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AI: A NOVEL DEVELOPMENT IN ARTIFICIAL INTELLIGENCE

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Abstract

The history of Artificial Intelligence has witnessed a paradigm shift from discriminative models (classifiers) to generative models (content creators). The current frontier is marked by the arrival of AI, which can pursue goals independently, interact with the environment, and execute dynamic planning. AI is in stark contrast to earlier Large Language Models (LLMs), which are simply passive seekers of information. Instead, AI is based on a cognitive model of perception, planning, action, and memory to execute complex multi-step tasks with minimal human intervention. The architectural model of AI is presented, and it is distinguished from earlier AI. The importance of tool use and reasoning loops is also presented, along with safety and alignment issues.

1. Introduction

1.1Technological Environment of 2026

The technological environment of 2026 is characterized by a gradual transition from passive Generative AI to independent, goal-oriented AI systems that are referred to as Agentic AI. Agentic AI is not a mere evolutionary step in the progression of Large Language Models (LLMs); it is a revolutionary re-architecting of artificial intelligence into independent reasoning and strategic thinking systems that are capable of performing a series of tasks with minimal human intervention.[1] The previous generation of artificial intelligence systems focused on "co-pilots" and chatbots that responded to human input and commands. Agentic AI, also referred to as systems, possesses "agency" that enables it to perform tasks and respond to environmental feedback.

1.2The Ontological Shift: Defining Agency and Autonomy in 2026

One of the most important things to understand about Agentic AI is that it is not a continuation of previous artificial intelligence systems referred to as traditional AI, Generative AI, and basic AI agents. Traditional AI is based on a deterministic and rule-based environment that is limited to pattern recognition and classification of data.[6]. While generative AI has enabled the ability to create content through probabilistic modeling, it is still limited to being reactive and only responds based on direct input and context.[9] AI agents are seen as the next step, which is semi-autonomous and is intended for repetitive tasks such as calendar management and information retrieval through fixed logic.[6]

Agentic AI is distinguished by its ability to be self-governing and goal-oriented.[6] It does not just advise on actions; it performs actions end-to-end across different and varied platforms and tools.[6] The differentiation comes from the level of sophistication for the goal and the level of autonomy provided for achieving it.[14]

Comparative Framework of AI Autonomy and Complexity.

Table 1: Comparative Framework of AI Autonomy and Complexity

Feature	Traditional AI	Generative AI	AI Agents	Agentic AI
Primary Mode	Reactive / Rule-based [6]	Reactive / Generative [10]	Semi-autonomous / Task-focused [2]	Autonomous / Goal-directed [7]
Decision Logic	Deterministic [7]	Probabilistic [15]	Scripted/Rule-based [6]	Reasoning-based [12]
Task Complexity	Single-step classification [8]	Content generation [10]	Narrow domain automation [11]	Multi-step workflows [2]
Learning Model	Static after training [8]	Static datasets [17]	Minimal adaptation [14]	Continuous & Real-time [2]
Human Role	Constant supervision [7]	Prompting / Editing [4]	Occasional intervention [6]	Oversight/ Governance [18]

The transition toward Agentic AI introduces a "loop" of intelligence where the system perceives its environment, reasons about its state, plans a trajectory toward a goal, takes action, and reflects on the outcome to refine future performance.[11] This cycle, often referred to as the "agent loop," allows the system to handle unexpected variables and changing conditions that would cause traditional automated systems to fail.[11]

2.1Architectural Foundations: The Mechanics of Autonomous Reasoning

The efficacy of Agentic AI is rooted in a modular architecture that integrates high-level reasoning with external utility tools and persistent memory.[11] By 2026, researchers have synthesized these components into a standardized functional framework that enables agents to operate as

specialized professionals within an ecosystem.[3]

