxes highlighting specific sections of text. On the right, the 'Content' tab of the analysis pane is selected, displaying a detailed breakdown of the analyzed text. It includes sections for 'Text' (Paragraph), 'Image', and 'Table'. The 'Text' section lists several paragraphs of text from the document, each with its own analysis results. The results include entities like 'Enhancing the patient and provider experience' and 'All kinds of publicly available information can be used with text analytics techniques which can be used to arm the sales rep with relevant information even before he or she meets the doctor. It's a totally different, digital game now.' The analysis pane also shows 'Run analysis' and 'Analyze options' buttons at the top.

The screenshot shows the Azure Document Analysis interface analyzing a receipt from 'Contoso'. The receipt details a purchase made on 6/10/2019 at 13:59. The items purchased were a Surface Pro 6 (\$1,998.00) and a Surface Pen (\$299.97). The total amount was \$2,516.28. The analysis pane on the right shows the results for the receipt, including fields like 'DocType: receipt.retailMeal', 'MerchantName: Contoso', 'Total: 2516.28', and 'MerchantAddress: 123 Main Street Redmond, WA 98052'. It also lists 'HouseNumber: 123', 'Road: Main Street', 'PostalCode: 98052', 'City: Redmond', 'State: WA', and 'StreetAddress: 123 Main Street'. The 'Run analysis' and 'Analyze options' buttons are visible at the top of the analysis pane.

The screenshot shows the Azure Custom Models interface. On the left, there's a 'Custom models' section with a heading 'Custom form models'. It says 'Extract information from forms and documents with custom models. Train a model by labeling as few as 5 example documents. (The' and 'Custom form models' below it. On the right, there are two examples: a 'W-9' form and a 'Request for Taxpayer Identification Number and Certification'. The W-9 form has several checkboxes for business entity types. The request form has sections for 'Name', 'Business entity type', 'Exemption from FATCA reporting code (if any)', and 'Requester's name and address (optional)'. A red box highlights the 'Requester's name and address (optional)' field, which contains the name 'Jamie Doe'.

- Document analysis
- Returns structured data representations.
- Regions of interest and relationships.
- Configure **Analyze options** for free and chargeable analysis

- Prebuilt models
- Invoices
- Receipts
- ID
- Recognizes and extracts key-value pairs.

- Custom models
- Train models with at least five sample data.
- Identify fields of interest to your organization.

Azure Content Understanding service

Screenshot of the Azure Content Understanding service interface showing the Test analyzer page.

The left sidebar shows the navigation menu:

- Overview
- Model catalog
- Playgrounds
- AI Services
- Build and customize
- Agents PREVIEW
- Templates PREVIEW
- Fine-tuning
- Content Understanding **PREVIEW** (selected)
- Prompt flow
- Assess and improve
- Tracing PREVIEW
- Evaluation
- Safety + security

My assets section:

- Models + endpoints
- Data + indexes
- Web apps

Management center button.

The main content area is titled "Test analyzer" and includes:

- "Run analysis" and "Upload test files" buttons.
- A preview window showing a sunset scene with wind turbines. A play button and a timeline from 00:00 to 00:09.976 are visible below it.
- A "Transcript" section labeled "Shot 00:00.000 => 00:09.976" and "WEBVTT".
- A "Key Frames" section.
- A results panel on the right showing analysis fields:

 - Fields**: description, background, shotType, videoCategories (1).
 - Result**:
 - description: A serene sunset scene featuring multiple wind turbines on a hill, silhouetted against a purple sky. The sun is setting on the horizon, creating a picturesque and tranquil atmosphere.
 - background: The video is set outdoors during sunset, showcasing a landscape with wind turbines on a hill.
 - shotType: WideAngle
 - videoCategories (1):

