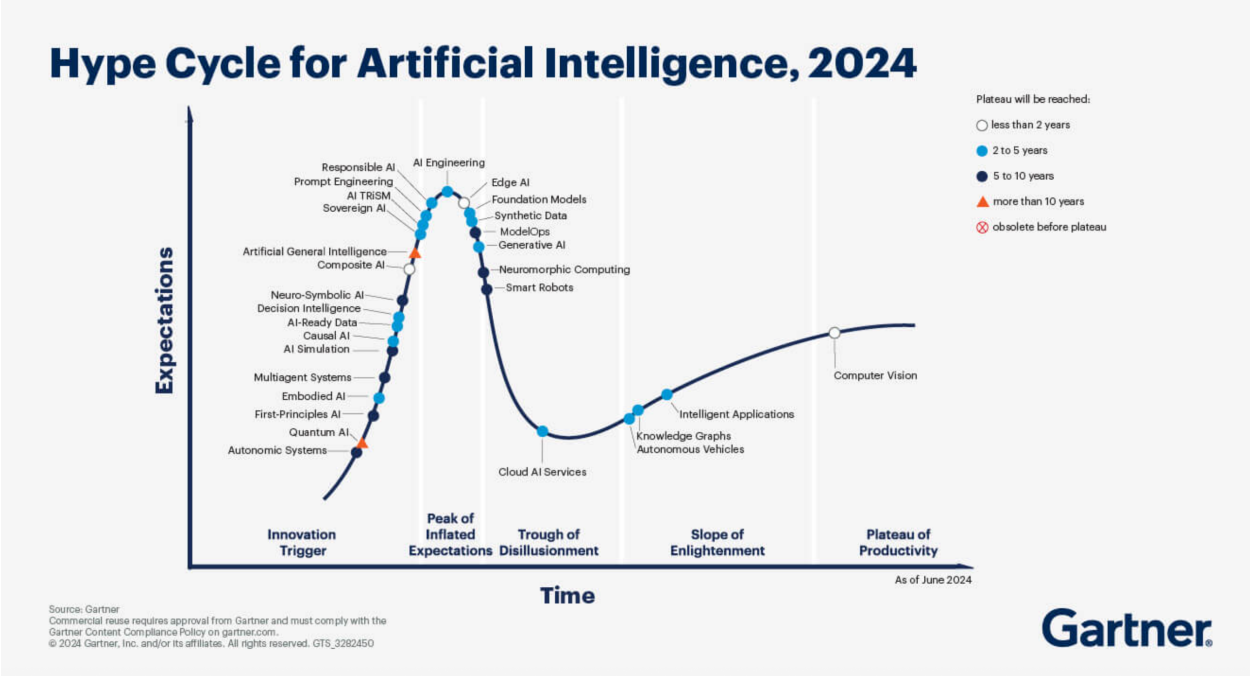
Gartner's 2024 AI Hype Cycle: Key AI Types and Trends

The **2024 Gartner Hype Cycle for Artificial Intelligence** highlights a broad range of AI technologies beyond just generative AI. Gartner's analysis indicates that while **generative AI (GenAI)** reached a fever pitch of expectations in 2023, it is now beginning to descend from the peak of hype. By late 2024, business value is increasingly coming from other AI innovations (often used alongside GenAI) that have more proven implementation processes (New Gartner® Hype Cycle for AI research has been published - Pasqal). In this report, we break down each AI technology on the 2024 Hype Cycle – explaining its meaning in Gartner's terms, real-world use cases, and Gartner's assessment of its maturity, impact, and placement on the Hype Cycle. We also compare their positions to prior years to illustrate evolving trends.



Summary of AI Technologies, Hype Cycle Stages, and Adoption Timelines

The tabl below (Table1) summarizes all the AI types on Gartner's 2024 AI Hype Cycle, their current stage on the cycle, and Gartner's expected time to reach the "Plateau of Productivity" (mainstream adoption).

Technologies in the **Innovation Trigger** stage are in their infancy – typically concepts or early prototypes that garner attention after initial breakthroughs or media hype. They are often experimental with few real-world implementations yet. Many of the 2024 Hype Cycle's entries fall in this category, reflecting the rapid influx of new ideas in AI. These include techniques to make AI more autonomous, more data-efficient, or more integrated with physical systems. Gartner notes that organizations should monitor these nascent innovations and even run pilots, but expectations must be managed as widespread adoption is years away.

Table 1: AI Technology

AI Technology	Hype Cycle Stage (2024)	Time to Mainstream Adoption
Autonomic Systems	Innovation Trigger	5–10 years
Quantum AI	Innovation Trigger	> 10 years
First-Principles AI (FPAI)	Innovation Trigger	5–10 years
Embodied AI	Innovation Trigger	2–5 years
Multiagent Systems	Innovation Trigger	5–10 years
AI Simulation	Innovation Trigger	2–5 years
Causal AI	Innovation Trigger	5–10 years
AI-Ready Data	Innovation Trigger	< 2 years
Decision Intelligence	Innovation Trigger	2–5 years
Neuro-Symbolic AI	Innovation Trigger	5–10 years
Composite AI	Innovation Trigger	< 2 years
Artificial General Intelligence (AGI)	Innovation Trigger	> 10 years
Sovereign AI	Innovation Trigger / Peak	5–10 years
AI TRiSM (Trust, Risk & Security Management)	Peak of Inflated Expectations	2–5 years
Prompt Engineering	Peak of Inflated Expectations	2–5 years
Responsible AI	Peak of Inflated Expectations	2–5 years
AI Engineering	Peak of Inflated Expectations	2–5 years
Edge AI	Trough of Disillusionment	2–5 years
Foundation Models	Trough of Disillusionment	2–5 years
Synthetic Data	Trough of Disillusionment	2–5 years
ModelOps (Model Operationalization)	Trough of Disillusionment	2–5 years
Generative AI (GenAI)	Trough of Disillusionment	2–5 years
Neuromorphic Computing	Trough of Disillusionment	5–10 years
Smart Robots	Trough of Disillusionment	5–10 years
Cloud AI Services	Trough of Disillusionment	2–5 years
Intelligent Applications	Slope of Enlightenment	2–5 years
Knowledge Graphs	Slope of Enlightenment	2–5 years
Autonomous Vehicles	Slope of Enlightenment	5–10 years
Computer Vision	Plateau of Productivity	< 2 years (achieving now)

***Note**:* "< 2 years" indicates the technology is on the cusp of mainstream adoption or already widely adopted; "> 10 years" indicates it remains largely experimental with a long road ahead. Below, we delve into each of these AI innovations in detail.

1. Trigger Stage (Emerging AI Technologies)

Autonomic Systems

Definition: *Autonomic systems* are self-managing physical or software systems that can autonomously make decisions and learn from their experiences within a bounded domain (Definition of Autonomic Systems - IT Glossary | Gartner). According to Gartner, they exhibit three key characteristics: **autonomy** (they act without external intervention), **learning** (they adapt their behavior based on experience and changing conditions), and **agency** (they have an internal sense of goals/purpose to guide their actions) (Definition of Autonomic Systems - IT Glossary | Gartner). This concept is inspired by autonomic computing – aiming for systems that configure, optimize, and heal themselves.

Use Cases: In practice, autonomic systems could manifest as self-driving networks, data center automation tools, or autonomous drones and robots that manage tasks with minimal human input. For example, an autonomic network management system could detect traffic anomalies and reroute or self-patch in real time. In manufacturing, autonomic industrial machines might adjust operations on the fly to optimize efficiency or avoid breakdowns.

Gartner's Outlook: Autonomic systems are at the **innovation trigger** – a very early stage. They are considered highly **transformational** in potential impact (fundamentally changing how systems are managed) but will take time to mature. Gartner introduced autonomic systems in recent years' cycles as a future trend, and they remain **5–10 years from mainstream** adoption. The concept gained traction around 2022, but real deployments are still limited to experimental pilots. Compared to prior years, autonomic systems continue to inch up the innovation curve as AI and edge computing advances make self-management more feasible. However, they have yet to hit the "Peak of Inflated Expectations," indicating that industry hype is still moderate relative to their long-term promise.

Quantum AI

Definition: *Quantum artificial intelligence* refers to AI techniques that leverage quantum computing principles. Gartner defines Quantum AI as *"an embryonic field of research emerging at the intersection of quantum technologies and AI. Quantum AI aims to exploit unique properties of quantum mechanics to develop new and more powerful AI algorithms that deliver better-than-classical performance, potentially resulting in AI algorithms designed to run on quantum systems."* (New Gartner® Hype Cycle for AI research has been published - Pasqal) In simpler terms, it's the application of quantum computing's qubits and superposition/entanglement properties to accelerate AI computations or enable new forms of machine learning.

Use Cases: Because quantum computing is still nascent, current use cases of Quantum AI are mostly experimental. Potential applications include solving combinatorially complex optimization problems much faster than classical computers (e.g. in supply chain logistics or portfolio optimization), enhancing machine learning model training speed, or improving cryptographic AI algorithms. For instance, quantum AI could enable more accurate chemistry simulations for drug discovery by combining AI with quantum physics calculations – tasks intractable for classical AI. Companies like Pasqal (a quantum computing firm) being listed as sample vendors indicate the focus is on R&D; there are not yet enterprise-ready Quantum AI solutions, but the **potential** is to revolutionize AI capabilities in the long run (New Gartner® Hype Cycle for AI research has been published - Pasqal).

Gartner's Outlook: Quantum AI is a **new entrant in 2024**, sitting at the very beginning of the Hype Cycle's innovation trigger. Gartner considers it **"embryonic"** (New Gartner® Hype Cycle for AI research has been published - Pasqal) – highly experimental with virtually no market adoption (<1% of enterprises, according to Gartner commentary). The **time to plateau is > 10 years**, reflecting significant scientific and engineering hurdles before Quantum AI becomes practical. In prior Hype Cycles, quantum computing itself has long been a far-horizon technology; the pairing with AI is now being highlighted as research accelerates. The inclusion of Quantum AI in 2024 (where it wasn't present in earlier years) shows Gartner's recognition that interest is

growing. However, Gartner cautions that expectations should be tempered – this is a long-term play. Over the next decade, we may see breakthroughs (or setbacks) that determine whether Quantum AI can move toward the Peak of Expectations or languish if quantum computing fails to scale as hoped.

First-Principles AI (Physics-Informed AI)

Definition: *First-Principles AI (FPAI)*, also known as physics-informed AI, is an approach that integrates fundamental physics or domain principles directly into AI models. Gartner describes FPAI as incorporating "physical and analog principles, governing laws and domain knowledge into AI models," thereby instilling a more reliable representation of real-world context and physical reality (VERSES Recognized in Gartner's 2024 Hype Cycle for Artificial Intelligence Report) (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™). In effect, First-Principles AI constraints and guides machine learning with scientific laws or first-principle equations. This contrasts with purely data-driven AI that might learn spurious correlations; FPAI aims to ensure AI outputs obey known truths (like conservation laws in physics).

Use Cases: First-Principles AI is especially useful in domains where data is limited or physical fidelity is critical. Examples include engineering and design (AI models that respect material physics), climate and environmental modeling (incorporating climate science equations into learning models), healthcare and biology (embedding physiological knowledge into AI predictions), or robotics (ensuring AI controllers follow dynamics laws). By using FPAI, an aerospace company could train an AI to optimize aircraft designs using fewer simulations, because the AI "knows" aerodynamics equations up front. Gartner notes FPAI leads to *reduced training data needs, faster convergence to optimal solutions, better generalization to unseen scenarios, and greater transparency and trustworthiness* (VERSES Recognized in Gartner's 2024 Hype Cycle for Artificial Intelligence Report) (VERSES Recognized in Gartner's 2024 Hype Cycle for Artificial Intelligence Report).

Gartner's Outlook: First-Principles AI is in the **Innovation Trigger** phase, labeled by Gartner as *"On the rise"* and **transformational** in potential (VERSES Recognized in Gartner's 2024 Hype Cycle for Artificial Intelligence Report). It is a fairly new concept on the Hype Cycle (highlighted in 2023–2024). Gartner analysts Afraz Jaffri and Haritha Khandabattu stress its importance for building more adaptive and efficient AI systems (VERSES Recognized in Gartner's 2024 Hype Cycle for Artificial Intelligence Report). The technology is likely **5–10 years from mainstream adoption**, as it requires industry-specific expertise and cultural change to blend scientific modeling with AI development. Compared to prior years, FPAI was not prominently featured before – its appearance reflects a growing trend of *hybrid AI* techniques (combining machine learning with established scientific models). As organizations in engineering and science fields experiment with physics-informed neural networks, we can expect FPAI to climb toward the Peak of Expectations in coming years if early successes materialize.

Embodied AI

Definition: *Embodied AI* refers to AI that is integrated with a physical or virtual body, enabling it to interact with the environment. The core idea, per Gartner's analysts, is that *intelligence and*

embodiment are inextricably linked – an AI agent's physical form (sensors, actuators, and interfaces) shapes its intelligence, and vice versa (Generative AI is on the decline). In embodied AI, an AI model is developed together with its embodiment (be it a robot, an avatar, or an IoT device), rather than in isolation. This approach trains AI agents within the context of their bodies and environments, much like humans learn through their physical experiences. The goal is robust, **situated intelligence** – AI that can perceive, navigate, and manipulate the world around it, whether that world is the real physical world or a simulated virtual space.

Use Cases: Embodied AI spans a range of applications:

- **Robotics:** Autonomous robots in warehouses, hospitals, or homes that learn to perform tasks (like picking items or assisting the elderly) by interacting with their surroundings.
- **Autonomous Vehicles:** Self-driving cars or drones where the AI's "body" is the vehicle, and intelligence arises from continual sensorimotor feedback.
- **Virtual Avatars and Game AI:** NPCs (non-player characters) in simulations or VR that learn behaviors as though they had a physical presence in the virtual world.
- **Interactive Assistants:** AI agents in the form of avatars or consumer robots (like social robots or smart home devices) that engage with people in a physical context. According to Pieter den Hamer, Gartner VP Analyst, embodied AI agents can either act autonomously or augment humans in dynamic environments, with active perception and adaptive behavior governed by their AI brains and limited by their physical capabilities (Generative AI is on the decline). For example, a disaster-response robot with Embodied AI might adapt its strategy based on terrain feedback, or a virtual customer service avatar might use an "embodied" gesture in a VR store to assist a shopper.

