IBM Technology Atlas

AI roadmap

Large-scale self-supervised neural networks, which are known as foundation models, multiply the productivity and the multimodal capabilities of AI. More general forms of AI emerge to support reasoning and commonsense knowledge.

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✅ Realized
🕛 In progress

	2024	2025	2026	2028	2030	2030+
AI journey	✅ *Build multimodal, modular transformers for new enterprise applications.*	🕛 *Alter the scaling of generative AI with neural architectures beyond transformers.*	*Bring robust, strategic reasoning and commonsense knowledge to enterprise AI.*	*Develop broadly intelligent agents that learn autonomously.*	*Build empathic and intrinsically responsible AI agents.*	*Build adaptable and generalist AI for effective human-machine collaboration.*
Strategy overview	✅ We will deploy enterprise AI assistants and applications using advanced transformers and developer-friendly frameworks to facilitate processing richer contextual information and enhanced control and monitoring of generative AI.	We will use a diverse selection of neural architectures beyond, and including, transformers that are co-optimized with purpose-built AI accelerators to fundamentally alter the scaling of generative AI.	Our AI systems will support faster learning and will have the ability to provide explanations through better introspection, retrospection, and different forms of reasoning.	We will build autonomous AI that can reliably and efficiently learn from its environment and respond to previously unseen situations through broad generalizations. These AI systems will start exhibiting aspects of cognitive intelligence.	Our AI agents will start to understand and adapt to human personality at both the individual and collective levels, thus enabling more natural and effective interactions. The systems empowered by these AI agents will exhibit the emergence of emotional intelligence.	Our AI models will be composed of modules with different cognitive abilities (e.g., perception, memory, emotion, reasoning, and action), enabling them to exhibit behavioral norms for social interactions and mutual theory of mind.
Why this matters to our clients and the world	🕛 LLM applications will broaden their scope by integrating more easily with the core enterprise systems. ✅ AI agents and applications will tremendously boost enterprise productivity.	The use of case-driven, end-to-end optimizations, from transistors to neurons, will make a vast range of trade-offs available for energy consumption, cost, and deployment form factors of AI, unlocking its potential at an unprecedented scale.	AI systems capable of fact-checking and reflective thinking will be faster and more accurate learners and planners. They will earn trust in real-world situations via demonstration of cognitive capabilities.	AI will be capable of continually and efficiently learning from multimodal input about how the world works. Those systems will learn to operate effectively even amid uncertainty and develop problem-solving skills.	AI will have the foundations of moral and ethical values and will hence respect social responsibility and self-governance. These AI systems will provide decision support to solve everyday tasks and pressing challenges at global scale.	By being able to predict, act, plan, and adapt to new situations and environments, these unified neural architectures will enable a broad variety of use cases requiring effective human-machine collaboration.
The technology or innovations that will make this possible	✅ Transformer architectures will become modular and multimodal. ✅ We will develop efficient inference techniques to enable cost-effective processing of large context windows. 🕛 We will develop LLM-oriented orchestration and compositional frameworks along with modules for AI alignment, trust guardrails, and generative-AI–specific monitoring and risk assessment.	We will develop novel neural building blocks along with novel reinforcement learning mechanisms to create fundamentally more capable and efficient AI models. We will develop a generative computing runtime to manage lower-level interactions with the model to unleash new capabilities in AI applications without the prompt engineering friction.	We will integrate advances in reasoning-focused architectures with learning modules. We will combine and control slow-learning systems with world models that rely on fast-learning systems such as episodic memory modules. We will advance planning techniques to enable the evolution of AI systems towards their end goals.	We will build agents augmented with multiple memory systems and multiple neural mechanisms that will interact autonomously with each other. We will develop hybrid neural architectures that will rationalize over constantly evolving information about the world. They will learn to refine their multi-scale world model and develop generalizable skills for complex problem-solving.	We will develop novel neural circuits for empathic accuracy and use them together with learning and reasoning modules for effective memory encoding and retrieval. Our AI systems will use deep, active inference mechanisms to efficiently integrate cognitive and empathic neural circuits toward interoception, self-control, and social awareness.	We will develop memory encodings of different sensory perceptions (e.g., visual, olfactory) that will make AI weigh rewards and threats, safely interact with the world, and find optimal ways to achieve goals. We will build AI hardware that will natively support heterogeneity in neurons and neural connections to provide a level of energy efficiency similar to biological intelligence.
How these advancements will be delivered to IBM clients and partners	✅ watsonx will introduce advanced modular LLMs along with developer-friendly application builders and governance features to accelerate development and deployment of AI applications. ✅ watsonx assistants will seamlessly integrate code and language to provide out-of-the-box productivity tools.	watsonx assistants will incorporate multiple AI agents targeted for different tasks and corresponding data modalities. watsonx will support a variety of cost-effective accelerators in its deployments.	watsonx will display cognitive characteristics, broadening its deployment to scenarios that require high trust in systems.	watsonx will support autonomous and broadly intelligent agents with appropriate trust guardrails.	watsonx will be empowered by both cognitive and emotional intelligence. We will equip it with motivational awareness and governance mechanisms while it provides critical decision support at different levels of social complexity.	watsonx will support effective human-machine and machine-machine collaboration.