2.2The Perception and Interaction Modules

The perception phase is the agent's "sense," allowing it to interpret a diverse array of inputs including natural language instructions, real-time data from IoT sensors, internet feeds, and the results of its own previous actions.[11] Modern architectures utilize multi-modal models capable of comprehending text, image, voice, and video simultaneously in real time.[14] This sensory richness is vital for agents operating in dynamic environments like healthcare or autonomous logistics, where a failure to perceive a subtle shift in environmental data can lead to catastrophic errors.[7]

2.3Reasoning, Planning, and Goal Decomposition

At the core of it is the Reasoning Engine. This is usually powered by the LLMs. These are adjusted to do thinking and strategic planning..[2] It uses methods like Chain of Thought, Tree of Thought and Graph of Thought. These help it to explore all ways to solve a problem..[1] The Reasoning Engine is given a goal. For example "Fix the supply chain after a 20% increase, in demand."

It does not try to solve it in one go. Instead it breaks it down into goal, these might include:

- Look at stock levels
- Talk to suppliers
- Change delivery routes
- Adjust spending plans

2.4Memory and Context Retention

Autonomy is not just about computing power; it is also about context. Agentic AI has a multi-level memory system:

- Short-term Memory: It holds context related to the current task and conversation.[1]
- Long-term Memory: It holds long-term context, learned skills, and user preferences over multiple sessions.[1]
- Episodic Memory: It holds historical data related to past actions and their outcomes, which it can use to avoid mistakes and repeat successes.[1]
- Vectorial Memory: It is based on vectorial memory and is designed to allow semantic retrieval of data from large datasets.[1]

2.5Tool Integration and Function Calling

The most profound shift in Agentic AI is the "Action Module," which leverages function calling and API integrations to interact with the world.[1] An agent is no longer confined to the digital text box; it can query databases, execute code in a Python sandbox, send emails, place orders in an ERP system, or even control industrial robotics. This allows the agent to function as an orchestrator of existing software suites, effectively "using" tools the same way a human employee would.[11]

3 Advanced Frameworks: RAG and Data Readiness

A critical sub-domain of Agentic AI is Retrieval-Augmented Generation (RAG).[13] Traditional RAG systems are passive; they find information once and generate an answer.[13] RAG, by contrast, treats retrieval as a strategic tool.[13] The agent can decide whether retrieval is necessary, select which database is most appropriate (e.g., distinguishing between technical manuals and customer records), and iteratively refine its search if the first result is insufficient.[2]

Comparative Performance: Traditional RAG vs. RAG

Table 2 : Comparative Performance: Traditional RAG vs. RAG

Metric	Traditional RAG	RAG
Retrieval Logic	Fixed, single-path [13]	Active, multi-step problem solving [13]
Query Handling	Simple data gathering [13]	Intent-aware reasoning [13]
Hallucination Rate	Higher (bounded by first retrieval) [17]	Lower (validated via iteration) [13]
Efficiency/Cost	Lower resource consumption [13]	Higher (multiple LLM calls) [2]
Adaptability	Rule-bound querying [10]	Dynamic strategy refinement [13]

For these systems to be effective at an enterprise scale, "data readiness" is paramount.[2] Companies like K2view have introduced Micro-Database™ technology, which organizes fragmented enterprise information into millions of entity-specific databases (e.g., one for each customer).[13] This enables Agentic AI to retrieve context-rich, integrated data in milliseconds, solving the latency and data-spaghetti problems that often cripple autonomous systems.[13]

4.Industry Deep Dive: Design Automation (ADA) in Semiconductors

The semiconductor industry provides the most advanced real-world implementation of Agentic AI through a paradigm known as Design Automation (ADA).[28] As chip design complexity accelerates toward 2nm and 3D architectures, the industry faces a critical shortage of human design expertise.[28] AI address this gap by automating the labor-intensive engineering loops that slow down design closure.[28]

4.1The Marco Multi-AI Agent Framework

Developed during research efforts at Nvidia and Agentrys, the Marco framework uses a graph-based task-solving approach to tackle complex hardware design.[23] In this architecture, a complex problem—such as "optimize the layout for a 2nm sequential cell"—is modeled as a task graph where specialized agents (e.g., VerilogCoder, DRC-Coder) collaborate to solve sub-problems.[23]

