NAIRR Pilot

Introduction to Artificial Intelligence (AI)

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CAMPUS CHAMPIONS

AI in the News

- **Two 2024 Nobel Prizes for AI**
  - **Physics:** Artificial neural networks
  - **Chemistry:** AI solved protein folding

Outline

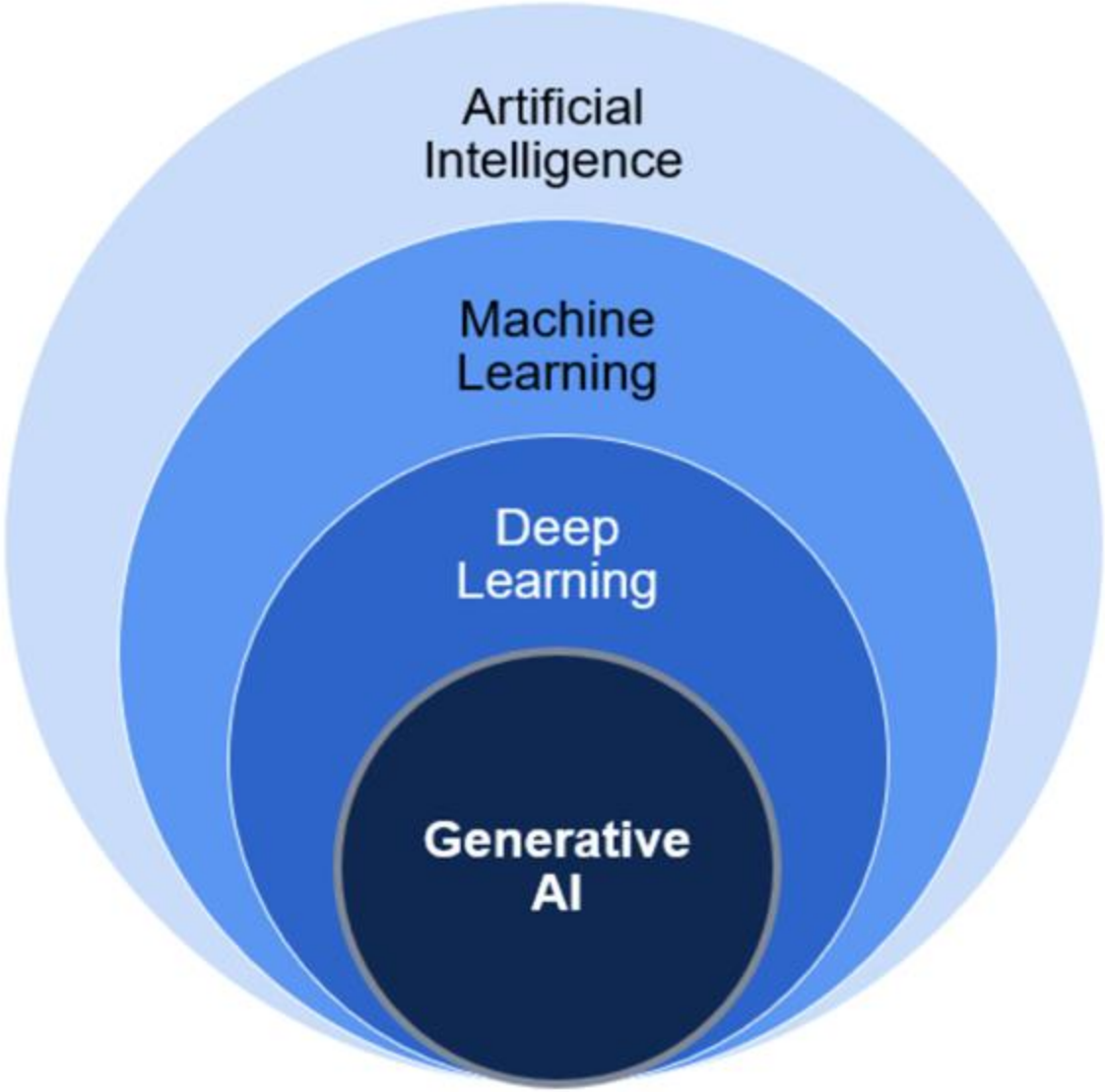


Image credit: Google

Artificial Intelligence (AI)

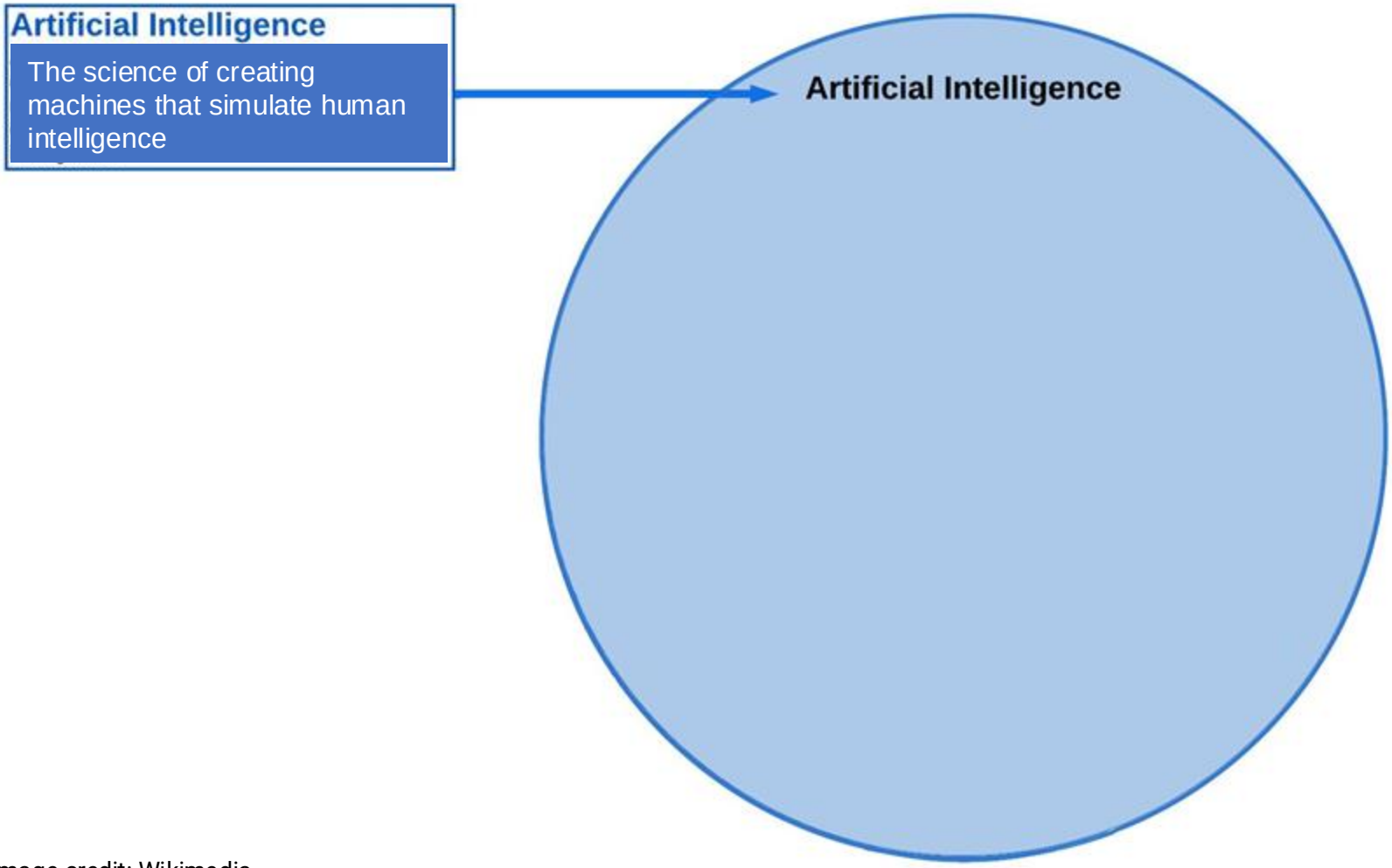


Image credit: Wikimedia

80-Year AI History Overview

1940s–1950s

Foundations of AI

In the 1940s, the first artificial neurons were conceptualised. The 1950s introduced us to the Turing Test and the term “Artificial Intelligence.

Image credit: Google

80-Year AI History Overview

2000s

The Genesis of Generative AI

Geoffrey Hinton propelled deep learning into the limelight, steering AI toward relentless growth and innovation.

Image credit: Google

AI Types

Narrow AI
Now

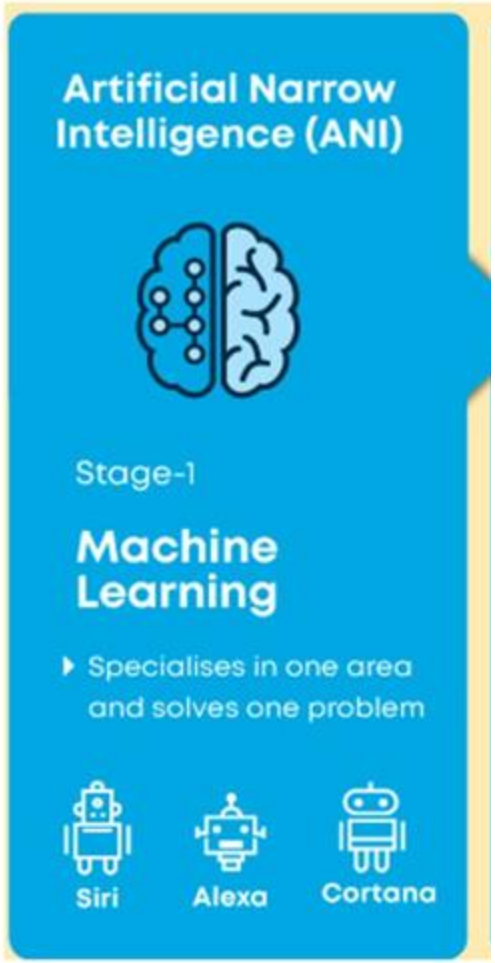


Image credit: Google

AI Techniques

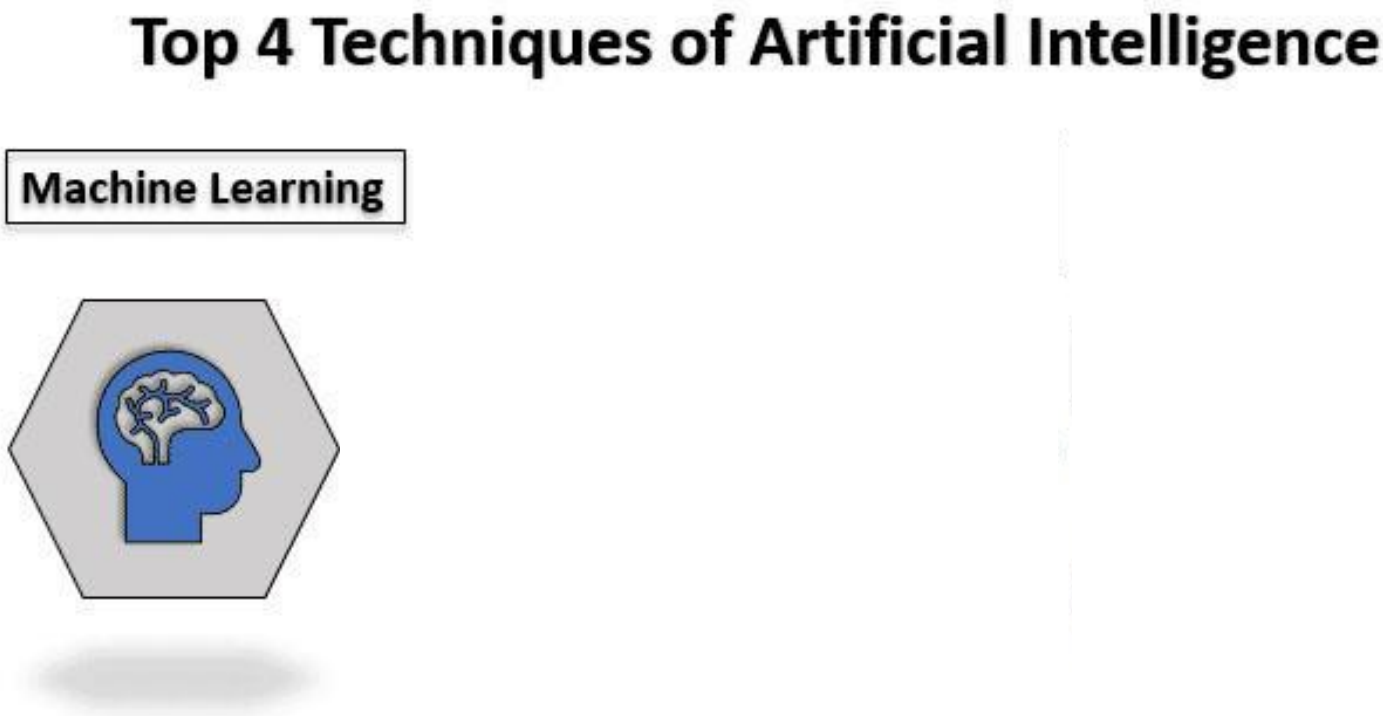


Image credit: Google

Machine Learning (ML)

