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# From Tools to Teammates: Agentic AI and the Future of Human-AI Collaboration in Education

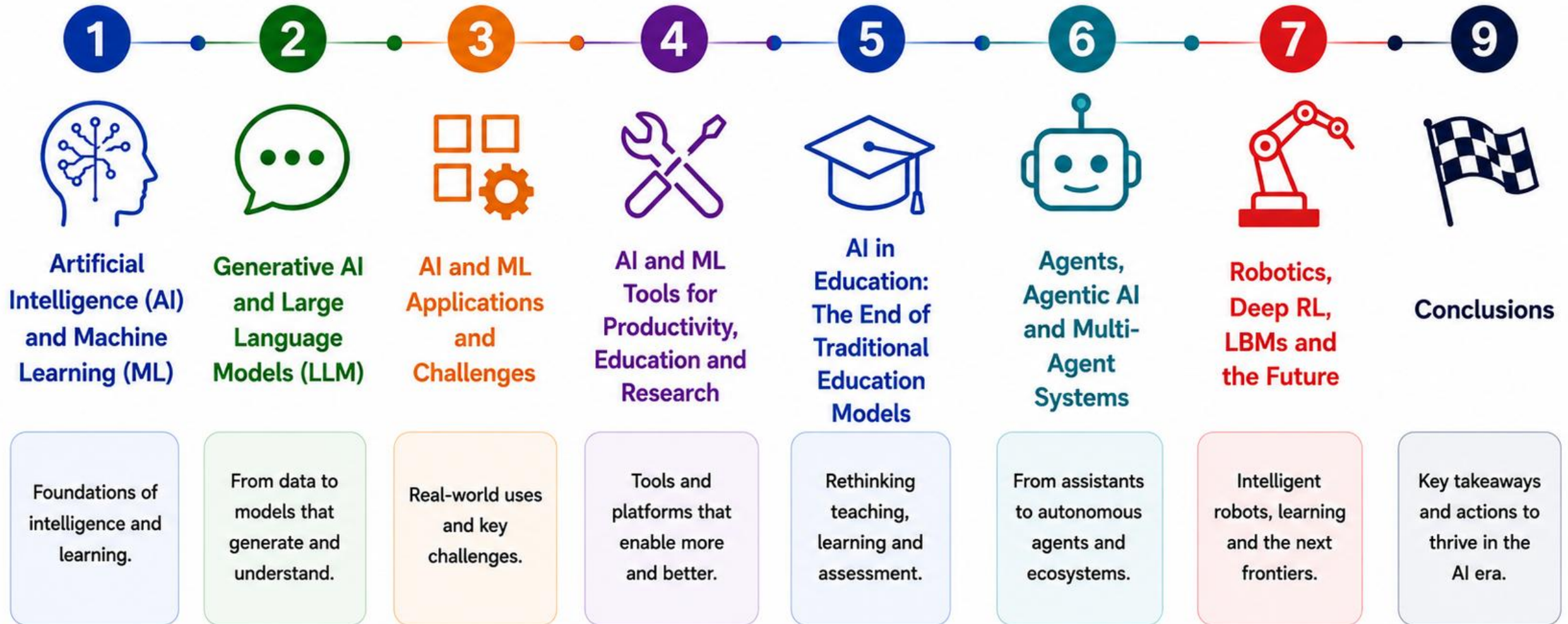
**Luís Paulo Reis**

[lpreis@fe.up.pt](mailto:lpreis@fe.up.pt)

Associate Professor at FEUP - Faculty of Engineering of the University of Porto  
Director of LIACC – Artificial Intelligence and Computer Science Laboratory, Univ. Porto  
Member of Coordinating Commission of LASI – Intelligent Systems Associate Laboratory  
President of the GA of APPIA – Portuguese Association for Artificial Intelligence

# AGENDA

## From Tools to Teammates: Agentic AI and the Future of Human-AI Collaboration in Education





# AI: From Tool to Partner

The discovery of a new world of intelligence.



AI is no longer just a Tool — It is a Partner!

## HUMAN INTELLIGENCE



**Solves new problems**

Handles novelty and ambiguity.



**Uses knowledge**

Built from experience, culture and education.



**Learns, reasons and adapts**

Understands context and meaning.



**Provides judgement, ethics and purpose**

Gives value and direction.

## WHAT IS AI?



**Intelligence**

Capacity to solve new problems through the use of knowledge.



**Artificial Intelligence (AI)**

Machines that perform tasks that when performed by humans require intelligence.

## AI AS A PARTNER

**Human strengths:**  
creativity, empathy, judgement, values, purpose



**AI strengths:**  
speed, scale, consistency, data processing, learning

Together, we solve bigger problems and create more impact.

## WEAK AI TO STRONG AI



**Weak AI / Narrow AI**

- Focused on specific tasks
- (e.g., recognition, translation, recommendation)
- Does one thing, very well
- Current AI systems



**Strong AI / AGI**

- General intelligence across domains
- Capable of any intellectual task
- Not science fiction anymore

From assistance → to collaboration → to autonomy

## THE EVOLUTION OF AI PARADIGMS



**RULES & LOGIC**  
(1950s–1980s)  
Symbolic AI and Expert Systems



**PATTERNS & DATA**  
(1990s–2000s)  
Machine Learning and Statistics



**DEEP LEARNING**  
(2010s)  
Big Data + Neural Networks



**GENERATIVE & AGENTIC AI**  
(2020s and beyond)  
LLMs, Multimodal, Agents, Towards AGI

## AI IN THE REAL WORLD



Education



Science



Industry



Mobility



Finance



Environment



And more



**KEY TAKEAWAYS**



AI is a partner, not just a tool.



Learning is more personal, active and collaborative.



The future is brighter when we learn together with technology.



Our responsibility: use AI ethically, inclusively and for the common good.



The future is not Humans vs AI, but Human + AI.

By combining the best of human intelligence and AI, we can build a better world.



# The World Is Changing Faster Than We Can Understand



AI won't replace humans — but **humans using AI** will replace humans not using AI

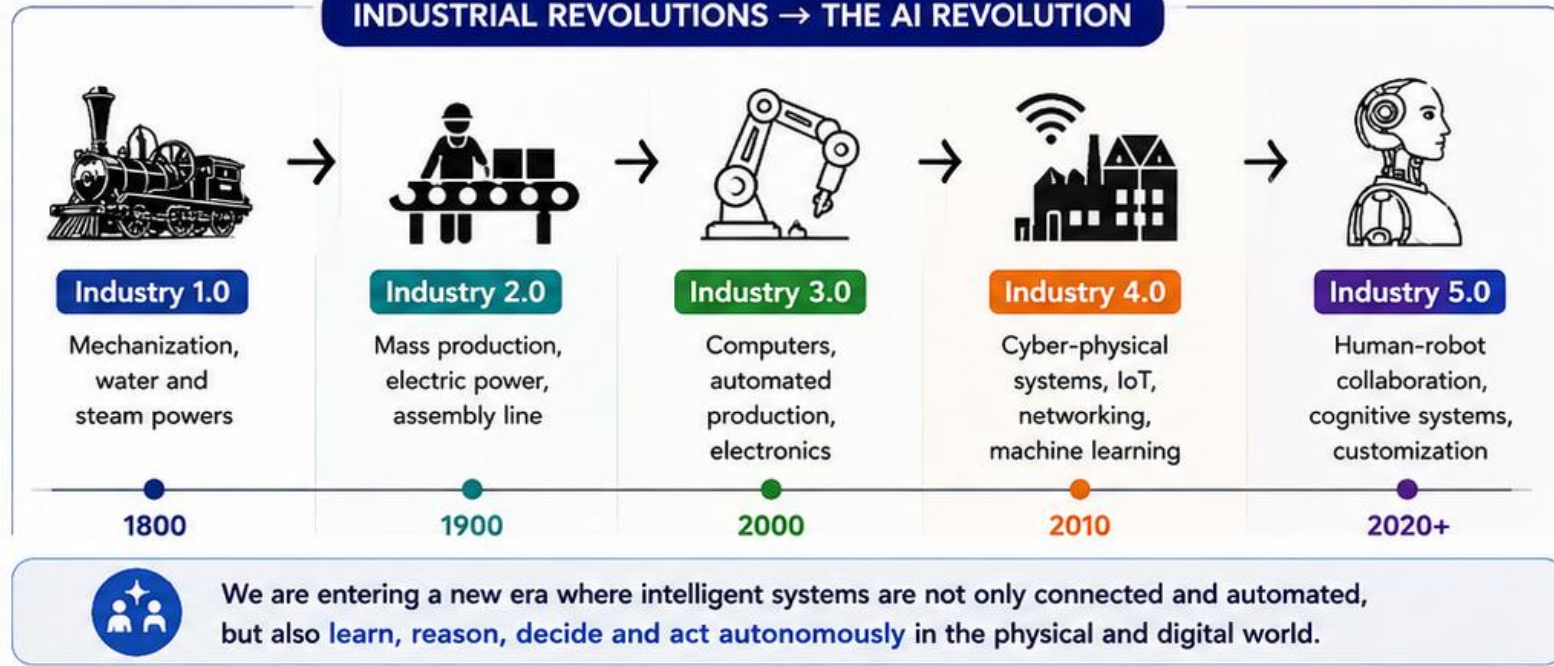


AI is moving from **tools** that assist humans to **agents** that act autonomously

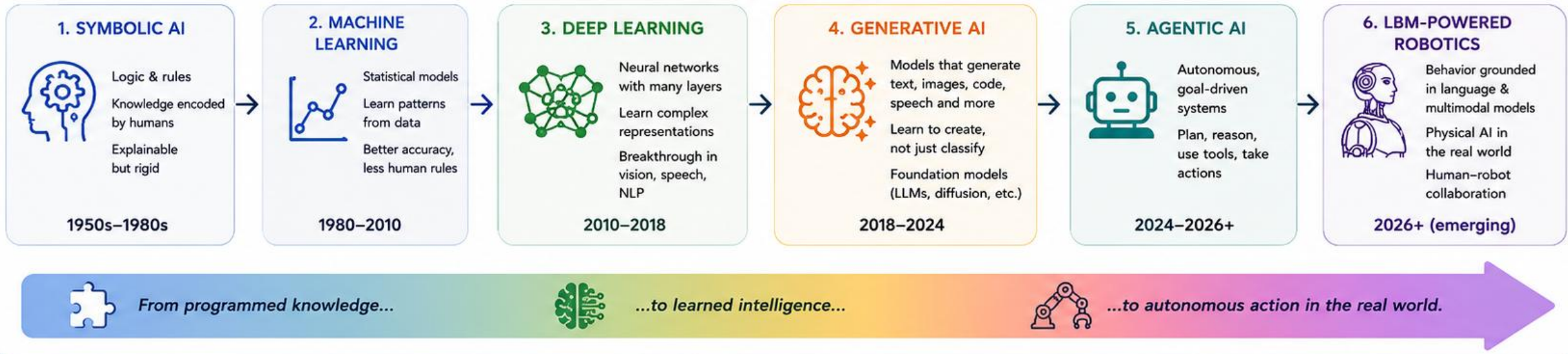


Autonomous, Physical, Goal-Driven, Learning Systems

## INDUSTRIAL REVOLUTIONS → THE AI REVOLUTION



## EVOLUTION OF AI PARADIGMS



# A.I. TIMELINE

Key breakthroughs and milestones that shaped Artificial Intelligence.



**1950**

## TURING TEST

Alan Turing proposes a test for machine intelligence. If a machine can trick humans into thinking it is human, then it has intelligence.



**1956**

## A.I. BORN

Term 'artificial intelligence' is coined by computer scientist John McCarthy at the Dartmouth Conference.



**1961**

## UNIMATE

First industrial robot, Unimate, goes to work at GM replacing humans on the assembly line.



**1964**

## ELIZA

Pioneering chatbot developed by Joseph Weizenbaum at MIT holds conversations with humans.



**1966**

## SHAKY

The first electronic person from Stanford. Shakey is a general-purpose mobile robot that reasons about its own actions.



**1997**

## DEEP BLUE

Deep Blue, a chess-playing computer from IBM defeats world chess champion Garry Kasparov.



**1998**

## KISMET

Cynthia Breazeal at MIT introduces Kismet, an emotionally intelligent robot in solar as it detects and responds to people's feelings.



**2011**

## SIRI

Apple integrates Siri, an intelligent virtual assistant with voice interface, into the iPhone 4S.



**2011**

## WATSON

IBM's Watson wins Jeopardy! answering complex questions in natural language.



**2012**

## ALEXNET

AlexNet wins the ImageNet competition by a large margin, launching the deep learning revolution.



**2014**

## EUGENE

Eugene Goostman, a chatbot, passes the Turing Test with a 33% of judges believing Eugene is human.



**2014**

## ALEXA

Amazon launches Alexa, an intelligent virtual assistant with a voice interface that completes shopping tasks and more.



**2016**

## ALPHAGO

DeepMind's AlphaGo becomes the first AI to defeat a world champion in the complex board game Go (4-1).



**2017**

## TRANSFORMER

"Attention Is All You Need" paper introduces the Transformer architecture.



**2018**

## BERT

Google releases BERT, improving natural language understanding for search and many NLP tasks.



**2020**

## GPT-3

OpenAI's GPT-3 demonstrates powerful few-shot and zero-shot learning across many tasks.



**2021**

## ALPHAFOLD 2

DeepMind's AlphaFold 2 solves the protein folding problem, a 50-year challenge in biology.



**2022**

## CHATGPT

ChatGPT brings conversational AI to millions, redefining how people interact with technology.



**2022**

## DALL-E 2

DALL-E 2 generates high-quality images from text descriptions.



**2023**

## GPT-4

GPT-4 delivers major gains in reasoning, coding and multimodal capabilities.



**2023**

## LEO & PHOENIX

Meta's Llama 2 and Anthropic's Claude 2 advance open and safe AI with strong performance.



**2023**

## GEMINI 1.0

Google DeepMind launches Gemini 1.0, a family of highly capable multimodal models.



**2024**

## SORA

OpenAI's Sora generates realistic videos from text prompts.



**2024**

## CLAUDE 3

Anthropic's Claude 3 series excels in reasoning, safety and long-context understanding.



**2024**

## GEMINI 1.5

Gemini 1.5 introduces long context (up to 1M tokens), enabling analysis of massive inputs.



**2024+**

## AGENTIC AI

AI agents plan, reason, and act independently across tools and environments.



**THE JOURNEY CONTINUES...**

Towards more capable, safe and beneficial AI for all.

# Strong AI – Star Wars and C3PO



*Video: Lucasfilm Ltd. (1977). Star Wars: Episode IV - A New Hope. [Film]. 20th Century Fox.*

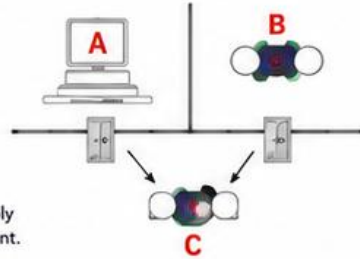
# The Birth of AI: From Dreams to Systems

*From the vision of thinking machines to the formalization of reasoning.*

## The Question Can machines think?

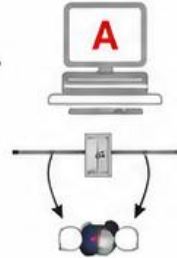


**1950**  
Alan Turing proposes the **Imitation Game (Turing Test)**  
A machine that can converse indistinguishably from a human is intelligent.



If the human judge (C) cannot reliably distinguish between A (human) and B (machine), the machine passes the test.

## The Beginning Formalizing Reasoning



**1950s–early 1960s**  
AI begins as a dream of formalising reasoning and solving complex problems through logic and symbolic manipulation.

## The Dartmouth Conference The Founding Moment of AI

**Summer 1956**  
Dartmouth College, USA  
The term “Artificial Intelligence” is born.  
A group of visionary scientists set the agenda for a new field that would change the world.

## The Founding Fathers of AI Dartmouth Conference, 1956



## Symbolic AI and Expert Systems



- **Knowledge is Power — Encoding the Mind into Rules!**
- Symbolic AI represents knowledge through symbols and rules
- **Examples:** MYCIN (medical diagnosis), DENRAL (chemical analysis)
- **Architecture:** inference engine + knowledge base
- **Early AI was explainable and logical!**
- **But could not learn or adapt...**



## Key Ideas That Shaped the Birth of AI

- Intelligence as Problem Solving:**  
Use knowledge and logic to solve new problems.
- Formalizing Reasoning:**  
Represent facts and rules; derive new conclusions.
- Knowledge Representation:**  
From expert knowledge to symbolic models.
- Vision and Collaboration:**  
Brilliant minds came together to launch a new science.



### The Birth of a New Science

From the dream of thinking machines to the first intelligent systems.



**Dream & Vision**  
Can machines think?



**Formalize & Reason**  
Logic, rules, symbols



**Build Systems**  
Expert systems, knowledge bases



**Towards Intelligence**  
From logic-based systems to learning, agents and robots.



### Legacy

The foundations of AI laid in the 1950s–60s continue to inspire today's intelligent systems.

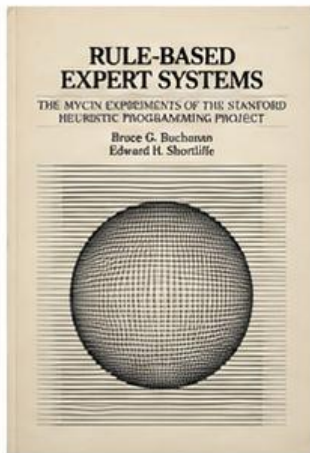


From the Turing Test to Expert Systems — the first steps on a journey that continues to shape our future.

# From Rules to Patterns: The Next Leap in AI

AI evolved from being programmed to being trained — learning how to do it from data.

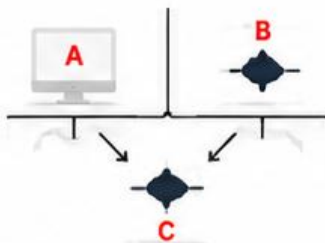
## 1. FROM RULES (EXPLICIT KNOWLEDGE)



Early AI systems were built by encoding knowledge as symbols and rules.

Examples:

- MYCIN (medical diagnosis)
- DENDRAL (chemical analysis)



Inference engine + knowledge base  
Explicit logic, human-designed rules

## 2. FROM RULES TO PATTERNS (LEARNING FROM DATA)

- ✓ Instead of telling the machine what to do, we let it learn how to do it.
- ✓ Machine Learning (ML) = algorithms that learn patterns from data.
- ✓ Learns from examples, improves with experience, adapts to new situations.



Examples:

- Email spam filters
- Handwriting recognition
- Early speech recognition

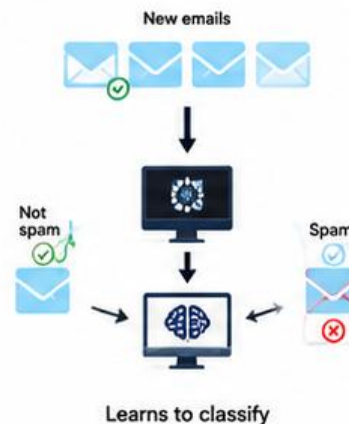


From explicit logic to statistical inference  
From programming to training

## 3. HOW MACHINE LEARNING WORKS

### Supervised Learning

Learn from labeled examples.