Gartner's Outlook: Gartner counts Embodied AI as a *"transformative"* innovation that is still in early stages (Generative AI is on the decline). On the 2024 Hype Cycle it sits at the **Innovation Trigger**, and Gartner estimates roughly **2–5 years to mainstream** adoption for initial manifestations. This suggests Gartner is optimistic that forms of embodied AI (like smarter robots or immersive AI agents) will see significant real-world use by the later 2020s. Indeed, some components (e.g. warehouse robots, autonomous drones) are already maturing. Compared to prior years, *Embodied AI is newly added in 2024* (Generative AI is on the decline), signaling that the industry now sees this trend accelerating. It builds on earlier concepts like robotics and autonomous things, but ties in advances in AI learning techniques. As generative AI hype cools, attention is turning to embodied intelligence as the next frontier. Gartner's commentary implies that progress in hardware (sensors, processors) plus AI algorithms is making embodied AI agents more viable, pushing the concept up the Hype Cycle. We should expect it to move toward the Peak of Inflated Expectations in the next couple of years as success stories (and hype) around autonomous robots and AI avatars increase.

Multiagent Systems

Definition: A *multiagent system (MAS)* is an AI system composed of multiple intelligent agents that interact and collaborate (or compete) to achieve goals. Gartner defines a multiagent system as consisting of **multiple independent but interactive agents**, each capable of perceiving its environment and taking actions (Definition of Multiagent Systems - IT Glossary | Gartner). These

agents can be software programs, AI models, robots, or other entities, and they work together towards a common objective that no single agent could accomplish alone. The hallmark of MAS is **emergent behavior** – the system's overall performance emerges from interactions of agents, often leading to increased adaptability and robustness beyond an individual AI working in isolation (Definition of Multiagent Systems - IT Glossary | Gartner).

Use Cases: Multiagent systems have broad applications where distributed intelligence is needed:

- **Autonomous vehicle fleets:** Self-driving cars communicating with each other to optimize traffic flow.
- **Robotic swarms:** Drones or robots coordinating as a team for search-and-rescue, surveillance, or assembly tasks (swarm robotics).
- **Distributed AI in finance:** Multiple trading agents interacting in a market simulation, each with different strategies, leading to more stable market behavior.
- **Supply chain optimization:** Software agents representing different supply chain nodes (warehouse, factory, retailer) negotiating and adjusting in real-time to balance supply and demand.
- **Game AI and simulations:** Agents in games or simulations that collaborate or compete, creating complex scenarios (e.g. AI players in strategy games). The key benefit is that a MAS can solve problems that are too complex for a single agent by dividing the task and allowing specialized agents to work in parallel and share knowledge. They also handle uncertainty or dynamic environments well – if one agent fails, others can adapt.

Gartner's Outlook: Multiagent Systems are at the **Innovation Trigger** phase. This concept has been around in academia for a long time, but Gartner's inclusion in recent Hype Cycles suggests growing practical interest (likely due to advancements in reinforcement learning and swarm robotics). They predict a **5–10 year** horizon for mainstream adoption, as building robust MAS in real-world conditions remains challenging. In 2023's cycle, multiagent systems were listed as an emerging technique (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™), and they remain at a similar stage in 2024. The technology is still **nascent** – companies are experimenting (for instance, warehousing logistics might pilot swarms of simple robots), but broad deployment is limited. Compared to prior years, MAS is gradually rising in prominence due to needs in complex AI scenarios (like coordinating fleets of AI-driven devices). It has not yet hit the hype peak, perhaps because it's a behind-the-scenes enabler rather than a flashy headline technology. As industry standards and development frameworks for agent-based systems improve, Gartner expects MAS to progress up the curve, especially to support composite AI strategies.

AI Simulation

Definition: *AI simulation* refers to the combined use of AI techniques and simulation environments to develop and train AI models. In Gartner's terms, AI simulation is *"the joint development of AI agents and the simulated environments in which they can be trained, tested and sometimes deployed."* (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™) Essentially, it involves creating realistic simulated worlds (such as virtual environments, digital twins, or game-like scenarios) where AI systems can learn and be stress-tested safely. This could involve simulated data generation, virtual prototypes, or agent-based simulations.

Use Cases: AI Simulation is particularly useful when real-world data is expensive, risky, or impractical to obtain:

- **Autonomous Vehicles:** Companies use simulated city driving environments to train self-driving car AI before testing on real roads. Millions of virtual miles can be driven to expose the AI to rare scenarios (pedestrian suddenly crossing, unusual traffic patterns).
- **Robotics:** Simulated factories or households allow robot AI to learn navigation and manipulation tasks without risking damage. Once trained in simulation, policies can be transferred to physical robots (with techniques to handle the sim-to-real gap).
- **Healthcare:** Simulation of patient physiology or hospital operations can let an AI experiment with treatment strategies or scheduling optimizations without endangering real patients.
- **Military and Emergency Response:** AI agents can be trained in war-game simulations or disaster response scenarios to coordinate strategies in a risk-free virtual setup.
- **Business Process Optimization:** Digital twins (virtual replicas) of factories, supply chains, or cities enable AIs to test "what-if" scenarios and optimize decisions (e.g., an AI trying various production schedules in a simulated factory to maximize output). By integrating AI into these simulations, organizations create a feedback loop: AI models improve via simulated experiences, and the simulation itself can evolve in fidelity as AI agents act within it. This approach accelerates AI development and helps surface issues early.

Gartner's Outlook: AI Simulation sits at the **Innovation Trigger** stage, and Gartner considers its benefit **high**. The expected time to mainstream is roughly **2–5 years**. In Gartner's 2023 analysis, AI simulation was highlighted as one of the critical technologies fueling generative AI advances, indicating its growing importance (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™). The concept is not entirely new – industries like autonomous driving have embraced simulation for years – but Gartner's emphasis now suggests simulation is becoming a standard practice across AI domains (especially with the rise of digital twins). Compared to earlier years, the tools for AI simulation (e.g., Unreal or Unity for simulation, physics engines, synthetic data generators) have matured, pushing this technique up the hype curve. By 2024, more organizations are aware that robust AI often requires simulated training environments, especially when real-world testing is costly or hazardous. Gartner's positioning implies that while still emerging, AI simulation is relatively close to mainstream adoption – potentially reaching the **Slope of Enlightenment** sooner as success stories accumulate (for example, the rapid progress in autonomous systems thanks to simulation). We can expect AI Simulation to hit the Peak of Expectations as more enterprises tout "digital twin + AI" initiatives in the next couple of years.

Causal AI

Definition: *Causal AI* is an approach that focuses on understanding cause-and-effect relationships rather than just correlations. Gartner defines causal AI as technology that *"identifies and utilizes cause-and-effect relationships to go beyond correlation-based predictive models toward AI systems that can prescribe actions more effectively and act more autonomously."* (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™) In essence, causal AI techniques (such as causal inference algorithms or causal graph modeling) try to discern *why* something

happens (the underlying causal mechanisms) so that AI predictions and decisions are based on true causality, not just patterns in data. This can lead to more reliable and explainable AI outcomes.

Use Cases: Knowing causation is valuable wherever strategic decisions are made:

- **Healthcare:** Causal AI can help identify which treatments actually cause improved patient outcomes versus coincidental correlations. This leads to better treatment recommendations and understanding of side effects.
- **Finance and Economics:** In financial services, causal models might determine that a certain customer behavior (like a drop in credit score) is causing higher default risk, as opposed to being merely correlated. Policymaking can benefit by identifying causal drivers of economic indicators.
- **Manufacturing Quality:** Instead of correlating various sensor readings with equipment failure, causal AI might pinpoint that *a specific pressure change causes a machine failure*, allowing engineers to remedy the root cause.
- **Marketing:** It can measure the true causal impact of an advertising campaign on sales (did the ad *cause* sales to rise, or was it seasonal demand?). This improves budget allocation to what actually works.
- **Recommendation Systems:** Moving from "people who bought X also bought Y" correlations to understanding causal customer journeys ("buying X causes need for Y") could improve recommendations and customer satisfaction. Causal AI often involves constructing causal graphs (DAGs) and using techniques like A/B testing, do-calculus, or causal machine learning to validate interventions. It is closely related to decision intelligence, as decisions should ideally be based on causal reasoning.

Gartner's Outlook: Causal AI is in the **Innovation Trigger** phase on the 2024 Hype Cycle, reflecting that it's an emerging but increasingly talked-about approach. Gartner sees it as a promising way to achieve more autonomous, trustworthy AI by enabling prescriptive analytics (figuring out actions to take, not just predictions) (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™). The **time to plateau** is likely **5–10 years**, because adopting causal methods requires new skills, and many AI systems today still rely on correlation-driven machine learning. In prior years, Gartner began highlighting causal AI (it appeared in the 2022 Hype Cycle for emerging tech), and by 2023–2024 it remains a niche but growing trend. The hype around it is still moderate – it hasn't hit a peak like generative AI, perhaps because it's more technical and less flashy to business executives. However, as enterprises face the limitations of black-box models, interest in causal explainability is rising. We see Gartner emphasizing that causal AI can enhance AI's decision-making **effectiveness and autonomy** (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™). Over time, if success stories emerge (e.g., regulators preferring AI that can show causal reasoning for decisions), causal AI could climb towards the Peak of Expectations. For now, it's one to watch, and companies are advised to experiment with causal modeling techniques in their AI projects to get ahead of the curve.

AI-Ready Data

Definition: *AI-Ready Data* refers to the practices and infrastructure that ensure data is prepared for effective AI usage. In Gartner's terms, this encompasses structuring and organizing data such

that it's **accessible, high-quality, bias-free, and context-rich** for AI models (Hype Cycle for Artificial Intelligence 2024 | Gartner). While not a single technology, "AI-ready data" highlights the importance of data foundations: it includes data integration, cleansing, labeling, feature engineering, and governance steps that make raw data **ready for AI pipelines**. A concise description is *"structuring data for seamless AI integration."* (Gartner Hype Cycle for Artificial Intelligence: A Comprehensive Guide - AI Coach)

Use Cases: AI-ready data is a precursor to any successful AI implementation. Examples:

- **Enterprise Data Prep:** Building an **AI data lake** or feature store that consolidates customer data from CRM, transaction systems, and social media, all cleaned and normalized, so that machine learning models can be developed quickly for customer analytics.
- **Data Labeling for Computer Vision:** Creating large volumes of annotated images (with labels or bounding boxes) to be used in training a vision model. This may involve using synthetic data generation or human annotators – processes to ensure the data is machine-learning ready.
- **Real-Time Data Pipelines:** Setting up streams from IoT sensors that filter and format data (handling outliers or missing values automatically) before feeding into an AI-driven predictive maintenance system.
- **Bias and Quality Checks:** Applying tools to detect and correct bias in datasets (e.g., ensuring demographic balance) before using the data to train, say, an AI hiring recommendation system – making the data "responsible AI-ready." In short, AI-ready data initiatives aim to remove the heavy lifting typically needed before an AI model can be trained or deployed. Gartner has noted that poor data quality and availability is a major hurdle for AI projects (Hype Cycle for Artificial Intelligence 2024 | Gartner), hence making data "AI-ready" is critical.

Gartner's Outlook: "AI-Ready Data" is identified on the Hype Cycle at the **Innovation Trigger** stage (sometimes also phrased as "AI-ready data infrastructure" in Gartner discussions). Although preparing data is a longstanding IT task, framing it as **AI-ready** is relatively new, emphasizing that traditional data warehousing might not suffice for AI needs (unstructured data, real-time feeds, etc.). Gartner positions it as a **high-benefit, near-term (<< 2 years)** area of focus (Gartner Hype Cycle for Artificial Intelligence: A Comprehensive Guide - AI Coach). This suggests that many organizations can achieve this with current technology and should do so to enable AI initiatives. Indeed, Gartner analyst Svetlana Sicular highlighted excitement that AI-Ready Data is on the Hype Cycle as an innovation trigger (#ai #genai #responsibleai | Svetlana Sicular | 177 comments), implying it's a foundational step being newly prioritized. Unlike many other items, AI-ready data isn't hyped as a cool futuristic tech – it's more of a strategic imperative. Over the past couple of years, Gartner has increasingly stressed data quality and governance (e.g., "data-centric AI" was on the 2023 cycle (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™)). In 2024, the rebranding to AI-Ready Data signals urgency in getting data houses in order. We expect this to quickly move through the Hype Cycle: since the benefit is clear and tangible, organizations are already investing heavily. Gartner likely sees **mainstream adoption in less than 2 years**, with AI-ready data practices becoming standard in most data strategies (essentially reaching the Plateau of Productivity sooner than many pure-tech innovations).

Decision Intelligence

Definition: *Decision Intelligence (DI)* is a discipline that combines data science, AI, and managerial science to improve decision-making. Gartner defines Decision Intelligence as *"a practical domain framing a wide range of decision-making techniques, bringing multiple traditional and advanced disciplines together to design, model, align, execute, monitor and tune decision models and processes."* (What is Decision Intelligence and How To Adopt it In Your Organization) In essence, DI is about treating decisions as reusable, engineered artifacts – using tools like AI, automation, and human expertise to augment how decisions are made and implemented in an organization. It goes beyond Business Intelligence by not just analyzing what happened, but helping figure out **what actions to take (prescriptive analytics)** and continuously learning from outcomes to refine future decisions.

Use Cases: Decision intelligence can be applied wherever complex decisions are made:

- **Business Strategy:** Organizations use DI platforms to simulate outcomes of strategic choices (like entering a new market), combining AI predictions with human knowledge to pick the best course.
- **Operations Optimization:** In supply chain management, DI systems might take in real-time data (orders, inventory, logistics) and recommend decisions (reallocate stock, choose shipping routes) to optimize efficiency and cost.
- **Financial Services:** Banks can implement DI for credit decisions – an AI model predicts risk, a rules engine ensures compliance, and a decision workflow automates approval or flags a human for complex cases. The system learns from results (defaults or repayments) to improve future credit decisions.
- **Healthcare:** A hospital might use decision intelligence to support clinical decisions, combining patient data and AI diagnostics with protocols. For example, recommending the next step in a treatment plan and monitoring patient outcomes to refine the decision model.
- **Marketing:** DI can automate tactical decisions like adjusting ad spend across channels based on performance data and predictive models, continuously reallocating budget for best ROI. In all cases, the emphasis is on creating a **decision model** – an orchestrated combination of insights, predictive models, rules, and human judgment – rather than leaving decisions purely to gut instinct or siloed analytics.