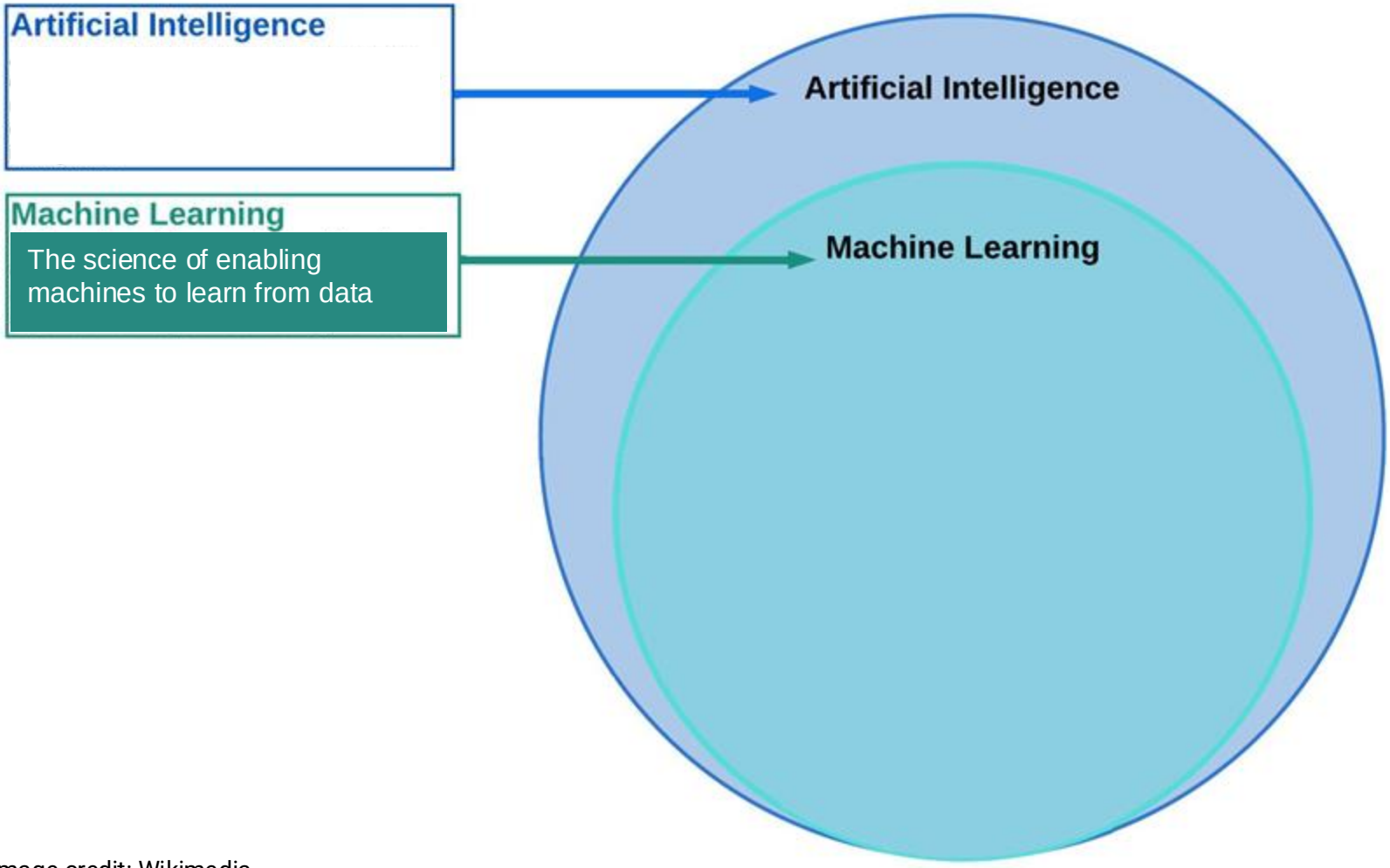
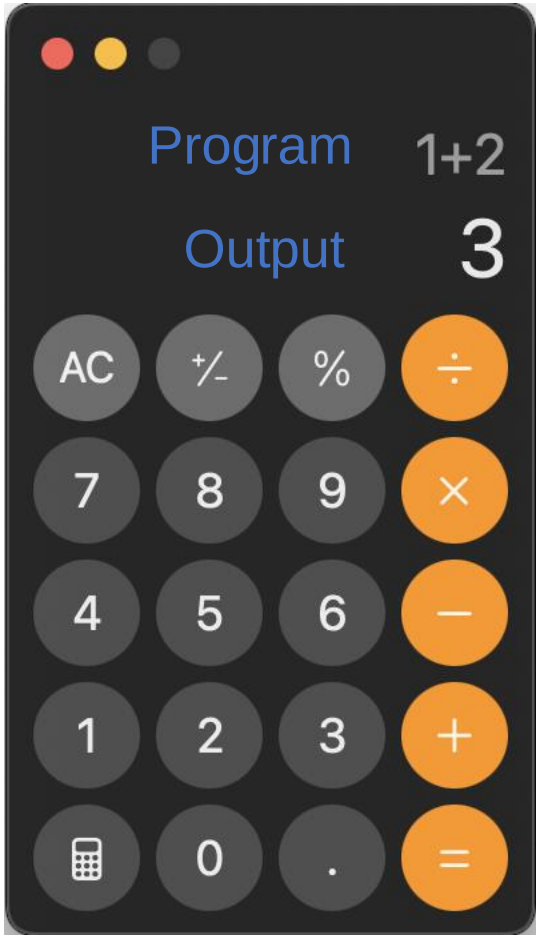


Image credit: Wikimedia

Computer Program (Program or Code or “Algorithm”)

Input	Program	Output
1, 2	Perform calculation 1+2=	3
x, y	f(x, y) = x+y	f(x, y)



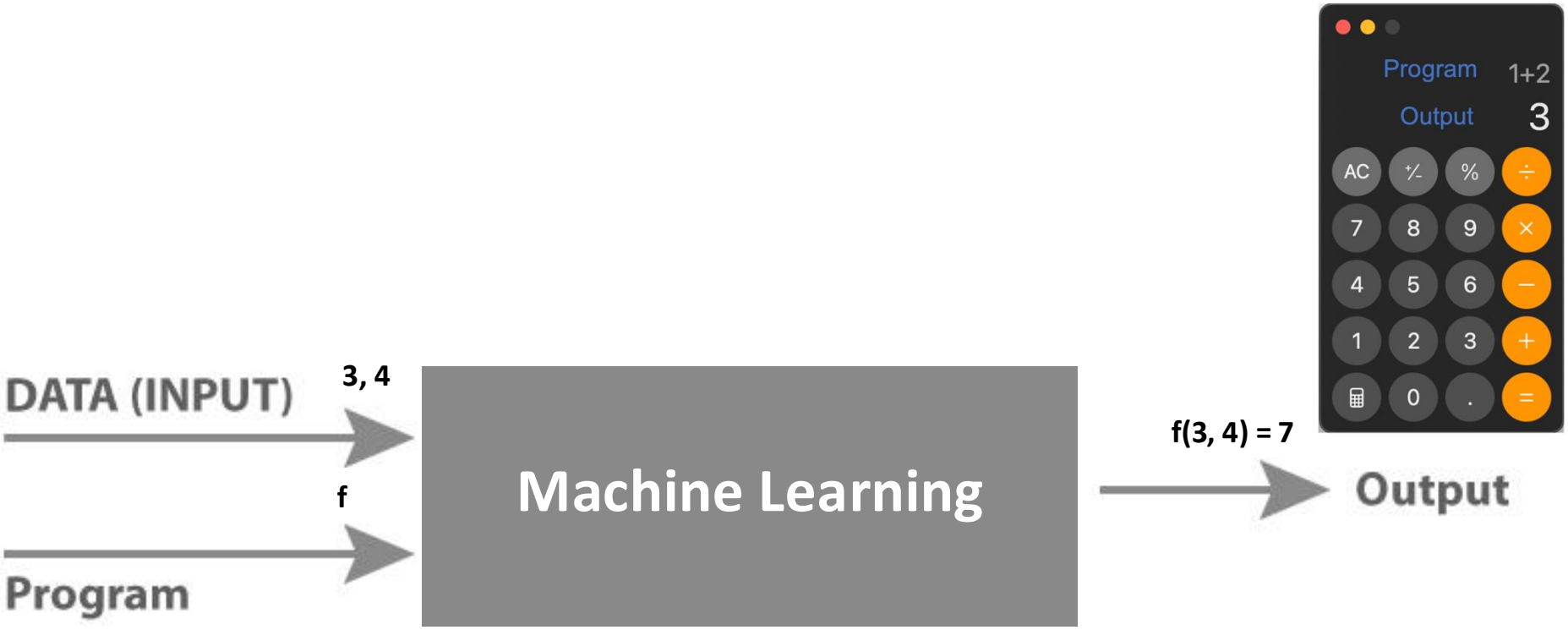
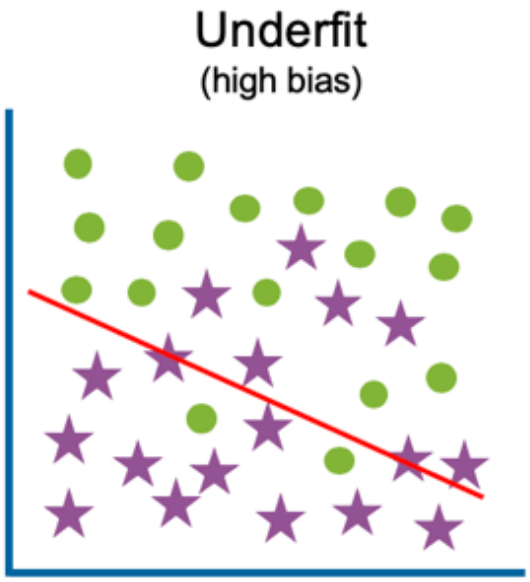


Image credit: Google

Machine Learning (ML)

Image credit: Google

Machine Learning (ML)