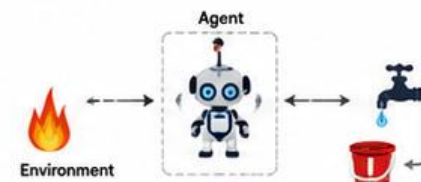
Learns to classify



From static programs to adaptive agents that learn, decide and improve

### Reinforcement Learning

Learn by trial, error and reward.



- 1 Observe
- 2 Choose action
- 3 Get reward/penalty
- 4 Update policy
- 5 Repeat and improve

## THE EVOLUTION OF AI PARADIGMS



Rules & Logic  
(1950s–1980s)  
Symbolic AI and  
Expert Systems



Patterns & Data  
(1990s–2000s)  
Machine Learning  
and Statistics



Deep Learning  
(2010s)  
Big Data + Neural  
Networks



Generative & Agentic AI  
(2020s and beyond)  
LLMs, Multimodal, Agents,  
Towards AGI

## KEY ENABLERS



More Data



More Compute



Better Algorithms



Human Collaboration



The shift from Rules to Patterns transformed AI from brittle systems into adaptive, learning machines. It opened the door to today's intelligent systems — and tomorrow's autonomous agents and robots.



Learning from data.  
Improving with experience.  
Creating a better future.

# Machine Learning

Field of artificial intelligence that gives **computer systems** the **ability to "learn"** (e.g., progressively **improve performance** on a specific task) from **data/results of their actions**, without being explicitly programmed

## Supervised Learning

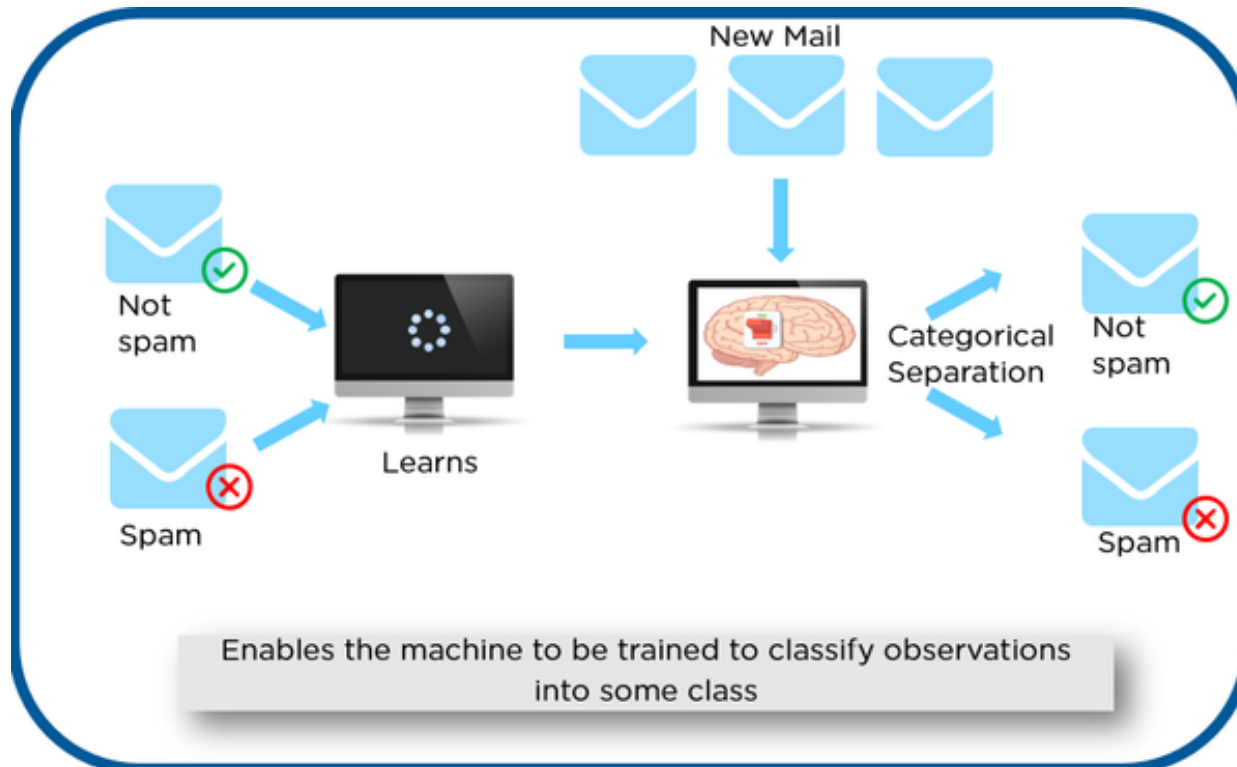


Image: <https://towardsdatascience.com/what-are-the-types-of-machine-learning-e2b9e5d1756f>

## Reinforcement Learning

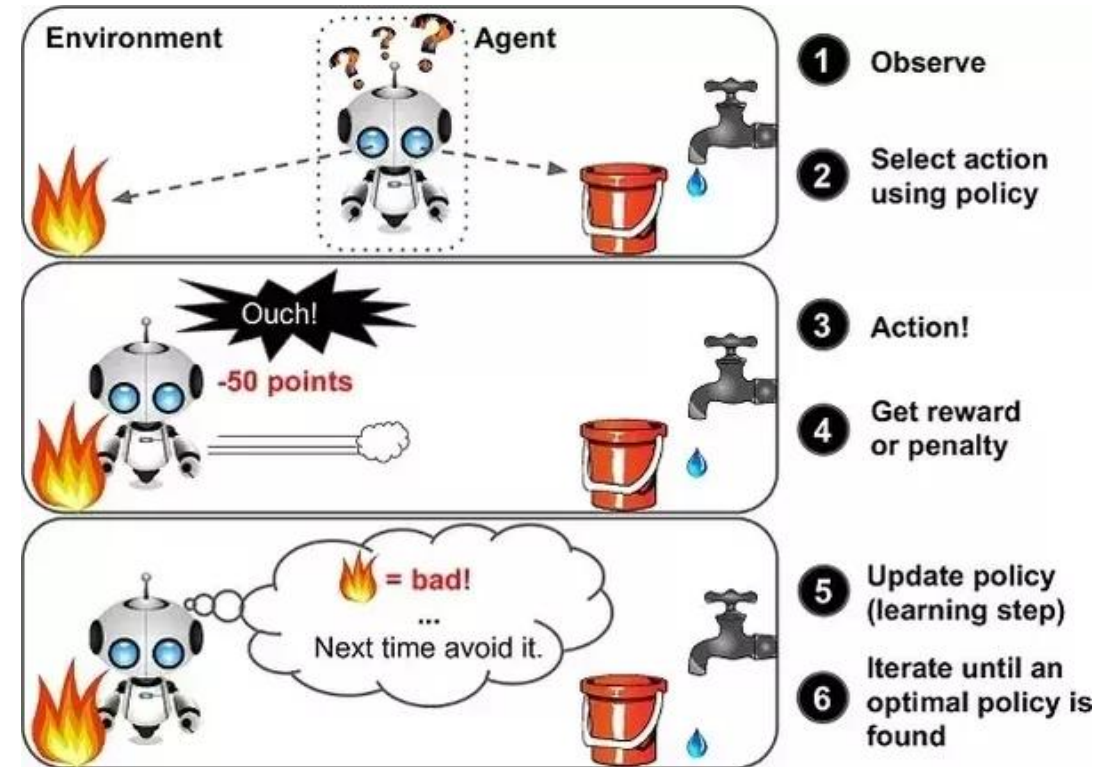


Image: <https://becominghuman.ai/an-introduction-to-machine-learning-33a1b5d3a560>

# Artificial Neural Networks (ANNs)

Inspired by the human brain. Powered by data. Built to learn.



Neural Networks are the foundation of Deep Learning and many AI breakthroughs.

## 1. WHAT IS A NEURAL NETWORK?

A neural network is a system of connected units (**neurons**) that work together to solve problems by **learning patterns from data**.



It **learns** from examples, not from explicit programming.



It finds **patterns** in complex data that humans may miss.

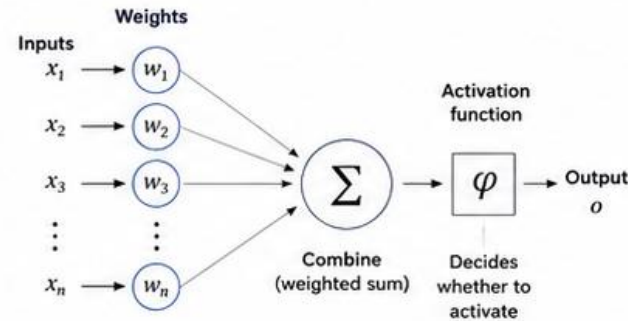


It gets **better** with more data and experience.

## 3. THE BUILDING BLOCK: A NEURON (SIMPLIFIED)

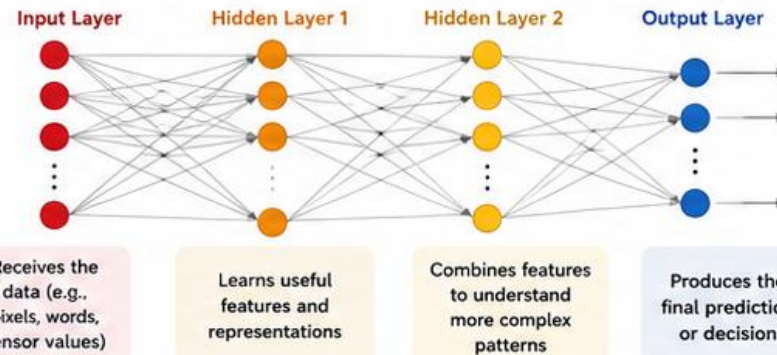
Each neuron takes inputs, processes them and produces an output.

$x_i$  = input signals  
 $w_i$  = learnable weights  
 $\Sigma$  = combine inputs  
 $\varphi$  = activation function  
 $o$  = output

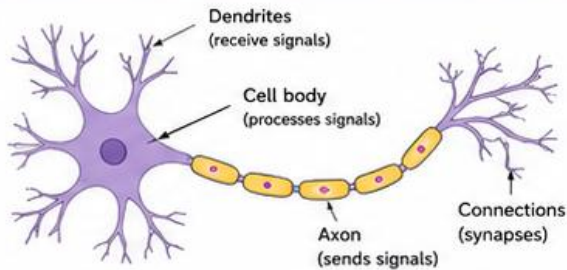


## 4. FROM ONE NEURON TO A NETWORK

Neurons are organized in layers. Information flows from left to right.



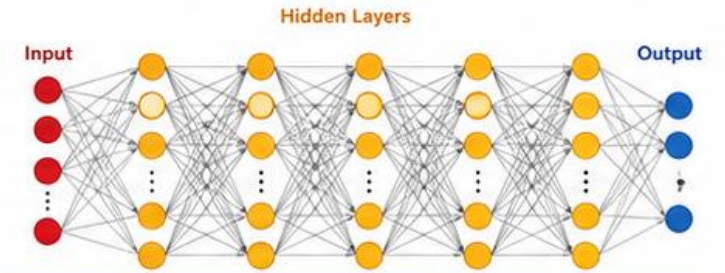
## 2. THE HUMAN BRAIN: OUR INSPIRATION



Millions of neurons connect and communicate through signals to help us think, learn and act.

## 5. DEEP NEURAL NETWORKS

By stacking many hidden layers, networks can learn very complex patterns and solve challenging tasks.



This is the power behind today's AI applications like speech, vision, robots and language models.

## 6. WHERE DO WE SEE THEM?



**Image Recognition**  
Identify objects and scenes



**Speech Recognition**  
Understand spoken words



**Language Models**  
Generate and understand text



**Robotics & Control**  
Make decisions in the real world



**Healthcare**  
Detect diseases, predict outcomes



Neural networks learn from data to make smart predictions and decisions.



Neural Networks mimic the brain's way of learning.

From simple connections to deep architectures, they enable machines to learn, adapt and solve problems that were once impossible.

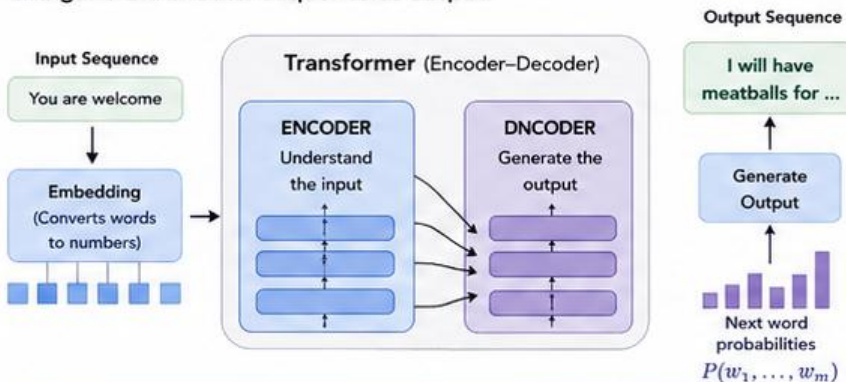


# Transformers, Attention & Generative AI (ChatGPT)

From understanding to creating: the foundation of today's intelligent systems

## 1. TRANSFORMER ARCHITECTURE: THE BIG PICTURE

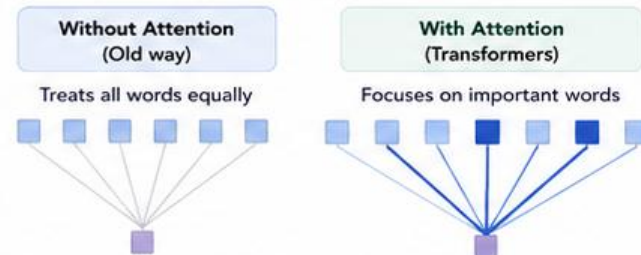
Transformers take a sequence (e.g., words) as input and generate another sequence as output.



Encoders understand the context. Decoders generate one token (word) at a time based on what came before.

## 2. ATTENTION: THE KEY IDEA

Attention allows the model to focus on the most relevant parts of the input when producing each part of the output.



**Benefit:** Captures long-range relationships, understands context better and scales to large sequences efficiently.

## 3. GENERATIVE AI: MACHINES THAT CREATE



Generative AI (GenAI) can create a wide variety of data: text, images, audio, video, code, 3D models and more.



It learns patterns from massive amounts of existing data.



Then it uses this knowledge to generate new, original and realistic content in response to prompts.



It mimics human creativity and can assist, inspire and automate many tasks.



Transformers + Attention are at the heart of most Generative AI models today.

## 4. CHATGPT: GENERATIVE AI IN ACTION



ChatGPT is a Large Language Model (LLM) built on the Transformer architecture.

- ✓ Trained on vast amounts of text (books, websites, articles, code, conversations...).
- ✓ Understands your prompt.
- ✓ Uses attention to reason over context.
- ✓ Generates helpful, coherent and human-like responses.

### How ChatGPT works (simplified)



Aligned and fine-tuned to be helpful, safe, and reliable.

You

Explain transformers simply.

ChatGPT

Transformers are a type of AI model that can understand the context of words in a sentence and generate new text by predicting the next most likely word, one step at a time.

...

## 5. IMPACT: WHY IT MATTERS



**Language:** chatbots, translation, summarization, writing



**Vision:** image generation, editing, understanding



**Code:** generation, completion, debugging



**Audio:** speech synthesis, transcription, music



**Robotics & Agents:** planning, decision making, control



From understanding language to creating content, Transformers and Generative AI are shaping the future.

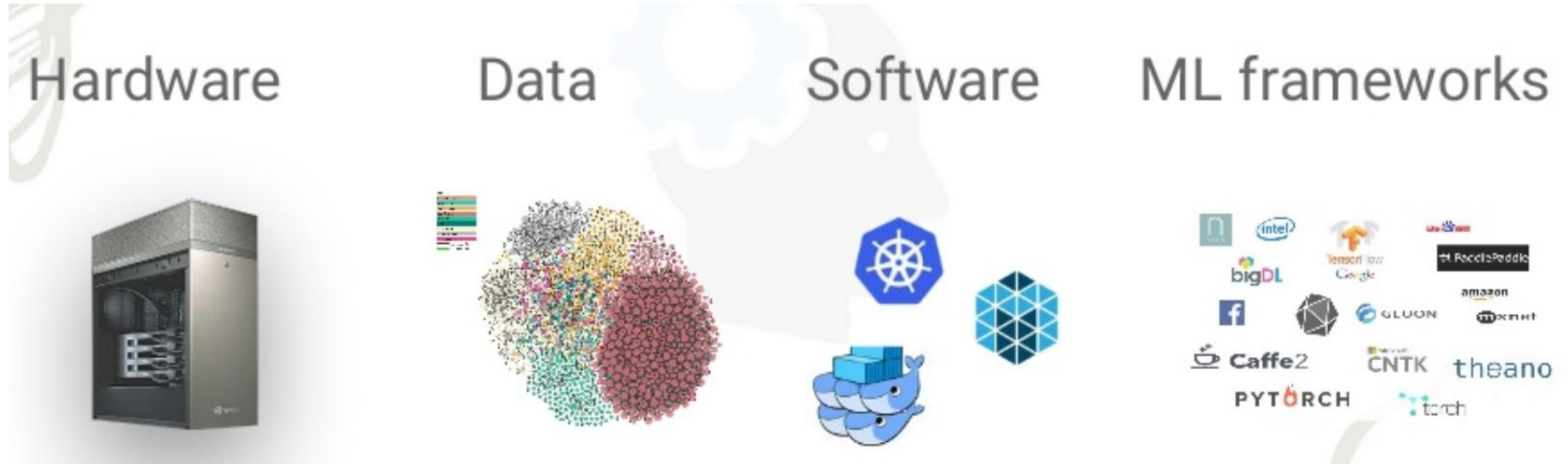


Attention lets models focus. Transformers scale understanding. Generative AI creates the future.

This is the technology behind ChatGPT and the next generation of intelligent systems.