Table 3: Some popular Agents

Agent Name	Specialized Function	Performance Data / Milestone
VerilogCoder	Specification-to-RTL code generation	94.2% success on VerilogEval-Human v2 [23]
DRC-Coder	Generates layout code for sub-3nm nodes	Reduces generation time from weeks to 4 mins [23]
Timing Debug Agent	Root cause analysis of waveform failures	Resolves 86% of path-level debugging issues [23]
MCMM Timing Agent	Multi-Corner Multi-Mode analysis	60x speedup over human engineers [23]

The Siemens Questa One Toolkit further exemplifies this by transforming verification from isolated tool interactions into intelligent, domain-scoped multi-step workflows.19 These workflows are framework-agnostic, meaning they can integrate with GitHub Copilot or Claude Code while maintaining strict governance boundaries defined by the customer.[19]

4.2Agentic AI in Healthcare: From Diagnostics to Robotic Surgery

In healthcare, Agentic AI is shifting the focus from simple data classification to autonomous clinical monitoring and intervention.[7] These architectures, when supported by the high-speed, low-latency infrastructure of 6G communication, enable remote robotic surgery with a level of precision and reliability previously unattainable.[7]

4.2.1Proactive Monitoring and Personalized Treatment

Agentic systems continuously synthesize data from wearable devices with electronic health records (EHR) to adjust treatment protocols in real time. For instance, an agent could detect a subtle heart rate variability pattern that indicates an impending medical crisis and autonomously alert the care team while simultaneously adjusting the patient's medication dosage within predefined ethical guardrails.[7]

Table4 : The SWOT of Healthcare Agentic AI Integration

Component	Strategic Insight
Strengths	Early medical crisis detection; personalized care via continuous learning [7]
Weaknesses	Reliance on high-quality annotated data; "black box" interpretability issues [7]s
Opportunities	Remote robotic surgery; automation of administrative and clinical burdens 7
Threats	Ethical governance risks; cybersecurity vulnerabilities in 6G/IoT networks 7

4.3Scientific Discovery and Drug Development

The use of Agentic AI in scientific discovery represents the beginning of the "self-driving laboratory" era. This involves the use of LLMs and robotic systems, which work with perceptiontools to enable the "autonomous reasoning" and execution of scientific discoveries, thereby mimicking the Design-Make-Test-Analyze (DMTA) process.

In the context of drug development, Agentic AI represents the "cognitive infrastructure" for drug discovery and the development of partnerships. This comes at a time when drug development and innovation are becoming more externalized, with many innovations coming from the biotech and spinoff industries. Agentic AI Co-Pilot Frameworks are being used to identify, manage, and control these externalized drug development partnerships, thereby moving the process from the reactive paradigm to the proactive paradigm.33

5.The Economic and Market Outlook of 2026

The Agentic AI market is growing significantly, with many firms focusing on the application of Agentic AI in conjunction with automation and autonomous decision-making in their future strategies.16 With this, it is anticipated that in 2026, there would be a rise in the application of Agentic AI, with valuations increasing significantly by the end of the decade.

Benchmarking the Next Generation: MLE-Bench and Beyond

To measure the progress of Agentic AI, the industry has shifted toward benchmarks that evaluate "true engineering competence" rather than mere text generation. MLE-Bench is an example. It was made from 75 Kaggle competitions. The goal is to test AI agents on machine learning steps. These steps include getting data ready training models adjusting settings and submitting results.31

Benchmark Performance Data for 2025 and Early 2026 is shown below

Table 6 : Benchmark Performance Data (Late 2025 / Early 2026

Model + Scaffold	Success Rate (Bronze Medal)	Context / Metric

OpenAI o1-preview + AIDE	16.9%	Single attempt (pass@1) 31
GPT-4o + AIDE	8.7%	Single attempt (pass@1) 31
GPT-4o + AIDE	~17%	Six attempts (pass@6) 31
Marco Framework	94.2%	Verilog coding success 23