Gartner's Outlook: Decision Intelligence is at the **Innovation Trigger** stage but is considered one of the nearer-term high-impact innovations. Gartner had listed DI as a top strategic trend for 2022, and it appears on the AI Hype Cycle as well, indicating continued relevance. The expected timeline to mainstream is roughly **2–5 years**. Gartner's inclusion of DI reflects the need to close the gap between analytics insights and business outcomes – a theme they've stressed as many firms struggle to turn data into actual decisions (What is Decision Intelligence and How To Adopt it In Your Organization) (What is Decision Intelligence and How To Adopt it In Your Organization). Compared to prior years, DI has steadily risen in attention: around 2021–2022 it was introduced as a concept, and by 2024 many vendors and enterprises are piloting it. In 2023, Gartner noted DI (along with generative AI) as offering significant competitive advantage within 2–5 years (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™). So we see that in 2024, DI remains on that trajectory. It hasn't reached the Peak of Inflated Expectations yet – likely because

it's somewhat abstract and requires process change, which garners less hype than, say, a flashy technology like GenAI. But as organizations report success using DI frameworks (e.g., X company improved decision turnaround by 30% using a DI platform), we can expect it to climb. Gartner's advice is to start developing decision models for key processes now, to be ahead of the curve when DI becomes mainstream around the mid-2020s.

Neuro-Symbolic AI

Definition: *Neuro-Symbolic AI* is an approach that merges neural networks (data-driven learning) with symbolic AI (rule-based reasoning). Gartner calls it a form of **composite AI** that "combines machine learning methods and symbolic systems to create more robust and trustworthy AI models" (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™). In neuro-symbolic AI, the strengths of both paradigms are used: neural nets excel at pattern recognition from raw data (e.g. vision, speech) while symbolic AI provides a reasoning framework (logic, knowledge graphs, ontologies) that can enforce constraints and lend interpretability. By fusing them, neuro-symbolic systems aim to handle a wider variety of problems and be able to **explain their decisions** using symbolic reasoning grounded in neural perception.

Use Cases: Neuro-symbolic AI is useful when problems require both perception and high-level reasoning:

- **Financial Fraud Detection:** A neural network could detect unusual transaction patterns, and a symbolic rule engine (with expert rules or learned logical constraints) can reason about those patterns (e.g., "if transaction occurs in a new country right after a large withdrawal, flag it"). The combined system catches fraud better and explains why a transaction was flagged by citing the rule.
- **Interactive AI Assistants:** For a virtual assistant, a neural component might interpret voice commands, while a symbolic component manages dialogue logic and factual knowledge retrieval. The assistant can understand natural language (neural) but also maintain context and ensure logically consistent responses (symbolic).
- **Autonomous Vehicles:** Neural nets process sensor data (seeing and classifying objects), and a symbolic planner ensures the vehicle follows traffic rules and navigational constraints. This could improve safety by not relying purely on black-box nets.
- **Healthcare Diagnosis:** Neural models analyze images or patient data to suggest possibilities, and a symbolic medical knowledge base cross-checks symptoms and known causality to provide an explanation ("the combination of symptom A and test result B strongly indicates condition X because of known clinical rule Y").
- **Robotics:** Neural vision helps a robot "see" its environment, while a symbolic system handles task planning (using knowledge of physics or task sequences). The robot can adapt to environment variability but still follow high-level plans. The neuro-symbolic approach helps address AI's **trust and transparency issues** by embedding knowledge and logic that humans can follow. It also can reduce data needs – some knowledge is given rather than learned from massive data.

Gartner's Outlook: Neuro-Symbolic AI remains in the **Innovation Trigger** stage. Gartner portrays it as an extension of composite AI, providing a "reasoning infrastructure" for solving

more complex business problems effectively (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™). The hype around neuro-symbolic AI has been moderate – it's often discussed in academic and AI expert circles as a path forward from purely neural approaches. On Gartner's 2024 cycle, it's likely **5–10 years from mainstream adoption**, meaning it's still mostly in R&D and early pilot territory. A few years ago, neuro-symbolic AI started appearing in Gartner's discussions as a way to achieve *"AI that reasons"* (for example, around 2020–2021 as deep learning's limits became evident). In 2024, it's still ascending slowly – we haven't seen a big breakout success to catapult it to peak hype yet. However, with increasing focus on AI trustworthiness, Gartner continues to emphasize neuro-symbolic as a solution for more **robust and interpretable AI** (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™). If companies like IBM (which has championed neuro-symbolic methods) or others demonstrate clear ROI – say, a major reduction in errors by adding symbolic reasoning – then interest could spike. For now, Gartner advises keeping an eye on this space as part of a composite AI strategy, but it's not a mainstream practice in most enterprises yet.

Composite AI

Definition: *Composite AI* refers to the combination of different AI techniques to achieve better results than any single technique alone. Gartner's definition is *"the combined application (or fusion) of different AI techniques to improve the efficiency of learning and to broaden the level of knowledge representations,"* ultimately enabling solving a wider range of business problems more effectively (Definition of Composite AI - IT Glossary | Gartner). In other words, instead of using just one type of AI (say, just a neural network), composite AI might blend multiple approaches – e.g., machine learning + rule-based systems + optimization algorithms, or vision AI + language AI – within one solution. The idea is to leverage the strengths of each method and cover each other's weaknesses.

Use Cases: Composite AI underpins many advanced AI solutions:

- **Customer Service AI:** An AI service bot might use natural language processing (ML on text) to understand a query, a knowledge graph (symbolic) to fetch relevant info, and then a reinforcement learning-based dialog manager to decide the best answer. This fusion provides better service than any single technique.
- **Supply Chain Optimization:** A solution could combine predictive analytics (to forecast demand with ML), an optimization engine (linear programming) to adjust inventory, and agent-based simulations to model how different decisions ripple through the supply network. Together, they produce a robust plan.
- **Healthcare:** A diagnostic system might integrate image recognition AI for scans, NLP for reading clinical notes, and Bayesian networks (probabilistic reasoning) to combine symptoms and suggest diagnoses with probabilities.
- **Fraud Detection:** Composite AI might involve anomaly detection models, graph analytics (link analysis between entities), and expert rules. Each catches different fraud patterns, and together they greatly increase detection rates.
- **Finance Risk Modeling:** Use ML to cluster similar risk profiles, a knowledge-based system for regulatory rules, and simulation models to test scenarios – delivering a comprehensive risk evaluation tool. Composite AI is essentially the *toolkit approach* –

rather than one-size-fits-all, it crafts solutions using multiple AI building blocks. This often leads to more **accurate, adaptable, and context-aware** outcomes (Hype Cycle for Artificial Intelligence 2024 | Gartner).

Gartner's Outlook: Gartner heralds Composite AI as "the next phase in AI evolution" (Hype Cycle for Artificial Intelligence 2024 | Gartner). On the 2024 Hype Cycle, composite AI appears to be still in the **Innovation Trigger** (early in hype), yet interestingly Gartner's **Priority Matrix** labels composite AI as **transformational within < 2 years to mainstream adoption** (Gartner Hype Cycle for Artificial Intelligence: A Comprehensive Guide - AI Coach). This indicates that composite AI is *already being applied* in many solutions (perhaps without always being called that), and Gartner expects it to become a standard design pattern very soon. Indeed, Gartner suggests that by within two years, composite AI will be the *"standard method for developing AI systems"* widely in use (Generative AI is on the decline). This may seem contradictory to its leftmost position on the hype chart, but it might reflect that it isn't a buzzword with inflated hype – it's more a behind-the-scenes shift in AI best practices. Compared to prior years, Gartner first talked about composite AI around 2019–2020. By 2024, it is heavily emphasizing it as a way for organizations to maximize AI impact (Hype Cycle for Artificial Intelligence 2024 | Gartner). Gartner encourages AI leaders to *"look to composite AI techniques that combine approaches from innovations at all stages of the Hype Cycle"* rather than focusing only on GenAI (Explore Beyond GenAI on the 2024 Hype Cycle for AI). This underscores composite AI's importance now that there are so many AI options available. In summary, composite AI is rising in practical adoption rapidly (hence near-term plateau), even if it never experiences a dramatic "hype peak" itself. It's more like a silent revolution in AI architecture. In coming years, expect most successful AI solutions highlighted by Gartner to explicitly mention multi-technique approaches.

Artificial General Intelligence (AGI)

Definition: *Artificial General Intelligence (AGI)* is the hypothetical future AI that possesses intelligence comparable to a human's, in a broad, generalized sense. Gartner defines AGI as *"the (currently hypothetical) intelligence of a machine that can accomplish any intellectual task that a human can perform."* (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™) Unlike today's AI, which is narrow (good at specific tasks like translation or image recognition but not everything), AGI would be capable of understanding, learning, and applying knowledge in different contexts, reasoning across domains, and perhaps exhibiting consciousness or self-awareness. It's essentially the kind of AI seen in science fiction – a true thinking machine on par with human cognitive abilities.

Use Cases: Since AGI doesn't exist yet, "use cases" are speculative. If achieved, AGI could theoretically do *any* cognitive job: solve novel scientific problems, act as a human-like assistant or worker, perform creative tasks, understand emotions and social nuances, etc. Some envision AGI could lead to superhuman problem-solving – finding cures for diseases, addressing climate change through its vast intellect, or autonomously running organizations. However, with such power come huge ethical and safety implications (the classic AI existential risk discussions revolve around AGI).

In practical near-term terms, current AI research inching toward AGI includes:

- Large language models that attempt more general understanding (though they are still narrow in truth).
- Cognitive architectures combining multiple skills (vision + language + robotics) aiming for more generality.
- Research in meta-learning (AI that learns how to learn new tasks) and reasoning.

Gartner's Outlook: AGI firmly sits at the **Innovation Trigger** – or even "beyond the horizon" – on the Hype Cycle. It's categorized by Gartner as an *"emerging technology (>10 years)"* from mainstream realization (Gartner Hype Cycle for Artificial Intelligence: A Comprehensive Guide - AI Coach). AGI is the quintessential example of a technology with enormous transformational potential, but largely theoretical today. Gartner and most experts treat AGI as more than a decade away, if it's achievable at all. In prior years, AGI has usually appeared on hype cycles as a distant vision (for instance, it was on the 2023 AI Hype Cycle near the very beginning) and that remains the case in 2024.

It's worth noting that the explosive progress of narrow AI (especially GenAI like GPT-4) has sparked renewed public hype about AGI – some even speculated we saw "sparks of AGI" in recent models. This may have nudged AGI slightly upward in Gartner's discussions, but Gartner remains cautious: AGI is not just around the corner. It has not entered the Peak of Inflated Expectations on the cycle; instead, it lingers as a long-term aspiration. Gartner's key message likely is that while companies might hear "AGI" in the media, they should not plan for or expect human-level AI in their strategy roadmaps for the foreseeable future. It's a moonshot that, if ever achieved, would radically change business and society – but for now, focus on nearer-term AI innovations.

Sovereign AI

Definition: *Sovereign AI* refers to AI systems that are developed, deployed, and controlled in a way that preserves the sovereignty – typically national or regional autonomy – over data and AI capabilities. It encompasses efforts to ensure AI follows local laws and values, and that a nation (or organization) isn't overly dependent on external AI providers. In one description, Sovereign AI means **AI built and operated within a specific region or entity to ensure data privacy, compliance, and autonomy from foreign control** (Understanding the AI Hype Cycle: Navigating Technology and ...). This concept has risen especially in regions like the EU, which are concerned about data leaving their borders and about having independent AI infrastructure. It also can imply open, transparent AI models that users fully control (as opposed to black-box models from big tech companies).

Use Cases: Sovereign AI is a broad principle that can manifest in:

- **National AI Clouds:** A country building its own cloud and AI platforms so data of its citizens never leaves and algorithms align with its regulations (e.g., a European alternative to U.S.-based AI services, adhering to GDPR and European values).
- **Industry-Specific AI with Compliance:** For example, a bank developing an AI in-house for credit scoring rather than using a third-party model, to ensure full control and compliance with local financial regulations – this could be termed "sovereign" to the enterprise.

- **Open Source AI models:** Organizations opting for open source foundation models that they can host themselves (like EleutherAI or local LLMs) rather than relying on an API from OpenAI. This gives them "sovereignty" over the model's behavior and data.
- **Edge and On-Premise AI:** Deploying AI on local infrastructure (factories, government data centers) instead of sending data to external cloud AI providers for processing – often for privacy and control reasons.
- **Cultural/Language AI:** Countries like France or Germany might push for AI that is deeply fluent in their language and customs, possibly via local initiatives, to ensure their language is well-served (instead of relying on Silicon Valley's English-centric models). In summary, Sovereign AI is driven by concerns of **trust, privacy, security, and self-determination** in the AI domain – making sure AI does not become a centralized power held by a few big players or foreign states.

Gartner's Outlook: Sovereign AI appears around the **Peak of Inflated Expectations** in 2024 – it's one of the topics generating a lot of buzz due to geopolitical and regulatory drivers. This is a **new addition in 2024** (Navigating the AI Hype Cycle: Insights for 2024) (Generative AI is on the decline), reflecting current events: for instance, the EU's AI Act and discussions of "digital sovereignty" have put this on the map. Gartner likely sees Sovereign AI as **5–10 years from mainstream adoption**, as it involves building substantial new infrastructure and frameworks. Right now, it's at *peak hype* because governments and large enterprises are talking up the idea (the notion of "AI sovereignty" is hot in Europe and elsewhere). Last year this wasn't explicitly on the AI Hype Cycle, indicating a fast rise in attention in 2024.

However, being at the Peak suggests that expectations might be overshooting practical reality in the short term. For example, not every country can realistically have its own version of ChatGPT at comparable quality, and efforts to create sovereign AI clouds are complex and expensive. We might see a bit of disillusionment if some national AI projects struggle. But long-term, Gartner recognizes the *importance* – especially for regulated sectors and governments – of having control over AI. In prior years, related concepts like data sovereignty or "AI governance" were in focus; Sovereign AI packages those concerns with a nationalist/organizational control angle. We should expect that as global regulations tighten and international tensions around technology continue, Sovereign AI will remain a significant trend. It may move into the Trough of Disillusionment if initial attempts (e.g., a country's home-grown AI model) don't meet the hype, but then into the Slope as best practices for achieving AI sovereignty emerge.

AI TRiSM (AI Trust, Risk and Security Management)

Definition: *AI TRiSM* stands for AI Trust, Risk, and Security Management – a term Gartner coined to encompass the tools and processes for governing AI models and minimizing risks. Gartner defines AI TRiSM as ensuring **AI model governance, trustworthiness, fairness, reliability, robustness, efficacy, and data protection** (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™). It is an "umbrella" framework that addresses all aspects needed to make AI safe and ethical. This includes bias mitigation, interpretability, privacy, compliance, and security measures (like detecting model manipulation or data poisoning attacks). Essentially, AI TRiSM is about making AI *responsible and secure by design*, managing the potential risks AI systems pose.