# Artificial Intelligence Today



 PyTorch

 TensorFlow

 scikit learn

 torch

 theano

 Keras

 APACHE Spark ML

 HUGGING FACE

# Generative AI Competition



# LLM Evolution

## 2022/3->2024/5

2022-23<sup>1</sup>

Jan 2025<sup>2</sup>

Anthropic

Claude

- Not multimodal (text only)
- Limited contextual understanding (difficulty with complex conversations)
- No tool usage

Claude 3.5

- Multimodal (text, audio, and images)
- Enhanced contextual understanding and coherence during long interactions
- Experimental computer usage capability for some users

Google

Google Bard

Gemini 2.0 Flash

OpenAI

GPT-3.5

- Not multimodal (text only)
- Fair reasoning ability (eg, scored high on SAT, but bottom 10% on bar examination)
- Limited contextual understanding (difficulty with coherence in complex conversations)
- Standard API access (for text generation)

OpenAI o1

- Multimodal (text and images)
- Advanced reasoning (eg, top 10% on bar examination)
- Enhanced contextual understanding (maintains coherence in long dialogues)
- Advanced API access (supports multimodal inputs)

Google Gemini

Google Bard

- Not multimodal (text only)
- Fair reasoning
- Limited contextual understanding (difficulty with complex conversations)
- Limited real-time data integration
- Low personalization (limited adaptability)

Gemini 2.0 Flash

- Multimodal (text, audio, and images)
- Advanced reasoning (capable of multistep problem-solving and nuanced analysis)
- Enhanced contextual understanding (maintains coherence in long dialogues)
- Real-time data integration (from Google Search)
- Advanced personalization (user context)

- Fair reasoning ability (eg, scored high on SAT, but bottom 10% on bar examination)
- Limited contextual understanding (difficulty with coherence in complex conversations)
- Standard API access (for text generation)

- Advanced reasoning (eg, top 10% on bar examination)
- Enhanced contextual understanding (maintains coherence in long dialogues)
- Advanced API access (supports multimodal inputs)

# Chatbot Arena LLM Leaderboard (12/04/2025)

Rank★ (UB)	Rank (StyleCtrl)	Model	Arena Score	95% CI	Votes	Organization	License
1	1	<a href="#">Gemini-2.5-Pro-Exp-03-25</a>	1437	+8/-6	7431	Google	Proprietary
2	2	<a href="#">ChatGPT-4o-latest (2025-03-26)</a>	1406	+7/-8	6612	OpenAI	Proprietary
2	4	<a href="#">Grok-3-Preview-02-24</a>	1402	+5/-5	13919	xAI	Proprietary
2	2	<a href="#">GPT-4.5-Preview</a>	1397	+5/-6	13443	OpenAI	Proprietary
5	8	<a href="#">Gemini-2.0-Flash-Thinking-Exp-01-21</a>	1380	+5/-4	25266	Google	Proprietary
5	4	<a href="#">Gemini-2.0-Pro-Exp-02-05</a>	1380	+4/-5	20136	Google	Proprietary
5	4	<a href="#">DeepSeek-V3-0324</a>	1370	+7/-7	4721	DeepSeek	MIT
7	5	<a href="#">DeepSeek-R1</a>	1359	+5/-5	15098	DeepSeek	MIT
8	13	<a href="#">Gemini-2.0-Flash-001</a>	1354	+4/-4	21065	Google	Proprietary
8	4	<a href="#">o1-2024-12-17</a>	1350	+4/-5	27831	OpenAI	Proprietary
10	13	<a href="#">Gemma-3-27B-it</a>	1342	+7/-6	9147	Google	Gemma
11	13	<a href="#">Qwen2.5-Max</a>	1340	+4/-4	19995	Alibaba	Proprietary
11	10	<a href="#">o1-preview</a>	1335	+5/-4	33175	OpenAI	Proprietary
14	13	<a href="#">o3-mini-high</a>	1325	+6/-4	16889	OpenAI	Proprietary
14	15	<a href="#">DeepSeek-V3</a>	1318	+4/-4	22843	DeepSeek	DeepSeek
14	20	<a href="#">QwQ-32B</a>	1315	+6/-8	6729	Alibaba	Apache 2.0
15	21	<a href="#">GLM-4-Plus-0111</a>	1310	+7/-5	6032	Zhipu	Proprietary

# Why Coding is Dead: Programming Will Be Made by AI

From Writing Code to Designing Solutions – AI Will Do the Implementation

## 1. From Programming to Machine Learning

Traditional Programming  
(We write rules)

Input + Program → Output



We tell the computer exactly what to do.

Machine Learning  
(We show examples)

Input + Data → Output



AI learns patterns from data and makes decisions.

## 2. The End of Coding?



Nvidia CEO Jensen Huang predicts the death of coding:

“Everyone in the world will be a programmer. This is the miracle of AI.”

- ✓ AI understands intent in natural language.
- ✓ It writes, tests, debugs and improves code.
- ✓ Soon, kids won't learn how to code — they will describe what they want to build.

## 3. Proof: ICPC World Finals 2025

OpenAI and Google DeepMind Outshine Students at World's Top Coding Contest

OpenAI scored a flawless 12/12 and Google DeepMind solved 11/12 problems.

The best human team (St. Petersburg State University, Russia) solved 11/12.

Next best human teams solved 10/12 problems.

Rank	Team / University	Country	Solved
1	OpenAI	USA	12/12
2	Google DeepMind	GBR	11/12
3	St. Petersburg State University	Russia	11/12
4	ICPC Tsinghua	China	10/12
5	Peking University	China	10/12
6	MIT	USA	10/12
...			

✓ All teams solved within the 5-hour time limit!

Source: ICPC World Finals 2025 Official Results

## 4. Why AI Will Make Programming (and Software Engineering) Obsolete



Understands Natural Language  
You describe what you want, AI writes the code.



Learns Best Practices  
AI uses billions of examples and always improves.



Tests and Debugs Itself  
AI finds and fixes bugs autonomously.



Builds Complete Systems  
From backend to frontend, database to deployment.



Ships Faster, Cheaper, Better  
AI delivers production-ready software in minutes.

## Software Engineering After AI

Focus shifts from writing code to:

- Defining problems and goals
- Designing architectures
- Ensuring safety, ethics and reliability
- Human-AI collaboration and oversight
- Creativity, innovation and impact

## 5. Real-World AI Coding Assistants (Already Transforming Work)



GitHub Copilot

AI pair programmer in your IDE



OpenAI Codex

Writes, explains and refactors code



Google Gemini

Builds full apps from prompts



Claude 3.5/4

Understands large codebases



Cursor / Replit v0 / Bolt

Builds and deploys with a prompt

## 6. The New Role of Humans



Problem Solvers  
Define the right problems to solve



System Designers  
Design systems, not just code



AI Orchestrators  
Guide, validate and ensure alignment



Innovators  
Create value, not just features

## The Future is Collaborative



AI writes the code.  
Humans create the future.



Coding is not dead — but the way we build software is.

The future belongs to those who can imagine, communicate, and collaborate with AI.



AI handles the syntax.



Humans drive the meaning.



Together, we build a better world.

# Technology is Changing Everything – Not Only What, But How

*AI will replace devices and transform the processes of how we work and create.*

**Before AI: We used tools**

Mobile Phone    Laptop    Keyboard    Mouse

**With AI: We interact**

Help me plan a trip to Japan

Here's a perfect itinerary for you!

The future is not about using more devices, but about having **intelligent partners** that understand us and get things done with us.

- ✔ Natural conversation
- ✔ Voice, text, images, gestures
- ✔ Context-aware and proactive
- ✔ Like interacting with another human

### AI Replaces More Than Devices – It Replaces the Process

Traditional Process (Manual & Linear)	AI-Powered Process (Conversational & Iterative)
<ul style="list-style-type: none"> <li> Search</li> <li> Copy / Type</li> <li> Edit</li> <li> Check</li> <li> Reformat</li> <li> Repeat...</li> </ul>	<ul style="list-style-type: none"> <li> Ask / Describe goal</li> <li> AI understands &amp; proposes</li> <li> You refine / give feedback</li> <li> AI Improves / adapts</li> <li> You re-interact</li> <li> Better result – faster!</li> </ul>

From doing tasks to guiding outcomes.  
From writing code to designing solutions with AI.

### AI Detectors Do Not Work (And Won't)

- ✗ Easily bypassed  
Paraphrase, translate, use multiple tools
- ✗ High false positives  
Punish human creativity and non-native writers
- ✗ Models evolve faster than detectors  
It's a cat-and-mouse game we can't win
- ✗ Focus should shift from AI detection to AI literacy and authentic assessment

**The future is not about catching AI use, it's about teaching how to use AI wisely.**

Trust, transparency and process > policing and paranoia

### So! You are the guy...

### That took all of our Jobs!

**The Great Shift**

Tools & Devices We used

→

Instructions & Commands We gave

→

Conversations & Collaboration We have

→

Outcomes & Impact. We achieve together

AI won't replace humans. But humans who work with AI will replace those who don't.

The future belongs to those who can imagine, ask, collaborate and iterate with AI.  
Learn continuously. Think critically. Create responsibly.

AI handles the execution

Humans drive the vision and values

Together we build a better future

# Google Search Engine



- **Hummingbird Algorithm**

- **PageRank algorithm** that covers a specific way of **giving pages credit based on the links from other pages** pointing at them
- Panda, Penguin and Payday to fight **spam**
- Pigeon designed to improve **local results**
- Top Heavy designed to demote **ad-heavy** pages,
- Mobile Friendly designed to reward **mobile-friendly** pages
- Pirate designed to fight **copyright infringement**

- **200 major ranking signals (up to 10,000 variations or sub-signals)**

- **Google RankBrain Algorithm**

- **Machine-Learning System**
- **3rd most important signal**
- Interpret searches people submit to **find pages that might not have the exact words** that were searched for



Articles  include patents  Case law

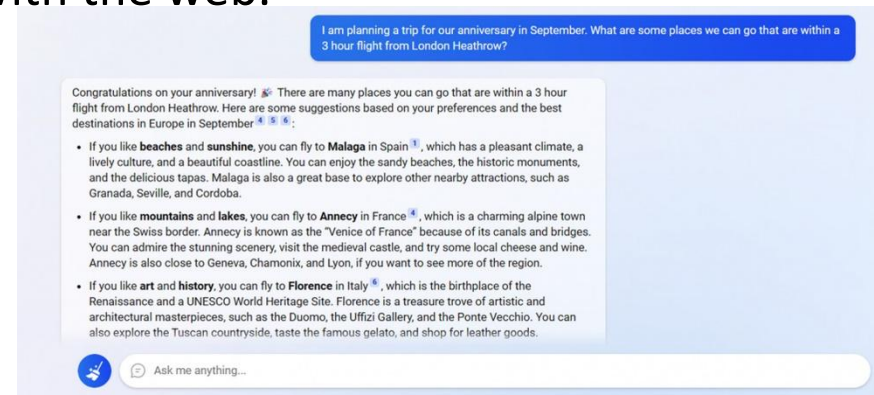
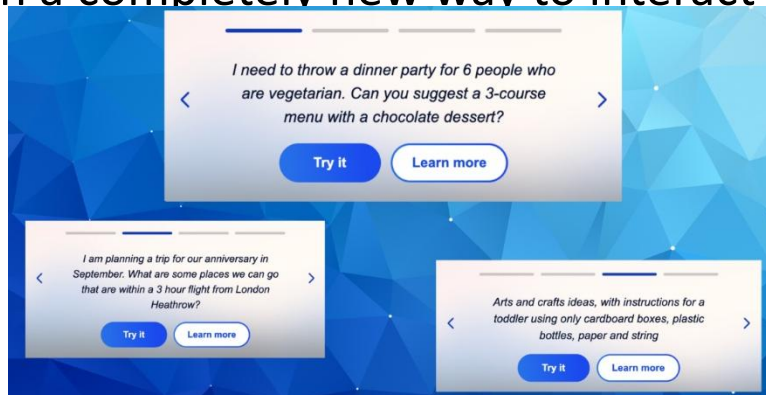
Stand on the shoulders of giants

# Bing Search Engine



## Reinventing search with AI with four technical breakthroughs:

- **Next-generation OpenAI model more powerful than ChatGPT** and customized specifically for search. It takes key learnings and advancements from ChatGPT and GPT-3.5/4.0 and it is even faster, more accurate and more capable
- **Microsoft Prometheus model.** Proprietary way of working with OpenAI model that allows to best leverage its power
- **Applying AI to core search algorithm.** AI model to core Bing search ranking engine, which led to the largest jump in relevance in two decades. Search queries are more accurate and more relevant
- **New user experience.** Reimagining interaction with search, browser and chat into a unified experience in a completely new way to interact with the web.



# GitHub Copilot



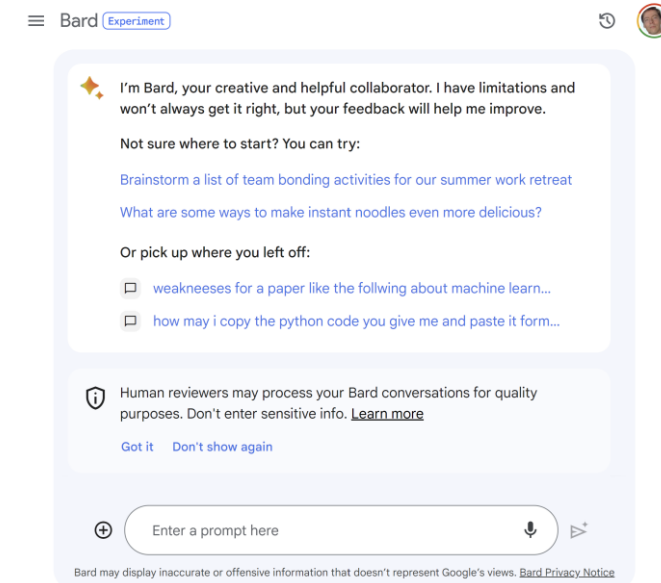
- **June 2021: GitHub Releases Copilot**
- **March 2023: GitHub uses OpenAI's GPT-4** to go way beyond auto-completing comments and code and gets chat and voice support



# Google Bard

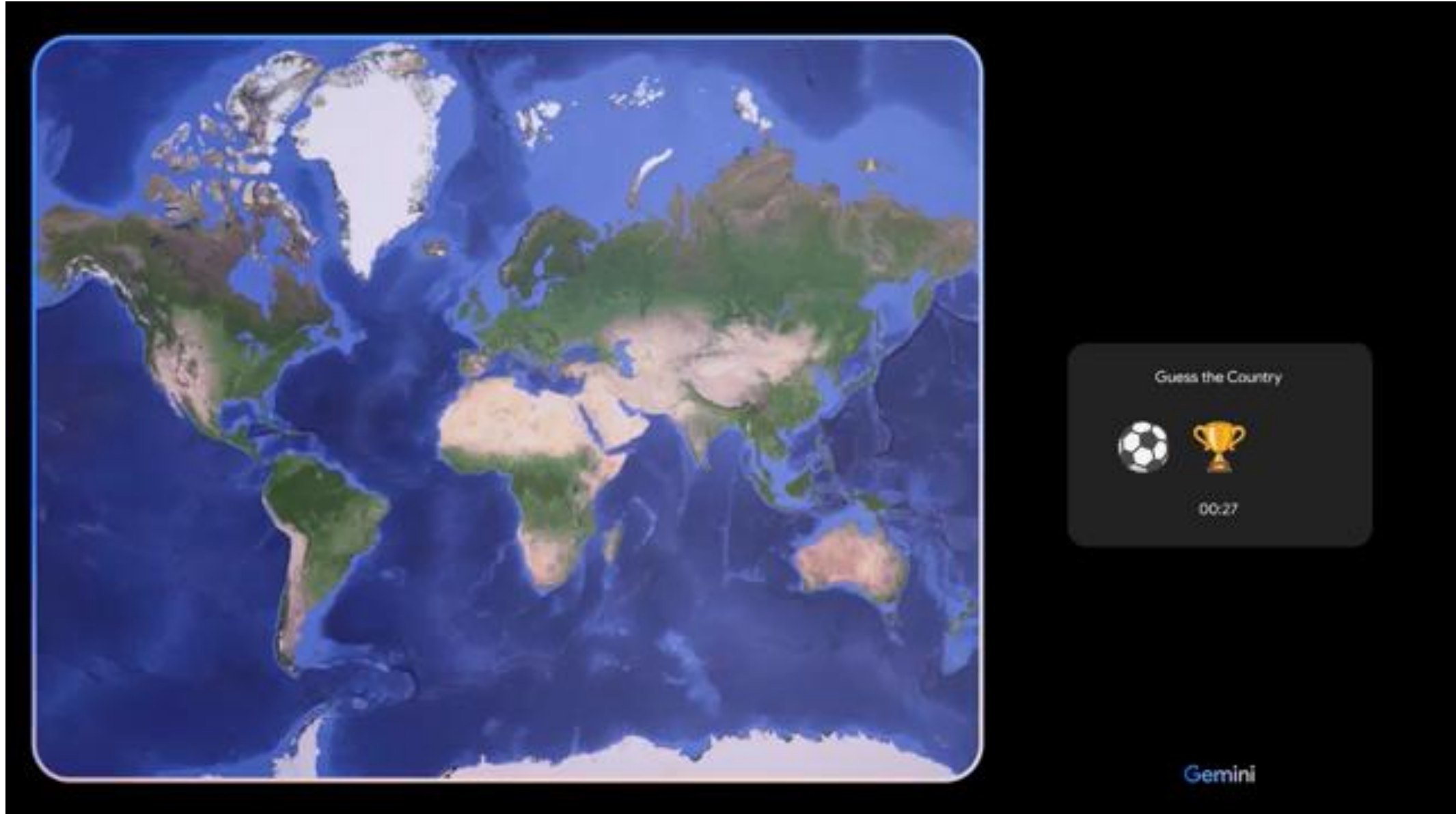


- Language Model for Dialogue Applications (LaMDA)
- Experimental conversational AI service, powered by LaMDA
- Very fast and easy to use



CATEGORIES	CHATGPT	BARD	BING
EASY TO USE	★★★★☆	★★★★★★	★★★★★☆☆
HELPFULNESS	★★★★☆	★★★★★★	★★★★★☆☆
ACCURACY	★★★★☆	★★★★★★	★★★★★★
CREATIVITY	★★★★★	★★★★☆☆	★★★★★☆☆
SPEED	★★★★☆	★★★★★★	★★★★★☆☆

# Gemini – Google Deep Mind



# Gemini

Google DeepMind About Research Technologies Discover

# Gemini 2.0

Built for the agentic era

Chat with Gemini Build with Gemini

Google AI Studio

Get API key

- Create Prompt
- Stream Realtime
- Starter Apps
- Tune a Model
- Library
- Allow Drive access
- Prompt Gallery
- API documentation
- Developer forum
- Changelog

Untitled prompt

System Instructions

Optional tone and style instructions for the model

## What will you build?

Push Gemini to the limits of what AI can do, powered by the Gemini API

Recipe List: List recipes in JSON format.

Confusion Matrix: Generate a confusion matrix in Python.

Run settings: Gemini 2.0 Flash Experimental, Token count 0 / 1,048,576, Temperature 1

Google AI Studio Stream Realtime

Get API key

System Instructions

## Talk with Gemini live

Interact with Gemini using text, voice, video, or screen sharing.

- Talk to Gemini: Start a real-time conversation using your microphone.
- Show Gemini: Use your webcam to share what you're looking at and get real-time feedback.
- Share your screen: Share your screen to show Gemini what you're working on.

Run settings: Gemini 2.0 Flash Experimental, Output format Audio, Voice Puck

- Spatial Understanding**: Upload a photo and combine 2D or 3D spatial analysis with reasoning. Ask Gemini to give you the locations of objects, text, and more.
- Video Analyzer**: An interactive video player that lets you summarize, describe scenes, extract text, search for objects, and more.
- Map Explorer**: Explore places in the world using Gemini and the Google Maps API. Ask Gemini to find you interesting places and more.