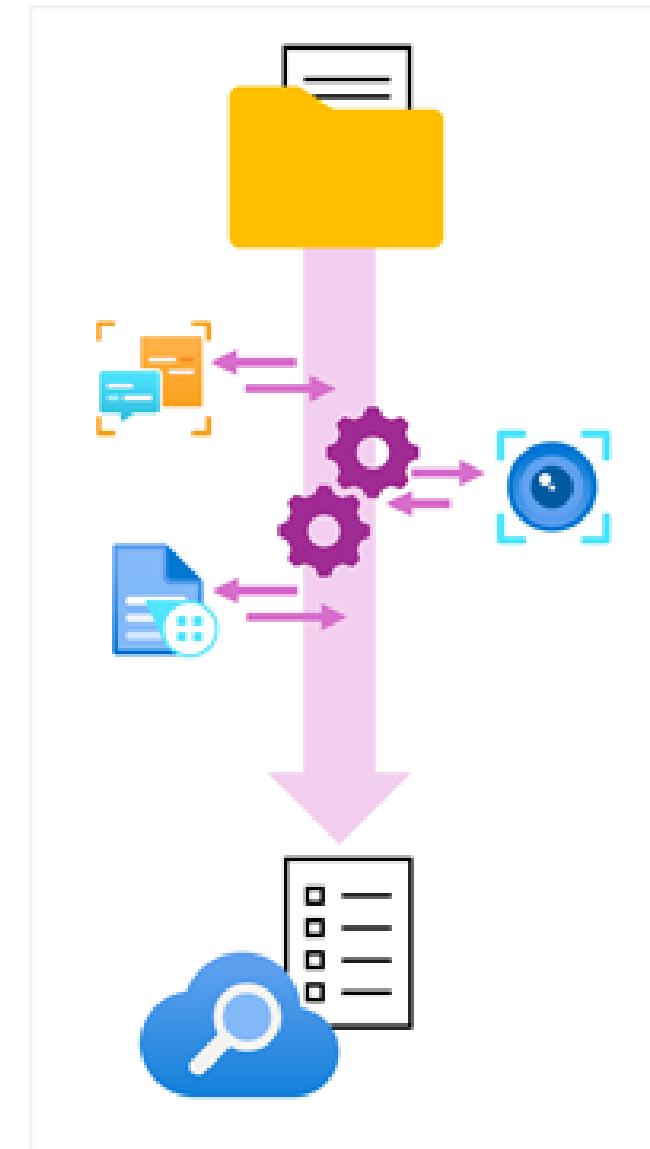
What is knowledge mining?

Organizations have a lot of content:

- Data is *locked away* in documents, PDFs, hand-written notes, etc.
- Time consuming and labour intensive to find data.
- Knowledge mining finds insights – *at scale*.

Azure AI Search is Azure's AI-powered knowledge mining platform.