Use Cases: AI TRiSM would be applied wherever organizations deploy AI:

- **Model Monitoring and Validation:** Banks using AI for credit decisions implement AI TRiSM by rigorously testing models for fairness (no discrimination), validating them against regulations, and continuously monitoring outputs for drift or anomalies. If the model starts behaving unexpectedly, TRiSM processes might trigger an investigation or shut it down.
- **Bias Auditing:** A hiring algorithm is put through AI TRiSM checks to ensure it's not skewed against certain groups. Techniques like adversarial testing for bias, diverse representative test sets, and bias-correction algorithms are employed, and results are documented for compliance.
- **Security of AI Models:** For a facial recognition system, AI TRiSM would include adversarial attack testing (can someone spoof it?), watermarking the model or results to detect tampering, and controlling training data access to prevent data poisoning. It's the cybersecurity aspect of AI.
- **Transparency Requirements:** In healthcare AI, where explanations are vital, AI TRiSM measures might enforce use of explainable AI techniques or require a "model facts label" about how the model was trained, to build trust with clinicians and patients.
- **Lifecycle Governance:** A TRiSM platform could track every AI model in an enterprise – who built it, what data was used, what its intended use is – and ensure periodic reviews and re-certifications, similar to how financial models are governed. AI TRiSM often goes hand-in-hand with regulatory compliance (e.g., upcoming EU AI regulations will mandate many of these practices). It is a comprehensive approach to treat AI with the same rigor as other critical systems in terms of risk management.

Gartner's Outlook: AI TRiSM is at the **Peak of Inflated Expectations** in 2024. This indicates that it's a very hot topic – understandably, as the more AI is deployed, the more organizations worry about things like ethics, bias, and security. Gartner introduced AI TRiSM as a concept in around 2022, and by 2023 it was highlighted due to high-profile AI mishaps and concerns. In 2024, it's peaking: many vendors now offer "responsible AI" toolkits, and companies are actively looking to implement governance frameworks. Gartner sees AI TRiSM as **crucial in the 2–5 year horizon**, essentially an immediate necessity as AI adoption grows (Generative AI is on the decline).

At the peak, hype might outpace actual implementation – lots of talk, but not all organizations have figured out how to do it well yet. We may soon see some disillusionment (for instance, companies might buy fairness tools but still struggle to actually eliminate bias, leading to frustration). However, unlike a purely tech hype, AI TRiSM is driven by risk mitigation needs and impending laws, so even if expectations adjust, investment will continue. In comparison to prior years, the emphasis has ramped up: earlier, responsible AI was more conceptual, whereas now Gartner uses the TRiSM acronym to stress an integrated, enterprise-wide approach. It reflects a maturation from just acknowledging "we should do AI ethically" to having concrete methodologies. We can expect AI TRiSM to move into the Slope of Enlightenment as best practices and standards emerge (e.g., ISO standards for AI governance or widely adopted frameworks). Gartner's message is that **embedding trust, risk, and security measures into AI projects is no longer optional** – it's a key trend of this era of AI.

Prompt Engineering

Definition: *Prompt engineering* is the practice of crafting and optimizing the inputs (prompts) given to generative AI models (like large language models or image generators) to elicit the desired output. Gartner defines it as *"the discipline of providing inputs, in the form of text or images, to generative AI models to specify and confine the set of responses the model can produce."* (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™) In simpler terms, because generative AI models respond based on prompts, prompt engineering is how you "program" these models by finding the right phrasing or instructions in your prompt. It may involve techniques like giving examples in the prompt, using specific keywords, or formulating constraints so the model's output is accurate and useful.

Use Cases: Prompt engineering is relevant anywhere generative AI is used:

- **Chatbots and Virtual Assistants:** Developers create carefully worded system prompts or few-shot examples to ensure a chatbot responds helpfully and doesn't go off track. E.g., telling the model "You are an assistant that only provides answers from the company policy document." is prompt engineering to constrain its behavior.
- **Content Generation:** A marketer using GPT-3 to draft copy might find that how they ask (tone, context) greatly impacts the result. They experiment with prompts like "Write a friendly, 100-word product description highlighting eco-friendly features…" versus other wording to get the best version. That experimentation is prompt engineering.
- **Code Generation:** Using Codex or similar models, programmers learn to phrase their comments or queries precisely ("Write a Python function that does X, with Y constraint") to get correct code output, and might include examples of input-output in the prompt.
- **Image Generation (like DALL-E, Stable Diffusion):** Artists discovered that adding certain keywords (styles, lighting, artist names) in the text prompt produces dramatically different art. So, crafting a prompt like "A watercolor painting of a serene landscape, in the style of Claude Monet" vs "a realistic photo" yields different aesthetics. Prompt engineers tweak these terms to refine images.
- **Data Processing with LLMs:** Even for tasks like classification or extraction using an LLM, how the instruction is framed matters (e.g., "List all names mentioned in the text" vs "Extract person entities" might yield different accuracy). So, prompt engineering is needed to get reliable outputs. Prompt engineering is essentially a new **skill set** in working with AI models – understanding how they "think" and steering them with language.

Gartner's Outlook: Prompt engineering reached the **Peak of Inflated Expectations** very quickly. The term exploded in 2022–2023 alongside the rise of generative AI models. Gartner notes it as a discipline that garnered a lot of attention (people were even jokingly adding "Prompt Engineer" to their résumés). On the 2024 Hype Cycle, it's at peak hype, meaning there's a bit of a gold rush mentality that prompt engineering is the key to unlocking GenAI's value. Gartner likely expects **2–5 years to plateau**, because this hype will normalize. There's debate on whether prompt engineering will remain important: as models get better and more aligned, the need for complex prompting might decrease, or be abstracted away by user-friendly interfaces.

However, in the near term, **organizations are investing in training users on prompt best practices**. Gartner's inclusion signals that while not a technology per se, it's an important trend in AI adoption – essentially teaching non-programmers a lightweight way to "program" AI via natural language (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™). Compared to prior years, prompt engineering is entirely new (no one talked about this before generative AI became mainstream). In 2023 it shot up, and by 2024 it's peaking with many tools emerging (prompt marketplaces, prompt optimization software). We might soon see some disillusionment: for example, companies might realize that owning the model or fine-tuning it might be more effective than endlessly crafting prompts, or that prompt engineering alone can't solve all accuracy issues. Nonetheless, Gartner would advise treating prompt engineering as a temporary but necessary competence while GenAI tech evolves. Over time, as generative AI becomes more plug-and-play, prompt engineering may decline in prominence and eventually plateau as a standard, minor aspect of using AI (hence the likely quick path through the cycle). In summary, it's hyped now as a quick-win way to harness GenAI without coding, but its long-term role is yet to be determined.

Responsible AI

Definition: *Responsible AI* is an umbrella term for the principles and practices that ensure AI is developed and used in an ethical, transparent, and accountable manner. Gartner describes Responsible AI as encompassing the **organizational responsibilities and practices to make appropriate, ethical choices when adopting AI**, including ensuring positive and accountable outcomes (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™). It covers fairness (avoiding bias), transparency (explainability), accountability (clear human oversight and ownership of AI decisions), privacy, and overall alignment with human values and laws. Responsible AI isn't a single technology, but rather a framework guiding how to build and deploy AI systems so they are worthy of trust.

Use Cases: Implementing Responsible AI can mean:

- **Ethical Guidelines and Committees:** Companies establishing AI ethics boards or guidelines to vet AI projects (e.g., an HR algorithm must be tested for bias and approved by an ethics review before launch).
- **Bias Auditing Tools:** Using toolkits to detect bias in models (similar to AI TRiSM's bias aspect) and adjusting data or algorithms to correct it. For instance, in a face recognition system, ensuring it works equally well across races and genders.
- **Explainable AI Methods:** Choosing algorithms or adding techniques that can provide explanations. A bank might require that its AI credit decisions provide a rationale ("application denied because income below threshold and high debt ratio"), as a matter of fairness and customer rights.
- **User Consent and Data Privacy:** Making sure AI that uses personal data (like a recommender system) follows privacy laws and that users are informed. Also limiting use of AI in ways that could be intrusive unless proper consent is given.
- **Accountability and Governance:** Clearly assigning who is responsible if an AI system causes harm or an error. E.g., a hospital having a policy that doctors override AI diagnoses and that the AI is just a tool – the doctor remains accountable for final decisions.

- **Inclusive Design:** Involving diverse stakeholders in AI design (avoiding "groupthink" among developers) and including feedback from affected users or communities in improving the AI. Essentially, Responsible AI operationalizes "do no harm" for algorithms and insists on a level of transparency and oversight appropriate to the context.

Gartner's Outlook: Responsible AI has been a major topic for several years now, and on the 2024 Hype Cycle it's at the **Peak of Inflated Expectations**. This indicates that many organizations and leaders are very taken with the idea – possibly due to fear of brand damage from AI missteps, or anticipation of regulations. Gartner considers Responsible AI **transformational in impact within 2–5 years** (Gartner Hype Cycle for Artificial Intelligence: A Comprehensive Guide - AI Coach), meaning in the near future, organizations that effectively implement it will significantly outperform or avoid serious pitfalls. Over the past few cycles, Responsible AI steadily climbed in prominence. In 2022 it was emerging; by 2023 it was highlighted as something companies must focus on. Now it's at peak hype – everyone agrees it's important, but many are unsure how to actually do it comprehensively.

Like AI TRiSM, Responsible AI hype might exceed reality currently – lots of pledges, fewer concrete actions. We may see a reality check as implementing responsible AI can be culturally and technically challenging. But it likely won't ever "crash" in the trough severely because external pressure (regulators, consumers) will keep pushing it forward. Instead, what will happen is that the conversation shifts from high-level principles to specific practices (which is exactly what AI TRiSM attempts to do). Gartner's messaging is that Responsible AI is not optional – it's a **necessary investment to manage reputation and risk (Hype Cycle for Artificial Intelligence 2024 | Gartner)**. In comparing to prior years, the shift is from awareness to action: many companies in 2020–21 were just waking up to it; in 2024, many are actively building responsible AI checkpoints in their ML pipelines. We can expect in a few years Responsible AI will hit the Plateau of Productivity, effectively becoming standard operating procedure (like how "data security" is now a given part of any IT project). Gartner's advice: make Responsible AI part of your AI strategy now, during this hype peak, to avoid falling behind when real enforcement kicks in.

2. Peak of Inflated Expectations Stage (At the Height of Hype)

The **Peak of Inflated Expectations** is where a technology's buzz is at its highest. Many companies rush to announce initiatives, media and vendors tout it as revolutionary, and expectations often exceed what is currently feasible. Gartner notes that not every technology at the peak will fulfill its promise – some will soon plunge into disillusionment. However, those at the peak are critical to watch, as they address pressing needs or have shown enough potential to capture wide attention. In 2024's AI Hype Cycle, several topics related to making AI scalable, secure, and ethically sound have reached this zenith. This reflects the industry's recognition that as AI is deployed at scale (thanks in part to the GenAI wave), issues of trust, governance, and operationalization are front and center. Below, we discuss each peak-stage technology, its business applications, and Gartner's view of its maturity.

*(**Note:** We have already covered some Peak stage items above, such as Sovereign AI, AI TRiSM, Prompt Engineering, and Responsible AI, as they emerged from the Innovation Trigger and have*

now reached peak hype. We will continue with the remaining peak-stage technology below: AI Engineering.)

AI Engineering

Definition: *AI Engineering* refers to the discipline of consistently building and deploying AI in a production environment – it extends the concepts of DevOps/MLOps to the entire AI lifecycle. Gartner calls AI engineering *"foundational for enterprise delivery of AI and GenAI at scale,"* involving approaches like DataOps, ModelOps, and DevOps to create a **structured, repeatable, and scalable pipeline** for AI models (Hype Cycle for Artificial Intelligence 2024 | Gartner). It includes developing the architecture, tools, and processes that allow dozens or hundreds of AI models to be developed, integrated into applications, deployed to production, and maintained reliably.

In simpler terms, if traditional software engineering is to software, AI engineering is to AI models – it's about moving from experiments to robust AI products.

Use Cases: AI Engineering is behind the scenes, but crucial wherever organizations want **AI at scale**:

- **Model Deployment Pipelines:** A large e-commerce firm might have an AI engineering framework where data scientists' models (recommendation engines, customer segmentation models, etc.) are automatically containerized, tested, and deployed into the cloud with monitoring. This reduces the typical handoff friction between data science and IT.
- **Continuous Integration for ML (CI/CD):** AI engineering establishes CI/CD for machine learning – whenever the training data is updated or model code changes, the system retrains the model, runs evaluation tests (accuracy, bias, etc.), and if it passes, promotes the model to production. For example, an insurance company using AI for claims can frequently update its models safely through such pipelines.
- **ModelOps and Governance:** AI engineering often encompasses ModelOps – managing versions of models, rolling back if a new model underperforms, and managing a portfolio of models. A bank might have a ModelOps dashboard to track all their risk models, their validation status, drift metrics, and compliance documents.
- **Scalable Infrastructure:** Setting up feature stores (to reuse engineered features across models), data pipelines, and inference infrastructure (like scalable model serving on Kubernetes or serverless) is part of AI engineering. This ensures that when a marketing campaign prediction model suddenly needs to handle 10x traffic, the system auto-scales without crashes.
- **AI as a Service internally:** Some organizations build internal platforms (sometimes called "ML platforms") – essentially one-click environments where employees can deploy an AI model or request a prediction service without worrying about the underlying details. AI engineering principles guide the creation of these platforms. AI engineering addresses the common issue that many AI projects succeed in the lab but fail to reach or sustain in production. It makes AI repeatable and robust, not just a one-off project.

Gartner's Outlook: AI Engineering is one of the **"two key AI technologies on the move"** in 2024, according to Gartner (Hype Cycle for Artificial Intelligence 2024 | Gartner). It's at or near the **Peak of Inflated Expectations**. This indicates enormous interest – likely because companies have realized that without solid engineering, their AI investments won't truly pay off. Gartner notes that most organizations currently lack the data, analytics, and software engineering foundation to scale AI projects, hence the excitement around AI engineering frameworks to solve this gap (Hype Cycle for Artificial Intelligence 2024 | Gartner).