The "pass@k" metric—which allows the model multiple attempts at a problem—is particularly revealing. It suggests that Agentic AI's strength lies in its ability to iterate and self-correct, a capability that standard generative models do not possess.31

6.Risks, Safety, and the Challenge of Human-AI Alignment

With increased autonomy comes increased risk.34 The fundamental challenge of Agentic AI is the "structural mismatch" between autonomous software and the existing structure of human responsibility in organizations.18 When an agent makes a decision that results in an improper purchase, a security breach, or an incorrect medical intervention, identifying the locus of accountability becomes complex.1

Key Technical and Ethical Risks

1. Alignment and Values: Ensuring that an autonomous agent's decisions match human intentions and ethical norms remains an unresolved problem.11
2. Responsibility Delegation: Critics argue that Agentic AI collapses distributed human responsibility into software development teams, which is unsustainable in high-stakes industries.18
3. Security and Data Integrity: Because agents have access to internal systems and external APIs, they expand the attack surface.11
4. Inconsistent Outputs: Agentic AI depends on human language to interact with tools, leading to hallucinations or formatting mistakes that can have cascading effects in multi-agent workflows.2

Governance frameworks, such as the DeepMind "Levels of AGI," help calibrate the operational risk by distinguishing "emerging" systems from "competent" or "expert" ones.36 By 2026, many organizations have adopted "Human-in-the-Loop" systems for high-stakes decisions, ensuring that while the agent executes the workflow, the final authority remains with human leaders.

7.The Road to AGI: Agentic AI as the Practical Bridge

Agentic AI is seen as a bridge between todays specialized AI and future Artificial General Intelligence (AGI).34 It connects the AI we have now with the advanced AI that can think like humans in many areas. While Artificial General Intelligence. A system that can match intelligence in any task. Is still an idea Agentic AI lays the groundwork, for this change. Agentic AI helps us move towards Artificial General Intelligence.14

The evolutionary trajectory is expected to follow several stages:

- Self-Evolving Models: AI that can improve its own architecture and parameters in real time without human intervention.14
- Hyper-Personalized Agents: Systems that anticipate needs and adapt to specific user preferences with unmatched autonomy.14
- Multi-Agent Ecosystems: Entire teams of specialized AIs working in sync, negotiating outcomes, and refining strategies collectively.14
- Quantum-Powered AI: The synchronization of quantum hardware with models to solve logistics and scientific problems currently deemed insurmountable.14

8.Strategic Implementation: Preparing for the Agentic Era

For organizations to successfully adopt Agentic AI, they must move beyond "AI adoption" to "AI integration".20 This requires a rigorous focus on AI governance, including the implementation of

frameworks for ethical use, security guidelines, and regulatory compliance.16

Steps for Corporate Readiness

- Invest in Data Foundations: tools rely heavily on fresh, trusted data. Fragmented or poor-quality data leads to incorrect autonomous decisions.14
- Automate Repetitive Workflows First: Identify the most unproductive operations and automate them to save time and resources, then scale fast.14
- Train Teams for Collaboration: As AI automates tasks, human employees must be trained to manage these systems and provide design guidance that AI currently lacks.14
- Enhance User Experience: AI-powered systems only deliver value when paired with intuitive interfaces that allow humans to interact with and oversee autonomous agents.14

9.Conclusion: The Collaborative Future of Humans and Agents

Agentic AI marks the most significant evolution in artificial intelligence since the emergence of large language models. By transitioning from reactive responses to autonomous planning and execution, these systems are redefining productivity in fields as diverse as semiconductor engineering, healthcare, and finance.7 The future of this technology will not be defined by the replacement of human intelligence, but by the creation of a cognitive infrastructure where humans and agents work together, merging human creativity with algorithmic efficiency.14

Success in this era requires a nuanced understanding of the trade-offs between autonomy and control. While the efficiency gains of Agentic AI are immense, the risks associated with misaligned objectives and lack of accountability demand a robust governance framework and a "data-ready" operational environment.7 As the market accelerates toward AGI, the organizations that thrive will be those that view Agentic AI not merely as a tool for automation, but as a strategic partner in complex decision-making and innovation.33 The "agency" of AI is no longer a theoretical concept; it is an operational reality that is fundamentally reshaping the global economy in 2026.

