

Journal of

Engineering Research

ISSN 2764-1317

vol. 6, n. 1, 2026

... **ARTICLE 12**

Acceptance date: 23/02/2026

THE EVOLUTION OF ARTIFICIAL INTELLIGENCE AGENTS: ARCHITECTURES, TRENDS, AND THE IMPACT OF AGENTIC AI

Henderson Matsuura Sanches

Processus University Center – UniProcessus

ORCID: 0000-0003-2354-3393



All content published in this journal is licensed under the Creative Commons Attribution 4.0 International License (CC BY 4.0).



Abstract: This article explores the development and evolution of artificial intelligence agents, from classical models to the emergence of agentic AI in 2025. It analyzes the transition from passive systems to autonomous entities capable of reasoning, planning, and executing complex tasks. The research is based on national and international scientific foundations, discussing architectures, practical applications, and ethical and governance challenges. The results indicate that agentic AI, driven by Large Language Models (LLMs), is redefining human-machine interaction and process automation, although it requires a careful approach to ethics and governance.

Keywords: AI Agents; Agentic AI; Multiagent Systems; Autonomy; Generative Artificial Intelligence.

Introduction

Artificial Intelligence (AI) has transformed various spheres of society, and one of its most significant advances is the development of **artificial intelligence agents**. These are software systems designed to perceive their environment, make decisions, and perform actions autonomously to achieve specific goals [2]. The evolution of these agents has been remarkable, moving from simple reactive systems to proactive and complex entities capable of reasoning, planning, and memory.

The year 2025 has been widely touted as the beginning of the “Age of Agents” or “Agentic AI,” marking a transition from passive AI models, such as traditional chatbots, to proactive agents that can perform complex tasks and interact with the real world in more sophisticated ways [1] [3]. This change is driven by advances in Lar-

ge Language Models (LLMs), which act as the “brain” of these agents, allowing them to understand natural language, plan, and even use tools to extend their capabilities [1].

This article aims to analyze the evolution of artificial intelligence agents, exploring their architectures, emerging trends for 2025, and the impact of agentic AI on various applications. We will discuss fundamental concepts, practical applications in sectors such as finance and public governance, and the ethical and governance challenges that accompany this transformative technology.

Theoretical Framework

Historical Evolution and Classical Models.

The concept of intelligent agents dates back to the early days of AI, with the idea of systems that can act autonomously. Classical models, such as reactive and deliberative agents, laid the foundation for understanding intelligent behavior. Belief-Desire-Intention (BDI) agents, for example, are a popular architecture that simulates beliefs (information about the environment), desires (goals to be achieved), and intentions (plans to achieve desires), enabling more sophisticated and goal-oriented behavior. [6]

Agentic AI and Large Language Models (LLMs)

Agentic AI represents the next frontier in the development of AI agents, where autonomy and the ability to perform complex tasks are significantly enhanced. The emergence of **Large Language Models**

(LLMs), such as GPT and Claude, has revolutionized this area. LLMs provide agents with the ability to understand, reason, and generate natural language, enabling them to interpret complex instructions, plan sequences of actions, and interact with users and other tools more intuitively [1].

In this context, the LLM acts as the agent's "brain," allowing it to perform "high-level thinking": understanding what the user wants, solving problems, and determining the next steps. The ability to use tools (tool-calling) is crucial, as it allows the agent to extend its functionality beyond the intrinsic capabilities of the LLM, interacting with APIs, databases, and other systems [1].

Modern Agent Architecture

The architecture of a modern AI agent, especially those powered by LLMs, generally includes the following components:

- **LLM (Large Language Model):** The core component for reasoning, understanding, and language generation.
- **Memory:** The ability to store and retrieve long- and short-term information, allowing the agent to maintain context and learn from past experiences.
- **Planning/Reasoning:** Module responsible for breaking down complex tasks into smaller sub-tasks and sequencing actions to achieve a goal.
- **Tools/APIs:** Set of external functionalities that the agent can invoke to interact with the environment, search for information, or perform specific actions (e.g.,

search the web, send email, access a database).

- **Perception and Action:** Modules that allow the agent to receive information from the environment and perform actions in it.

This architecture allows AI agents not only to respond to commands, but also to initiate actions, adapt to new situations, and work autonomously to achieve their goals [2].

Methodology

This article was prepared through a qualitative and exploratory literature review. Data collection was carried out from various sources, including:

- **Academic databases:** Brazilian Digital Library of Theses and Dissertations (BDTD) [4] [5] and SBC OpenLib (SOL) [6].
- **Technology and news portals:** IBM Think [1], Google Cloud [2], Microsoft Blogs [3], and LinkedIn [7].
- **Specialized media:** YouTube channels focused on AI trends [8].