High training error
High test error

Image credit: Google

Machine Learning (ML) Types

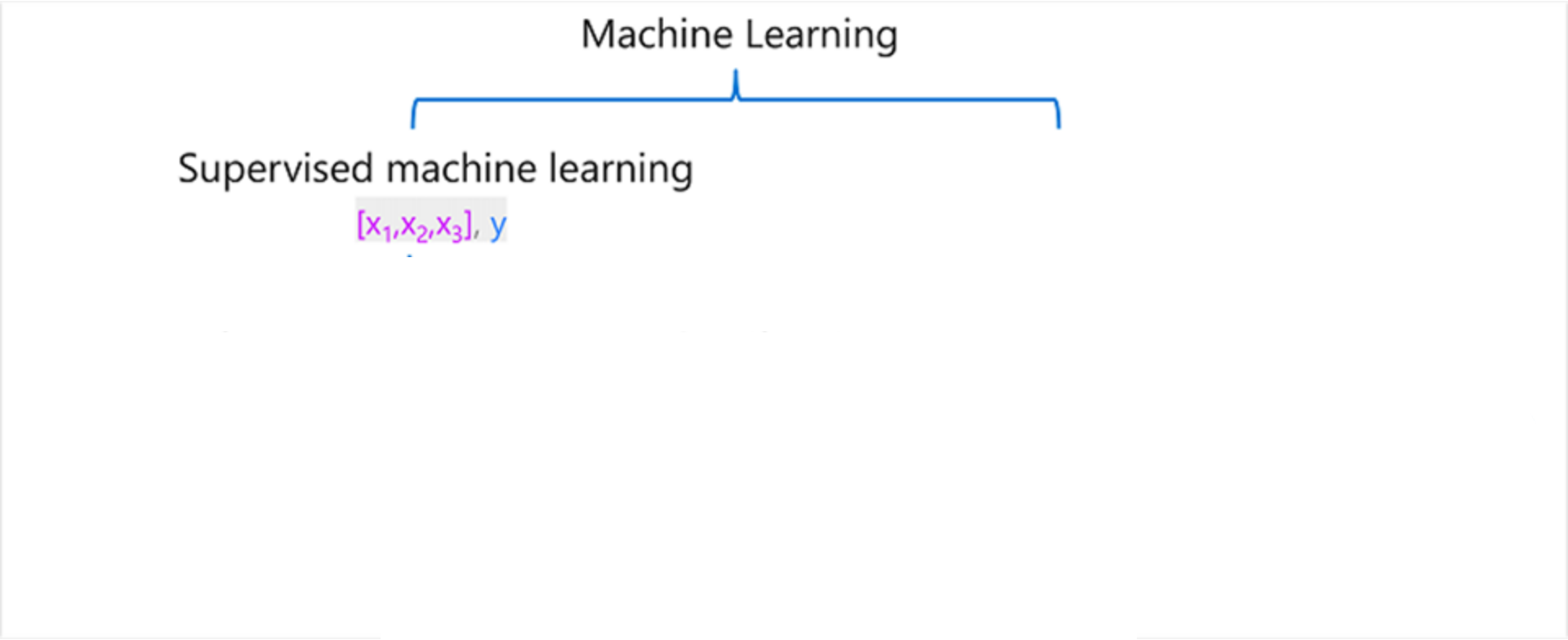
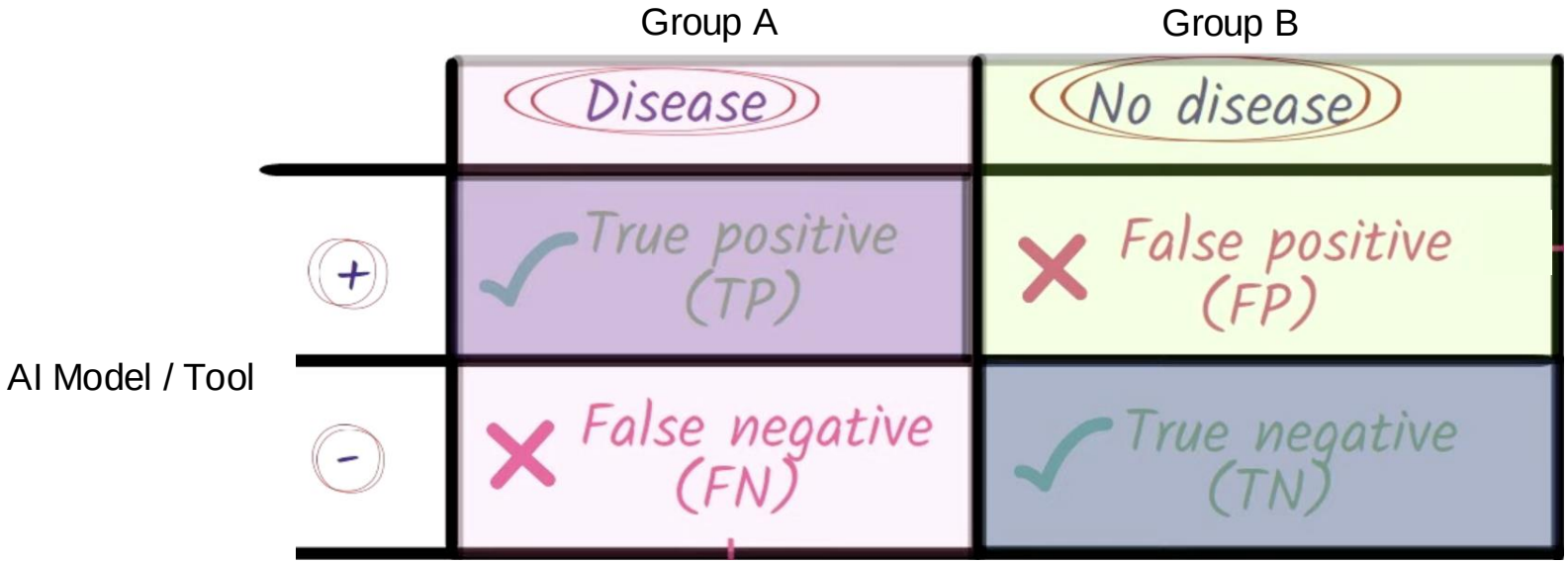


Image credit: Microsoft

Binary Classification Performance



Sensitivity =

$$TP\% = \frac{TP}{TP + FN}$$

Specificity =

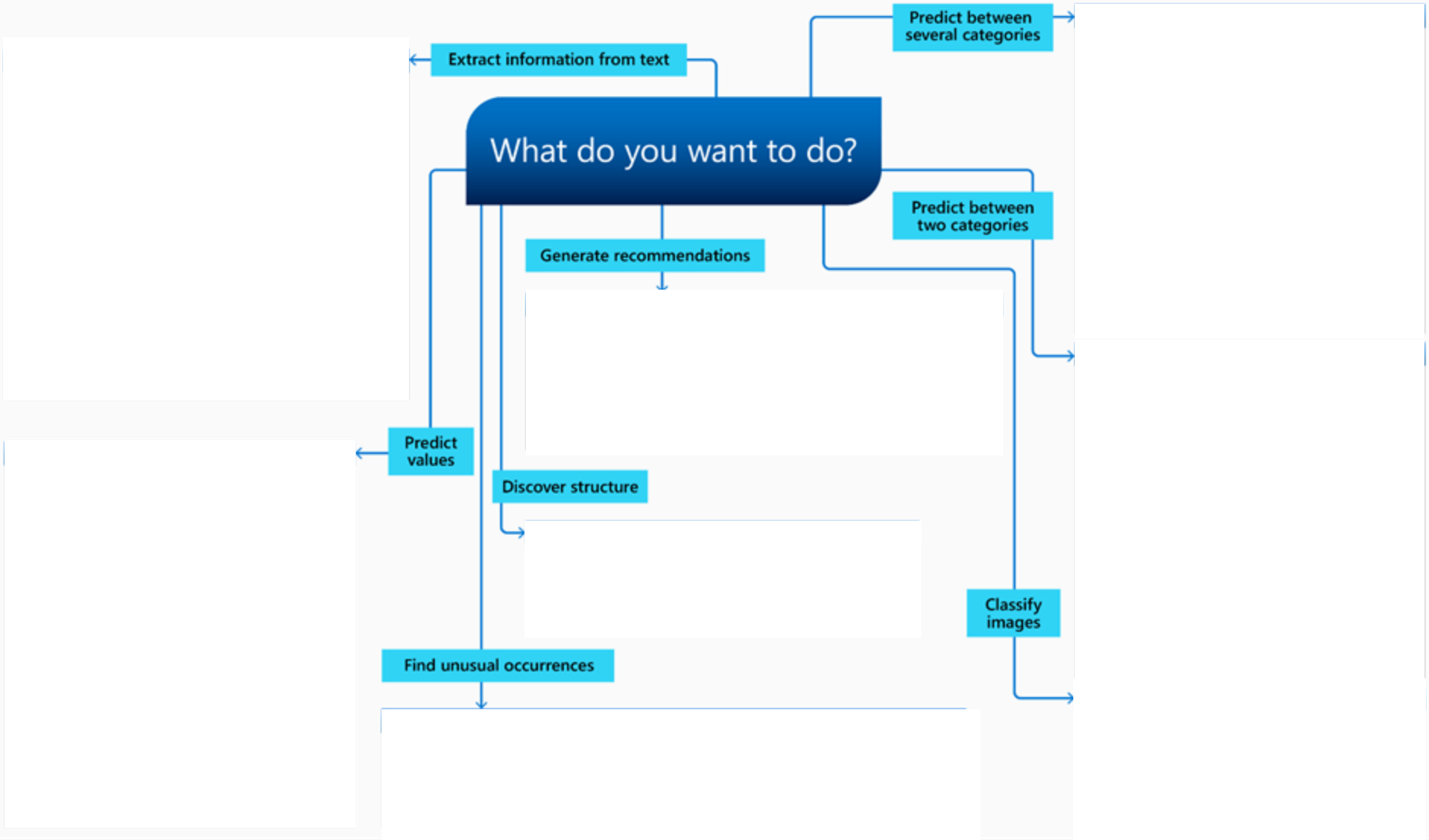
$$TN\% = \frac{TN}{TN + FP}$$

Image credit: Google

Machine Learning Algorithm Cheat Sheet

This cheat sheet helps you choose the best machine learning algorithm for your predictive analytics solution.
Your decision is driven by both the nature of your data and the goal you want to achieve with your data.

Microsoft Azure



Deep Learning (DL)