**Gemini Advanced**

Upgrade your Google One plan to get Gemini Advanced


€21.99 €0 for 1 month, €21.99/month after

# Microsoft Copilot



# Claude




 Good morning, Luis Paulo

How can Claude help you today?

Claude 3.5 Sonnet

Get started with an example below

 Add content

Summarize meeting notes

Generate interview questions

Extract insights from report




**NEW**

**Artifacts**

Create and iterate on documents, code, and more within Claude. [Try it out](#)



 Your recent chats ^

[View all](#) →

## Claude for Desktop Beta

Your AI partner on desktop. Fast, focused, and designed for deep work.

 Windows


 Windows (arm64)

 macOS

## Take Claude with you

Talk to Claude, anywhere you go. Brainstorm ideas, get answers, and analyze images on the go.

 Apple App Store

 Google Play



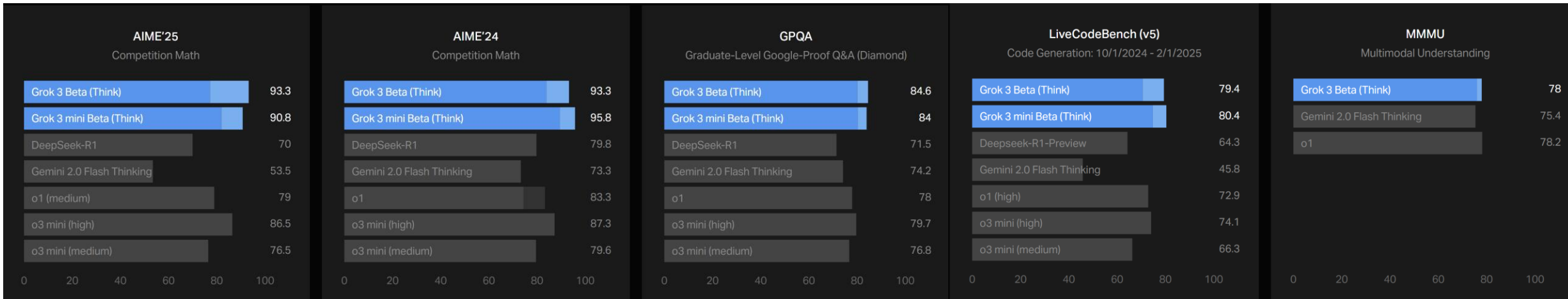
Pro

€18 + VAT / month

- 5x more usage versus Free plan
- Access to Projects to organize documents and chats
- Ability to use more models, like Claude 3 Opus
- Early access to new features

[Subscribe to Pro](#)

# Grok 3 – Chocolate xAI



# Perplexity AI



**Perplexity AI** is a conversational search engine that uses large language models (LLMs) to answer queries using **sources from the web** and **cites links** within the text response.



The screenshot shows the Perplexity AI interface. At the top, the Perplexity logo is on the left, and the user profile 'lpreis1970' with a timestamp '4m' is on the right. Below the profile is a search bar containing the query 'who are the top researchers in AI in portugal today'. The interface includes a sidebar on the left with navigation options: Home, Discover, Spaces, and Library. The main content area displays the search results for the query. It features a large heading 'who are the top researchers in AI in portugal today' and a sub-heading 'Based on the most recent information available, several top AI researchers in Portugal stand out:'. Below this, there is a 'Sources' section with a card for 'INESC-ID AI researchers ranked as some of the best in...' and a link to 'inesc-id'. The results are listed in three numbered items:

1. Paulo Novais from the University of Minho, who leads the ISLab laboratory at the ALGORITMI centre and coordinates LASI, the largest associated laboratory in Portugal <sup>3</sup>.
2. Luís Paulo Reis, an Associate Professor with Aggregation at FEUP and Director of LIACC – Artificial Intelligence and Computer Science Laboratory <sup>2</sup> <sup>3</sup>.
3. Manuela Veloso, currently the Director of J.P. Morgan AI Research and formerly a member of Carnegie Mellon University. She is internationally renowned for her work in artificial intelligence and robotics <sup>3</sup>.

# Grammarly

Grammarly

EDU

My Grammarly

Trash


Account

Apps

Support

Sign Out  
lpreis@fe.up.pt

## Grammarly Apps




### Grammarly for Windows

Grammarly for your desktop is your one-stop solution to get writing suggestions across a wide array of desktop apps and websites.

By downloading Grammarly for Windows, you agree to the [Terms and Conditions](#) and [Privacy Policy](#). California residents, see our [CA Privacy Notice](#).

Install




### Grammarly for Chrome

Grammarly's browser extensions offer writing suggestions in Google Docs and other sites across the web.

Active

Re-install



### Grammarly for iPhone and iPad

Write confidently and professionally across all your apps and websites with Grammarly's writing suggestions, anywhere you go.

Install

# DeepL



DeepL Translator ▾

DeepL Pro

Why DeepL? ▾

API

Plans and pricing

Apps

FREE

Start free trial

Login



Translate text  
31 languages



Translate files  
.pdf, .docx, .pptx

Pick up where you left off with your **30-day free trial** of DeepL Pro. ✕

Detect language ▾

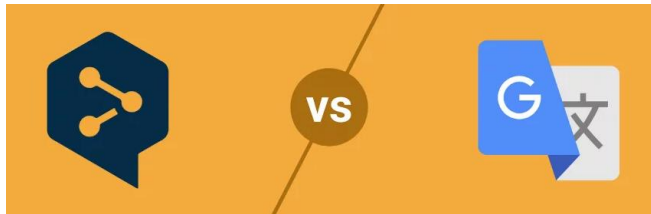


English (UK) ▾

Glossary

Type to translate.

Drag and drop to translate PDF, Word (.docx), and PowerPoint (.pptx) files with our document translator.



DeepL Translator



Tech giants Google, Microsoft and Facebook are all applying the lessons of machine learning to translation, but a small company called DeepL has outdone them all and raised the bar for the field. Its translation tool is just as quick as the outsized competition, but more accurate and nuanced than any we've tried.

TechCrunch, USA



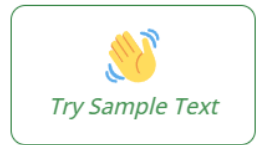
# QuillBot

- 
- 
- 
- 
- 
- 
- 
- 
- 
- 
- 

Modes: Standard Fluency **Formal** Simple Creative Expand Shorten

Synonyms:  

QuillBot will rewrite your text. Start by writing or pasting something here and then press the Paraphrase button.

 Try Sample Text

 Paste Text

**Paraphrase**

Placeholder text for the output area.

**Paraphraser**

**Summarizer**

**Grammar Checker**



Vocabulary enhancement feature, Thesaurus powered by AI, Integrations (Word, GoogleDocs), Grammar check, Summarizing tool

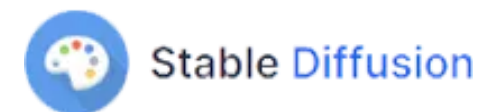
# Image Generation - Dall-E

**DALL·E 3 is an AI system that can create realistic images and art from a description in natural language**

An astronaut riding a horse in photorealistic style



A beach similar to "praia da baia" in Espinho with surfers, surfing in the sea and big waves



# AI Tools (LLMs) Powering Search, Chat, Translation and More.

The right tool for the right task. AI augments human intelligence.

## 1. SEARCH & DISCOVERY

Smarter search. Better answers.

-  **Google Search**  
AI Overviews, Gemini and advanced ranking
-  **Microsoft Bing**  
AI-powered search with Copilot integration
-  **Perplexity**  
Answer engine with sources in real-time
-  **You.com**  
Privacy-first search with AI assistance
-  **Grok (xAI)**  
Real-time search powered by X data

 From links to answers.  
From keywords to understanding.

## 2. CHATBOTS & AI ASSISTANTS

Conversational AI that helps you think, create and solve.


-  **ChatGPT**  
All-around assistant for any task
-  **Microsoft Copilot**  
Integrated in Windows, Office and your workflow
-  **Gemini (Google)**  
Advanced reasoning and multimodal AI
-  **Claude**  
Safe, thoughtful and long-context assistant
-  **Grok (xAI)**  
Bold AI with real-time awareness and personality

 From Q&A to deep reasoning.  
From tasks to teamwork.

## 3. TRANSLATION & LANGUAGE

Break language barriers. Communicate globally.


-  **DeepL**  
Most accurate AI translation
-  **Google Translate**  
Instant translation in over 100 languages
-  **Microsoft Translator**  
Real-time text, voice and conversational AI
-  **Linguee**  
Context-aware translations and dictionary
-  **Reverso**  
Translation with examples, grammar and context

 From words to meaning.  
From local to global.

## 4. WRITING & GRAMMAR

Write better. Clearer. Smarter.

-  **Grammarly**  
Grammar, tone, clarity and style suggestions
-  **QuillBot**  
Paraphrasing, summarizing and rewriting
-  **DeepL Write**  
AI writing assistant with DeepL quality
-  **LanguageTool**  
Grammar, style and spelling checker
-  **ProWritingAid**  
In-depth writing analysis and reports

 From correct to compelling.  
From writing to impact.

## 5. PRODUCTIVITY & KNOWLEDGE

Work smarter. Learn faster. Stay organized.


-  **Notion AI**  
Notes, docs, tasks with AI superpowers
-  **Microsoft 365 Copilot**  
AI in Word, Excel, PowerPoint, Outlook and more
-  **Google Workspace AI**  
Gmail, Docs, Sheets and Slides with AI
-  **Otter.ai**  
AI meeting notes and summaries
-  **Tome**  
AI presentations and storytelling

 From information to insight.  
From busy to productive.

## 6. CODE & DEVELOPMENT TOOLS

Code faster. Debug smarter. Build better.

-  **Codex**  
AI coding agent by OpenAI
-  **Claude Code**  
Agentic coding and refactoring by Anthropic
-  **GitHub Copilot**  
AI pair programmer in your IDE
-  **Cursor**  
AI-first code editor built for speed
-  **Replit Agent**  
Build, run and deploy apps with natural language
-  **Tabnine**  
AI code completion where you code
-  **Sourcegraph**  
AI code search and understanding

 From writing code to building solutions.  
From developers to AI-empowered builders.

## 7. BEST MODELS LEADING THE WAY (2026)

Top frontier and open models.

### Proprietary (Commercial) Models

-  **GPT-5.5 (OpenAI)**
-  **Claude Opus 4.8 (Anthropic)**
-  **Gemini 3.5 Pro (Google)**
-  **Grok 4.3 (xAI)**

### Open Source / Open-weight Models

-  **Llama 4 Maverick (Meta)**
-  **Gemma 4 12B (Google)**
-  **Mistral Large 3 (Mistral AI) or Mistral Medium 3.5**

 Models are evolving fast. Performance, context, multimodality and reasoning keep improving.  
The future is open, competitive and accelerating.

## 8. WHY IT MATTERS

-  **Privacy & Control**  
Choose the right tool for your data needs.
-  **Security First**  
Protect your information and intellectual property.
-  **Cost Effective**  
Many powerful tools are free or affordable.
-  **Human + AI**  
AI augments you. You stay in control.

The best results come from choosing the right AI tool and using it wisely, ethically and responsibly.

 **Trust.**  
Transparency, Accountability.



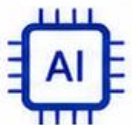
# Small Language Models. Open Source LLMs. Big Impact.

Powerful AI in your hands. Private, transparent, cost-effective, and built for real-world needs.

## WHAT ARE SLMs AND OPEN SOURCE LLMs?

### SMALL LANGUAGE MODELS (SLMs)

Compact models (1B–13B parameters) designed to be efficient, fast, and deployable anywhere.



- ✓ Lower compute
- ✓ Lower latency
- ✓ Easier to fine-tune

### OPEN SOURCE LLMs

Openly available models with access to weights, code and training details.



- ✓ Transparency
- ✓ Collaboration
- ✓ Freedom to innovate



They put the power of AI back in the hands of individuals, teams and organizations.

## WHY THEY MATTER



### Data Privacy

Keep your data local. No need to send sensitive information to the cloud.



### Security & Control

You control the model, the data, and the infrastructure.



### Cost-Effective

Run on consumer hardware. No expensive API calls.



### Transparency & Trust

Audit, understand and improve. No black boxes.



### Customization

Adapt and fine-tune for your domain, language and specific needs.

## POPULAR OPEN SOURCE LLMs (EXAMPLES)

Model	Parameters	License	Strengths
Llama 3.1 (8B)	8B	Meta Llama 3.1	Strong general performance, multilingual, tool use
Mistral 7B	7B	Apache 2.0	Fast, efficient, great for coding
Gemma 2 (9B)	9B	Gemma License	High quality, safe, Google ecosystem
Phi-3 Mini	3.8B	MIT	Very small, very fast, great for on-device
Qwen 2.5 (7B)	7B	Apache 2.0	Multilingual, strong reasoning and code



A growing ecosystem driven by communities and innovation. No vendor lock-in. No limits to what you can build.

## WHERE THEY SHINE



### Enterprise & Gov

Private AI for internal documents, analysis and automation.



### Healthcare

Patient data analysis, clinical notes, health assistants.



### Education

Personal tutors, content generation, assessment support.



### Development

Code completion, documentation, bug analysis.



### Industries & IoT

On-device intelligence, predictive maintenance, edge analytics.



From personal productivity to mission-critical systems. SLMs and open source LLMs make AI practical and accessible.

## WHY PROPRIETARY CLOUD-ONLY MODELS ARE LIMITING

- ✗ Your data leaves your control  
Risk of data leaks and privacy violations
- ✗ Vendor lock-in  
High switching costs and dependence
- ✗ Limited transparency  
Hard to audit, understand or trust
- ✗ Ongoing costs  
Pay-per-use adds up over time
- ✗ Cannot customize deeply  
Restricted fine-tuning and adaptation

The future belongs to those who control their data and their models.



Privacy. Freedom. Control. That's real power.

## THE FUTURE IS OPEN, LOCAL AND RESPONSIBLE



**Download**  
Choose the best model for your need.



**Deploy**  
Run it locally or on your own infrastructure.



**Adapt**  
Fine-tune with your data and your logic.



**Interact**  
Use it as your intelligent partner every day.



AI is not owned by a few. It belongs to all who build, share and use it responsibly.



Open models. Private data. Real impact.



Build it. Understand it. Improve it.



Together we create a better, safer and more inclusive AI future.



Your data. Your model. Your rules.



Open today. Stronger tomorrow. Unstoppable together.

# Retrieval Augmented Generation (RAG)

Connecting the Power of LLMs with Your Data.



RAG combines the **knowledge of Large Language Models** with **your own trusted data**. It retrieves relevant information and uses it to generate **accurate, up-to-date and reliable answers**.

## WHAT IS RAG?



RAG is an AI architecture that **retrieves relevant information** from external sources and **augments the prompt** sent to an LLM to generate **better responses**.

## WHY IS RAG IMPORTANT?



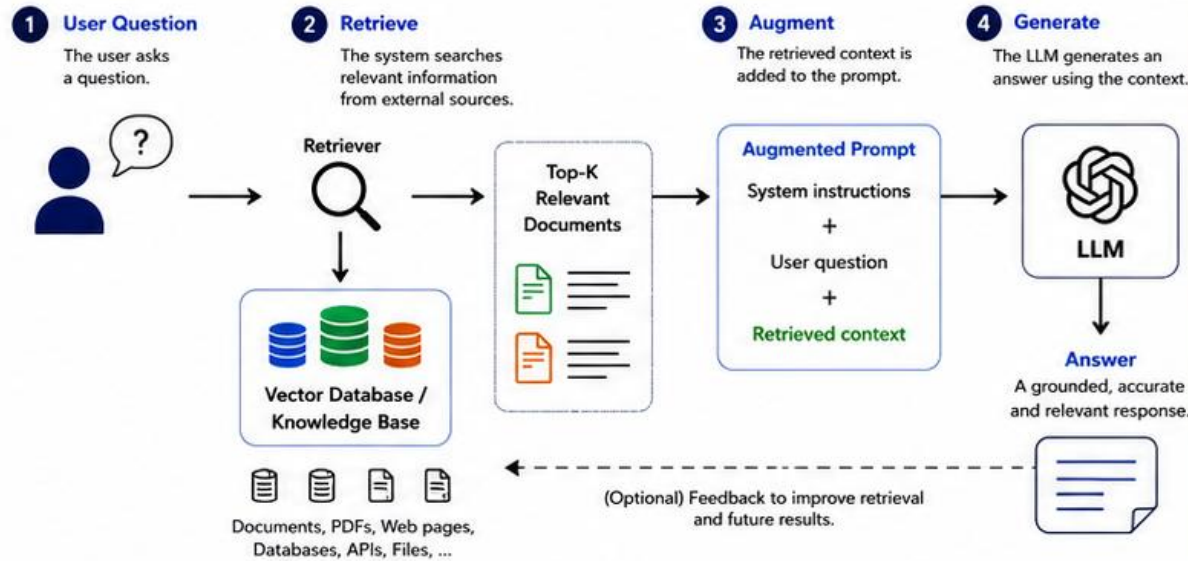
- ✓ **More accurate:** answers grounded in real and verifiable data.
- ✓ **Up-to-date:** accesses the latest information beyond the LLM's training.
- ✓ **Domain specific:** connects to your private or specialized knowledge.
- ✓ **Transparent:** easier to trace sources and reduce hallucinations.
- ✓ **Cost efficient:** no need to retrain models for new data.

## WHERE IS RAG USED?



- Enterprise search & knowledge bases
- Customer support & help desks
- Research & academic assistants
- Legal, medical, financial analysis
- Content generation with real data

## HOW RAG WORKS – THE 4 STEP FLOW



## RAG VS. LLM ALONE

### LLM Alone

- ✗ Limited to training data
- ✗ Can be outdated
- ✗ More hallucinations
- ✗ Hard to verify sources
- ✗ Not domain-aware

### RAG

- ✓ Accesses external data
- ✓ Always up-to-date
- ✓ More accurate answers
- ✓ Sources are traceable
- ✓ Adapts to your domain

## POPULAR RAG TOOLS & FRAMEWORKS



... and many more in the open-source ecosystem.

## ADVANCED RAG ENHANCEMENTS



**Better Retrievers**  
Hybrid search, dense + sparse, metadata filters.



**Re-Rankers**  
Cross-encoder models reorder for relevance.



**Query Rewriting**  
Understand intent better, expand the query.



**Context Compression**  
Keep the most relevant info, reduce noise.



**Evidence Manipulation**  
Select, structure and cite evidence in the answer.

## KEY TAKEAWAY



RAG is the bridge between general intelligence and your specific knowledge. It turns LLMs into trustworthy, useful and domain-aware assistants.



**Better answers. Your data. Your control.**



RAG does not replace LLMs – it makes them smarter, safer and more useful by grounding their answers in real-world knowledge.