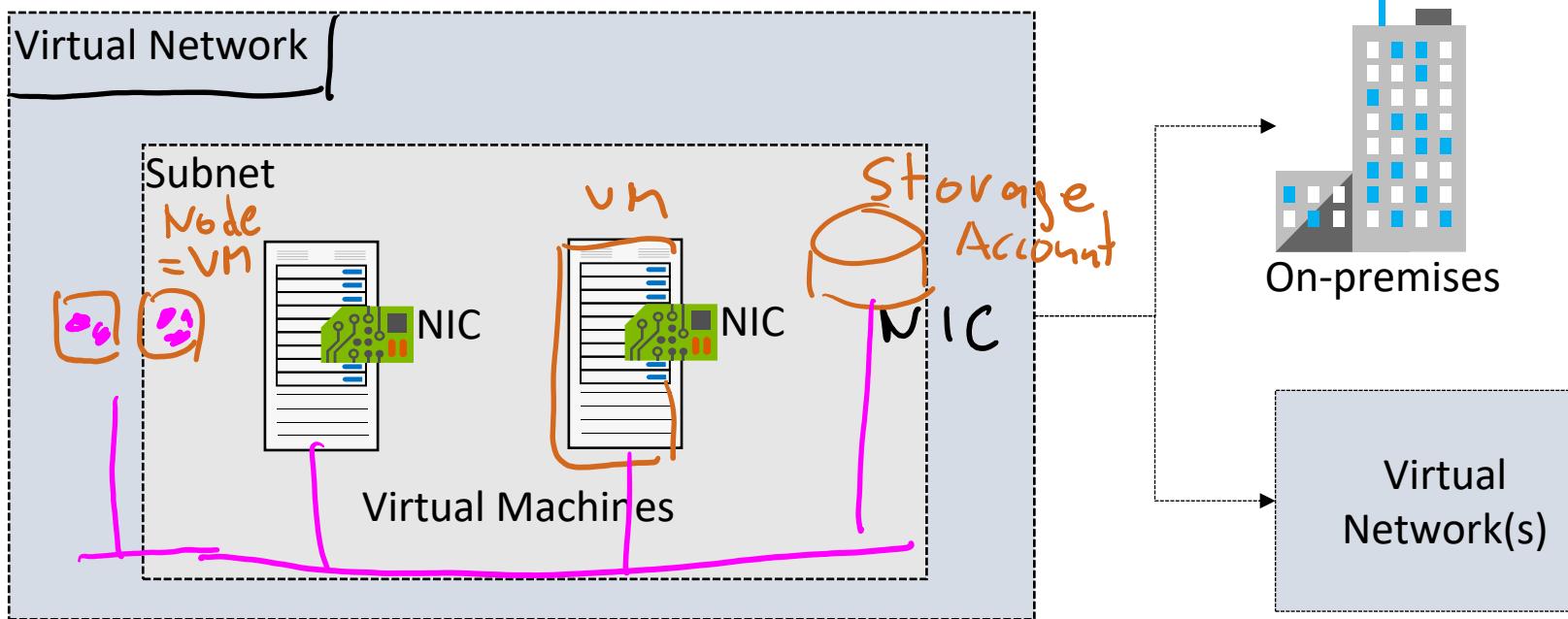
- Azure AI Search results contain only your data, and can include new insights powered by AI
- Offered as Platform as a Service (PaaS) solution, meaning Microsoft manages the infrastructure and availability



Configure Virtual Networks

10.18
192.168.1.16
172.16.1.12

Plan Virtual Networks



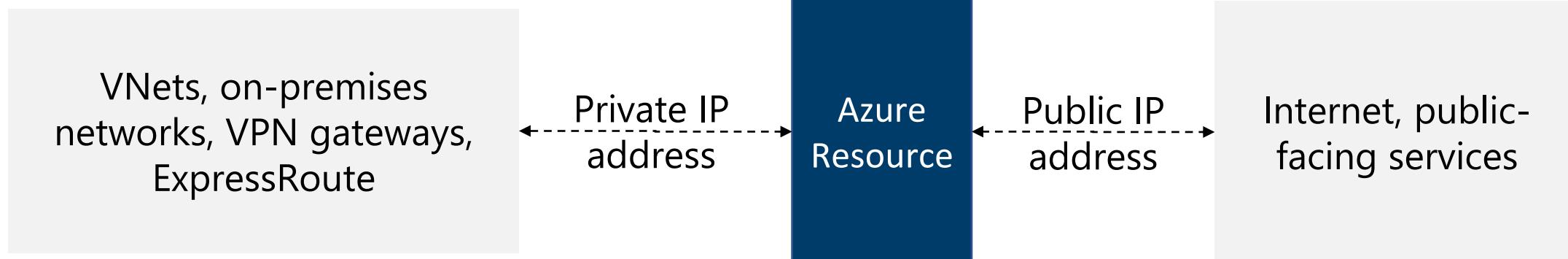
Logical representation
of your own network

Create a dedicated
private cloud-only
virtual network

Securely extend
your datacenter with
virtual networks

Enable hybrid
cloud scenarios

Plan IP Addressing



Private IP addresses - used within an Azure virtual network (VNet), and your on-premises network, when you use a VPN gateway or ExpressRoute circuit to extend your network to Azure

Public IP addresses - used for communication with the Internet, including Azure public-facing services