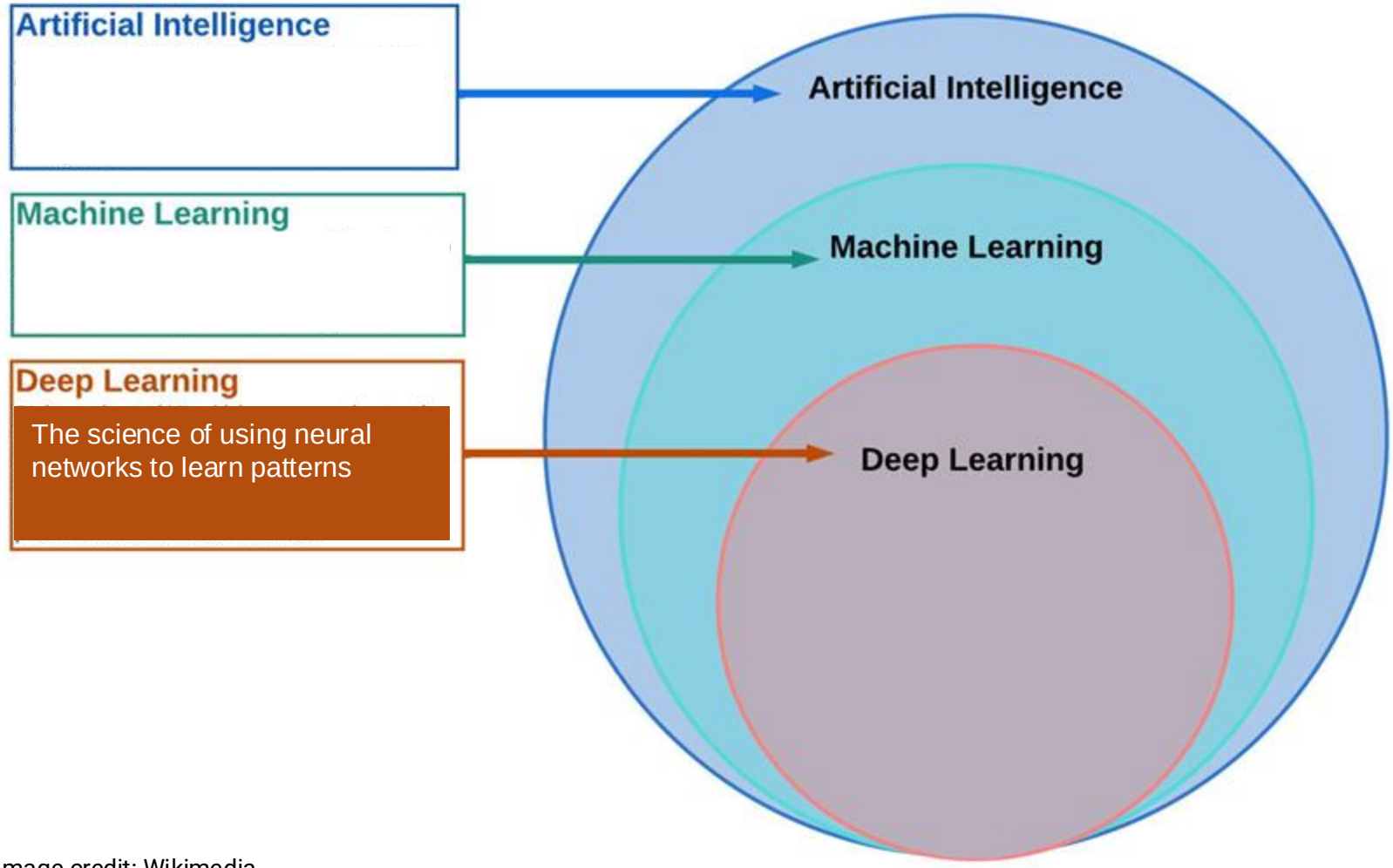


Image credit: Wikimedia

Biological vs Artificial Neuron

Biological neuron

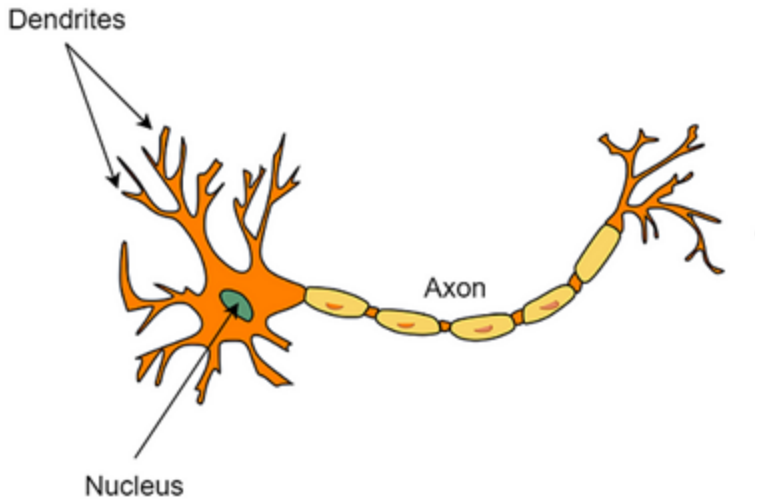
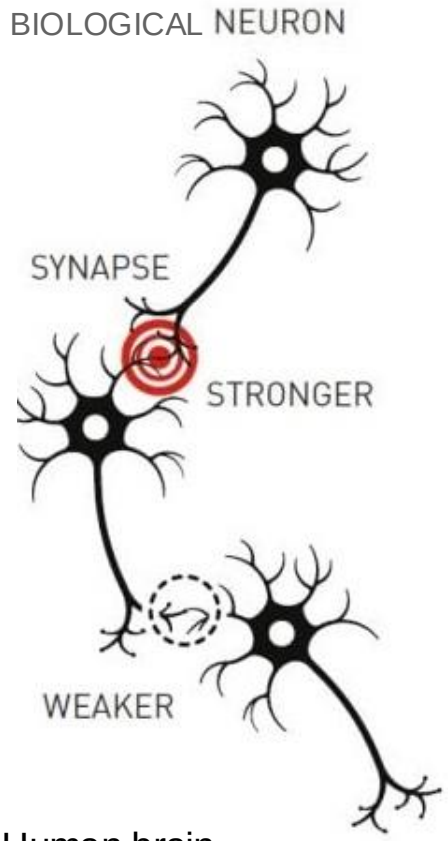


Image credit: Google

Learning: Biological vs Artificial Neural Network



Human brain
100B (1B=1K M) Neurons
100T (1T=1M M) Synapses

Image credit: nobelprize.org

Artificial Neural Network (ANN)

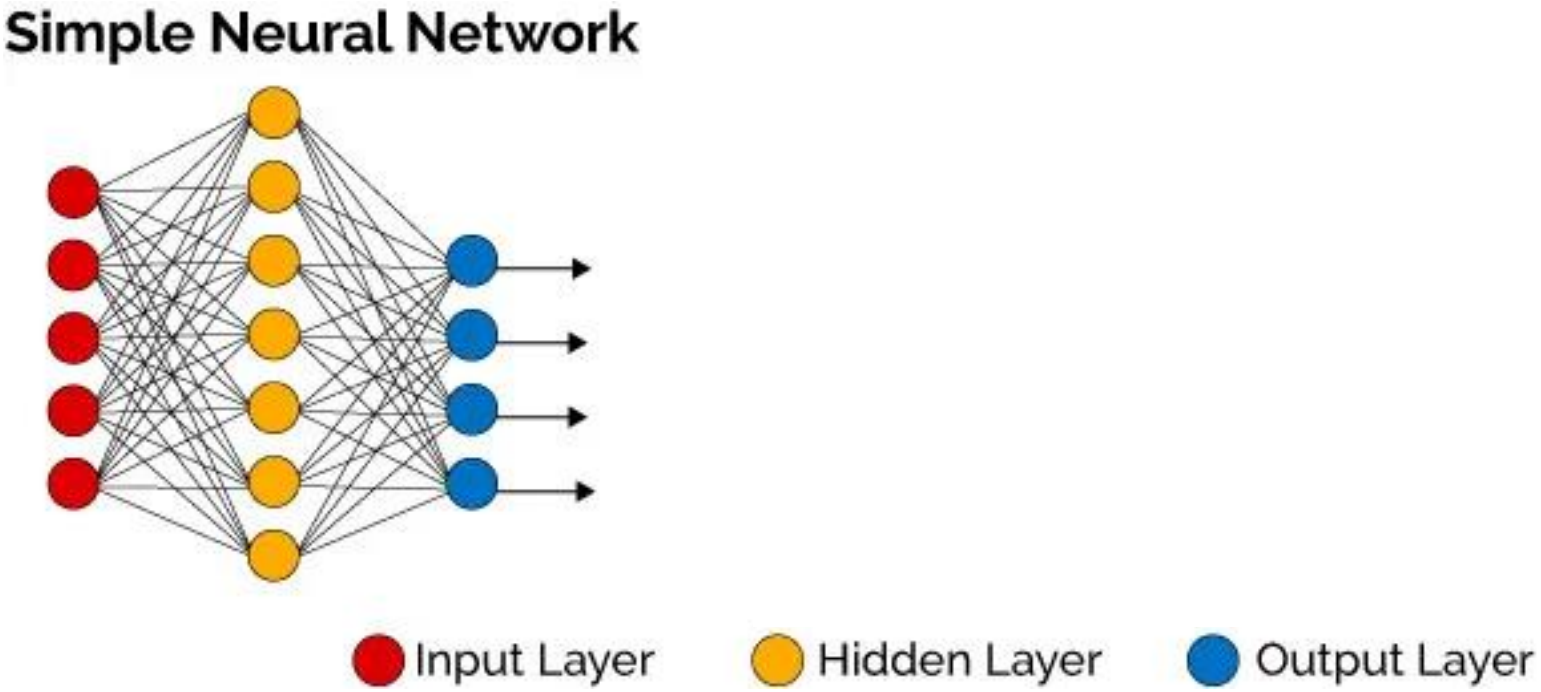
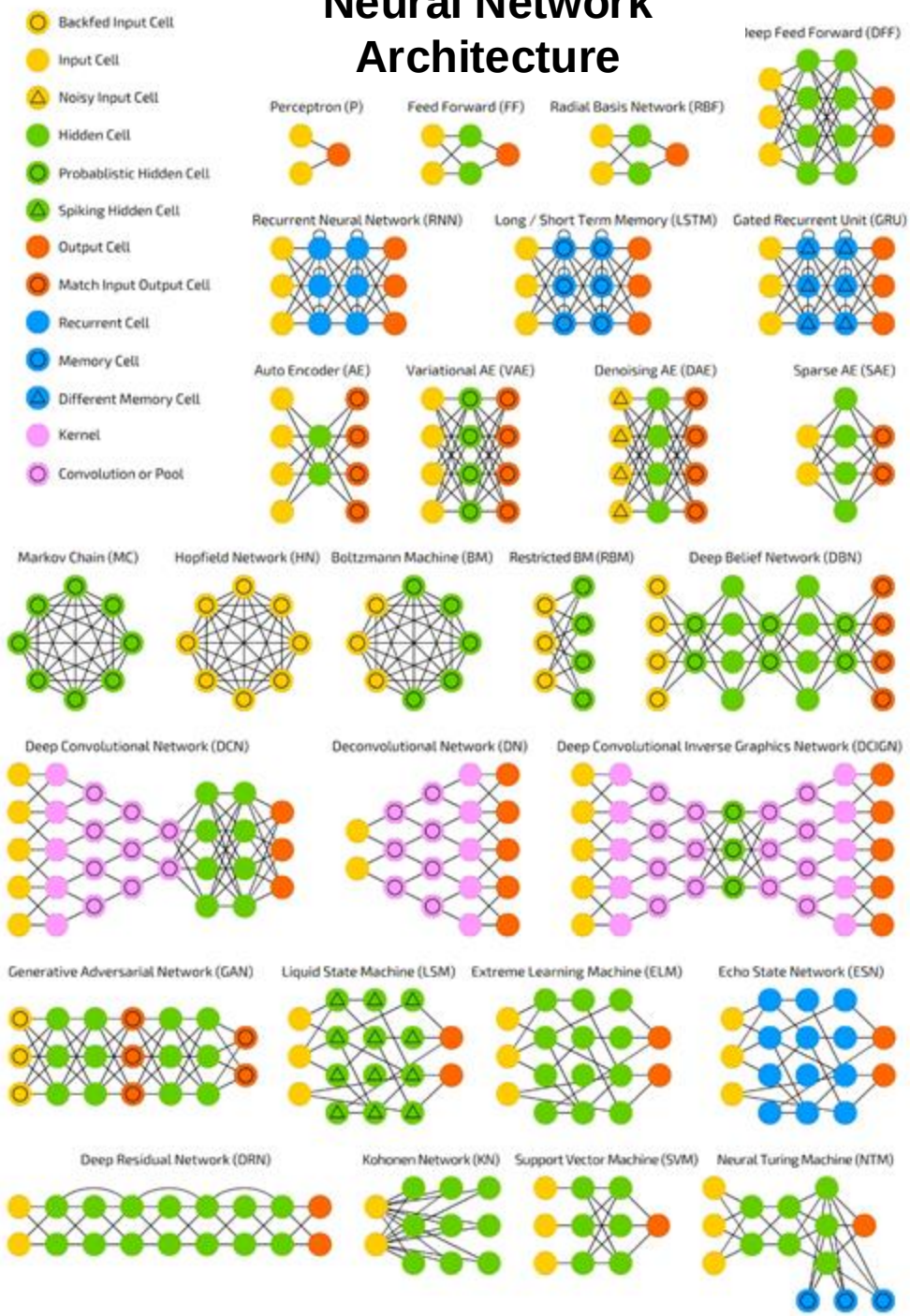


Image credit: Google

Neural Network Architecture



Transformer Architecture
Generated Pre-Trained Transformer (GPT)