Trust & Accuracy



Timeliness



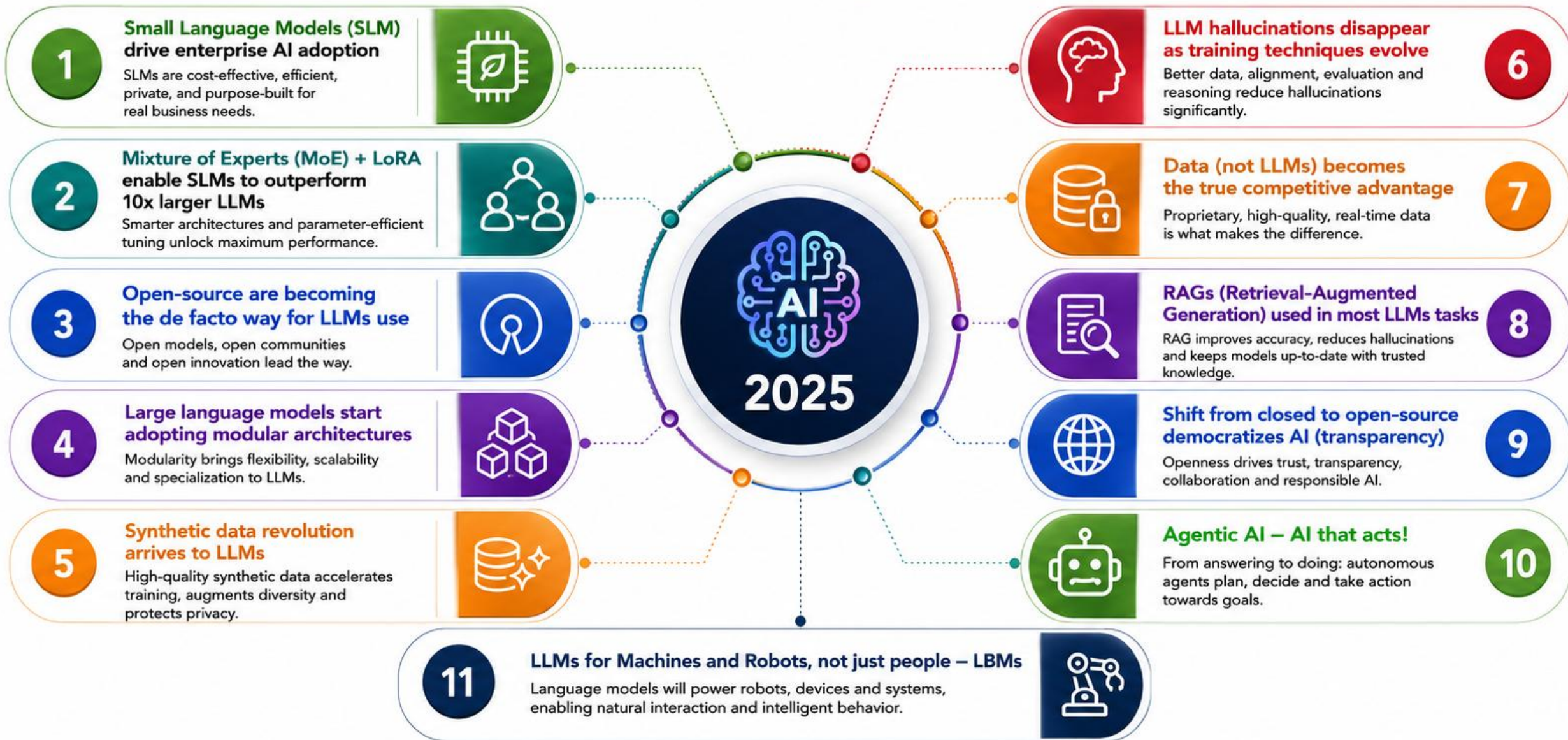
Privacy & Control



Built for Your Domain

# AI & LLM Key Trends in 2025

What's shaping the future of Artificial Intelligence and Language Models



# AI Tools Compendium



Porto Business School



AI Tool Compendium

Curated by Pedro Miguel Reis and Luis Paulo Reis

9 categories · 46 tools · prices

in EUR · May 2026

Search a tool, vendor or feature...



## CATEGORIES

Communication & Video Conferencing 4

Productivity & Office Suites with AI 2

**Standalone AI Assistants 5**

Project Management & Work 5

Async Communication & Knowledge 6

Coding & Development with AI 6

AI Content Creation 6

Automation & Agents 5

Research & Analysis 7

### Authors

**Pedro Miguel Reis**

Data & AI Practice Director, Capgemini Engineering

**Luis Paulo Reis**

FEUP · LIACC · Universidade do Porto

Last refresh: May 2026

## Standalone AI Assistants

*The chat-based generalists every executive should know.*

These are the consumer-grade endpoints to frontier models. Most professionals already use one — usually whatever was first to hand. The mature stance is to use 2–3 deliberately: each has clear strengths and weaknesses.

Decision lens: ChatGPT for breadth and ecosystem, Claude for long documents and reasoning, Perplexity for cited research, Gemini for Google integration, Copilot Free as a friction-free entry point.

Compare side-by-side

ChatGPT

Claude

Gemini

Perplexity

Microsoft Copilot (free)

### Side-by-side: Standalone AI Assistants

Quick scan across 5 tools. Click a tool tab above for the full profile.

DIMENSION	CHATGPT	CLAUDE	GEMINI	PERPLEXITY	MICROSOFT COPILOT (FREE)
AI BUNDLED?	Free tier Yes	Free tier Yes	Free tier Yes	Free tier Yes	Free tier Yes

## Side-by-side: Communication & Video Conferencing

Quick scan across 4 tools. Click a tool tab above for the full profile.

DIMENSION	MICROSOFT TEAMS Microsoft	ZOOM Zoom Communications	GOOGLE MEET Google	CISCO WEBEX Cisco
AI BUNDLED?	Yes	Free tier Yes	Yes	Free tier Yes
ENTRY PRICE	<b>M365 Business Basic</b> €5.60/user/mo	<b>Basic (free)</b> Pro €11.40/user/mo	<b>Business Starter</b> €6.90/user/mo	<b>Free</b> Webex Meet €12.40/user/mo
KILLER FEATURE	Intelligent meeting recap with action items + speaker timeline.	Auto meeting summaries and next-step extraction (free with paid plans).	'Take notes for me' — Gemini auto-summarises the meeting.	AI Assistant: meeting summaries, transcription, action items.
BEST FOR	Organisations already in Microsoft 365. Internal collaboration at scale, regulated industries needing tenant-level controls.	External-facing meetings, sales calls, webinars, mixed-organisation collaboration.	Organisations on Google Workspace; inclusive multilingual collaboration; lightweight 'just send a link' meetings.	Regulated industries (banking, healthcare, public sector), Cisco-equipped meeting rooms, hybrid work scenarios with heavy device investment.
WATCH OUT	⚠️ External meetings with mixed-vendor participants — Zoom is more universally accepted.	⚠️ Deep document collaboration during the meeting — Teams/Meet do this better.	⚠️ Deep enterprise telephony / contact center scenarios — Teams or Zoom Phone fit better.	⚠️ Startups and SMBs — overkill for the use case and lower mind-share with external participants.
LEARNING CURVE	<b>Medium</b> — UI is feature-rich; AI features are scattered across tabs.	<b>Low</b> — most users already know it.	<b>Low</b> — browser, one click.	<b>Medium</b> — admin console is dense.
LINK	<a href="https://microsoft.com/microsoft-teams">microsoft.com/microsoft-teams</a> ↗	<a href="https://zoom.us">zoom.us</a> ↗	<a href="https://meet.google.com">meet.google.com</a> ↗	<a href="https://webex.com">webex.com</a> ↗

## Side-by-side: Productivity & Office Suites with AI

Quick scan across 2 tools. Click a tool tab above for the full profile.

DIMENSION	MICROSOFT 365 + COPILOT Microsoft	GOOGLE WORKSPACE + GEMINI Google
AI BUNDLED?	Yes	Yes
ENTRY PRICE	<b>M365 Business Basic</b> €5.60/user/mo	<b>Business Starter</b> €6.90/user/mo
KILLER FEATURE	Word: draft, rewrite, summarise documents; bring in context from emails/files.	'Help me write' in Gmail and Docs; tone adjustment, expand/shorten.
BEST FOR	Organisations with existing M365 footprint, IT-led adoption, and enterprise compliance needs.	Cloud-native teams, education, fast-moving startups, organisations valuing real-time collaboration over Office parity.
WATCH OUT	⚠️ Bleeding-edge teams who want the latest LLM features fast — Microsoft moves on quarterly cycles.	⚠️ Heavy Excel power users — Sheets has gaps with Power Query, complex pivots, financial models.
LEARNING CURVE	Medium — Copilot UI varies app-by-app; users need 30–60 min onboarding to get value.	Low — UI is clean and consistent.
LINK	<a href="https://microsoft.com/microsoft-365">microsoft.com/microsoft-365</a> ↗	<a href="https://workspace.google.com">workspace.google.com</a> ↗

## Side-by-side: Standalone AI Assistants

Quick scan across 5 tools. Click a tool tab above for the full profile.

DIMENSION	CHATGPT OpenAI	CLAUDE Anthropic	GEMINI Google	PERPLEXITY Perplexity AI	MICROSOFT COPILOT (FREE) Microsoft
AI BUNDLED?	Free tier <b>Yes</b>	Free tier <b>Yes</b>	Free tier <b>Yes</b>	Free tier <b>Yes</b>	Free tier <b>Yes</b>
ENTRY PRICE	Free Plus €17.10/mo	Free Pro €17.10/mo	Free Google AI Pro €17.09/mo	Free Pro €17.10/mo	Copilot (free) Copilot Pro €17.10/mo
KILLER FEATURE	GPT-5 reasoning model for hard problems.	Best-in-class long-document analysis (legal, financial, research).	Deep Research: multi-step web research producing structured reports.	Multi-model selector: pick GPT-5 / Claude / Gemini / Sonar per query.	GPT-4o-class model on the free tier.
BEST FOR	Versatile day-to-day assistant, brainstorming, code, data analysis, content drafting. The safest single-tool choice.	Knowledge work involving long documents (legal, M&A, regulatory). Senior writers and analysts. Engineering leaders who use Claude Code.	Google Workspace organisations, Android-heavy teams, anyone needing massive context windows or live multimodal interaction.	Executives doing market research, due diligence, competitive intel; analysts who need verifiable answers; anyone who lost trust in Google's AI Overviews.	First-time users; quick utility tasks; no-account scenarios; mobile.
WATCH OUT	⚠️ Long-document analysis with 100K+ tokens — Claude has a longer context window.	⚠️ Real-time current events — no native web browsing in chat by default (use the API).	⚠️ Pure code-reasoning tasks — Claude/ChatGPT lead on engineering use cases.	⚠️ Free-form creative writing — the academic citing style gets in the way.	⚠️ Power users — feature ceiling is lower than ChatGPT Plus or Claude Pro.
LEARNING CURVE	Low for chat; Medium to extract pro-level value (custom GPTs, projects).	Low for chat; Medium to leverage Projects/Artifacts effectively.	Low — feels like a smarter Google Assistant.	Low — looks and feels like a search engine.	Very low.
LINK	<a href="https://chatgpt.com">chatgpt.com</a>	<a href="https://claude.ai">claude.ai</a>	<a href="https://gemini.google.com">gemini.google.com</a>	<a href="https://perplexity.ai">perplexity.ai</a>	<a href="https://copilot.microsoft.com">copilot.microsoft.com</a>

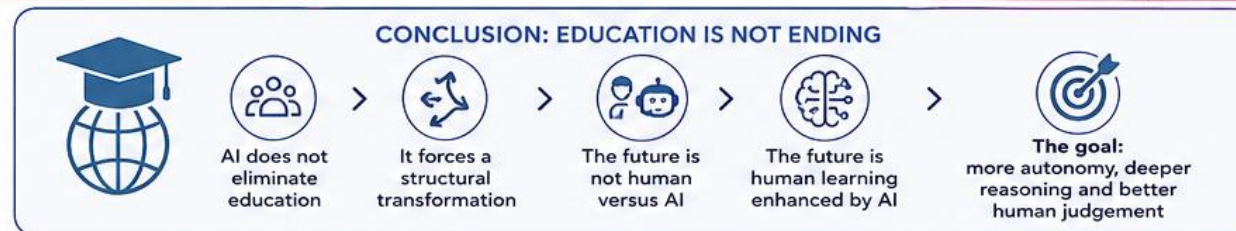
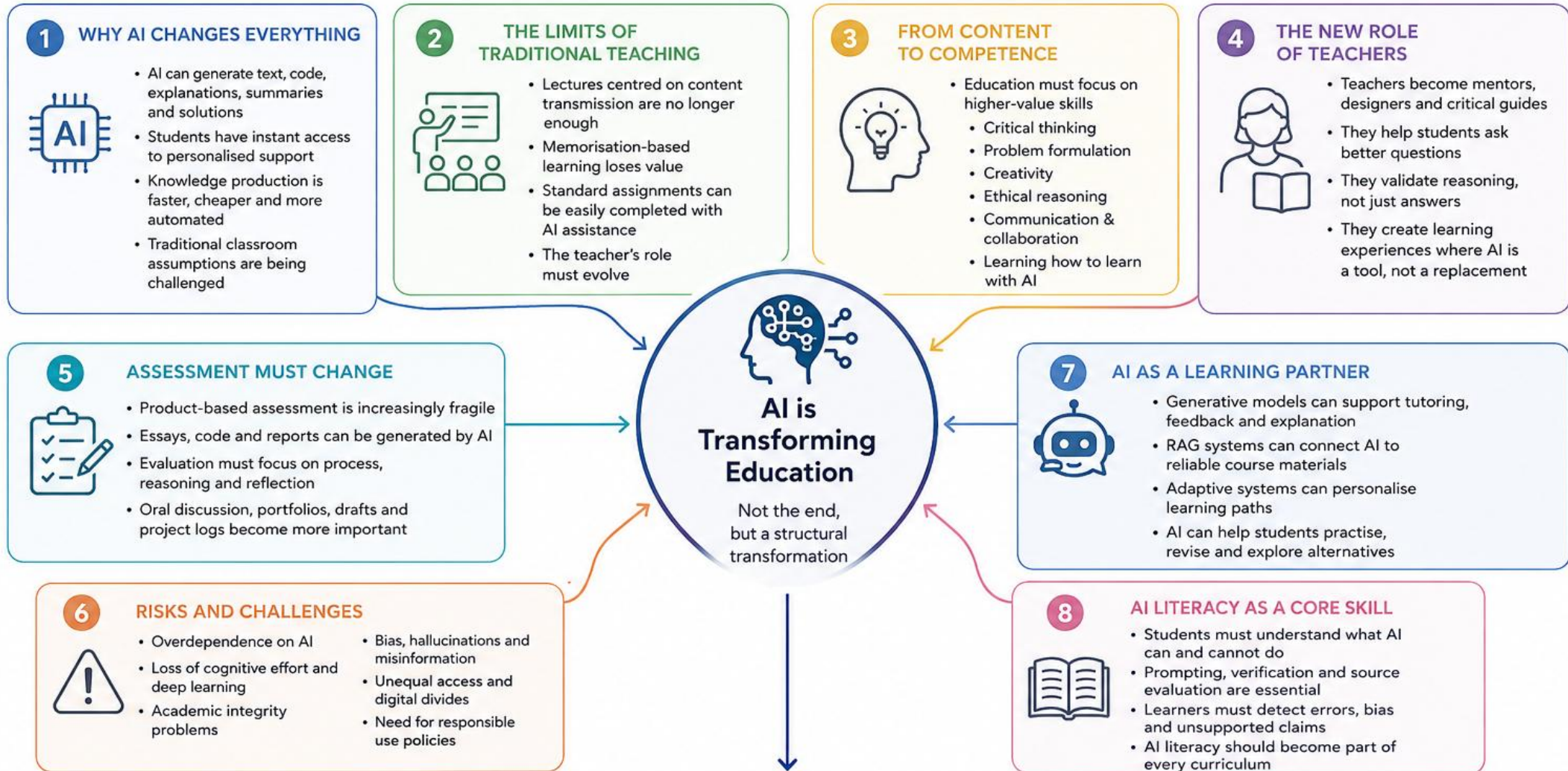
# AI and ChatGPT in Education

**“AI and Can Complement Learning, Not Replace It!”**  
**From Knowledge Transmitter → Learning Architect**



# Teaching in the Age of AI: The End of Traditional Models?

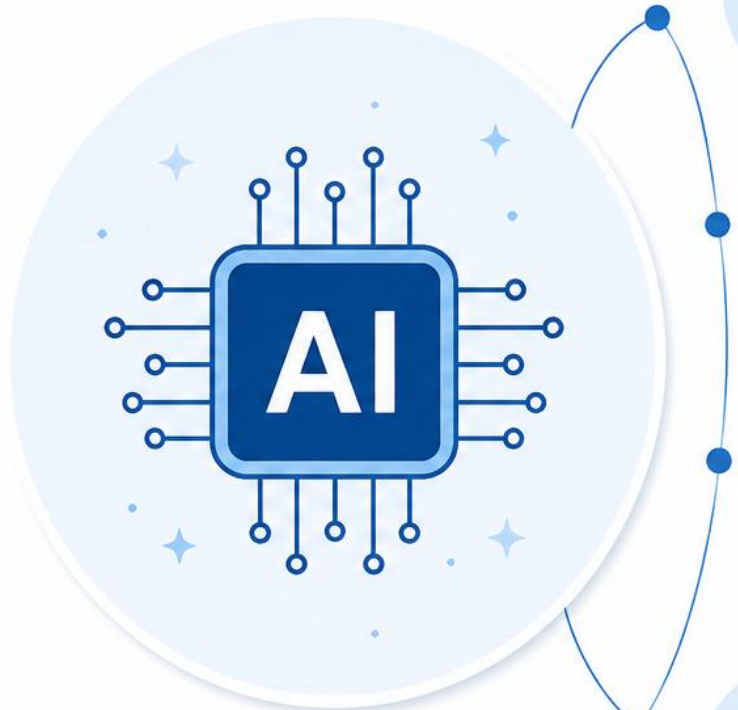
From Content Delivery to Human Development



1

# Why AI Changes Everything

*AI is transforming the foundations of teaching and learning.*



## AI can generate text, code, explanations, summaries and solutions

Generative AI produces high-quality content and solutions across many domains.



## Students have instant access to personalised support

AI tools provide 24/7 assistance, tailored to individual needs and learning pace.



## Knowledge production is becoming faster, cheaper and more automated

AI accelerates research, analysis and creation, reducing time and cost.



## Traditional classroom assumptions are being challenged

What was once scarce (information, expertise, time) is now abundant and on demand.

# 2 The Limits of Traditional Teaching

*What worked in the past is no longer enough in the age of AI.*

## KEY LIMITATIONS



### Lectures centred on content transmission

Delivering information is no longer the main value of teaching.



### Memorisation-based learning loses value

When information is instantly available, memorisation is easy and easily outsourced.



### Standard assignments can be easily completed with AI assistance

AI can generate essays, reports, code and solutions that look high quality.



### The teacher's role must evolve

From the main source of knowledge to a designer of learning and a guide.