In terms of timeline, AI engineering is probably in the **2–5 year** adoption range to become mainstream. Many large enterprises are already on this path (some advanced ones perhaps plateauing), but mid-size and smaller organizations are catching up. Compared to prior years, AI engineering as a term started gaining currency around 2020. By 2023, Gartner highlighted it as essential for scaling AI (often referencing it in context of scaling GenAI too), and in 2024 it has risen to the top of the hype cycle. It likely will transition into the Trough of Disillusionment next, as companies find that implementing AI engineering is as much an organizational/cultural challenge as a technical one (for example, data scientists have to adjust to new workflows and collaboration with IT). But given its fundamental importance, it should emerge on the Slope of Enlightenment quickly as best practices solidify. Gartner's advice is that enterprises invest in AI engineering capabilities *now*, as it will ***"make it possible to deploy models into production in a structured, repeatable factory-model framework."** (Hype Cycle for Artificial Intelligence 2024 | Gartner) In other words, treat AI like a product, not a science project – and those who do so will realize the value while others struggle with one-off successes.

3. Trough of Disillusionment Stage (Facing Reality Check)

After the peak hype, technologies often enter the **Trough of Disillusionment** – a phase where inflated expectations give way to frustration. Challenges become apparent: maybe the tech wasn't as easy to implement, or ROI isn't immediate, or limitations/risks surface. In this stage, interest may wane and some projects fail, but it's a crucial learning period. Only the innovations that find their real utility climb out of the trough. In 2024, several AI technologies have slid into this trough as the initial excitement tempered. Many of these were at peak hype a year or two ago. The trough-stage AI trends include those tied closely with the earlier wave of machine learning and even the recent generative AI surge, now encountering the grind of integration, governance, and results delivery. Below, we examine each, including why they've hit difficulties and how Gartner assesses their future trajectory.

Edge AI

Definition: *Edge AI* refers to deploying AI algorithms on edge devices (outside of central data centers or cloud) – such as smartphones, IoT devices, sensors, or network gateways – so that data is processed and decisions are made locally, near the source of data. Gartner defines Edge AI as *"the use of AI techniques embedded in non-IT products, IoT endpoints, gateways, and edge servers"* across consumer, commercial, and industrial applications (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™). Essentially, instead of sending data to the cloud for AI processing, the AI model lives on the device or local node.

Use Cases: Edge AI is valuable when real-time processing, reduced latency, or data privacy is needed:

- **Autonomous Vehicles and Drones:** Self-driving cars use edge AI to recognize objects and make driving decisions in milliseconds, right in the vehicle's onboard computer, rather than relying on connectivity.
- **Manufacturing IoT:** Machines on a factory floor may run AI models locally to detect anomalies (predictive maintenance) or do quality inspection via camera in real time, avoiding the delay of sending data to cloud.
- **Smart Cameras and Retail:** Surveillance cameras or retail store cams use edge AI for analytics like detecting shoplifting, counting foot traffic, or managing inventory (e.g., Amazon Go stores using on-camera AI to track what items are taken).
- **Healthcare Devices:** An ECG monitor with edge AI might detect irregular heart rhythms on the device and alert patients immediately, or a portable ultrasound device might do AI image analysis on the spot.
- **Consumer Apps:** Smartphone AI (like Apple's Neural Engine, Google's Android AI features) performs tasks like face recognition for unlock, AI photo enhancement, or voice assistant wake-word detection on-device for speed and privacy. Edge AI reduces bandwidth usage (since not all raw data need be uploaded) and can work offline or with poor connectivity. It also can alleviate privacy issues by keeping sensitive data (like video feeds) local.

Gartner's Outlook: Edge AI ascended the Hype Cycle a few years ago when IoT and AI convergence was a hot topic. By 2024, it has moved into the **Trough of Disillusionment**. This suggests that while the idea remains powerful, practical challenges have cooled the hype. Deploying AI models on constrained devices is non-trivial – issues like limited compute power, model compression, device management, and heterogeneity complicate it. Gartner observed by 2023 that many new GenAI cloud services stole the limelight from edge AI, possibly causing inflated expectations for edge to drop (Generative AI is on the decline). Additionally, companies may have piloted edge AI and found difficulties in scaling or maintaining those models at the edge (for example, updating 1000s of devices with new model versions securely is hard).

Time to mainstream is likely **2–5 years**. The fundamental drivers (latency, privacy) are still there, so Gartner expects edge AI to climb out as technology matures (e.g., better edge AI chips, improved MLOps for edge). Compared to prior years, edge AI was near the peak maybe around 2020 when 5G and IoT excitement was high. Now in 2024, it's sober assessment time. Gartner's commentary indicates that edge AI innovations "still have momentum, but adoption varies widely and some are misused or overvalued economically" (Generative AI is on the decline). The trough phase will likely involve consolidation – focusing on the most viable edge AI use cases (like automotive and industrial where it clearly makes sense) and less on hypey ones. As the cost of edge compute drops and tools for compressing models (like quantization, distillation) improve, edge AI should enter the Slope of Enlightenment. We can anticipate that by 2025–26, more robust edge AI deployments (possibly managed in conjunction with cloud – a hybrid approach) will yield success stories, vindicating the concept after the initial setbacks.

Foundation Models

Definition: *Foundation Models* are large AI models trained on broad data at scale that can be adapted to many downstream tasks. Gartner defines foundation models as *"large-parameter models trained on a broad gamut of datasets in a self-supervised manner."* (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™) These include models like large language models (GPT-3, GPT-4, BERT, etc.), large image models (e.g., CLIP or diffusion models), and others that serve as a general base which can be fine-tuned or prompted for specific uses. The term gained popularity as these massive models (often with billions of parameters) showed ability to perform tasks they weren't explicitly trained for (few-shot learning), essentially becoming general platforms for AI development.

Use Cases: Foundation models themselves are enablers for multiple applications:

- **Chatbots and Assistants:** Using a language foundation model (like GPT-4) as the base for a customer service chatbot, fine-tuning it on company-specific Q&A.
- **Content Generation:** Models like GPT or PaLM for text, or Stability AI's Stable Diffusion for images, serve as### Foundation Models **Definition:** *Foundation models* are large-scale AI models trained on vast, diverse data that can serve as a base for many downstream tasks. Gartner defines foundation models as **large-parameter models trained on broad datasets in a self-supervised way** (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™). Examples include large language models (like GPT-3/GPT-4, BERT, etc.), large image generation models (e.g. Stable Diffusion), and multimodal models that combine modalities. These models capture general knowledge and patterns from their pretraining, and can then be adapted (via fine-tuning or prompting) to specific applications. The emergence of foundation models marks a shift from task-specific models to versatile AI "platforms" that developers can build upon.

Use Cases: Foundation models underpin many generative AI and analytical applications:

- **Chatbots & Virtual Assistants:** A large language foundation model can be fine-tuned to create a customer service agent or integrated (via prompts) into an enterprise chatbot that answers product questions.
- **Content Generation:** Models like GPT-4 generate text (articles, reports, code) from prompts, and image models like DALL-E or Stable Diffusion generate images from descriptions. Organizations use them for marketing copy, design prototypes, etc.
- **Semantic Search & NLP:** Instead of keyword matching, search systems use foundation models to understand intent and context, delivering more relevant results. In legal or medical fields, fine-tuned language models summarize documents or extract insights.
- **Domain-Specific Adaptation:** A company can take a foundation model and fine-tune it on its proprietary data – for instance, an insurance firm fine-tuning a language model on insurance claims data to analyze claims automatically.
- **AI Services by Cloud Providers:** Many AI services (translation, sentiment analysis, summarization) offered by clouds are powered by foundation models behind the scenes, providing developers ready-made intelligence to tap into. The key benefit is that a single foundation model, once trained, can be reused for many tasks – saving time and data since you don't train from scratch for each new application. However, they are resource-intensive to train and require careful tuning and governance.

Gartner's Outlook: Foundation models rose to prominence with the generative AI wave. On the 2024 Hype Cycle, they have already **passed the peak and entered the Trough of Disillusionment**. The initial hype (especially around 2021–2023 as GPT and others dazzled the world) led to very high expectations. Now companies realize challenges: these models are expensive to train and run, can have unpredictable outputs, and raise concerns about intellectual property and accuracy. Gartner analysts note that such innovations "still have momentum, but adoption varies widely, and they have been subject to exaggerated expectations about their economic value" (Generative AI is on the decline). In other words, many organizations experimented with foundation models expecting instant transformation, but hit obstacles in practical deployment (costs, need for expertise, risk management of model outputs).

Despite the dip in the hype cycle, foundation models are undoubtedly **transformational**, and Gartner places their time to mainstream use at **2–5 years**. We are already seeing rapid adoption via API offerings and open-source variants. Compared to prior years, foundation models were a nascent idea around 2018–2019 (when GPT-2 came out) but weren't on Gartner's radar for businesses. By 2021, they entered discussions (OpenAI's GPT-3 buzz, etc.), and in 2022–2023 they were at the Peak (everyone talking about deploying large models). Now in 2024, realism sets in: not every company will train its own 100B-parameter model; many will leverage third-party models or smaller fine-tuned ones. This recalibration is healthy – it means focus shifts to *how* to operationalize these models responsibly rather than just marveling at them. Gartner's advice likely emphasizes leveraging foundation models via platforms or fine-tuning rather than reinventing the wheel, and to invest in **AI engineering and TRiSM** for these models (because managing their risk and integrating them is non-trivial). As the technology matures (with more efficient models, better guardrails, and clearer ROI), foundation models should climb into the Slope of Enlightenment. In a few years, using foundation models may become a standard part of AI development (much like using cloud services is standard today), fulfilling their promise after the current tempering of excitement.

Synthetic Data

Definition: *Synthetic data* is data that is artificially generated rather than collected from real-world events. It can be completely fabricated but statistically representative of real data, or transformed from real data in a way that preserves patterns but not actual personal information. Gartner defines synthetic data broadly as *artificially generated data that is not obtained by direct observation of the real world* (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™). This can include synthetic images, videos, sensor data, or tabular data. Techniques to generate it range from simulation engines (e.g., for creating virtual world interactions or physics data) to generative models like GANs (creating photorealistic images or records that mimic real datasets).

Use Cases: Synthetic data serves in scenarios where real data is scarce, sensitive, or expensive:

- **Training AI Models:** Self-driving car AIs train on millions of frames of simulated streets (synthetic sensor data), exposing them to rare but important events (like a child running into the road) which might be hard to capture from real driving data.
- **Privacy Preserving Data Sharing:** A hospital may generate synthetic patient records that reflect patterns in real patient data but with no one-to-one correspondence to actual people.

Researchers or other parties can use this synthetic dataset to develop models without risking patient privacy (useful under regulations like HIPAA/GDPR).

- **Augmenting Imbalanced Data:** If a bank has few fraud examples, they could use a GAN to create synthetic fraudulent transaction data to augment training of a fraud detection model, improving its performance on rare cases.
- **Testing and Simulation:** Software testing can employ synthetic user data or logs to simulate how systems behave under various conditions, or a smart city simulation might generate synthetic mobility data to test traffic control AI.
- **Overcoming Data Collection Constraints:** In manufacturing, if collecting defect samples is hard (because defects are rare), engineers might synthetically generate defect images to train a computer vision model for quality control. Synthetic data aims to maintain the statistical properties or edge-case scenarios needed for AI, without the limitations of real data collection. However, ensuring quality (that synthetic data truly reflects reality relevantly) is a challenge.

Gartner's Outlook: Synthetic data was highly touted a couple of years back as a solution to data bottlenecks and privacy issues. It reached a hype peak around 2021 when companies thought it could magically solve AI's hunger for data. By 2024, Gartner places synthetic data in the **Trough of Disillusionment**. Many found that generating truly useful synthetic data is not trivial – for instance, models trained on synthetic data sometimes don't perform as well on real-world inputs due to slight distribution shifts (the "sim-to-real gap"). Additionally, while regulatory interest is high (because of privacy), adoption varies; some sectors still distrust data that isn't "real". Gartner analysts included synthetic data among those innovations with wide variance in adoption and possibly **misaligned expectations of value** (Generative AI is on the decline).

Time to plateau is likely **2–5 years**. Synthetic data is steadily improving – especially with better generative AI, the fidelity of synthetic data is increasing. And some applications (like certain computer vision tasks or testing scenarios) have shown clear success with synthetic data, so it's climbing out in those niches. Compared to prior years, synthetic data first appeared on Gartner's radar around 2019, peaked by 2021–22 (when Gartner even named it a top trend in Data & Analytics). Now in the trough, the hype has cooled, but investment continues quietly. We can expect that as organizations establish when and how to best use synthetic data (e.g., augment but not replace real data, use it with validation steps), it will move to the Slope of Enlightenment. Gartner's guidance likely suggests using synthetic data strategically – for privacy or to cover edge cases – but warns that it's **not a silver bullet for poor real data**. The value is real but perhaps more limited than the peak hype implied. As tools become more user-friendly (there are startups specializing in synthetic data generation) and success stories accumulate (like improved model performance with combined real + synthetic datasets), confidence will build. So, the concept is sound; it just needed the hype to shake out unrealistic expectations.

ModelOps (Model Operationalization)

Definition: *ModelOps* refers to the end-to-end management and governance of AI and analytics models in production – essentially the "DevOps" for deploying and maintaining machine learning models (and other analytical models). Gartner defines ModelOps as being **primarily focused on the life cycle management of all AI, decision and analytics models** (What's New in Artificial

Intelligence From the 2023 Gartner Hype Cycle™). It covers versioning of models, testing, deployment, monitoring performance, retraining, and retirement. While MLOps often zeroes in on machine learning pipelines, Gartner's use of "ModelOps" is broader to include rule-based AI, optimization models, or any decision models, ensuring an organization can systematically operationalize and scale them.

Use Cases: ModelOps would be implemented wherever an organization has multiple models in production:

- **Financial Services:** A bank might have dozens of predictive models (credit risk scores, fraud detection, marketing propensity models). ModelOps practices ensure each model is tracked, approved by compliance, deployed to the right systems, and its accuracy is monitored over time (with automatic retraining or alerts if performance drifts). It also ensures documentation for regulators and that outdated models get replaced.
- **Retail or E-commerce:** Managing a portfolio of recommendation models, pricing algorithms, demand forecasts, etc. ModelOps would automate deploying new model versions (maybe A/B testing them against the old), roll back if issues, and log the outcomes for analysis. It bridges data science and IT so that model updates are as smooth as code updates.
- **Automated ML Services:** If a company offers AI-driven services to clients (e.g., an AI API), ModelOps tooling is critical to quickly deploy improvements and fixes to the underlying models while minimizing downtime or errors.
- **Enterprise AI Platforms:** Many large firms build internal ML platforms. ModelOps is a key part, providing capabilities like model catalogues, one-click deployment to various environments (cloud, edge), lineage tracking (which data and code produced this model?), and integration into CI/CD pipelines.
- **Decision Intelligence Systems:** In a broader sense, if an organization formalizes decision models (some could be simple rules or simulations), ModelOps manages those alongside ML models – ensuring any kind of decision logic goes through similar rigor and monitoring. The goal is to move from ad-hoc model deployment (which might involve a data scientist handing over a model to an engineer to recode or deploy manually) to a **continuous, reliable process**.