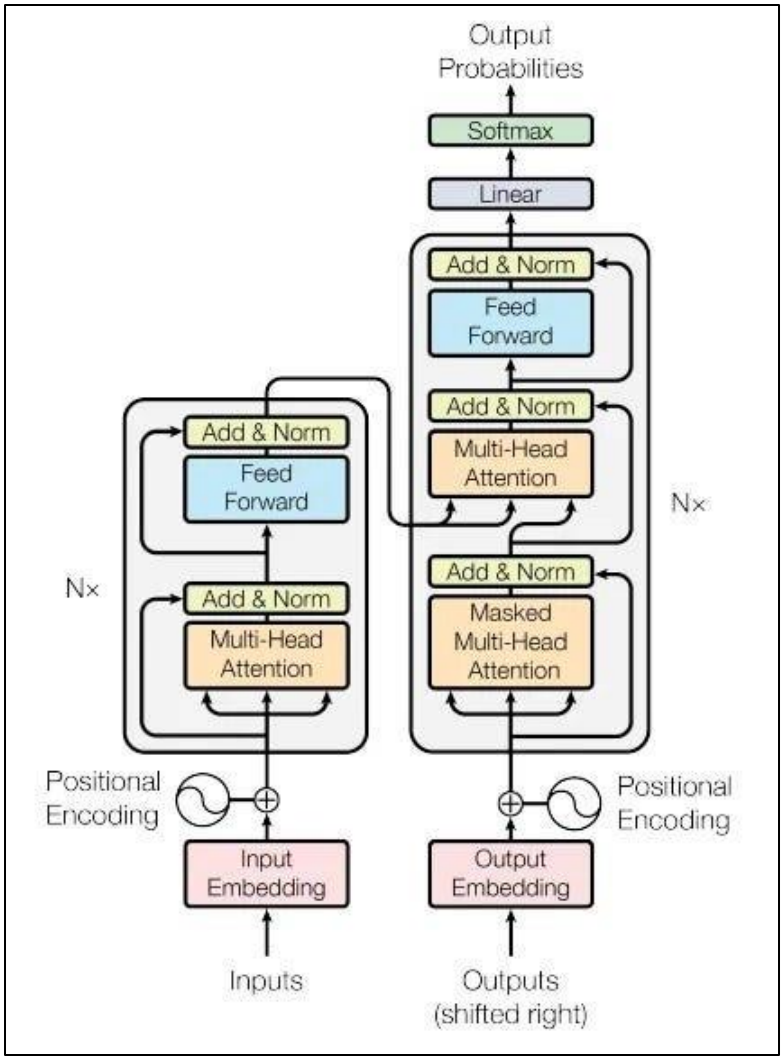


Image credit: Google

Generative AI (genAI or gAI)

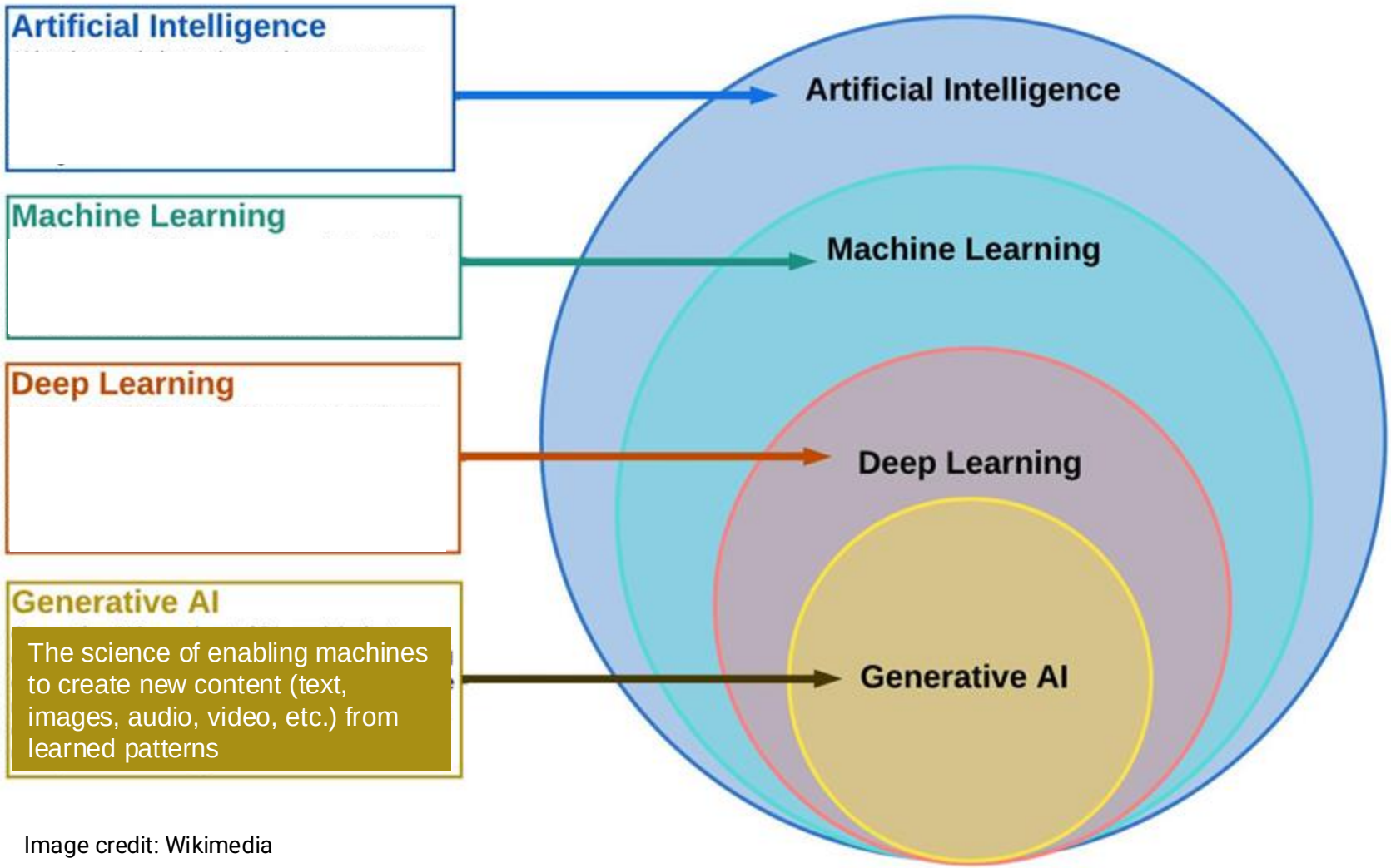
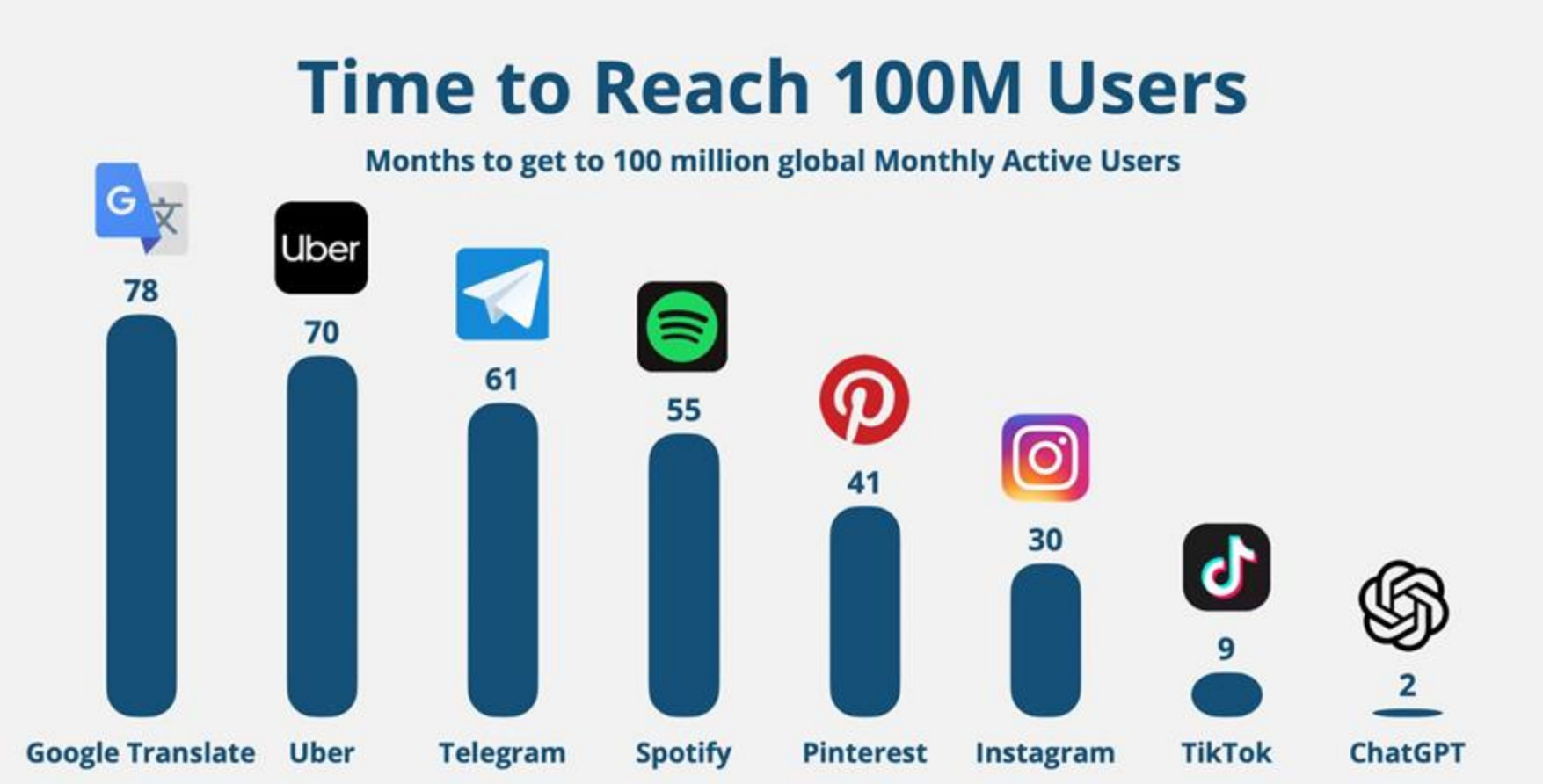


Image credit: Wikimedia

Generative AI tool: ChatGPT



5.8 years

2.5 years

2 months

Image credit: Google

Generative AI tools

CATEGORY	TOOLS			
AI Bot	ChatGPT	Google Bard	Bing AI	Claude
Video Creation	Runway	HeyGen	Veed.io	Pictory
Images	Midjourney	DALL-E 3	Leonardo.ai	Firefly
Presentation	Tome	Slides.ai	Decktopus	Beautiful.ai
Research	Harpa	Perplexity	Glasp	ChatPDF
Prompt Writing	G-Prompter	OctiAI	Snack Prompt	PromptPal
Productivity	Taskade	Audio Pen	Notion AI	Xembly
Writing	EssayService.ai	Grammarly	Jasper AI	Wordtune

Image credit: Google

Generative AI tool: ChatGPT

GENIUS VS AI (FEB/2024)

	 Average human	 Terence Tao	 William James Sidis	 GPT-4	 Gemini 1.0 and 1.5
IQ percentile	50th	**>99.9th**	**>99.9th**	**>99.9th**	**>99.9th**
Languages	2	2	25+	90+	**200+**
Books read	700	700+	700+	4,000,000+	**10,000,000+**
Working memory	7 words	9+ words	9+ words	128,000 words	**7,000,000 words**
Long-term memory	74TB	74TB	74TB	40TB	**80TB**
SAT score	1050 (50th)	**~1460 (97th)**	-	1410 (94th)	

Sources: Working memory extrapolated from Miler, 1956, and Cowan, 2000, https://doi.org/10.1017/S0140525X01003922. Long-term memory extrapolated from Stanford, 2010, https://pubmed.ncbi.nlm.nih.gov/21092855/. Alan D. Thompson. Sep/2023, Feb/2024. https://lifearchitect.ai/iq-testing-ai