## THE IMPACT ON EDUCATION



Information is instant and always available



AI can produce content at scale and on demand



Students can reach the "answer" without the journey



Traditional methods show decreasing returns



## WHAT THIS MEANS



- ✓ Content delivery is no longer a competitive advantage.
- ✓ Students need more than access to information.
- ✓ Education must develop judgement, not just knowledge.
- ✓ The focus must shift from what students know to what they can do and how they think.



### Education must move from transmission to transformation.

The goal is not to teach more content, but to build the capabilities that matter in an AI-augmented world.



Critical thinking



Problem solving



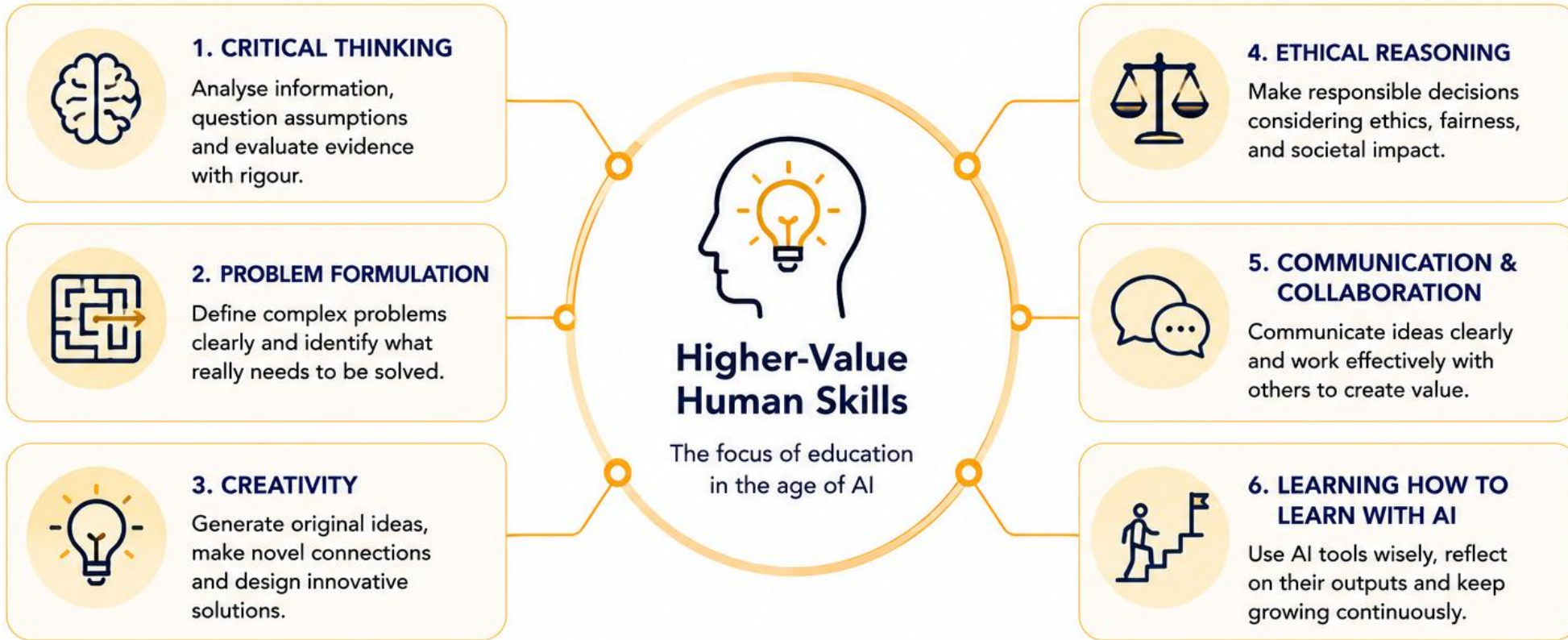
Human skills and values



Lifelong learning

# 3 From Content to Competence

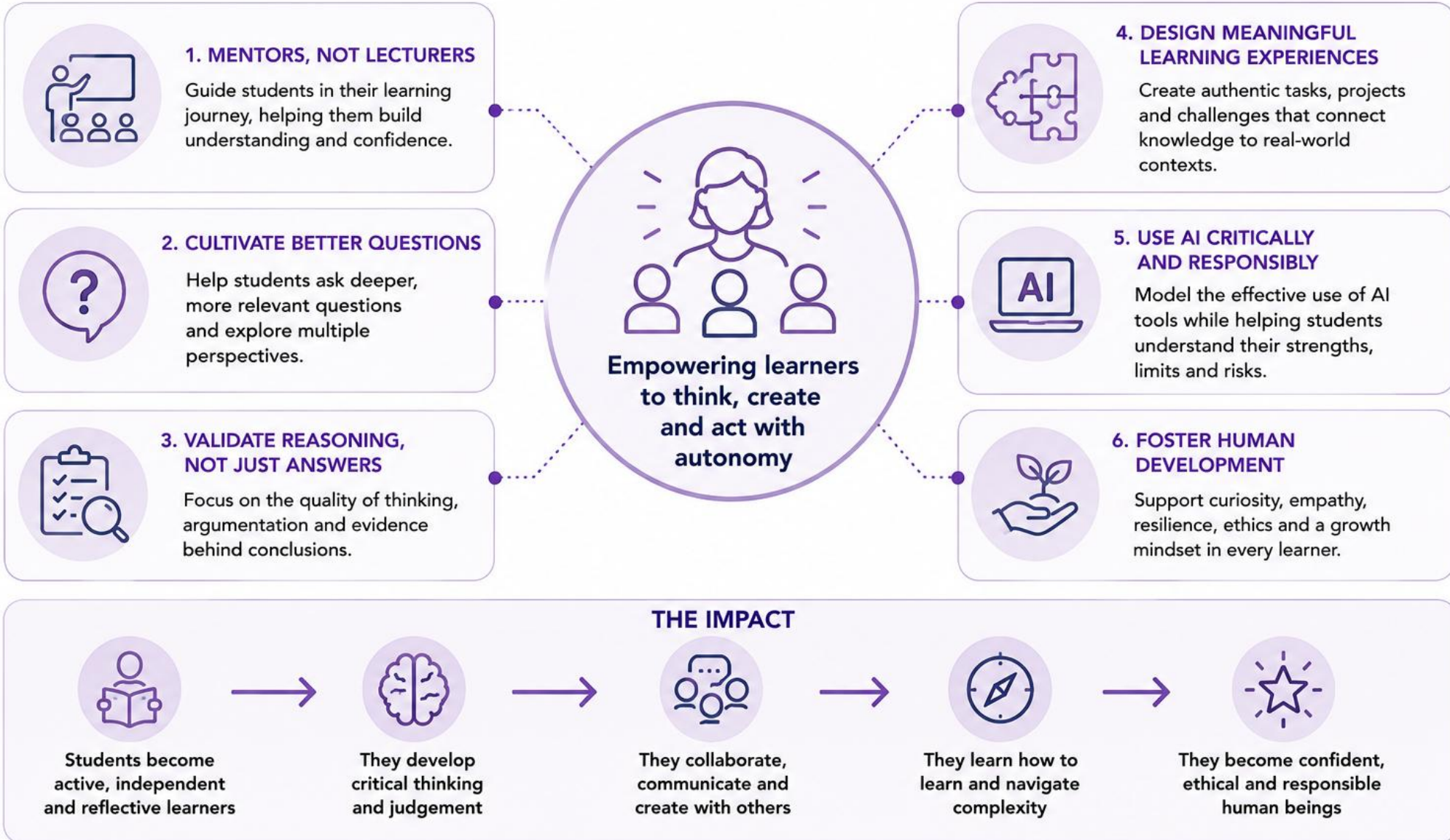
Education must focus on developing the skills that AI cannot replace.



# 4

## The New Role of Teachers

*From knowledge transmitters to learning mentors and critical guides.*



# 5 Assessment Must Change

From evaluating what students produce, to understanding how they think.

## THE OLD MODEL: PRODUCT-BASED

### Focus on the final product



**Essays, reports, presentations**  
AI can generate high-quality content in seconds.



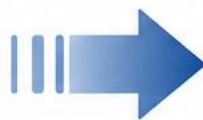
**Code, solutions, calculations**  
AI can produce correct answers and working code.



**Standard tests and quizzes**  
Easy to complete with AI assistance or hidden help.



**Grades based on final output**  
Limited insight into learning, effort or understanding.



A necessary shift

## THE NEW MODEL: PROCESS-BASED

### Focus on the learning process



**Reasoning and argumentation**  
Evaluate how students think, structure ideas and justify conclusions.



**Drafts, iterations and learning logs**  
Value the evolution of ideas and the reflection behind choices.



**Oral discussions and presentations**  
Assess understanding through dialogue, defense and questioning.



**Portfolios and authentic projects**  
Showcase integrated learning across time, contexts and challenges.



**Self and peer assessment**  
Promote metacognition, autonomy and responsibility for learning.

## WHAT THIS SHIFT ENABLES



**Deeper understanding** of student thinking and learning processes.



**Stronger academic integrity** by making learning visible.



**Better preparation** for complex, real-world problems.



**More meaningful feedback** that guides growth and improvement.



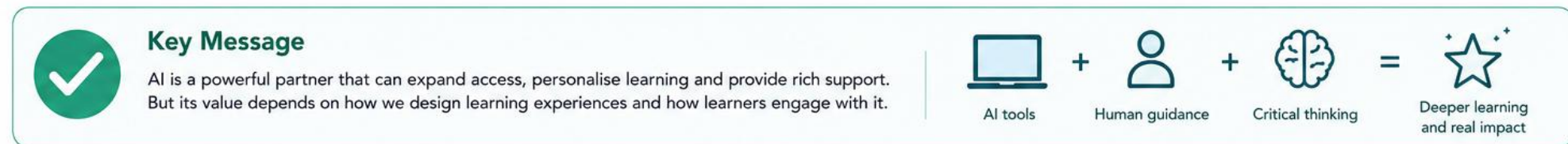
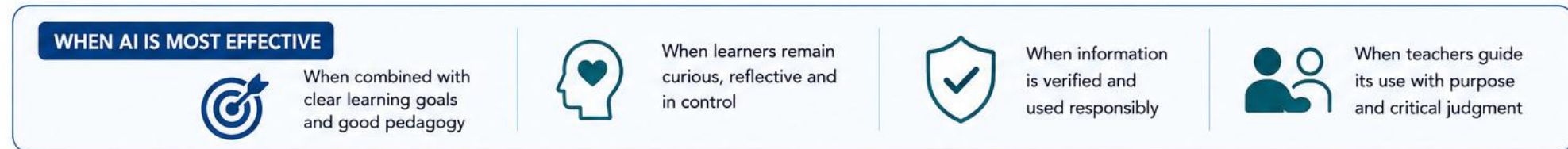
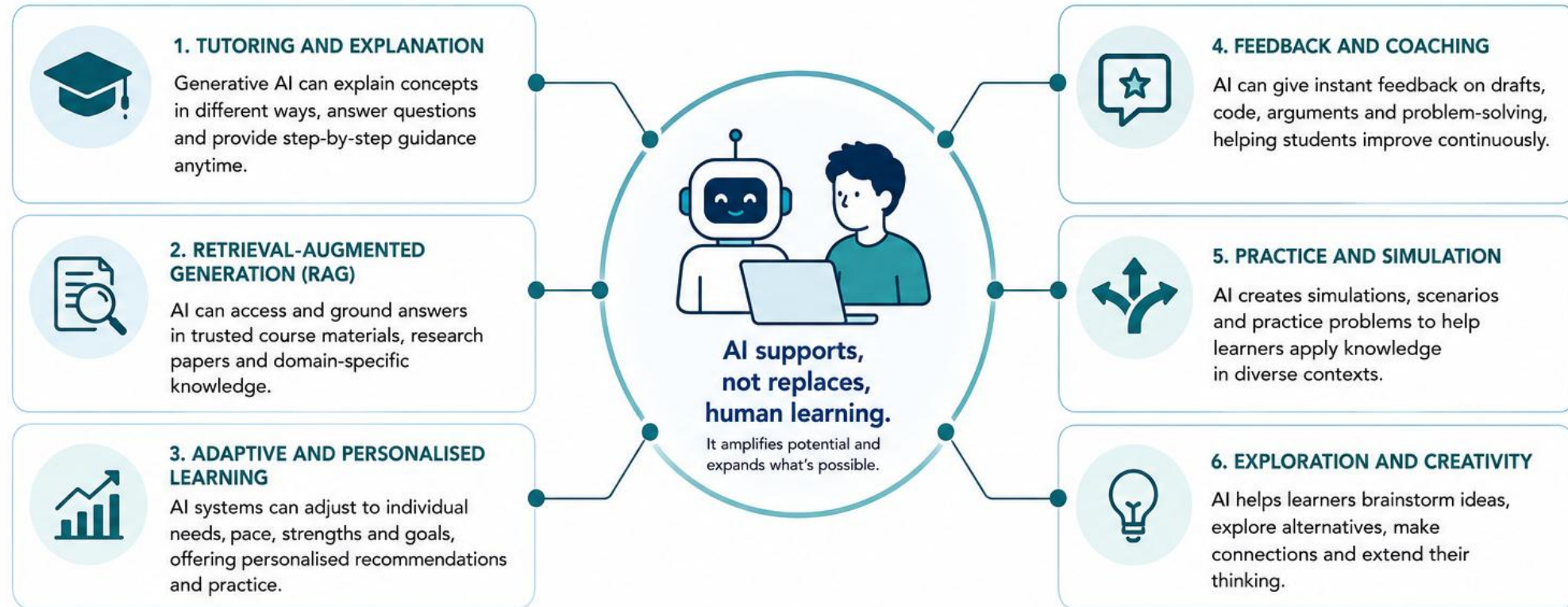
**Alignment with the future** where process, creativity and judgement matter most.



**Key takeaway:** When AI can produce the answer, assessment must focus on the thinking, the process, and the learner behind the work.

# 6 AI as a Learning Partner

AI tools can enhance learning when used purposefully and responsibly.



# 7 Risks and Challenges

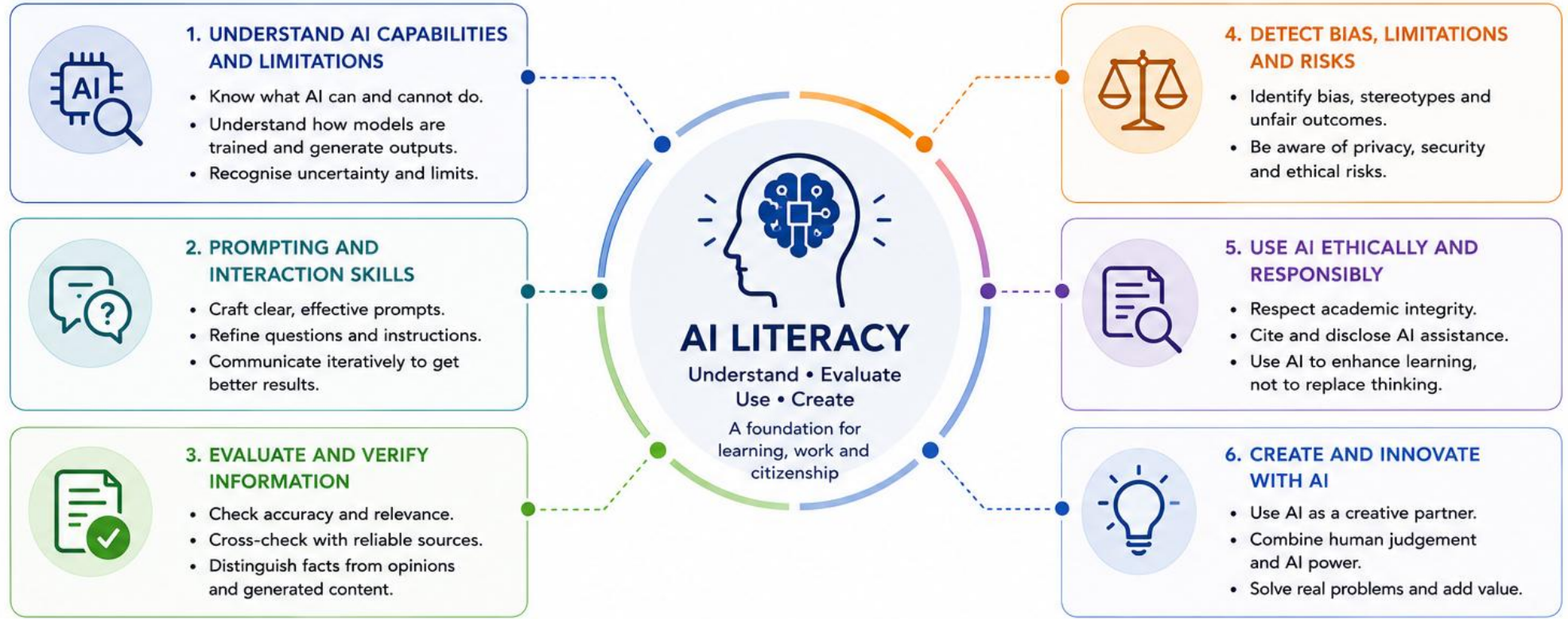
AI brings great opportunities for education, but also significant risks that we must understand and address.



**Key Takeaway** AI's risks are real, but manageable. With awareness, policies and responsible practices, we can create a safe, fair and empowering learning environment.

# 8 AI Literacy as a Core Skill

To thrive in the age of AI, learners must understand, evaluate and use AI wisely.



**★ Key Takeaway** | AI literacy empowers learners to make better decisions, protect themselves, create value and contribute positively to a future shaped by AI.

# The Future of AI in Education

Looking ahead to emerging trends and possibilities that can shape the future of learning.

## KEY TRENDS SHAPING THE FUTURE



### 1. HYPER-PERSONALISED LEARNING

AI will tailor learning to each learner's needs, pace and interests.

- Adaptive content and pacing
- Real-time feedback
- Personal learning pathways



### 2. AI AS A LEARNING COMPANION

Intelligent tutors and assistants will provide continuous support.

- 24/7 help and guidance
- Conversation and practice
- Motivational support



### 3. SKILLS FOR THE AI ERA

Education will focus on uniquely human skills and AI literacy.

- Critical thinking
- Creativity and innovation
- Empathy and ethics
- AI literacy and data fluency



### 4. LIFELONG AND UBIQUITOUS LEARNING

Learning will be anytime, anywhere and across the lifespan.

- Microlearning and just-in-time
- Seamless across contexts
- Supporting career transitions



### 5. HUMAN-AI COLLABORATION

AI will augment human capabilities and enable richer collaboration.

- Co-creation and ideation
- Enhanced teamwork
- More time for meaningful human interaction



### 6. ETHICAL AND RESPONSIBLE AI

Trust, fairness and wellbeing will be central to the future of AI in education.

- Privacy and data protection
- Transparency and fairness
- Inclusive and equitable design

## PREPARING LEARNERS FOR THE FUTURE



### Build strong foundations

Ensure core knowledge and foundational skills remain a priority.



### Foster adaptable mindsets

Encourage curiosity, resilience and a growth mindset.



### Cultivate human strengths

Develop communication, empathy, creativity and ethical reasoning.



### Support wellbeing and inclusion

Ensure technology supports mental health, belonging and equity.