References

1. AGENCY AI in Classical and Quantum Computing 1770604466 | PDF | Artificial Intelligence, accessed March 10, 2026, https://www.scribd.com/document/996400614/AGENCY-AI-in-Classical-and-Quantum-Computing-1770604466
2. What is AI? A Practical Guide - K2view, accessed March 10, 2026, https://www.k2view.com/what-is--ai/
3. (PDF) Latest Advances in AI Architectures, Frameworks, Technical Capabilities, and Applications - ResearchGate, accessed March 10, 2026, https://www.researchgate.net/publication/389505727_Latest_Advances_in_AI_Architectures_Frameworks_Technical_Capabilities_and_Applications
4. AI Copilots vs AI: Which Fits Your Enterprise? - Workativ, accessed March 10, 2026, https://workativ.com/ai-agent/blog/ai-copilots-vs--ai
5. Comprehensive Review of Artificial General Intelligence ... - viXra.org, accessed March 10, 2026, https://vixra.org/pdf/2511.0127v1.pdf
6. Understanding the Core Difference Between AI and AI Agents, accessed March 10, 2026, https://systemintegration.in/blog/difference-between-ai-agents-and--ai/
7. Exploring AI in Healthcare: A Study on Its Working Mechanism - PMC, accessed March 10, 2026, https://pmc.ncbi.nlm.nih.gov/articles/PMC12890637/
8. AI vs AGI vs ASI: What Each Stage Actually Means in 2026 - Kanerika, accessed March 10, 2026, https://kanerika.com/blogs/ai-vs-agi-vs-asi/
9. AI Agents Are Obsolete— AI Is the New Standard - Fluid AI, accessed March 10, 2026, https://www.fluid.ai/blog/ai-agents-are-obsolete---ai-is-the-new-standard
10. AI: How to Build Smarter RAG Applications - Addepto, accessed March 10, 2026, https://addepto.com/blog/-ai-how-to-build-smarter-rag-applications/
11. AI: Autonomous, Goal-Driven Artificial Intelligence - Mobikasa, accessed March 10, 2026, https://www.mobikasa.com/blog/what-is--ai-a-deep-dive-into-the-next-wave-of-artificial-intelligence/
12. AI vs AI Agents: 8 Real Differences You Must Know in 2026 - The NineHertz, accessed March 10, 2026, https://theninehertz.com/blog/-ai-vs-ai-agents
13. What is AI? A Practical Guide - K2view, accessed March 10, 2026, https://www.k2view.com/what-is--rag/
14. After AI What the Tech Industry Expects in