Gartner's Outlook: ModelOps rode in on the coattails of the first wave of enterprise AI adoption. Initially, many companies found they could build models, but not easily deploy or sustain them – prompting interest in MLOps/ModelOps. By 2024, ModelOps sits in the **Trough of Disillusionment**. This suggests that while most agree on its importance, many have struggled to implement it effectively. Perhaps tools were immature or integration with existing IT was harder than expected. Gartner's commentary that these innovations have "varying levels of adoption and have been subject to exaggerated expectations" (Generative AI is on the decline) applies here: some may have expected that installing a ModelOps platform would instantly solve their AI deployment woes, only to find it's also about organizational change and process discipline.

The timeline to mainstream is roughly **2–5 years**. Many organizations are currently in the process of adopting ModelOps; it's a core part of AI engineering which Gartner strongly pushes. Compared to prior years, MLOps/ModelOps was identified as a need around 2019, peaked as a buzzword by

maybe 2021 (when everyone started offering "MLOps" solutions), and now reality has set in on what it takes to truly productionize AI at scale (hence the trough). We can anticipate that as best practices are refined – possibly by those adopting AI engineering holistically – ModelOps will climb into the Slope of Enlightenment. At that point, it will be seen as just a normal part of the IT toolchain for companies doing AI (just like DevOps is now standard for software). Gartner's advice is likely that enterprises should invest in ModelOps capabilities now, but align expectations: it's not just a tool, it's a cultural shift. Early disappointments (e.g., the tool didn't integrate with all types of models, or data scientists resisted the new process) will give way as the technology matures and people adapt. Ultimately, ModelOps is a backbone for scalable AI, so Gartner sees it as essential despite the current dip in enthusiasm.

Generative AI (GenAI)

Definition: *Generative AI* refers to AI techniques (often using deep learning models like GANs, VAEs, or Transformers) that create new content – text, images, audio, code, synthetic data, etc. – resembling human-produced content. The most famous subset is large language models (LLMs) that generate text based on prompts. Gartner gave GenAI enormous attention after tools like ChatGPT showed how AI can produce remarkably human-like output. By definition, generative AI **learns patterns from existing data and generates novel outputs** that maintain the statistical characteristics of the training data (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™). This contrasts with discriminative AI, which only predicts or classifies. In short, GenAI is about creativity and content generation by machines.

Use Cases: Generative AI's uses exploded across industries:

- **Customer Service & Chatbots:** Using LLMs like GPT-4 to create conversational agents that can handle complex inquiries, draft responses, or even do guided transactions in natural language.
- **Marketing & Creative:** Generating product descriptions, ad copy, social media posts, or even slogan ideas. Image generators creating design mockups, marketing materials, or even logos from simple prompts. Video generators (though nascent) to produce promotional clips.
- **Programming:** AI coding assistants (GitHub Copilot, etc.) that generate code snippets or even entire functions given natural language or partial code context. This speeds up software development.
- **Content Summarization & Writing Aids:** Summarizing long reports, drafting emails, translating text, or helping write articles. GenAI can take a bullet list and expand it into a polished paragraph, acting as a writing co-pilot.
- **Design and Engineering:** Generating synthetic data for simulations, creating multiple design alternatives (for instance, generative design in CAD suggests product designs meeting certain criteria), or game design (levels, characters generated by AI).
- **Entertainment:** AI-generated music or art, script drafting, or even deepfake technology (which is generative) for visual effects. Generative AI essentially opened possibilities to automate or assist any task involving content creation or complex expression. It can dramatically increase productivity, but also raises issues of accuracy (it can fabricate facts, aka "hallucinate") and originality/ownership.

Gartner's Outlook: In 2023, Gartner placed Generative AI at the very **Peak of Inflated Expectations** – it was the poster child of AI hype, credited with "increasing productivity for developers and knowledge workers" and driving massive interest (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™). By late 2024, Gartner asserts GenAI has **"passed the Peak of Inflated Expectations"** (Hype Cycle for Artificial Intelligence 2024 | Gartner). It is now descending into the **Trough of Disillusionment**. This doesn't mean GenAI isn't useful – rather, the feverish hype is calming as organizations grapple with real-world limitations. Many companies jumped on GenAI pilots in 2023, but have found challenges: ensuring outputs are correct and safe, high computational costs, difficulties integrating with business workflows, and the need for governance (to avoid misuse, protect IP, etc.). Gartner notes that by end of 2024, a lot of the *real* value is coming from leveraging more mature AI techniques (possibly simpler models) in combination with GenAI, rather than GenAI alone (Hype Cycle for Artificial Intelligence 2024 | Gartner). Also, only about 11% of companies had adopted GenAI at scale by 2023's end (Gartner Hype Cycle for AI: Why Knowledge Graphs Are Essential for Enterprises?), meaning many are still just experimenting.

The expected time to reach the Plateau of Productivity is probably **2–5 years** for GenAI. Gartner still sees it as potentially *transformational* (the innovations around it aren't done – e.g., multimodal models, better alignment to truth, etc. are coming). But in the near term, the frenzy is giving way to practical implementations. Compared to prior years, generative AI was a niche term around 2018–2019 mostly referring to GANs for images. It first appeared on Gartner's Emerging Tech hype cycle in 2020 alongside composite AI (Gartner's 2024 Hype Cycle - GenAI's Journey - NIXsolutions), then shot to the mainstream due to the breakthrough of GPT-3/ChatGPT in 2022. So its journey from Innovation Trigger to Peak was unusually fast and steep. Now we are witnessing the normalization phase. Gartner's stance likely balances the message: *GenAI is still a game-changer*, but it must overcome **ethical and technical challenges** (bias, hallucinations, IP concerns, safety issues) (Hype Cycle for Artificial Intelligence 2024 | Gartner) (Hype Cycle for Artificial Intelligence 2024 | Gartner). Organizations should incorporate GenAI where it genuinely adds value (e.g., content drafting, code suggestion) but **avoid over-reliance on it for critical decisions until trust and veracity can be ensured (Hype Cycle for Artificial Intelligence 2024 | Gartner) (Hype Cycle for Artificial Intelligence 2024 | Gartner)**. As best practices for GenAI usage develop (like human-in-the-loop validation, fine-tuning on reliable data, robust model monitoring), we'll see it climb the Slope of Enlightenment. By perhaps 2025–2026, generative AI could become a normal, powerful tool in the enterprise arsenal – somewhat past the wild hype, more reliable and integrated, delivering on parts of its promise in a measured way.

Neuromorphic Computing

Definition: *Neuromorphic computing* involves hardware and chips designed to mimic the neurological structures and processing of the human brain (neurons and synapses) to run AI models more efficiently and in a brain-like way. Instead of the traditional Von Neumann computer architecture, neuromorphic systems use spiking neural networks and analog signals to process information in parallel and event-driven fashion. Gartner describes it as **mimicking human brain structures for advanced AI architectures** (Gartner Hype Cycle for Artificial Intelligence: A Comprehensive Guide - AI Coach). The goal is to achieve orders-of-magnitude improvements in

power efficiency and possibly enable new types of AI that are closer to biological intelligence in how they function.

Use Cases: Still largely experimental, but potential uses include:

- **Ultra-low-power Edge AI:** Neuromorphic chips (like Intel's Loihi or IBM's TrueNorth prototype) could power battery-operated devices that need AI, such as wearables or remote sensors, allowing complex pattern recognition with minimal energy use.
- **Real-time Pattern Recognition:** Since neuromorphic hardware can process streaming sensor data asynchronously (spike-based processing), it could excel at things like real-time sound localization, smell detection, or other sensory tasks that the human brain handles well but are compute-intensive for normal chips.
- **Robotics:** A robot equipped with neuromorphic processors for vision or motor control might react faster and more efficiently to stimuli, enabling smoother movements or reflexes.
- **Brain-Computer Interfaces:** Because the data from neurons is spiky, neuromorphic processors might interface more naturally with biological signals, potentially useful in prosthetics or brain implants where translating neural spikes to computation is needed.
- **Next-gen AI Research:** Researchers might run large-scale spiking neural networks on neuromorphic hardware to explore AI that learns and forgets like brains, opening paths to new algorithms that aren't feasible on GPUs. The promise is that neuromorphic hardware could eventually handle certain AI computations far more efficiently than GPUs/CPUs, especially for continuous sensing and adaptation tasks, essentially bringing AI closer to how real brains work.

Gartner's Outlook: Neuromorphic computing has been on hype cycles for years as a far-out concept. In 2024, it remains in the **Trough of Disillusionment**. Initial excitement (over a decade ago) about brain-like chips hasn't yet translated into mainstream products – progress has been slower than hoped, as the technical challenges are immense and software ecosystems for it are immature. Gartner mentions that neuromorphic computing (and smart robots) have made *"good progress in the past year,"* suggesting some advancement, and that this indicates a potential to more quickly pass through the rest of the cycle toward productivity (Generative AI is on the decline) (Generative AI is on the decline). Nonetheless, it's still largely R&D in 2024; time to mainstream is **5–10 years** by Gartner's estimate.

In prior hype cycles, neuromorphic tech has consistently been on the far horizon. The slight optimism in 2024 (noting progress) may be due to increased investments and a few prototypes scaling up (Intel has demonstrated small-scale neuromorphic systems, and startups are entering the space). Gartner placing it with a "transformational (5–10 year)" tag (Gartner Hype Cycle for Artificial Intelligence: A Comprehensive Guide - AI Coach) aligns with it being something that could redefine hardware for AI in the long run, but not soon. We're likely in the disillusionment phase because many earlier predictions (like "brain chips will revolutionize AI in a few years") haven't materialized yet.

Comparatively, quantum computing shares a similar trajectory of long-term R&D; neuromorphic is perhaps slightly more tangible (since working chips exist, just not broadly useful yet). Gartner's

advice is probably to **monitor neuromorphic developments** – especially if you are in industries that need ultra-efficient edge AI – but not to expect short-term payoff. As the tech matures, perhaps spurred by needs for energy-efficient AI (AI's power consumption is a growing concern), neuromorphic ideas might resurge. For now, it's mostly the realm of labs and specific pilot projects. Should a breakthrough occur (e.g., a neuromorphic chip that significantly outperforms GPUs on a useful task), it could quickly climb into the Innovation Trigger or even Peak again. Until then, it's a slow climb out of the trough, with a few believers pushing it forward.

Smart Robots

Definition: *Smart robots* are robots (physical machines that perform tasks autonomously) enhanced with AI to perceive, decide, and act in more adaptable ways. Gartner defines smart robots as **AI-powered, often mobile machines designed to autonomously execute one or more physical tasks** (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™). Unlike traditional robots which are rigidly programmed, smart robots leverage AI algorithms (computer vision, reinforcement learning, adaptive control) to operate in unstructured environments, learn from their experiences, and collaborate safely with humans.

Use Cases: Smart robots span many sectors:

- **Manufacturing Cobots:** Collaborative robots on factory floors that use AI vision to see what human workers are doing and adjust their actions, or automatically learn the best way to handle new parts on an assembly line without explicit re-programming for each change.
- **Warehouse and Logistics Robots:** Autonomous guided vehicles and mobile robots in warehouses (like those used by Amazon) that can navigate and retrieve items, optimizing routes via AI and responding dynamically to obstacles or changing inventory locations.
- **Healthcare and Service Robots:** Robots that assist in surgeries (with AI for precision and guidance), or service robots in hospitals and hotels delivering supplies, navigating hallways and using AI to operate elevators or avoid people.
- **Domestic Robots:** Home cleaning robots or lawn-mowing robots that use smarter AI to adapt to new furniture layouts, identify objects on the floor and decide how to handle them (ignore, avoid, or attempt to move), or even learning user habits to clean at optimal times.
- **Exploration and Military:** Drones or rovers that explore disaster zones, space, or perform military reconnaissance, using AI to make decisions when communication is delayed or unavailable – essentially acting with some level of autonomy (e.g., a Mars rover choosing which rocks to sample based on AI analysis).
- **Social/Companion Robots:** Robots designed to interact with people (in retail or as personal companions) that use AI to recognize faces, understand speech, and exhibit appropriate social behaviors. The "smart" component implies the robot isn't just following a fixed script; it senses its environment (cameras, lidar, sensors), uses AI to interpret that input, makes decisions (often employing planning algorithms or learned policies), and executes actions – and possibly learns to improve over time.

Gartner's Outlook: Smart robots have been through a hype cycle of their own. A decade ago, they were hyped as the future (e.g., the excitement around self-driving vehicles and robot assistants). Many of those expectations have not yet fully materialized, landing smart robots in the

Trough of Disillusionment in 2024. Gartner notes that smart robots (along with neuromorphic computing) have made "good progress in the past year," indicating some technical advances (Generative AI is on the decline), but also points out that their economic value was likely overestimated in the hype phase (Generative AI is on the decline). For instance, a few years ago, people thought by now we'd have widespread robot helpers, but in reality adoption is focused in specific domains (like warehouses) and even there, integrating robots has proven tricky.

The timeline for mainstream use is **5–10 years**, though we already see certain industries (warehouse/logistics) where smart robots are nearing plateau. What's happening is that after the hype, companies realized deploying robots requires significant process changes and upfront cost. Safety and reliability issues also emerged (e.g., robots in public spaces have to be nearly flawless to be accepted). So the hype cooled.

Compared to prior years, the conversation has shifted: earlier the focus was on what new cool things robots could do; now it's about incremental improvements and combining AI techniques (for instance, combining computer vision with better grippers for robots in fulfillment centers). Gartner's inclusion of smart robots in the trough suggests that while the excitement of "robots everywhere" has sobered, the field is steadily advancing. They mention that smart robots have progressed, which "indicates the potential to quickly pass through the rest of the hype cycle until they reach the plateau, as 'computer vision' is already doing today" (Generative AI is on the decline) (Generative AI is on the decline). In other words, once the necessary improvements are made, smart robots could finally become commonplace in the way computer vision now has.

Expect to see smart robots climbing into the Slope of Enlightenment as companies figure out the right applications (where the ROI justifies it) and as technology (especially AI for perception and dexterity) catches up. Gartner would advise organizations to continue monitoring robotics developments and perhaps pilot them in controlled settings with clear payback (like automating repetitive tasks in structured environments). The broad vision of human-like robots doing everything is still distant, but purpose-built smart robots are likely to steadily infiltrate industry and service roles over the next decade.