### Empower through AI literacy

Teach learners to understand, evaluate and use AI wisely.



### Inspire purpose and impact

Help learners use AI to solve real problems and create positive change.

## OPPORTUNITIES WE CAN CREATE TOGETHER



Expand access to quality education for all.



Personalise learning and unlock every learner's potential.



Prepare learners for meaningful work and civic life.



Build more inclusive, equitable and just societies.



Drive innovation for a better and sustainable future.



## Key Takeaway

The future of AI in education is not about machines replacing humans, but about working together to empower every learner to thrive.



Human + AI = Limitless Potential

# Research with AI



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## Scopus AI: Trusted content. Powered by responsible AI.

Empower your research journey with Scopus AI – your dynamic GenAI-powered research companion.

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Consensus vs ChatGPT  
Your AI Research Assistant

# scite\_

Your AI Research Assistant

Ask questions and receive evidence-based answers from real research

Assistant Search Tables  
Ask a question... (type '/' for menu)  
Settings Sources  
ResearchRabbit

### Elsevier's Five Responsible AI Principles

- We consider the real-world impact of our solutions on people
- We take action to prevent the creation or reinforcement of unfair bias
- We can explain how our solutions work
- We create accountability through human oversight
- We respect privacy and champion robust data governance

Ask a research question to generate a concise summary report



New Collection New Category Connect to Zotero  
Filter: Custom  
Abstracts Comments  
1 selected paper  
Mohammadmehra Kasaei Zhibin Li  
Learning hybrid locomotion skills—Learn to exploit residual actions and modulate model-based gait control  
Frontiers in Robotics and AI 2023  
PDF  
This work has developed a hybrid framework that combines machine learning and control approaches for legged robots to achieve new capabilities of balancing against external perturbations. The framework embraces a kernel which is a model-based, full parametric closed-loop and analytical controller as the gait pattern generator. On top of that, a neural network with symmetric partial data augmentation learns to automatically adjust the parameters for the gait kernel, and also generate compensatory actions for all joints, thus significantly augmenting the stability under unexpected perturbations. Seven Neural Network policies with different configurations were optimized to validate the effectiveness and the combined use of the modulation of the kernel parameters and the compensation for the arms and legs using residual actions. The results validated that modulating kernel parameters alongside the residual actions have improved the



















# Concerns of AI and ChatGPT in Research: A Global Overview

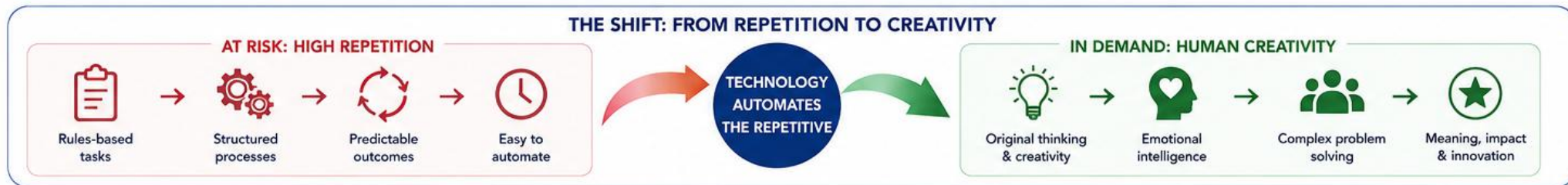
AI offers powerful tools for research, but also raises critical concerns that require awareness, ethical responsibility and robust safeguards.



# Jobs Most at Risk of Disappearance

Repetition Disappears. Creativity Remains!

CATEGORY	EXAMPLES OF VULNERABLE JOBS	MAIN REASON	HOW AI / AUTOMATION IMPACTS
 <b>1. ROUTINE COGNITIVE WORK</b>	<ul style="list-style-type: none"> <li>Data-entry clerks</li> <li>Bookkeeping assistants</li> <li>Basic translators</li> <li>Call-center operators</li> </ul>	 LLMs and automation tools now handle structured language, classification, and documentation with high accuracy.	 Automates writing, classifying and processing information quickly and with fewer errors.
 <b>2. REPETITIVE MANUAL LABOR</b>	<ul style="list-style-type: none"> <li>Assembly-line workers</li> <li>Packaging operators</li> <li>Basic machine operators</li> </ul>	 Robotics and computer-vision systems enable continuous, precise, and low-cost automation.	 Machines perform repetitive physical tasks faster, safer and around the clock.
 <b>3. BASIC ADMINISTRATIVE SUPPORT</b>	<ul style="list-style-type: none"> <li>Scheduling assistants</li> <li>Document clerks</li> <li>Travel agents</li> </ul>	 Intelligent assistants automate planning, documentation, and coordination tasks.	 AI schedules, organizes and manages information with minimal human input.
 <b>4. CUSTOMER SUPPORT (SCRIPTED)</b>	<ul style="list-style-type: none"> <li>FAQ operators</li> <li>First-level support agents</li> </ul>	 Conversational AI and voicebots deliver standardized and context-aware responses instantly.	 Handles common inquiries 24/7 with consistent quality and lower cost.
 <b>5. LOW-COMPLEXITY ANALYTICAL TASKS</b>	<ul style="list-style-type: none"> <li>Junior analysts</li> <li>Simple report writers</li> </ul>	 Auto-analytics tools and dashboards convert raw data into insights automatically.	 Data is processed, analyzed and visualized without manual intervention.
 <b>6. BASIC DIGITAL &amp; PROGRAMMING TASKS</b>	<ul style="list-style-type: none"> <li>Basic programmers</li> <li>Web developers (basic)</li> <li>Software test assistants</li> <li>Data-cleaning technicians</li> </ul>	 Generative-AI coding assistants produce and debug code, run tests and generate documentation autonomously.	 Speeds up development and reduces the need for repetitive coding and testing tasks.





**KEY TAKEAWAY**

AI and automation excel at repetitive, predictable tasks.  
**Human creativity, judgment and empathy remain irreplaceable.**


+

+











































+


Learn    Adapt    Create    Lead

Focus on what makes us uniquely human.

# Emerging High-Value Roles in the AI Economy

Hybrid experts who can make AI systems reliable, explainable, and human-compatible!

DOMAIN	EMERGING ROLES	CORE HUMAN VALUE			IMPACT
 <b>1. AI DEVELOPMENT &amp; OVERSIGHT</b>	 <ul style="list-style-type: none"> <li>AI trainer</li> <li>Explainability engineer</li> <li>Responsible-AI officer</li> <li>Model auditor</li> </ul>	 Ethics	 Transparency	 Trust	 Builds trustworthy, auditable and safe AI systems that people can rely on.
 <b>2. HUMAN-AI COLLABORATION</b>	 <ul style="list-style-type: none"> <li>Prompt engineer</li> <li>AI workflow designer</li> <li>Cognitive-interface architect</li> </ul>	 Creativity	 Context understanding	 Human insight	 Designs intuitive interactions and workflows that align AI with human goals and values.
 <b>3. INDUSTRY &amp; OPERATIONS</b>	 <ul style="list-style-type: none"> <li>Predictive-maintenance expert</li> <li>Human-robot collaboration manager</li> <li>Smart-factory strategist</li> </ul>	 Technical reasoning	 Safety	 Efficiency	 Optimizes operations and predicts issues while keeping people and systems safe.
 <b>4. ROBOTICS &amp; AUTONOMOUS SYSTEMS</b>	 <ul style="list-style-type: none"> <li>Robot-behaviour designer</li> <li>Reinforcement-learning specialist</li> <li>Multi-robot coordination engineer</li> <li>Human-robot interaction designer</li> <li>Ethical-autonomy advisor</li> </ul>	 Embodied intelligence	 Trust	 Safety by design	 Creates autonomous systems that act safely, collaborate with people, and adapt to the real world.
 <b>5. PUBLIC SECTOR &amp; LAW</b>	 <ul style="list-style-type: none"> <li>Algorithmic-governance advisor</li> <li>AI-policy analyst</li> <li>Digital-law specialist</li> </ul>	 Accountability	 Fairness	 Privacy & rights	 Ensures AI is used fairly, legally and in the public interest.
 <b>6. EDUCATION &amp; HEALTH</b>	 <ul style="list-style-type: none"> <li>Learning-analytics expert</li> <li>Clinical-AI interpreter</li> <li>Digital-wellbeing coach</li> </ul>	 Empathy	 Human judgment	 Wellbeing	 Improves outcomes by combining data and AI with care, empathy and human judgment.
 <b>7. SOCIETY &amp; COMMUNICATION</b>	 <ul style="list-style-type: none"> <li>AI ethicist</li> <li>Fact-checking analyst</li> <li>AI literacy facilitator</li> </ul>	 Social responsibility	 Critical thinking	 AI literacy	 Builds an informed, ethical and resilient society in the age of AI.

## WHAT MAKES THESE ROLES HIGH-VALUE?



Require uniquely human strengths (judgment, ethics, empathy, creativity).

+



Bridge the gap between AI capabilities and real human needs.

+



Improve trust, safety, fairness and accountability in AI systems.

+



Drive innovation, productivity and positive impact at scale.

+



Shape a future where AI serves people and society.



## KEY TAKEAWAY

The future belongs to **hybrid experts** who combine domain knowledge, human values and AI skills to solve real problems responsibly.



Human Values

+



AI Skills

+



Domain Expertise





















=



High Value Impact

# Reskilling for the AI Era

Thriving in an AI-driven world requires new skills, mindsets and values.

SKILL DOMAIN	KEY SKILLS	WHY IT MATTERS	OUTCOMES
 <b>1 COGNITIVE &amp; PROBLEM-SOLVING</b>	 <ul style="list-style-type: none"> <li>Analytical thinking</li> <li>Complex problem-solving</li> <li>Systems thinking</li> <li>Design reasoning</li> <li>AI-augmented decision-making</li> </ul>	 <p>As AI automates analysis, humans must focus on framing problems, interpreting outputs, and designing creative, high-impact solutions.</p>	 <ul style="list-style-type: none"> <li>Better decisions</li> <li>Innovative solutions</li> <li>Strategic impact</li> <li>Human-AI advantage</li> </ul>
 <b>2 ARTIFICIAL INTELLIGENCE AND ROBOTICS</b>	 <ul style="list-style-type: none"> <li>AI and data literacy</li> <li>Robotics knowledge</li> <li>Automation design</li> <li>Human-robot collaboration</li> <li>Cybersecurity and digital ethics</li> </ul>	 <p>The new digital baseline requires understanding, supervising, and questioning intelligent systems rather than just using them.</p>	 <ul style="list-style-type: none"> <li>Effective AI use</li> <li>Safer systems</li> <li>Responsible innovation</li> <li>Future-ready capability</li> </ul>
 <b>3 HUMAN &amp; SOCIAL INTELLIGENCE</b>	 <ul style="list-style-type: none"> <li>Communication</li> <li>Empathy</li> <li>Cross-cultural collaboration</li> <li>Negotiation</li> <li>Leadership in human-AI teams</li> </ul>	 <p>Value shifts from execution to empathy, creativity, and trust—areas where humans remain irreplaceable.</p>	 <ul style="list-style-type: none"> <li>Stronger relationships</li> <li>Inclusive teamwork</li> <li>Trust and influence</li> <li>Human-centered impact</li> </ul>
 <b>4 LEARNING &amp; ADAPTABILITY</b>	 <ul style="list-style-type: none"> <li>Self-directed learning</li> <li>Cognitive flexibility</li> <li>Curiosity</li> <li>Resilience</li> <li>Growth mindset</li> </ul>	 <p>Lifelong learning becomes the central professional competency—learning, unlearning, and relearning at speed.</p>	 <ul style="list-style-type: none"> <li>Continuous growth</li> <li>Adaptability to change</li> <li>Career resilience</li> <li>Long-term relevance</li> </ul>
 <b>5 ETHICAL, STRATEGIC &amp; SUSTAINABILITY</b>	 <ul style="list-style-type: none"> <li>Ethical reasoning</li> <li>Sustainability awareness</li> <li>Policy &amp; governance literacy</li> <li>Foresight</li> <li>Inclusion &amp; social responsibility</li> </ul>	 <p>Work must align with human and planetary goals—balancing innovation with accountability and long-term vision.</p>	 <ul style="list-style-type: none"> <li>Ethical leadership</li> <li>Sustainable impact</li> <li>Social trust</li> <li>Purpose-driven work</li> </ul>

## HOW TO RESKILL SUCCESSFULLY



## ★ KEY TAKEAWAY

The future belongs to those who combine AI fluency with uniquely human strengths.  
Reskill today. Lead tomorrow. Create a better future for all.



# New & Emerging Trends (2026+)

What's next in AI and the Intelligent World



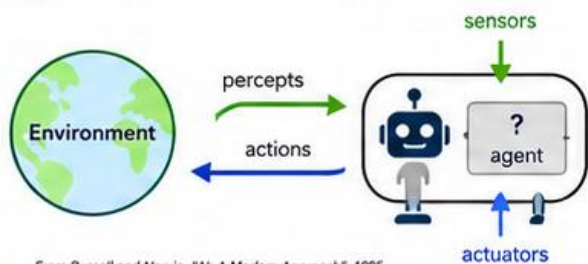
# Agentic AI: From Perception to Action, Alone or Together

Agentic AI systems perceive, reason, plan and act autonomously to achieve goals and create value.

## 1 WHAT IS AN AGENT?

### Agent (1995):

“Computational System, situated in a given **environment**, that has the ability to **perceive** that environment using **sensors** and **act**, in an **autonomous way**, in that environment using its **actuators** to fulfill a given function.”



From Russell and Norvig, "AI: A Modern Approach", 1995

## 2 WHAT MAKES AN AGENT "AGENTIC"?

- Goal-directed**  
Pursues objectives autonomously
- Perceive & Understand**  
Interprets the environment via sensors & data
- Reason & Plan**  
Thinks, decomposes tasks and plans next steps
- Act & Execute**  
Uses tools and actuators to take action
- Learn & Adapt**  
Improves from feedback and experience
- Autonomous**  
Operates with minimal human intervention

From reactive → proactive → intentional → adaptive

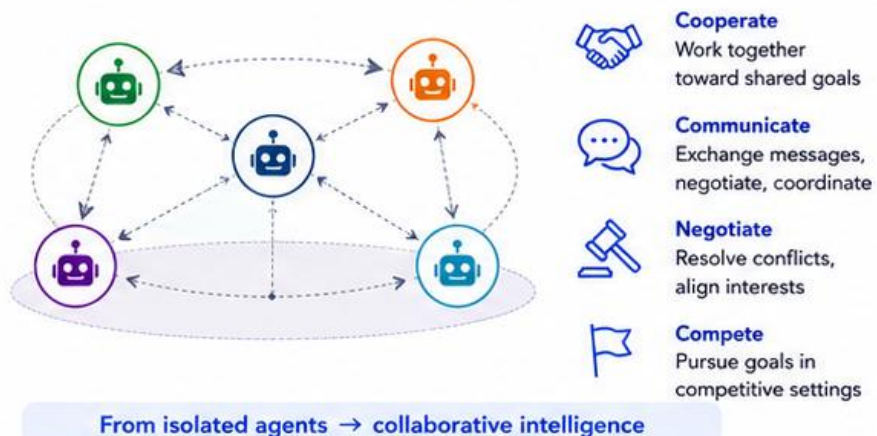
## 3 HOW AN AGENTIC SYSTEM WORKS



Goal Achieved ✓ or Re-plan ↻

## 4 MULTI-AGENT SYSTEMS (MAS)

Agents exhibit **autonomous** behavior and interact with other agents to achieve individual or collective goals.



From isolated agents → collaborative intelligence

## 5 WHERE AGENTIC AI IS IMPACTING

- Enterprise Automation**  
Autonomous workflows and processes
- Healthcare**  
Clinical copilot, diagnosis, patient support
- Finance**  
Trading agents, risk analysis, fraud detection
- Robotics**  
Autonomous robots in real-world tasks
- Education**  
Personalized tutors and learning agents
- Science & Discovery**  
Research agents, simulations, hypothesis gen.

## 6 KEY ENABLERS POWERING AGENTIC AI

- Foundation Models**  
Stronger reasoning and generalization
- RAG & Memory**  
Access to real-time knowledge & context
- Tools & APIs**  
Extend capabilities beyond the model
- Long-Horizon Planning**  
Handle complex, multi-step tasks
- Safety & Alignment**  
Guardrails, ethics, and human oversight
- Compute & Infra**  
Scalability, latency, and reliability

# Agentic AI – Manus AI

Ranking Candidates for Reinforcement Learning Engineer Role

organize information from each resume, analyze their RL expertise based on their project experience, and provide you with a ranked list of candidates. Let me get started by examining the resumes.

Knowledge recalled(2)

- Extract resumes from ZIP file ^  
Starting to extract and analyze resumes for RL algorithm engineer candidates.  
Executing command `mkdir -p resumes && unzip -o upload/resumes_1_to_10.zip -d resumes`  
Creating a todo list to track resume analysis progress.  
Creating file `todo.md`
- Create candidate review task list ^  
Starting to read and analyze each resume, focusing on RL expertise and project experience.  
Browsing `file:///home/ubuntu/resumes/resume_1.pdf`
- Read and analyze individual resumes ^  
Continuing to read and analyze resumes, focusing on RL expertise and project experience.  
Viewing the page  
Continuing to read and analyze resumes, troubleshooting PDF viewing issues.  
Scrolling down  
Analyzing resume content for candidate 1, focusing on RL-related experience.  
Scrolling to top  
Analyzing resume content for candidate 1 (Amelia Martin), focusing on RL-related experience.  
Thinking

Message Manus

Manus is working: Read and analyze individual resumes

it can work like a human - first unzipping the file

Manus's Computer

Manus is using Browser

Scrolling to top

file:///home/ubuntu/resumes/resum...

resume\_1.pdf

Amelia Martin  
ameliamartin@outlook.com | +61 537 567 148  
Seoul, South Korea

**SUMMARY**  
Motivated Legal Assistant with 9 years of experience in Customer Service. Skilled in communication and strategic thinking with a strong focus on delivering results. Eager to contribute to team success through hard work and dedication.

**EDUCATION**  
**Bachelor of Arts - Stanford University**  
Computer Science 2017  
Graduated with highest honors. Published paper on "Privacy-Preserving Machine Learning Techniques" in Journal of Computer Science. Relevant coursework: Operating Systems, Artificial Intelligence. GPA: 3.6/4.0.

**WORK EXPERIENCE**  
**Officer - Vertex Corporation**  
London, UK Feb 2021 - Present  
• Optimized workflows, reducing efficiency by 40%.  
• Optimized workflows, reducing process time by 25%.  
• Managed key initiatives that improved employee engagement by 75%.  
• Identified opportunities for improvement and implemented solutions.

**Supervisor - Nexus Industries**  
Paris, France Nov 2018 - Apr 2021  
• Created and maintained documentation for business processes.  
• Conducted research and analysis to inform decision-making.  
• Led team of 7 professionals, improving productivity by 40%.  
• Identified opportunities for improvement and implemented solutions.  
• Provided expertise and guidance on industry trends.