Large Language Models (LLMs)

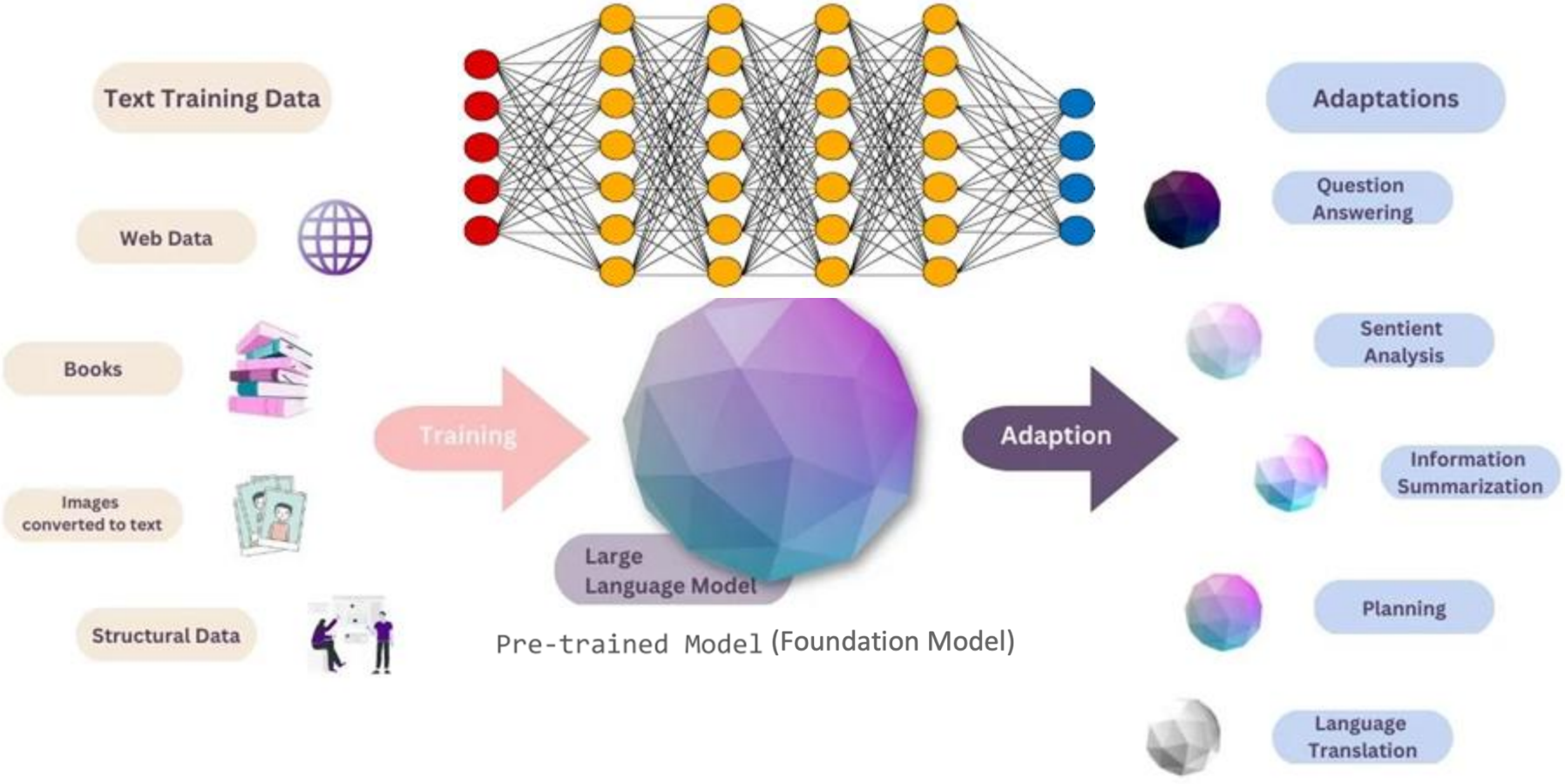


Image credit: Google

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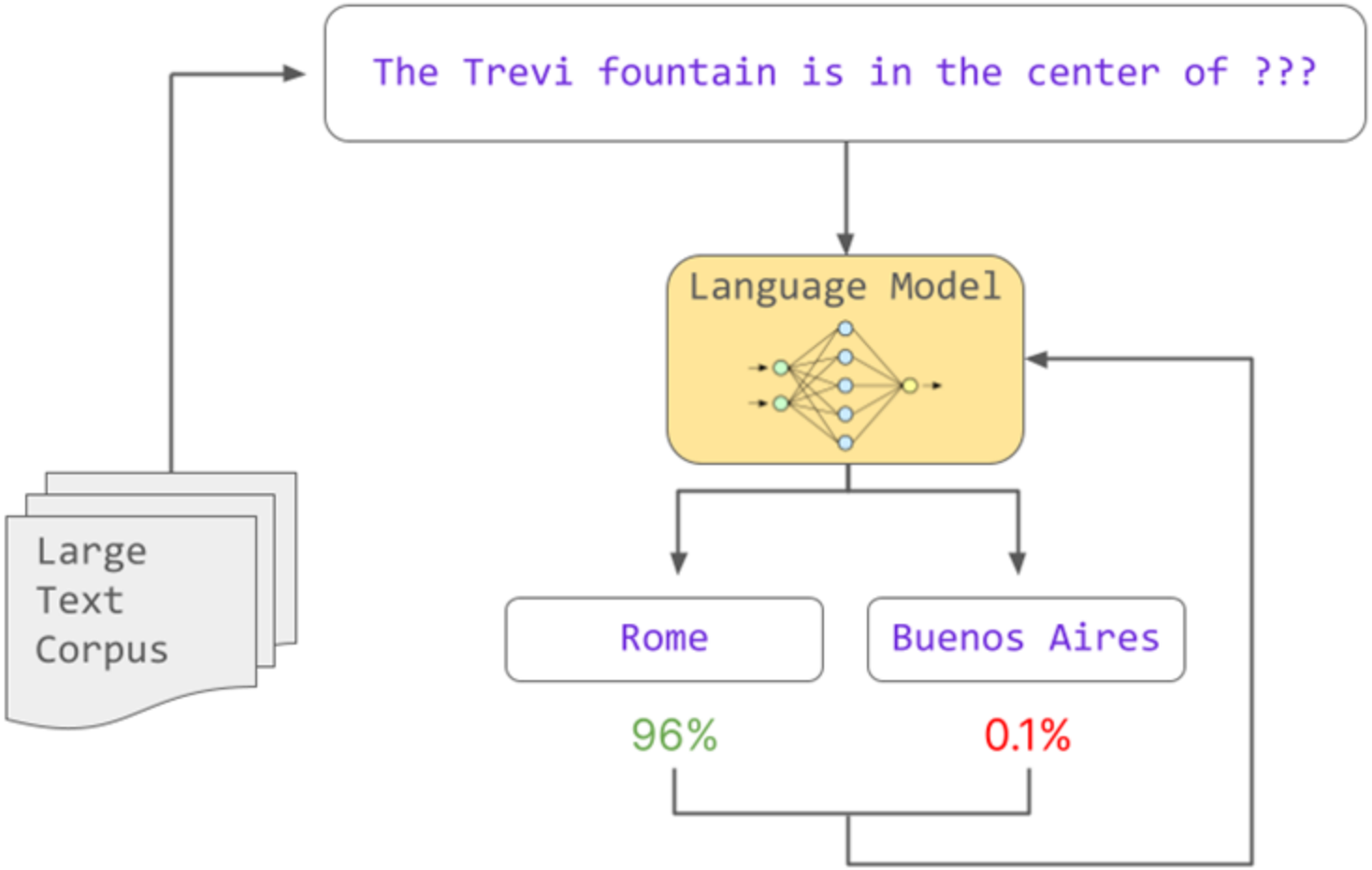

Image credit: Google

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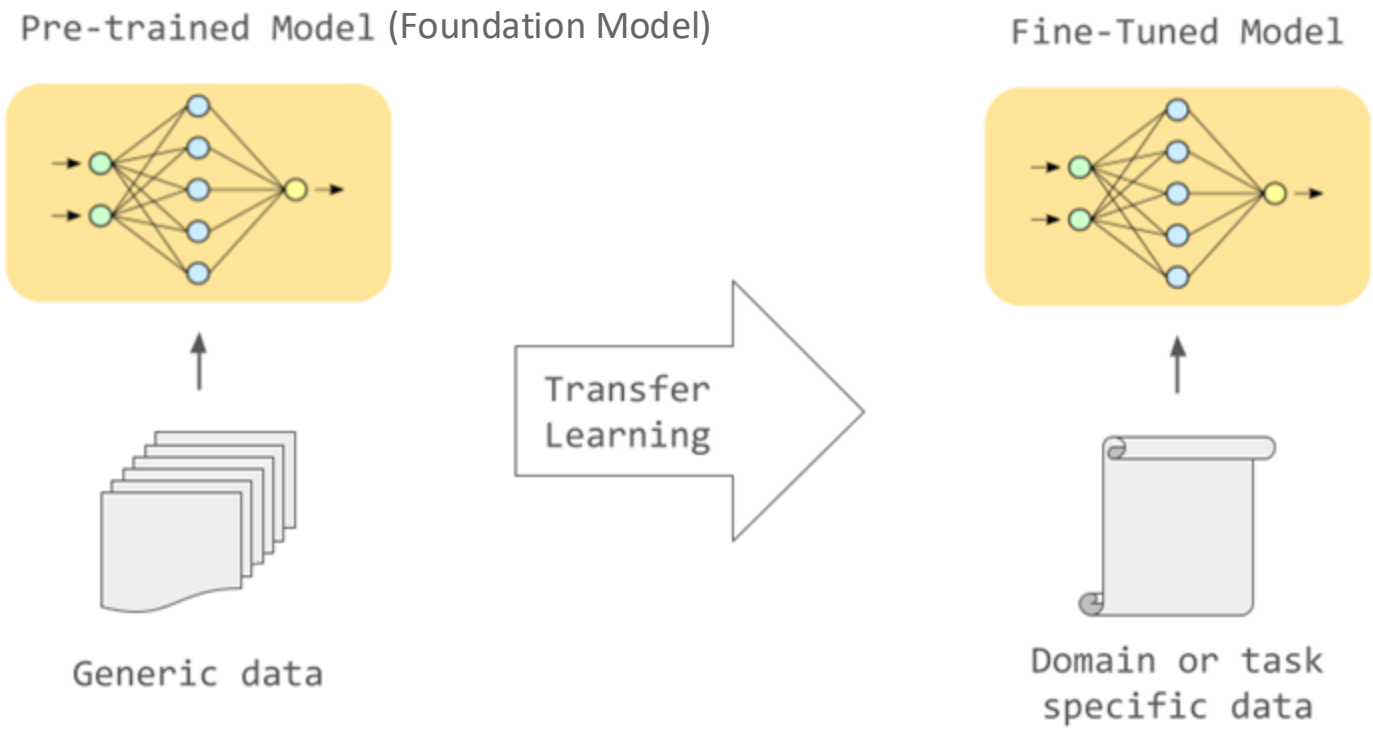