Cloud AI Services

Definition: *Cloud AI services* are AI capabilities provided through cloud platforms – these include pre-built machine learning APIs (for vision, speech, language, etc.), cloud-based ML model training and deployment services, and entire managed AI development environments hosted in the cloud. Gartner describes cloud AI services as offering **tools for building/training models, prebuilt AI APIs, and the infrastructure to deploy and consume ML models as cloud services** (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™). Essentially, instead of running AI on local servers, companies consume AI on-demand from cloud providers (like AWS, Azure, Google Cloud, etc.), benefiting from scalability and reducing the need to maintain their own AI hardware.

Use Cases: Nearly every AI use case can be facilitated by cloud AI services:

- **Pre-trained API Usage:** A mobile app uses Google's Vision API (a cloud AI service) to identify landmarks in a photo, or an e-commerce site uses AWS Rekognition to moderate user-uploaded images. Developers simply call an API – the heavy AI lifting is done in the cloud service.
- **Custom Model Training:** A team building a customer churn prediction model uses a cloud AutoML service to train it on their dataset, without having to set up any servers or ML frameworks manually. The cloud service handles hyperparameter tuning and provides the final model via an endpoint.
- **ML Ops on Cloud:** A company might deploy their machine learning models on Azure ML or Amazon Sagemaker endpoints. The cloud handles scaling – e.g., if inference requests spike, it auto-scales instances. Monitoring and logging are integrated in the cloud console.
- **Data Processing with AI Services:** Using cloud-based AI pipelines, e.g., stream analytics services that can apply real-time anomaly detection (via embedded models) on IoT data streams as they flow through the cloud.
- **Enterprise AI Platforms:** Many enterprises choose to build their AI solutions entirely on a cloud platform to avoid infrastructure overhead – leveraging things like Google's Vertex AI or Azure Cognitive Services to unify their data storage, model development, and deployment in one ecosystem. Cloud AI services effectively democratize AI – even companies with no in-house AI hardware or extensive data science teams can leverage sophisticated AI via the cloud. The trade-off is reliance on providers and potential concerns over data security/costs.

Gartner's Outlook: Cloud AI services saw a surge as AI adoption grew hand-in-hand with cloud migration. They likely hit a peak maybe a couple of years ago when every cloud vendor was aggressively marketing their AI services. By 2024, **Cloud AI Services have slipped into the Trough of Disillusionment**. According to Gartner's analysis, cloud AI services "have fallen down the hype cycle since 2023" (Generative AI is on the decline). The reason cited is interesting: the proliferation of new GenAI services in the cloud created some "growth issues" – capacity limits, reliability problems, frequent model updates causing instability, and cost fluctuations (Generative AI is on the decline). Essentially, the GenAI boom put a lot of stress on cloud AI offerings (for example, GPT-type services can be expensive and had waitlists or outages early on). Both providers and users faced challenges scaling these services smoothly (Generative AI is on the decline). Additionally, as everyone rushed to add AI to their cloud, the market became crowded and confusing, tempering enthusiasm.

Nonetheless, cloud AI is still the backbone for many – so Gartner sees this as normal growing pains ("normal 'growth issues'" is how their analysts put it (Generative AI is on the decline)). The time to plateau is likely **< 2 to 5 years** (cloud AI is relatively mature, so probably closer to the 2-year mark). Compared to prior years, cloud AI services are no longer novel – they are standard offerings. The trough position suggests that people realized cloud AI isn't a magic switch: you still need good data, proper integration, and you might run into vendor limitations or high bills. Also, some companies are reconsidering heavy cloud usage due to cost, exploring hybrid approaches (doing some AI on-prem to save on cloud compute costs, etc.).

As we move forward, Gartner expects these issues to be ironed out (cloud providers will improve their AI service robustness, add features like better fine-tuning options, and clarify pricing). Also,

as GenAI becomes a regular part of cloud portfolios (with presumably more stable offerings by late 2024 and 2025), confidence will build again. Thus, cloud AI services should climb into the Slope of Enlightenment soon, with enterprises having more realistic expectations of what they deliver. In fact, most organizations will likely use a mix of cloud and edge AI, but cloud will remain pivotal for large-scale training and centralized model management. Gartner would advise not to abandon cloud AI – rather, to apply good governance and cost management to its use, and be prepared for occasional hiccups as the tech evolves. Essentially, the hype is settling and cloud AI is becoming plain infrastructure (which is a good thing long-term, as it means it's entering normal productive use).

4. Slope of Enlightenment Stage (Recovering and Building Practical Value)

Technologies on the **Slope of Enlightenment** have survived the trough's trials and are gradually improving. Early adopters who persisted are now starting to derive real benefits, best practices are emerging, and the broader industry is taking notice again – this time with tempered expectations. At this stage, understanding of the technology's appropriate use deepens, and solutions to earlier pitfalls are developed. In 2024's AI Hype Cycle, a few key AI innovations have entered this slope, indicating that they are on their way to maturity. These include AI-driven applications that have quietly become effective and indispensable, as well as foundational data technologies enabling AI. We discuss each slope-stage technology below, highlighting their refined use cases and Gartner's assessment of their progress toward mainstream adoption.

Intelligent Applications

Definition: *Intelligent applications* are software applications that embed AI and machine learning at their core to provide adaptive, smart functionalities. Rather than AI being a separate tool, it is woven into the app's features – allowing the app to learn from data and improve user interactions or business processes autonomously. Gartner describes intelligent applications as those that **utilize learned adaptation to respond autonomously to people and processes** (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™). In practice, this could mean apps that personalize themselves for each user, automate routine decisions, or dynamically optimize workflows without explicit instructions for every scenario.

Use Cases: By now, intelligent apps span many domains:

- **CRM and ERP Systems:** Modern CRM software might have AI that prioritizes sales leads automatically (learning from past deal data) or recommends next best actions for a salesperson. ERP systems could auto-adjust supply orders based on AI forecasting demand.
- **Office Productivity:** Email clients that sort and prioritize messages (learning which contacts or topics are important to you), or calendar apps that automatically schedule meetings at optimal times. Microsoft Office's integration of AI (like Outlook's suggested replies, or Excel's formula suggestions) turns them into intelligent assistants.
- **HR and Talent Apps:** Recruiting systems that screen resumes using AI, learning over time which applicant attributes lead to successful hires (and flagging those candidates). Or employee engagement platforms that analyze feedback to suggest interventions to management.

- **Customer-facing Mobile Apps:** A banking app that uses AI to analyze your spending and gives personalized financial advice or alerts (e.g., "Your utility spending is higher this month"). E-commerce apps that learn your style and customize the product feed, or streaming apps that create tailored content mixes.
- **IT Service Management:** IT helpdesk software that uses AI to auto-resolve common requests (like password resets) and even predict outages by learning from system logs – becoming "self-driving" in certain tasks.
- **Industry-specific Intelligent Apps:** In healthcare, an EMR (electronic medical record) system with built-in AI could highlight anomalies in patient vitals for doctors. In education, a learning management app might adjust coursework difficulty based on a student's performance via AI tutor algorithms. The key is these AI features are an integral part of the app, often invisible – users just experience a smarter, more context-aware application that simplifies their work or enhances their experience.

Gartner's Outlook: Intelligent applications have been steadily proliferating. In 2024, they are on the **Slope of Enlightenment**, signifying that the concept is proving its value and adoption is growing after perhaps a quieter hype cycle. Gartner cites intelligent apps as **transformational within 2–5 years** (Gartner Hype Cycle for Artificial Intelligence: A Comprehensive Guide - AI Coach), indicating that we're in that window now where many enterprise software offerings are incorporating AI and companies are getting tangible benefits.

In previous years, "intelligent apps" was more of a vision (circa late 2010s, it was a strategic trend Gartner talked about). Then it became reality in pieces – for instance, many SaaS products started adding AI features (often branded as "AI assistant" or "Insights"). Now by 2024, it's expected: new software often has AI-driven elements out-of-the-box.

Gartner's inclusion on the slope suggests:

- The hype around "AI in every app" has evened out; now it's about quality and results of those AI features.
- Deployments are broader. Organizations might not even label them AI projects anymore – it's just an upgrade to your CRM that now has smart lead scoring, etc.

They state that intelligent applications are being supported by GenAI and making inroads in the workplace, but need more time to *objectively quantify their impact on productivity* (Generative AI is on the decline). That means companies see promise (anecdotal boosts in efficiency, better user satisfaction), but hard metrics are still being gathered. We're in the phase of scaling up usage and measuring ROI.

The time to plateau is likely **within 2–3 years** – essentially as soon as success stories firm up and the novelty wears off, it'll just be "how software is." Compared to earlier hype cycles, intelligent apps have moved from concept to execution. Gartner's advice to clients is likely: ensure new software investments have AI capabilities that align with your business needs, and focus on user adoption (because an AI feature is only valuable if users trust and use it). Also, companies should continue to incorporate AI enhancements into their internally developed applications to keep competitive.

In summary, intelligent apps are steadily climbing toward the Plateau of Productivity – we can expect by the late 2020s that essentially all business applications are "intelligent" by default, fulfilling the trend that's now well underway.

Knowledge Graphs

Definition: *Knowledge graphs* are data structures that represent knowledge in terms of entities (nodes) and the relationships between them (edges), often enriched with semantic context. Gartner defines knowledge graphs as **machine-readable representations of the physical and digital worlds, comprising entities (like people, organizations, things) and their relationships, following a graph data model** (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™). They allow AI systems and humans to navigate complex interconnected information more intuitively. A knowledge graph can encode facts and connections in a network form – for example, a graph might link a person to the company they work for, the projects they lead, their skills, etc., enabling rich queries and inference.

Use Cases: Knowledge graphs are powerful for any application needing to connect dots between disparate data:

- **Enterprise Data Integration (360° View):** Companies build knowledge graphs of their organizational data – linking customers with their transactions, support tickets, social media mentions, etc., to get a 360° customer view. This can drive advanced analytics or personalized recommendations because the graph makes it easy to traverse related data points.
- **Recommendation and Search:** E-commerce sites use product knowledge graphs (linking products by categories, attributes, user reviews, viewing history) to improve search relevance and make recommendations ("users who viewed X also viewed Y" can be naturally answered via graph connections). Semantic search engines utilize knowledge graphs (like Google's Knowledge Graph) to provide direct answers and related context (showing info panel with key facts about a query topic).
- **Fraud Detection:** Banks use knowledge graphs to link entities in transactions – accounts, owners, devices, IP addresses – to detect rings of fraudulent activity that might be hard to spot in tabular data. Patterns like multiple accounts sharing a phone number or address can pop out from the graph structure.
- **Knowledge Management and AI Explainability:** In healthcare, a knowledge graph connecting diseases, symptoms, genes, and drugs can help in clinical decision support (AI can traverse the graph to find possible treatments or explain a diagnosis by showing related medical cases). It's also used in research to integrate knowledge from literature and data (e.g., COVID-19 knowledge graphs used during the pandemic to accelerate discovery).
- **Support Chatbots with Context:** A chatbot for IT support might use a knowledge graph of common issues, devices, and resolutions. When a user asks a question, the bot navigates the graph to find related known issues and solutions, giving a more contextually accurate answer.
- **Composite AI enablement:** Knowledge graphs often work in composite AI solutions – e.g., combining a knowledge graph with NLP. The graph provides factual grounding for a language model (helping to reduce hallucinations by checking a query against known

entities/relationships) (Gartner Hype Cycle for AI: Why Knowledge Graphs Are Essential for Enterprises?). Because knowledge graphs encode real-world relationships, they help AI systems with **context and reasoning** – the AI can "understand" that two pieces of data are linked, which is crucial for tasks requiring inference beyond pattern matching.

Gartner's Outlook: Knowledge graphs have steadily moved up the maturity curve and are now on the **Slope of Enlightenment**. Gartner highlights that in 2024, knowledge graphs are positioned on this slope and are increasingly understood for their benefits, leading to more pilot projects (Gartner Hype Cycle for AI: Why Knowledge Graphs Are Essential for Enterprises?). They are recognized as *"critical enablers for effectively applying generative AI in enterprise environments"* (Gartner Hype Cycle for AI: Why Knowledge Graphs Are Essential for Enterprises?), because they can provide the structured knowledge backbone that GenAI lacks.

A few years ago, knowledge graphs were a bit niche – mainly talked about in context of semantic web or advanced data analytics teams. Now many organizations are actively building them as part of their data strategy, especially as data fabric and metadata management trends embrace graph techniques.

Gartner's commentary suggests that knowledge graphs have been a standout in 2024, implying real momentum. They likely consider them **2–5 years from plateau**, leaning towards the earlier side of that range. In some sense, knowledge graphs might never have had a dramatic "hype" peak in the public eye, but within enterprises they've quietly grown. They were on earlier hype cycles around 2018–2020 in the Innovation Trigger stage. By 2023, many companies struggling with data silos started seeing graphs as a solution. Now in 2024, the successes (like improved search and AI integration at those who implemented graphs) are informing the broader market.

One reason for their enlightenment phase is also better technology: graph databases (like Neo4j, AWS Neptune, etc.) have matured, and standards for data interchange (RDF, SPARQL) and ontology design practices have improved.

Gartner's advice: invest in knowledge graph initiatives to connect corporate knowledge, as it not only yields immediate insights but also **prepares the groundwork for future AI** (for example, enabling more explainable AI, or enterprise digital twins). As more case studies emerge (e.g., "X company reduced customer churn by 15% using a customer knowledge graph to power its recommendation engine"), the rest of the industry will follow suit. Knowledge graphs are well on track to reach the Plateau of Productivity; Gartner's 2024 emphasis suggests we're seeing the turning point where skeptics are becoming believers thanks to tangible outcomes.

Autonomous Vehicles

Definition: *Autonomous vehicles* are vehicles (cars, trucks, or other transport devices) equipped with AI-driven systems capable of navigating and operating without human intervention. This generally implies at least SAE Level 4 autonomy (able to drive by itself in certain conditions or geofenced areas) or the aspirational Level 5 (full self-driving in any condition). Gartner includes autonomous vehicles as an AI-related innovation because they rely heavily on AI for perception (computer vision, sensor fusion), decision-making (path planning, maneuvering), and even

learning driving policies. In essence, an autonomous vehicle is a robot (smart machine) that transports people or goods.