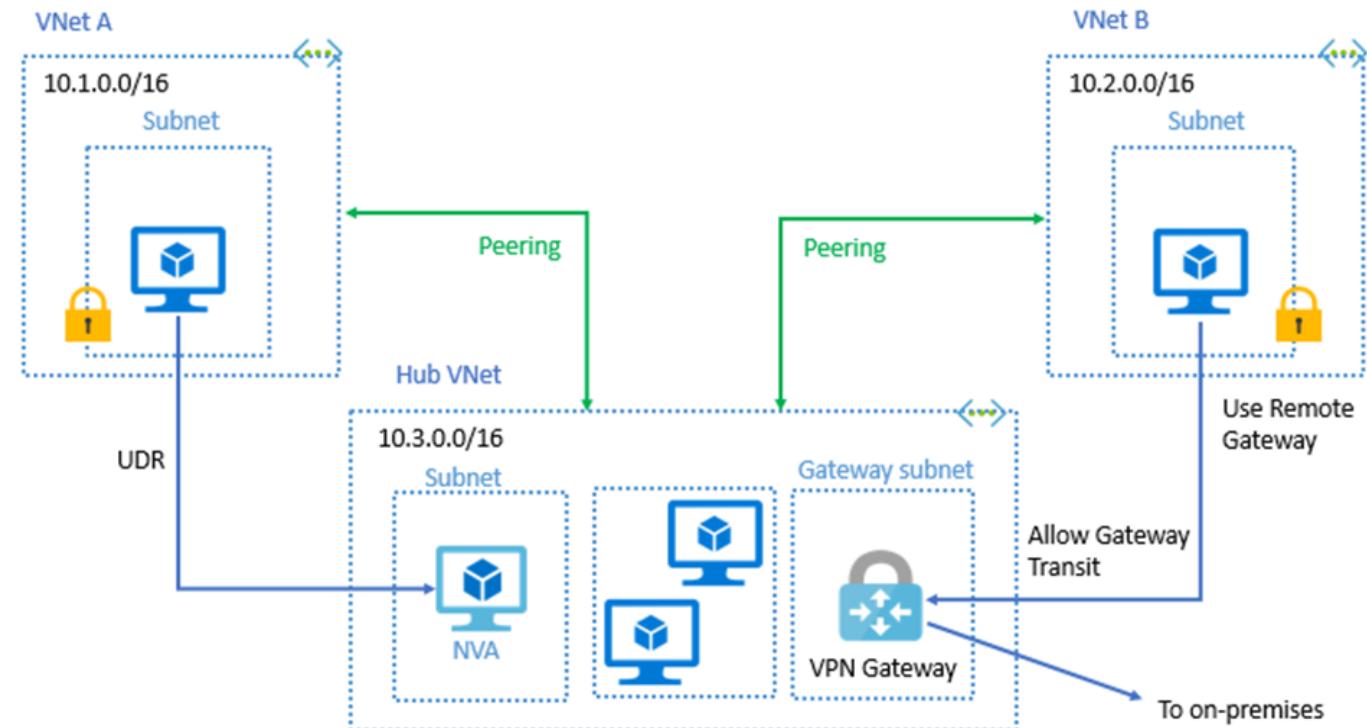
Configure VNet Peering

Determine Gateway Transit and Connectivity Needs

Gateway transit allows peered virtual networks to share the gateway and get access to resources