Image credit: Google

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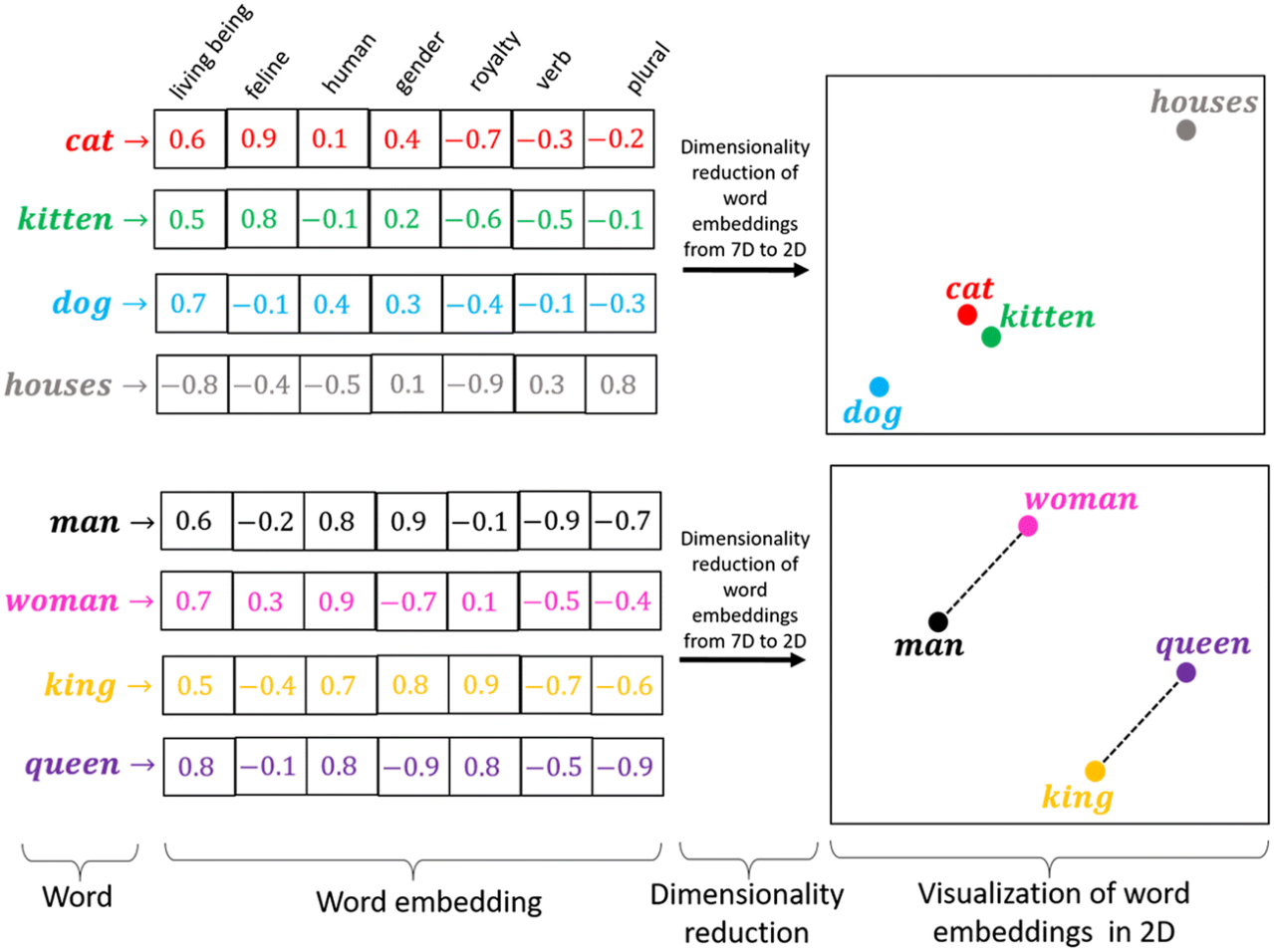
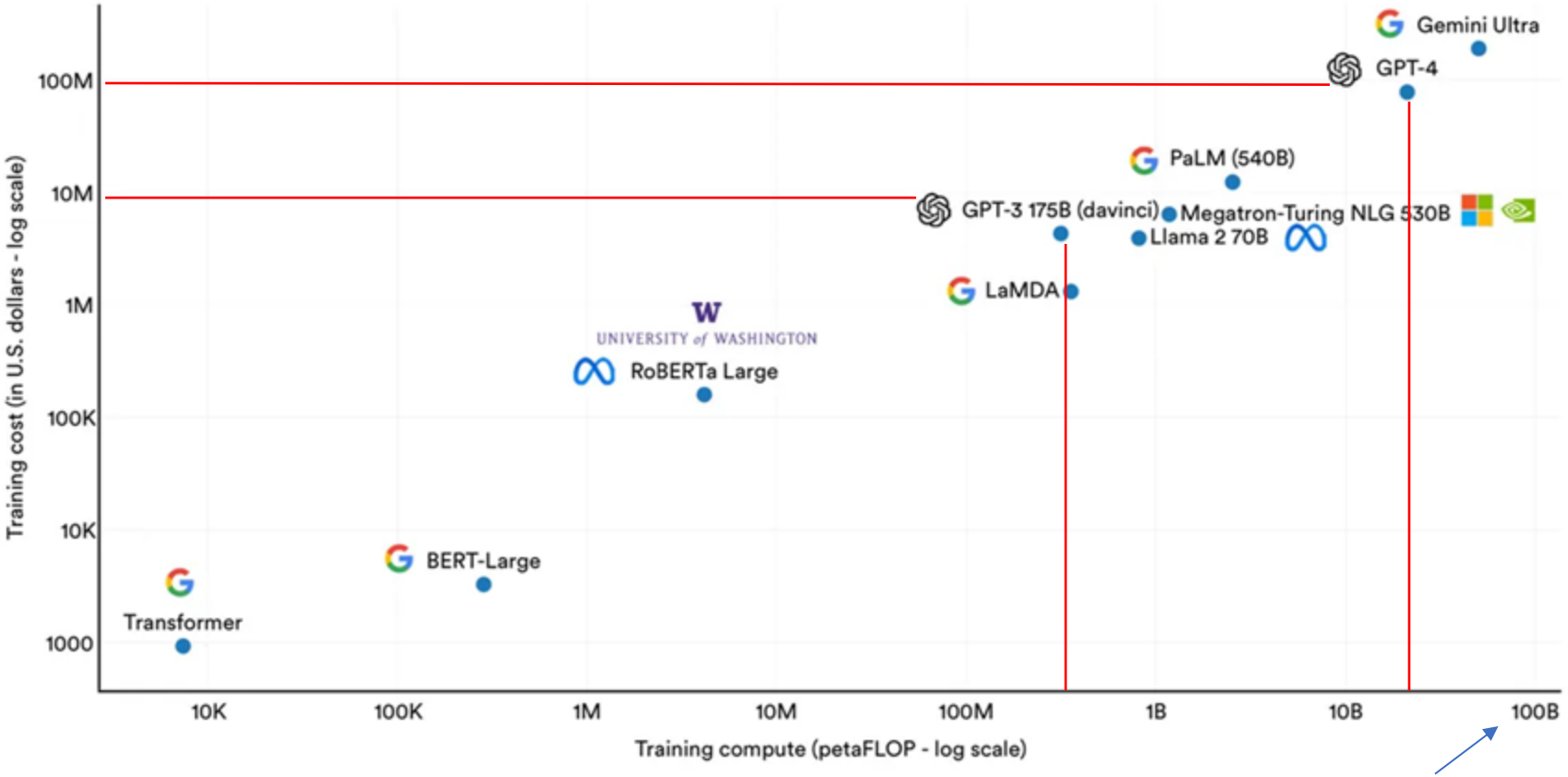


Image credit: Google

LLM Size

Image credit: Google

LLM Cost

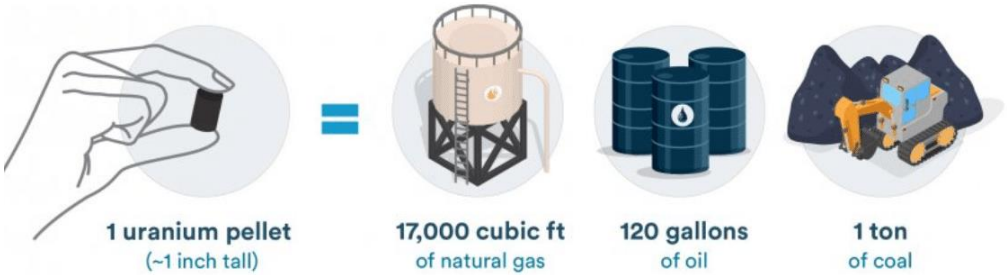


1B = 1K M
1T = 1M M
1P = 1K T

100B petaFLOP/month = 25K homes electricity/year

Image credit: Google

Fusion Energy



Fusion Energy

Computer Science Researchers Receive U.S. Department of Energy Grant

Author: Dr. Wes Bethel

February 19, 2024

Enhancing LLMs

Trains model from scratch

Image credit: Google

Retrieval Augmented Generation(RAG)

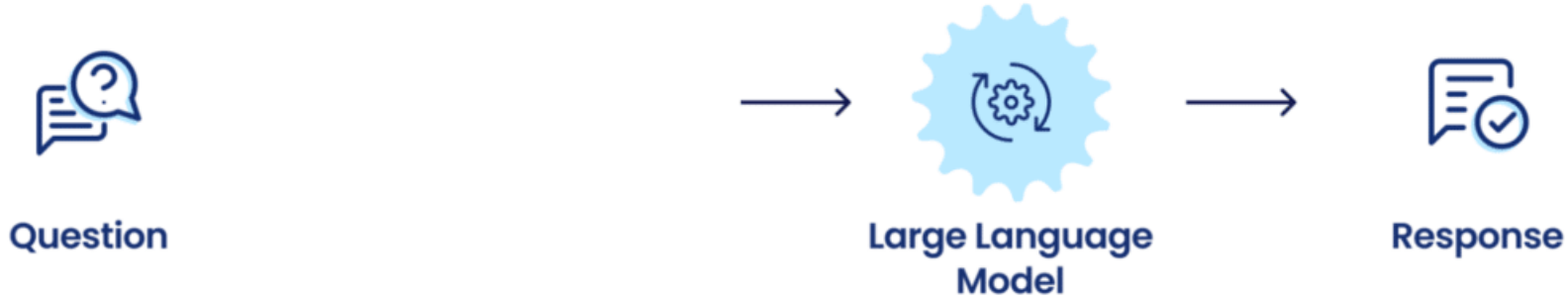


Image credit: Google

Retrieval Augmented Generation(RAG)

Without RAG: LLM model has to be the only source of knowledge

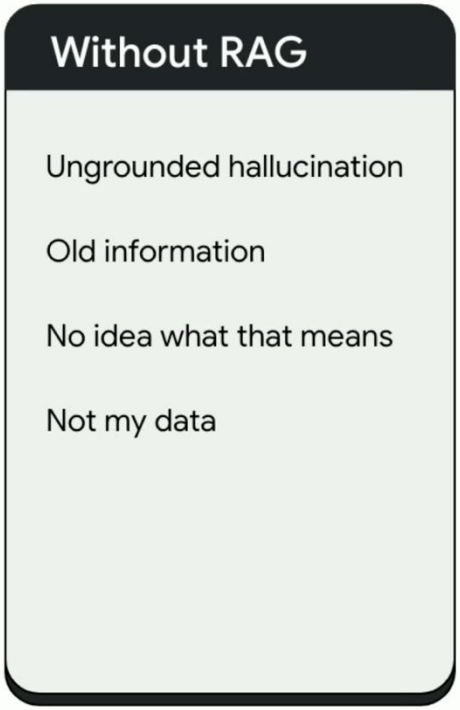


Image credit: Google

High-Performance Computing (HPC)