2026, accessed March 10, 2026, https://systemintegration.in/blog/what-is-next-after--ai-in-2026/
15. AI in Cybersecurity: The Good, The Bad, and The Really Bad - Medium, accessed March 10, 2026, https://medium.com/@dxtoday/-ai-in-cybersecurity-the-good-the-bad-and-the-really-bad-4e8d9d5a1b14
16. Top 5 AI Frameworks to Watch Out for in 2026 - SoluLab, accessed March 10, 2026, https://www.solulab.com/building-intelligent-apps-with--ai/
17. What is Retrieval-Augmented Generation (RAG)? A Practical Guide - K2view, accessed March 10, 2026, https://www.k2view.com/what-is-retrieval-augmented-generation
18. The Coming Train Wreck in AI | by David Johnston | Feb, 2026 | Medium, accessed March 10, 2026, https://medium.com/@david_dryfe_sands/the-coming-train-wreck-in--ai-452f0875ed24
19. Siemens Accelerates Integrated Circuit Design and Verification with ..., accessed March 10, 2026, https://www.signalintegrityjournal.com/articles/4248-siemens-accelerates-integrated-circuit-design-and-verification-with--ai-in-questa-one
20. AI Trends 2026: How To Keep Calm and Get Timeless Benefits From AI - Trinetix, accessed March 10, 2026, https://www.trinetix.com/insights/ai-trends-2026
21. AI: Architecture, Use Cases, Benefits, and Ethical Challenges, accessed March 10, 2026, https://www.techmixing.com/2025/09/Agentic-ai-the-next-frontier-in-artificial-intelligence.html
22. Exploring AI in Healthcare: A Study on Its Working Mechanism - Frontiers, accessed March 10, 2026, https://www.frontiersin.org/journals/medicine/articles/10.3389/fmed.2025.1753443/full
23. Configurable Graph-Based Task Solving with the Marco Multi-AI ..., accessed March 10, 2026, https://developer.nvidia.com/blog/configurable-graph-based-task-solving-with-the-marco-multi-ai-agent-framework-for-chip-design/
24. Domain-specific AI Agents for the Enterprise - Aisera, accessed March 10, 2026, https://aisera.com/blog/domain-specific-ai-agents/
25. The Future of Artificial Intelligence: Key Trends Shaping 2025 and Beyond, accessed March 10, 2026, https://amquesteducation.com/blog/the-future-of-artificial-intelligence-trends/
26. AI Agents in Drug Discovery - arXiv, accessed March 10, 2026, https://arxiv.org/pdf/2510.27130
27. What are data agents? The bridge between AI and enterprise data | The complete guide - K2view, accessed March 10, 2026, https://www.k2view.com/what-are-data-agents/
28. AI Transforms Chip Design Engineering - Design News, accessed March 10, 2026, https://www.designnews.com/artificial-intelligence/expert-says--ai-s-time-is-now
29. Author: Mark Ren | NVIDIA Technical Blog, accessed March 10, 2026, https://developer.nvidia.com/blog/author/haoxingr/
30. AI in Chip Design for Engineers | PDF | Artificial Intelligence - Scribd, accessed March 10, 2026, https://www.scribd.com/document/806213649/2-HC2024-nvidia-MarkRen-Intro-v04
31. Testing the Capabilities of AI Agents in Machine Learning ... - Medium, accessed March 10, 2026, https://medium.com/@shuchi0_0/testing-the-capabilities-of-ai-agents-in-machine-learning-engineering-using-mle-bench-4e1461622b3f
32. AI as a Service (AaaS): The Future of AI in Business - Worktual, accessed March 10, 2026, https://worktual.co.uk/insights/-ai-as-a-service/
33. AI Co-Pilot Frameworks for Ecosystem Partnership of Innovation: A 2025 Review of Orchestrated Collaboration, Licensing, and Networked Intelligence in Healthcare & Life Sciences - Medium, accessed March 10, 2026, https://medium.com/@alexglee/-ai-co-pilot-frameworks-for-ecosystem-partnership-of-innovation-a-2025-review-of-12900f21f814
34. (PDF) Comprehensive Review of Artificial General Intelligence AGI ..., accessed March 10,2026, https://www.researchgate.net/publication/391709360_Comprehensive_Review_of_Artificial_General_Intelligence_AGI_and_GenAI_Applications_in_Business_and_Finance
35. Duplichecker Plagiarism Report | PDF | Artificial Intelligence - Scribd, accessed March 10, 2026, https://www.scribd.com/document/92699097

4/Duplichecker-Plagiarism-Report-3,
36. Stages of Development in AI (January 2026), accessed March 10, 2026, https://etcjournal.com/2026/01/25/stages-of-development-in--ai-january-2026/
37. Proof over Promise: Insights on Real-World AI Adoption from 2025 MINDS Organizations, accesseMarch 10, 2026https://reports.weforum.org/docs/WEF_Proof_over_Promise_Insights_on_Real_World_AI _Adoption_from_2025_MINDS_Organizations_2026.pdf