No VPN gateway is required in the peered spoke virtual network

Default VNet peering provides full connectivity



IP address spaces of connected networks can't overlap

Manage and control traffic flow with routes

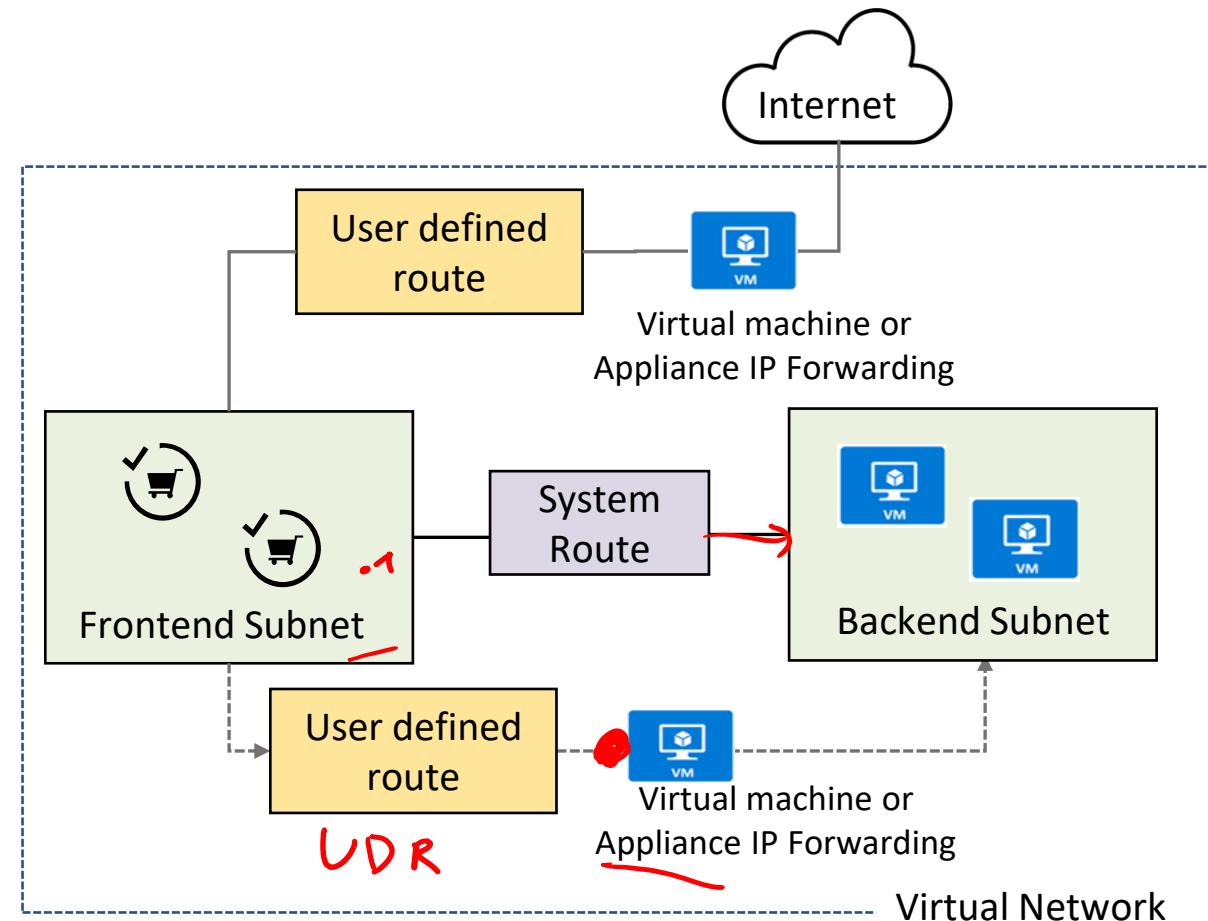


Identify User-Defined Routes

A route table contains a set of rules, called routes, that specifies how packets should be routed in a virtual network

User-defined routes are custom routes that control network traffic by defining routes that specify the next hop of the traffic flow

The next hop can be a virtual network gateway, virtual network, internet, or virtual appliance