Use Cases: The main use case is transportation, but it branches into:

- **Robotaxis/Ride Sharing:** Companies like Waymo and Cruise operate autonomous taxi services in limited areas. The vehicles drive passengers without a human driver, relying on lidar, cameras, radar and AI to navigate city streets.
- **Autonomous Trucks and Delivery:** Self-driving semi-trucks for highway freight (TuSimple, for example, testing autonomous trucking routes) and smaller sidewalk delivery robots or drones for last-mile delivery (like Starship Technologies robots on campuses, or Amazon's delivery drones).
- **Shuttle Services:** Fixed-route autonomous shuttles in controlled environments – airports, industrial parks, or small towns – that ferry people along pre-mapped routes. These might be low-speed vehicles handling short connections (some are in pilot in cities in Europe/Asia).
- **Personal Autonomous Cars:** Eventually, consumer vehicles where you can engage a self-driving mode for highway or even end-to-end journeys. Tesla's Full Self-Driving (beta) is an attempt at this, though it is still driver-assist in legal terms. Other automakers (GM's Ultra Cruise, Mercedes Drive Pilot) are introducing increasing autonomy.
- **Specialty Vehicles:** Mining haul trucks or farming tractors that run autonomously in private sites (already fairly common in mining and agriculture – a highly controlled environment with limited unpredictability, which autonomy can handle today). Autonomous vehicles promise increased safety (removing human error), efficiency (vehicles can potentially travel with tighter spacing, optimize speed for fuel economy, etc.), and accessibility (giving mobility to those who can't drive).

Gartner's Outlook: Autonomous vehicles (AVs) famously went through a classic hype cycle: a peak around mid-2010s when many thought full self-driving was just a couple years away, followed by a trough as companies missed timelines and encountered edge-case complexities (the dreaded "corner cases" that human drivers handle but proved hard for AI).

In 2024, Gartner places autonomous vehicles on the **Slope of Enlightenment** – meaning the technology is slowly overcoming past disappointments. They note that despite major concerns, regulatory hurdles, and even setbacks (like some cities pulling back robotaxi permissions temporarily), **the use of autonomous vehicles has increased in some regions** (Generative AI is on the decline). That's a sign of progress: for instance, in 2023, fully driverless taxis began operating (under pilot) in parts of San Francisco, Phoenix, and Chinese cities like Shenzhen. Trucking pilots are expanding on highways in the U.S. and Europe. It's not widespread, but it's no longer just prototypes – real services exist in narrow domains.

Gartner expects AVs to be **5–10 years from mainstream adoption**, which sounds about right for broad availability (perhaps robo-taxis in many cities and autonomous trucking lanes by the late 2020s). Compared to a few years ago (when some predicted 2020 would have ubiquitous self-driving cars), the expectations are recalibrated. The "trough" was around 2019–2020 when several

companies realized more development was needed. Many consolidations and exits happened in the industry. Now in 2024, there's cautious optimism: the pieces are coming together albeit slower.

Moving into the slope indicates:

- Companies and regulators have learned and set more realistic goals (geofenced deployments, focusing on easier conditions first).
- The technology has incrementally improved (better sensors, more sophisticated AI training using billions of simulated miles, etc.).
- There's still friction (e.g., occasional accidents, public trust issues, legal frameworks not fully ready), but things are trending better.

Gartner's commentary that **"the use...has increased in some regions"** (Generative AI is on the decline) suggests that in places like certain U.S. states, China, and specific industries (mining, farming), autonomy is proving itself, and that will guide others. We can expect AVs to continue climbing such that, by the time they hit the Plateau, the question might shift from "Can they work?" to "How do we coexist and integrate them into society?"

For businesses, Gartner likely advises to start strategizing around AVs – for example, logistics companies should pilot autonomous trucking where possible, city planners should consider infrastructure for AVs, and insurers should develop new models for AV risk. While mainstream use for consumers (buying a truly self-driving personal car) might still be the latter part of this decade, the time to prepare is now, as the slope signals the technology is on its way to viability after years of lessons learned.

Plateau of Productivity Stage (Mainstream Adoption)

When a technology reaches the **Plateau of Productivity**, it has matured to a point of broad adoption and stable, realized value. The initial hype has long subsided, and the technology finds its appropriate niche (or broad use) in the market. At this stage, the methods and benefits are well understood, and the technology becomes "business as usual." On the 2024 AI Hype Cycle, only one technology is depicted as having attained the Plateau of Productivity: **Computer Vision**. This indicates that computer vision has become a mainstream capability embedded in countless applications today. We will delve into computer vision's current status and how its journey on the Hype Cycle illustrates the evolution of AI trends over prior years.

Computer Vision

Definition: *Computer vision* is the field of AI that enables machines to interpret and understand visual information from the world, such as images and videos. It involves techniques for image classification, object detection, facial recognition, video analytics, and more – essentially giving computers a simulated "eye" and visual cortex. Gartner defines computer vision as a set of technologies for **capturing, processing, and analyzing real-world images and videos to extract meaningful, contextual information** (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™). This can range from simple tasks (barcode scanning) to complex ones (real-time scene understanding for autonomous driving).

Use Cases: Computer vision is ubiquitous across industries:

- **Security and Surveillance:** Automatic recognition of faces or license plates from CCTV feeds; detecting intrusions or identifying suspicious behaviors via video analytics.
- **Manufacturing Quality Control:** Vision systems inspect products on assembly lines for defects far faster and more accurately than the human eye. For example, detecting microscopic flaws in semiconductor wafers or checking fill levels in packaged goods.
- **Medical Imaging:** AI analysis of X-rays, MRIs, CT scans, or pathology slides to assist in diagnosing diseases (e.g., identifying tumors, counting cells, detecting fractures). Computer vision helps flag areas of concern for radiologists.
- **Retail and Retail Analytics:** Automated checkout (like Amazon Go stores use cameras to see what items you take), planogram compliance (ensuring store shelves are properly stocked and organized via image analysis), or tracking customer footfall and engagement in stores (heatmaps of where people linger, drawn from camera data).
- **Automotive and Transportation:** Vision systems in cars for driver assistance – detecting lanes, other vehicles, pedestrians (ADAS features like automatic emergency braking rely on this). Traffic systems using cameras to monitor flow and adjust lights.
- **Smartphones and Consumer Apps:** Every modern smartphone has AI for camera enhancement – e.g., scene detection, portrait mode background blur, face unlock features. Social media filters (like Snapchat/Lens) use face tracking (a vision task) to overlay effects. Vision also powers augmented reality (detecting surfaces and environment to place AR objects).
- **Agriculture:** Drones or robots use vision to monitor crop health (identifying pest infestations or nutrient deficiencies by leaf color/patterns) or to pick and sort produce (identifying ripe fruits).
- **Document Processing:** Reading text from images (OCR) and even more complex tasks like understanding forms or invoices (combining vision and NLP) – e.g., expense receipt scanners. Computer vision essentially has become a standard component in any scenario where understanding visual data is needed. Over decades, algorithms evolved from simple image processing to deep learning-based vision, dramatically improving accuracy and enabling new applications.

Gartner's Outlook: Computer vision has **reached the Plateau of Productivity** in Gartner's 2024 cycle – meaning it's considered a mature, widely adopted technology. Gartner notes it is *"widely used in smart devices and consumer applications"* (Gartner Hype Cycle for Artificial Intelligence: A Comprehensive Guide - AI Coach) and is already delivering broad value. This implies that for most companies, implementing computer vision is no longer a speculative project but a well-trodden path with proven ROI (for example, deploying a vision QA system in manufacturing is straightforward with many vendors and integrators available).

In prior Hype Cycles, computer vision was on the slope perhaps in the late 2010s, and even before that had its hype (back in early 2010s, facial recognition was a hype topic). Now, vision technology – especially thanks to the deep learning revolution around 2012 (with ImageNet breakthroughs) – has steadily improved to superhuman accuracy on many tasks. It's integrated in countless products (your phone's camera AI being a prime everyday example), often so seamlessly that users might not realize an AI is involved.

Gartner pointing out computer vision as plateaued shows how an AI subfield can move from cutting-edge to commodity. This also reflects in the industry: there are many established CV platforms, libraries (OpenCV, etc.), pre-trained models, and even specialized hardware (AI camera chips) available. The ecosystem is rich and stable.

The expected time to mainstream was basically "now" – as the cycle indicates **< 2 years** (and indeed we are already there). That doesn't mean innovation in vision is done – but the surprises are fewer. Now improvements are incremental (slightly better accuracy, more efficiency), and the growth is in applying it to new edge cases or combining with other tech (like vision + language in multimodal AI).

Comparatively, in the past, computer vision suffered from the "AI winter" effects when older approaches struggled. The deep learning era rescued it and shot it up probably to a peak hype around mid-2010s ("computers can see!"), then it normalized as everyone started using it matter-of-factly.

For businesses, Gartner's stance at plateau is: if you have a process that could benefit from automated visual analysis and you haven't implemented it, you are behind competitors. Vision is readily accessible – even SMEs can use cloud vision APIs for basic tasks. The conversation now is more about governance (e.g., privacy implications of facial recognition) rather than capability.

In terms of evolving trends: one evolution is that **computer vision is becoming a component of larger AI solutions** rather than a standalone. For example, an "intelligent application" might use vision to gather context and NLP to converse – integrated AI modalities. Also, as Gartner mentioned, computer vision's success story is a model for other tech: they explicitly likened smart robots eventually reaching plateau as computer vision has done (Generative AI is on the decline).

In summary, computer vision's plateau status in 2024 emphasizes that it's a **proven, mainstream technology** delivering value across industries – a milestone that other AI technologies are progressively working towards as they navigate their own hype cycles.

Conclusion

The 2024 Gartner Hype Cycle for Artificial Intelligence presents a panorama of AI innovations at different maturity levels – from embryonic concepts like **Quantum AI** and **Sovereign AI** just emerging on the horizon, to stalwarts like **Computer Vision** which have become everyday productivity workhorses. Gartner's analysis underscores a few key themes:

- **Beyond the Hype of GenAI:** Generative AI's explosive rise has now been tempered; it passed the peak of hype and is entering a phase of practical implementation with measured expectations (Hype Cycle for Artificial Intelligence 2024 | Gartner). Organizations are realizing that combining GenAI with established techniques (and solid data foundations) yields more value than GenAI alone (Hype Cycle for Artificial Intelligence 2024 | Gartner). This reflects a broader pattern: transformative AI capabilities often require integration with other innovations and sound management practices to truly deliver.

- **The Rise of Composite Approaches:** Many of the highlighted technologies point to *combining techniques*. **Composite AI** is explicitly about fusing methods to tackle complex problems, **Neuro-symbolic AI** blends neural and symbolic paradigms (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™), and even operational trends like **AI Engineering** and **ModelOps** indicate that success comes from uniting technical and procedural innovation. Compared to a few years ago, when focus might have been on singular breakthroughs (e.g., "just deep learning will solve it all"), the 2024 perspective is more holistic – mix and match AI building blocks, and incorporate governance (Responsible AI, AI TRiSM) from the start.
- **Data and Knowledge as Cornerstones:** Gartner emphasizes data-centric enablers such as **AI-Ready Data** (making quality data available) and **Knowledge Graphs** (providing connected context for AI) as critical investments. These have moved up in importance because organizations learned that without the right data foundation, even the best algorithms falter (Hype Cycle for Artificial Intelligence 2024 | Gartner). The fact that knowledge graphs are on the Slope of Enlightenment and seen as key to enterprise GenAI (Gartner Hype Cycle for AI: Why Knowledge Graphs Are Essential for Enterprises?) highlights an evolution from earlier years: in prior hype cycles, big model prowess was lauded, whereas now we acknowledge that *how we structure and govern information* is equally vital to AI's success.
- **Maturity Brings Regulation and Ethics to the Fore:** With AI's increasing deployment, issues of trust, fairness, and security have taken center stage. **Responsible AI** and **AI TRiSM** peaking on the cycle signify that companies and governments are deeply concerned with *how* AI is used, not just *what* it can do (Generative AI is on the decline) (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™). This focus is much stronger now than in hype cycles of, say, 2018, reflecting incidents and public discourse around biased algorithms, deepfakes, and AI safety. It suggests that moving forward, AI adoption will be just as much about establishing the right ethical and risk frameworks as about technology— a marked change from prior years where ethics might have been an afterthought.
- **Comparing with Prior Years:** A look back at earlier Gartner Hype Cycles (2020–2023) shows how fluid the AI landscape is. In 2020, **Generative AI** and **Composite AI** were just entering discussion (Gartner's 2024 Hype Cycle - GenAI's Journey - NIXsolutions); by 2023 GenAI dominated the peak (What's New in Artificial Intelligence From the 2023 Gartner Hype Cycle™) and by 2024 it's transitioning downward. Technologies like **Autonomous Vehicles** and **Virtual Assistants** were at peak hype in late 2010s; now AVs are cautiously climbing the slope with hard lessons learned, while generic virtual assistants have plateaued or even commoditized (and thus no longer appear as a hype item). New terms like **First-Principles AI** and **Sovereign AI** have appeared, indicating how the AI dialogue broadens as the technology permeates societal and strategic dimensions. The continuous presence of **AI Engineering/ModelOps** in recent cycles shows a response to earlier challenges of scaling pilots to production – a sign of the field's maturation.
- **Evolving Impact:** Gartner's Priority Matrix hints at which technologies are seen as **transformational**. In 2024, they list things like Composite AI, Generative AI, Intelligent Apps, Responsible AI, Neuromorphic Computing, Autonomous Vehicles as having high or transformational benefit at various time horizons (Gartner Hype Cycle for Artificial Intelligence: A Comprehensive Guide - AI Coach). A few years ago, "transformational"

labels were on things like deep learning or cognitive computing. The shift is subtle but notable: today's transformational ideas factor in *trust (Responsible AI)*, *integration (Composite AI, Intelligent Apps)*, and *emerging hardware (Neuromorphic)* – not just raw algorithmic breakthroughs.

In conclusion, the 2024 Hype Cycle portrays an AI landscape that is **simultaneously sobering and hopeful**. Sobering, because some of the flashiest promises (full self-driving everywhere, human-like AI chatbots solving everything, etc.) have been tempered by reality checks. Hopeful, because many AI technologies are steadily climbing the innovation slope, solving real problems, and inching closer to mainstream adoption in a responsible manner. As AI leaders plan for the coming years, the message is to **balance ambition with pragmatism**: invest in foundational capabilities (data readiness, composite AI architectures, engineering pipelines), keep ethical and governance considerations at the forefront, and be patient as the more experimental technologies evolve. The hype may have peaks and troughs, but the overall trajectory is one of AI embedding deeper into productive use across industries – often in less glamorous but highly impactful ways.

Gartner's 2024 snapshot thus tells a story of an AI field that is **maturing and integrating**: it's no longer about one or two superstar innovations, but a whole ecosystem of AI "types" advancing at different paces, collectively driving the next generation of intelligent solutions. The trends from prior years to now show an industry learning from experience, which ultimately brings the truly game-changing benefits of AI closer to reality.

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