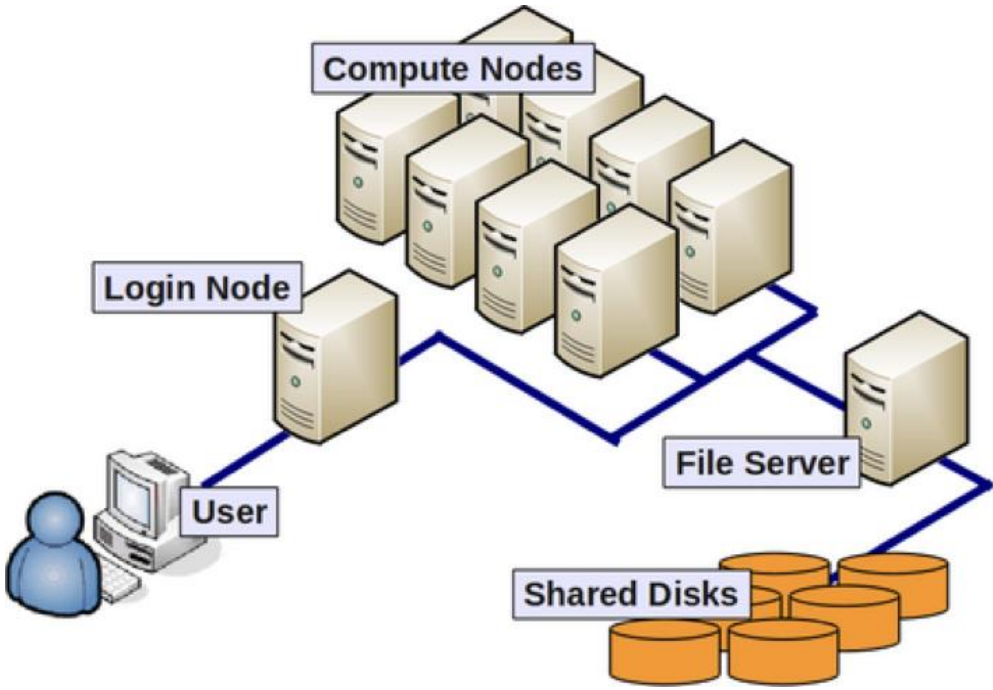


Image credit: Google

AI and High-Performance Computing (HPC)

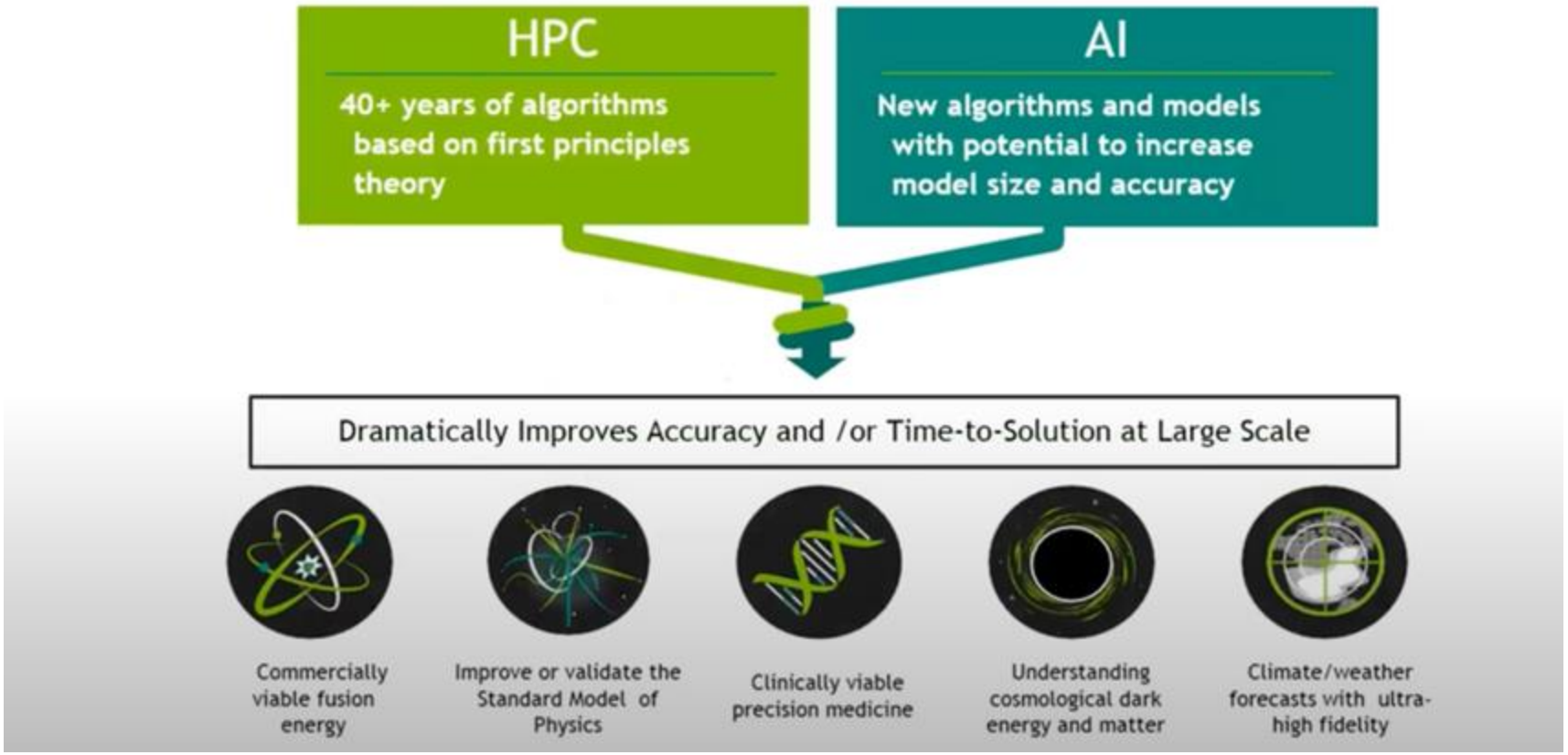


Image credit: Google

AI Ethical Considerations

Image credit: Google

AI Summary

Artificial Intelligence

Simulate human intelligence

Machine Learning

Learn patterns from data

Deep Learning

Use neural networks to learn patterns

Generative AI

Create new content from learned patterns

Large Language Model (LLM)

Learn to understand natural language

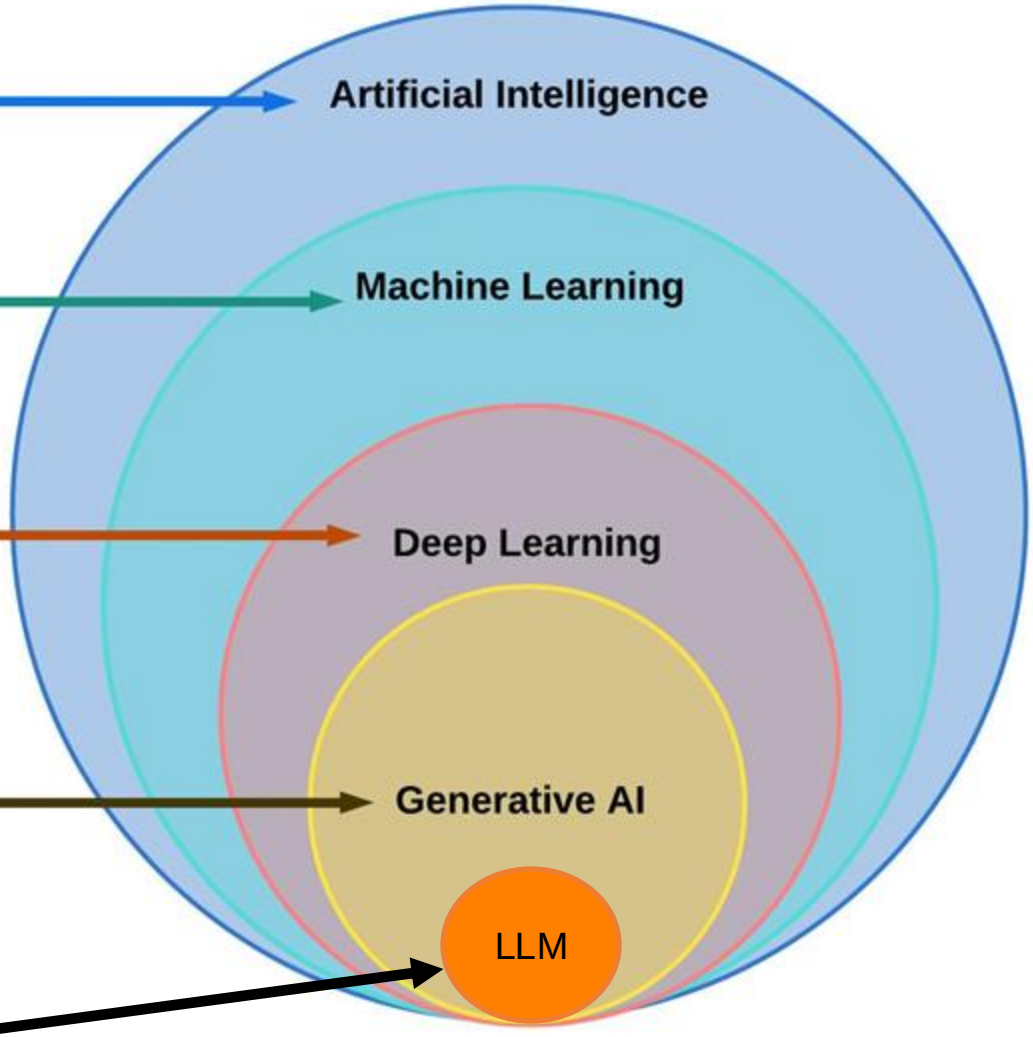


Image credit: Wikimedia

Essential AI Skills to Accelerate Research

- **ChatGPT:** Solve problems, reason, and code
- **Jupyter:** Interactive coding on PC & HPC
- **PyTorch:** GPU-powered deep learning

- 🚀 **AI & HPC Workshops**
  - 🖥️ 1️⃣ **Using Personal Computer (PC)**
    - ✨ AI Magic with Jupyter!
    - 📊 Visualize AI Data!
    - 🤖 Simple ML Model
    - 🧠 Deep Neural Network (DNN)
    - 💬 Introduction to LLMs
    - 📚 LLM + RAG
    - 🔍 Ethical AI & Future Trends
  - 💻 2️⃣ **High-Performance Computing (HPC)**
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    - 🔍 Ethical AI & Future Trends

https://github.com/DrAlzahrani/HPC-AI-Resources/wiki

Essential AI Skills to Accelerate Research

- **ChatGPT:** Solve problems, reason, and code
- **Jupyter:** Interactive coding on PC & HPC
- **PyTorch:** GPU-powered deep learning

🖥️ 3. Getting Started with Jupyter Notebooks

What is a Jupyter Notebook? 📒

A Jupyter Notebook is like a smart digital notebook where you can write and run Python code in small sections (cells). Think of it as typing notes and instantly running experiments on a computer! 📝💡

🔹 **Jupyter = Digital Lab Notebook for AI & Coding!** 🚀

Open Google Colab

1️⃣ Open your browser and go to Google Colab.
2️⃣ Click **+ New notebook**.

🐍 4. Your First Python Code (Step-by-Step) 🚀

🔹 Print a Message 🖨️

➕🐍 Add a New Code Cell

1️⃣ Click **+ Code** in the top left to add a new code cell.
2️⃣ Copy and paste the following into the new code cell.

🔗 ChatGPT explanation for the code

```
# The print function outputs the message to the screen
print("Hello AI World!")
```

3️⃣ Click **Run** (▶) and check the output!

✅ If done correctly, you should see: `Hello AI World!` printed below the cell.

https://github.com/DrAlzahrani/HPC-AI-Resources/wiki

My AI Research

1. Accelerating Academic Research Using AI and HPC
2. AI-Based Cancer Detection
3. AI-Driven Academically At-Risk Student Detection
4. AI-Powered Support Systems
5. AI Deep Neural Networks (DNN or Deep Learning, DL) and Large Language Models (LLMs)
    1. Overfitting
    2. Bias
    3. Explainability
    4. Scalability
    5. Adversarial Attacks
6. AI for Scientists
7. AI for Everyone
8. AI-Based System to Defend Against Moving Threats (Military)
9. AI-Based System to Detect Suspects (Law Enforcement)
10. AI-Based System to Detect Interactions (Scientific and Entertainment)
11. AI-Based Software Vulnerability Detection
12. AI-Based Cyber Threat Detection

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