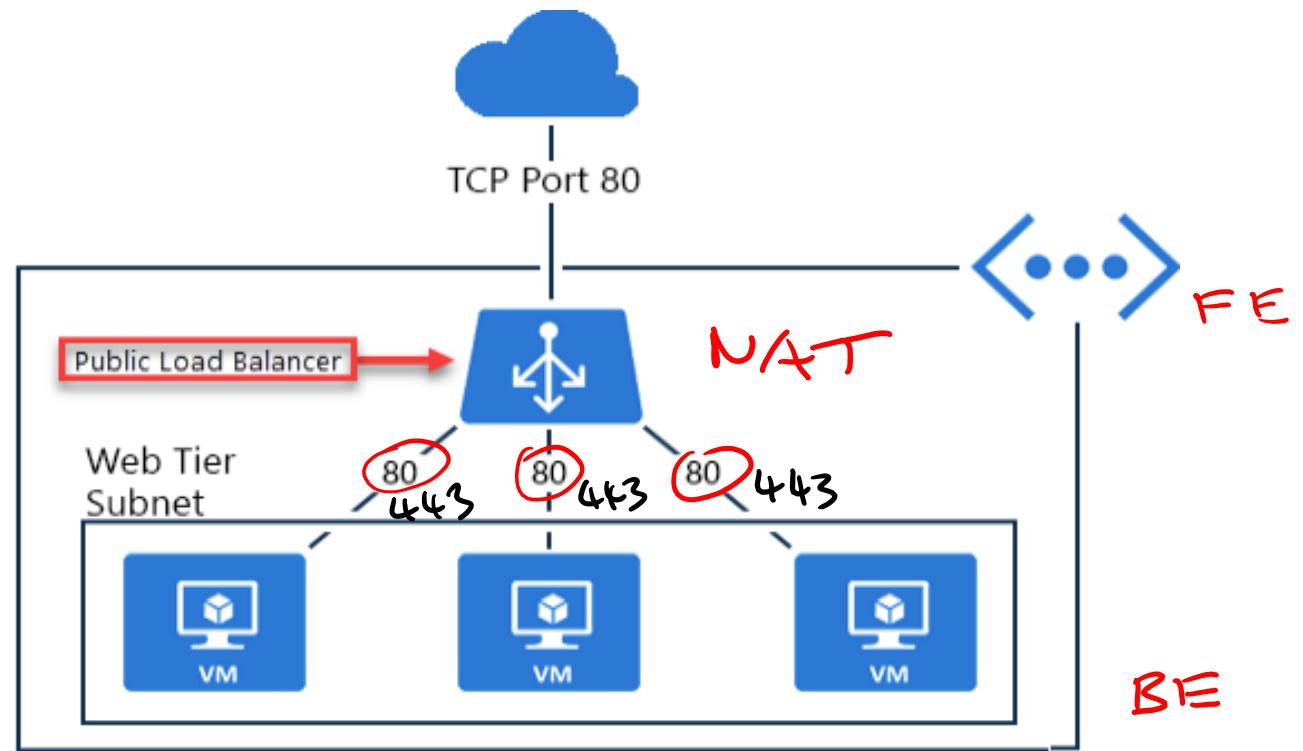
Introduction to Azure Load Balancer

Choose a Load Balancer Solution

Feature	Application Gateway	Front Door	Load Balancer	Traffic Manager
Usage	Optimize delivery from application server farms while increasing application security with web application firewall.	Scalable, security-enhanced delivery point for global, micro service-based web applications.	Balance inbound and outbound connections and requests to your applications or server endpoints.	Distribute traffic to services across global Azure regions, while providing high availability and responsiveness.
Protocols	HTTP, HTTPS, HTTP2	HTTP, HTTPS, HTTP2	TCP, UDP	Any
Private (regional)	Yes		Yes	
Global		Yes		Yes
Env	Azure, non-Azure cloud, on premises	Azure, non-Azure cloud, on premises	Azure	Azure, non-Azure cloud, on premises
Security	WAF	WAF, NSG	NSG	