**Director - Summit Group**  
Chicago, IL May 2016 - Mar 2018  
• Managed key initiatives that improved quality metrics by 30%.  
• Identified opportunities for improvement and implemented solutions.  
• Developed and implemented strategies that increased productivity.  
• Created and maintained documentation for technical workflows.  
• Managed key initiatives that improved compliance rate by 50%.

**PROJECTS**  
**SARSA Algorithm for Cliff Walking Environment**  
Research Assistant 2023  
• Implemented the SARSA on-policy reinforcement learning algorithm for a cliff walking environment.  
• Compared performance with Q-learning in terms of safety and optimality.  
• Developed a simple GUI to visualize agent behavior during training and testing phases.  
• Documented findings on how on-policy learning produces safer but less optimal paths.

**Customer Experience Improvement**  
Implementer 2025  
• Implemented best practices that improved quality and consistency.  
• Implemented solution that streamlined onboarding and reduced process time by 25%.  
• Collaborated with cross-functional teams to deliver solution that enhanced customer

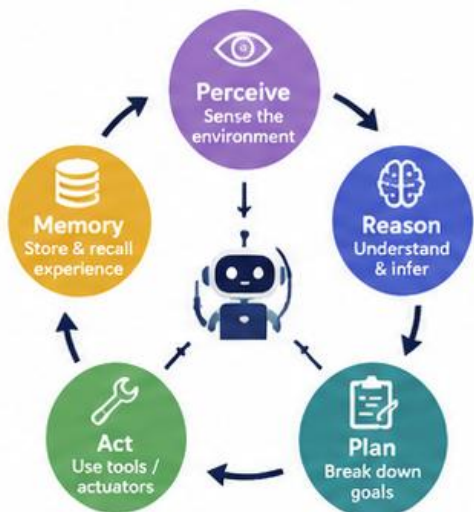
<https://www.youtube.com/watch?v=K27diMbCsuw>

# Deep Reinforcement Learning (DRL)

The Learning Engine Powering Agentic AI and the Future of Robotics

## 1. AGENTIC AI: REASON, PLAN, ACT

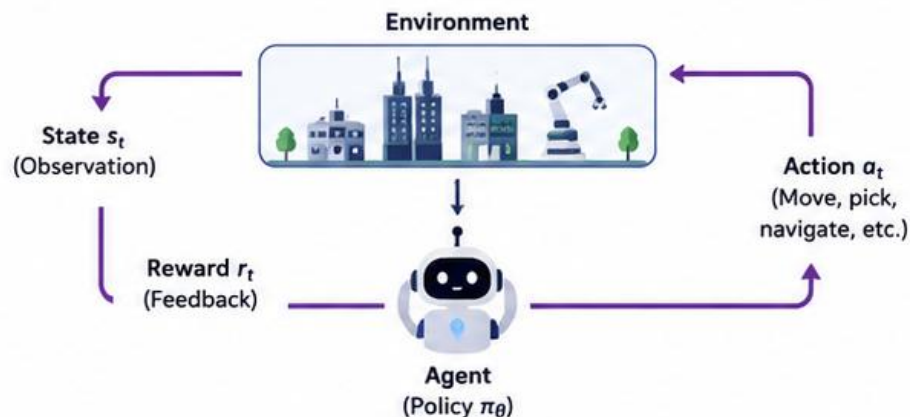
Agentic AI systems perceive, reason, plan and act to achieve goals autonomously using tools and memory.



Agentic AI provides the “brain”.  
DRL provides the ability to learn the best actions through experience.

## 2. DEEP REINFORCEMENT LEARNING: LEARN BY DOING

DRL enables agents to learn optimal behaviors through trial and error, maximizing cumulative rewards over time.



### Core Idea

The agent learns a policy  $\pi_{\theta}(a|s)$  that maps states to actions to maximize expected cumulative reward.

### How DRL Works



### Key Algorithms

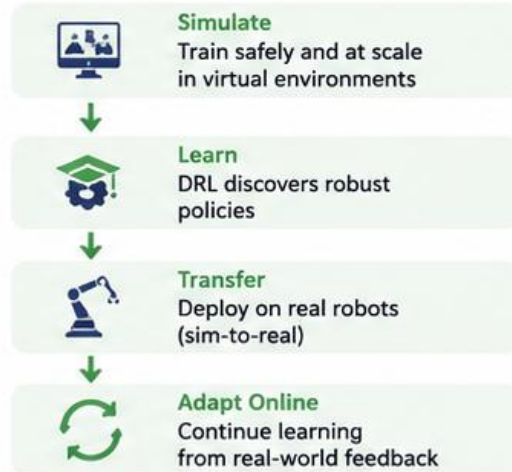
- DQN
- PPO
- SAC
- A3C / IMPALA
- Rainbow

### Why DRL Complements Agentic AI

- ✓ Handles complex, high-dimensional and uncertain environments
- ✓ Learns from real-world interactions
- ✓ Discovers strategies not easy to program
- ✓ Adapts continuously to change

## 3. BRIDGING TO ROBOTICS

DRL turns decisions into skills. From simulation to the real world.



## 4. THE FUTURE

- 🚀 Generalizable robotic skills across tasks and domains
- 🤖 Human-AI-Robot collaboration in dynamic environments
- 🌐 Autonomous systems at scale in industry, logistics, health, space
- ★ Embodied intelligence: from perception to action to goals

## THE IMPACT



More capable autonomous systems



Safer, more efficient and adaptive robots



Breakthroughs in science, engineering and industry



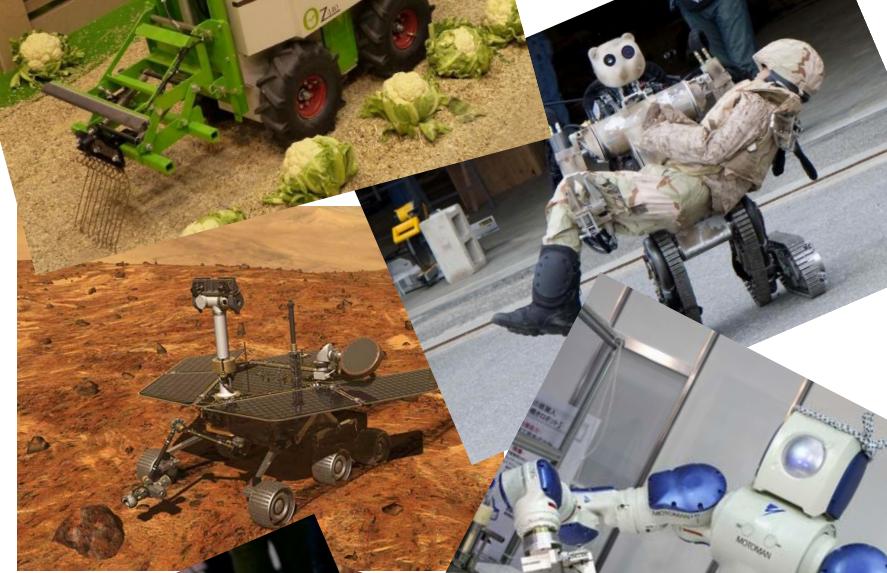
Bringing physical AI into everyday life

# Strong AI – Star Wars and C3PO



*Video: Lucasfilm Ltd. (1977). Star Wars: Episode IV - A New Hope. [Film]. 20th Century Fox.*

# AI in Robotics

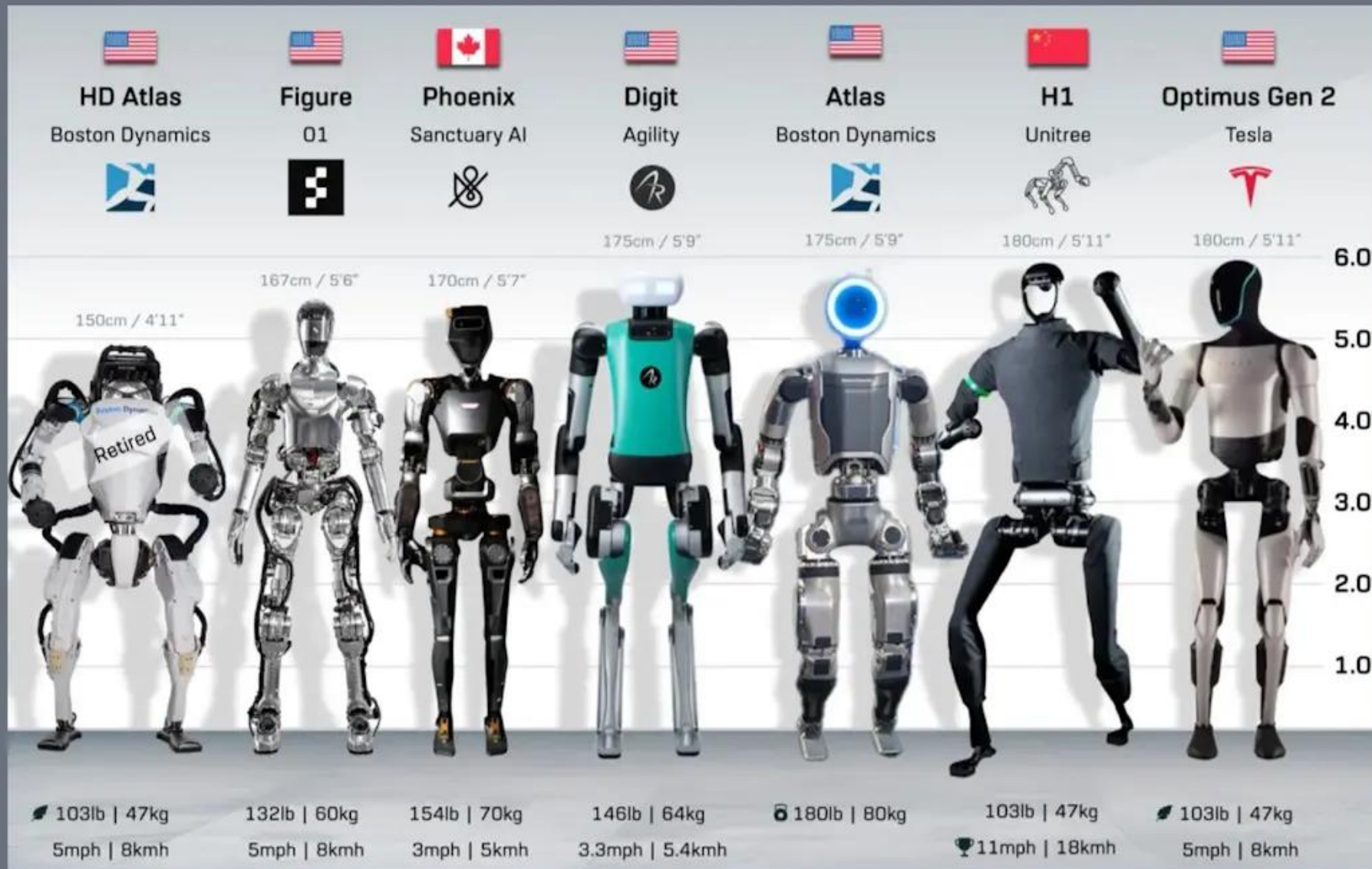


# Robotics – Atlas Robot



Video: Boston Dynamics: Atlas Gets a Grip - [https://www.youtube.com/watch?v=e1\\_Dir1EhG30&channel=BostonDynamics](https://www.youtube.com/watch?v=e1_Dir1EhG30&channel=BostonDynamics)

# Robotic Humanoids



[https://pplware.sapo.pt/high-tech/existem-tantos-robos-humanoides-que-fica-dificil-distingui-los-mas-este-grafico-pode-ajudar/?fbclid=IwY2xjawl1Zg9leHRuA2FlbQlXMQABHS\\_EdekrviewLEglyq3RZRfPy-HaU4MdNtaFgqa6bT2lkcoYfBoF\\_Jkqd9w\\_aem\\_RO6nDQ16bQJ51jD6bM6-TQ](https://pplware.sapo.pt/high-tech/existem-tantos-robos-humanoides-que-fica-dificil-distingui-los-mas-este-grafico-pode-ajudar/?fbclid=IwY2xjawl1Zg9leHRuA2FlbQlXMQABHS_EdekrviewLEglyq3RZRfPy-HaU4MdNtaFgqa6bT2lkcoYfBoF_Jkqd9w_aem_RO6nDQ16bQJ51jD6bM6-TQ)

# China New Year Celebration Humanoid Robotics



# Agentic AI in Education: From Assistants to Learning Agents

*AI is evolving from answering questions to pursuing learning goals*



Agentic AI systems can plan, act, monitor progress, use tools and adapt support to help students achieve their learning goals **over time**.

## THE EVOLUTION OF AI IN EDUCATION

### 1. AI CHATBOT / ASSISTANT



#### Answers Questions

- Responds to prompts
- Provides information
- One-shot interactions
- No memory of learning goals



### 2. AI TUTOR / COPILOT



#### Guides Learning

- Explains concepts
- Helps practice and solve problems
- Gives feedback and hints
- Supports within a session



### 3. AGENTIC LEARNING PARTNER



#### Plans, Acts, Monitors and Adapts

- Sets and pursues learning goals
- Plans steps and selects resources
- Uses tools and takes actions
- Monitors progress and adapts support
- Remembers and builds over time



**Plan**  
Break down goals  
into steps



**Act**  
Take actions and  
use tools



**Monitor**  
Track progress  
and understanding



**Adapt**  
Adjust strategies  
and support



**Reflect**  
Promote reflection  
and improvement

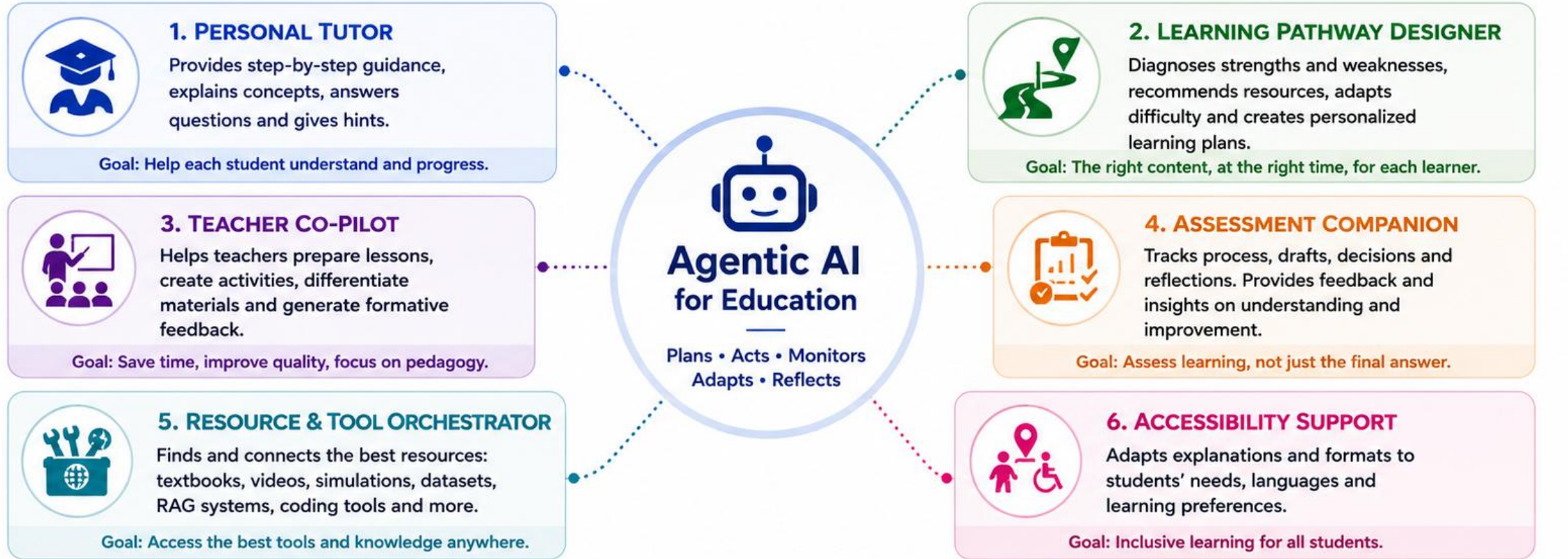


**Key Message:** Agentic AI moves education from answering questions to orchestrating learning experiences, helping students plan, practice, reflect and improve—over time.









# Agentic AI in Education: What Educational Agents Can Do

*Agents act on goals, use tools, and adapt to support students, teachers and institutions.*



 **Key Message** Agentic AI orchestrates learning activities, supports teachers, and empowers students to **learn better, deeper and more autonomously.** 

**EXAMPLES IN ACTION**

-  Plans a revision schedule for an upcoming exam.
-  Guides a student through a coding project step by step.
-  Gives feedback on an essay and suggests improvements.
-  Identifies topics where the class is struggling.
-  Adapts explanations in different languages and formats.
-  Helps create a personal learning plan for a goal.

# Conclusions: AI for Learning, Agents for Learning, Robots for Learning

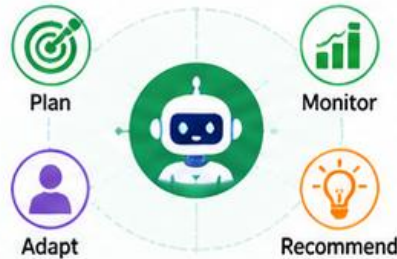
*From tools to teammates — building a future where humans and intelligent systems learn together.*

## 1 AI FOR LEARNING



AI explains, personalizes and supports every learner.

## 2 AGENTIC AI FOR LEARNING



Agents plan, monitor and adapt learning over time.

## 3 ROBOTICS FOR LEARNING



Robots bring learning to life through action, experimentation and collaboration.

## ★ KEY TAKEAWAYS



AI is now a **Partner**, not just a Tool.



We've moved from **Symbolic Logic** to self-learning **Agents and Robots**.



AI will be **everywhere** — in Education, Research, Industry, Healthcare and Daily Life.



**Agentic AI, LBMs, VLA models and DRL** power the next generation of intelligent systems.



The real challenge is ensuring AI grows **with us, not against us.**



## The future of education is Human-AI-Robot Collaboration

*Together we learn, create and solve real-world problems.*



Human-Centered and Ethical



Safe, Responsible and Transparent



Inclusive and Equitable



Curiosity, Creativity and Critical Thinking



Empowerment for All Learners



Let's embrace AI, Agentic AI and Robotics as allies in education.

The goal is not to replace humans — but to **amplify human potential.**



**LIACC**



**U.PORTO**  
**FEUP** FACULDADE DE ENGENHARIA  
UNIVERSIDADE DO PORTO

# From Tools to Teammates: Agentic AI and the Future of Human-AI Collaboration in Education

**Luís Paulo Reis**

[lpreis@fe.up.pt](mailto:lpreis@fe.up.pt)

Associate Professor at FEUP - Faculty of Engineering of the University of Porto  
Director of LIACC – Artificial Intelligence and Computer Science Laboratory, Univ. Porto  
Member of Coordinating Commission of LASI – Intelligent Systems Associate Laboratory  
President of the GA of APPIA – Portuguese Association for Artificial Intelligence