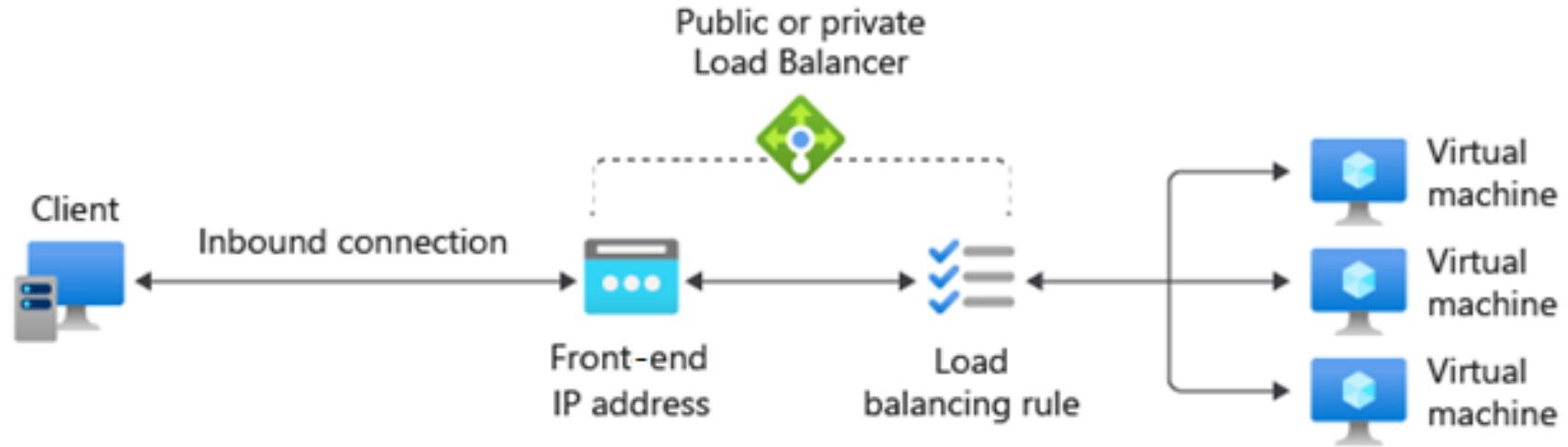
Implement a Public Load Balancer

- Maps public IP addresses and port number of incoming traffic to the VM's private IP address and port number, and vice versa
- Apply load balancing rules to distribute traffic across VMs or services



WAF SSL Term.
 → App Gw

Create load balancer rules



Maps a frontend IP and port combination to a set of backend pool and port combination

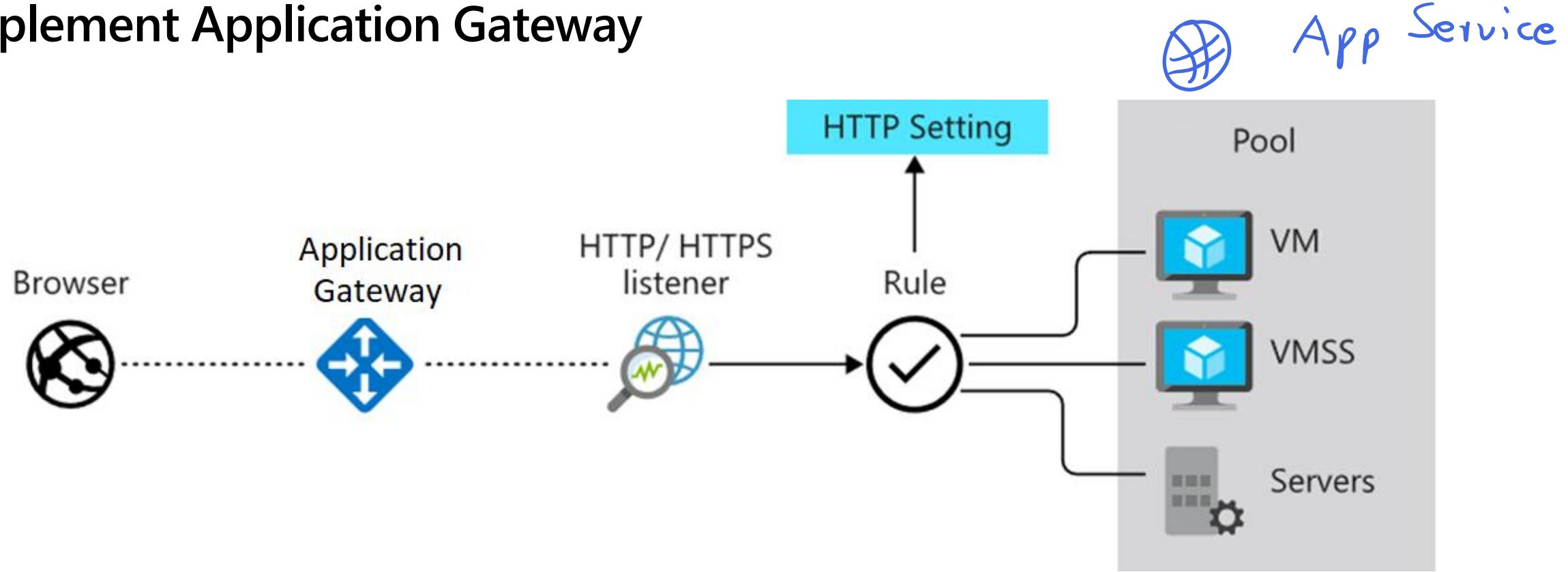
Rules can be combined with NAT rules

A NAT rule is explicitly attached to a VM (or network interface) to complete the path to the target

Introduction to Azure Application Gateway



Implement Application Gateway



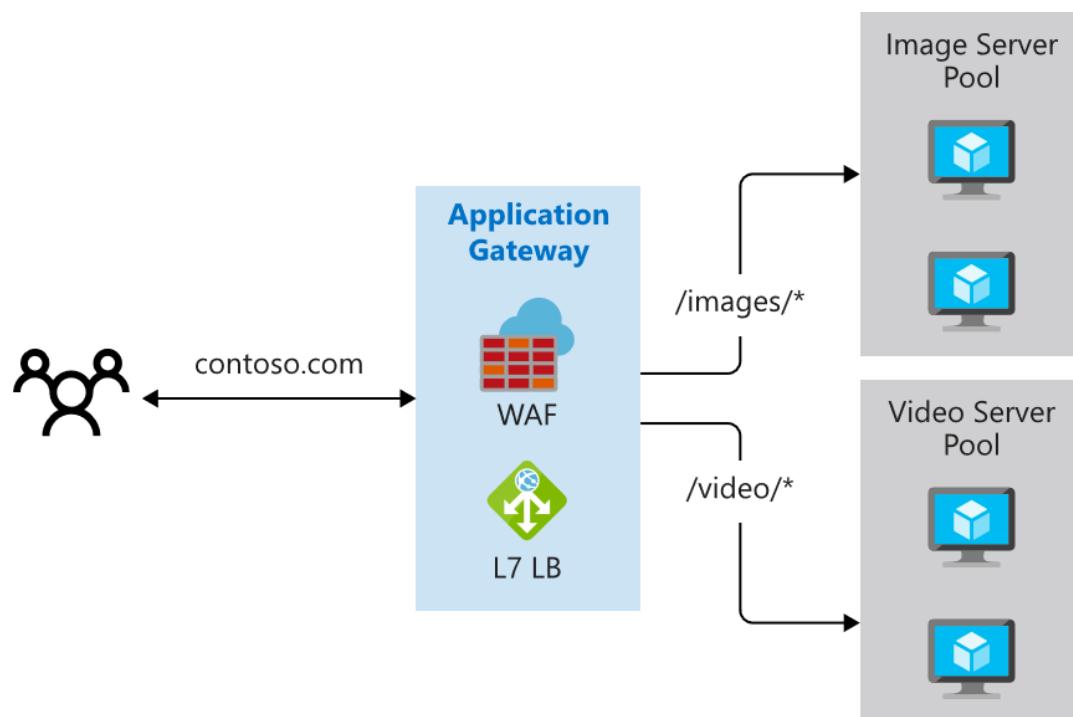
Manages web app requests

Routes traffic to a pool of web servers based on the URL of a request

The web servers can be Azure virtual machines, Azure virtual machine scale sets, Azure App Service, and even on-premises servers

Determine Application Gateway Routing

Path-based routing



Multiple-site routing