The research focused on publications and news from 2024 and 2025 to ensure that the information on the latest trends and advances in artificial intelligence agents was up to date. Analysis of the collected material allowed for the identification of key concepts, predominant architectures, emerging applications, and challenges associated with the implementation and governance of AI agents.

Development and Discussion

Trends: The Era of Proactive Agents

The current artificial intelligence landscape is marked by the consolidation of **Agent AI or AI Agents** as one of the main trends. The expectation is that AI agents will become increasingly proactive and autonomous, capable of performing complex tasks without constant human intervention [1] [3]. The main trends include:

- **Proactive Automation:** Agents that not only respond to commands, but also anticipate needs and initiate actions to optimize processes and workflows.
- **Agent Orchestration:** The development of systems capable of managing and coordinating multiple AI agents to work together to solve larger and more complex problems [1].
- **Multicloud Integration:** Frameworks for automation and governance of AI agents in hybrid and multicloud environments, especially relevant for the public sector [5].
- **Advanced Conversational Agents:** Chatbots that use generative AI to provide more contextualized, secure, and efficient responses, with growing applications in the financial sector [6].

This evolution promises to transform the way companies operate, increasing productivity and efficiency in several areas [7].

To illustrate the diversity and capabilities of AI agents, the following tables present a comparison of development frameworks, enterprise platforms, and the fundamental technical capabilities of modern agents.

Table 1 presents a comparison of AI agent development frameworks. Adapted from o-mega.ai (2026) [9].

Table 2 presents a comparison of AI agent platforms for business use. Adapted from IBM (2025) [1].

Table 3 shows the fundamental technical capabilities of modern AI agents. Adapted from Google Cloud (2025) [2].

The year 2025 is marked by the consolidation of **Agent AI** as one of the main trends in artificial intelligence. The expectation is that AI agents will become increasingly proactive and autonomous, capable of performing complex tasks without constant human intervention [1] [3]. The main trends include:

- **Proactive Automation:** Agents that not only respond to commands, but also anticipate needs and initiate actions to optimize processes and workflows.
- **Agent Orchestration:** The development of systems capable of managing and coordinating multiple AI agents to work together to solve larger and more complex problems [1].
- **Multicloud Integration:** Frameworks for automation and governance of AI agents in hybrid and multicloud environments, especially relevant for the public sector [5].

Framework	Developer	Main Approach	Supported Languages	Key Features
LangGraph	LangChain	Graph-based (DAGs)	Python, JavaScript	Refined control, cyclic flows, integration with the LangChain ecosystem.
CrewAI	Open Source	Role-based	Python	Collaboration between agents, sequential and hierarchical processes, easy to use.
AutoGen	Microsoft	Conversation-based	Python, .NET	Dialogue between multiple agents, code execution support, highly customizable.
LlamaIndex	LlamaIndex	Data-focused (RAG)	Python, TypeScript	Orchestration of agents focused on data retrieval and indexing.
Manus	Google	General Purpose (Agent-as-a-Service)	Python, JavaScript, Shell	Automation of complex tasks, web browsing, interaction with tools, iterative planning.

Table 1: Comparison of Agent Development Frameworks *Adapted from o-mega.ai (2026).*

Platform	Company	Application Focus	Integration	Differential
Agentforce	Salesforce	CRM and Sales	Native to the Salesforce ecosystem	Autonomous agents integrated directly with customer data.
Copilot Studio	Microsoft	Productivity and Office	Microsoft 365, Azure	Creation of custom agents with low-code.
watsonx Orchestrate	IBM	Process Automation	IBM Cloud, SAP, Oracle	Focus on governance, compliance, and automation of complex workflows.
Google Agent Builder	Google Cloud	Search and Conversation	Google Cloud Platform (GCP)	Ease of creating search and conversation agents using Vertex AI.
Manus	Google	Workflow Automation	Linux Sandbox	Execution of complex tasks, user interaction, use of various tools (shell, browser, file).

Table 2: Comparison of Agent Platforms for Businesses (Enterprise) *Adapted from IBM (2025).*

Capability	Description	Importance
Reasoning	Ability to break down complex problems.	Essential for autonomy and solving non-trivial problems.
Tool-calling	Interaction with APIs and external systems.	Allows the agent to perform actions in the real world (e.g., sending emails).
Long-Term Memory	Retention of context between sessions.	Crucial for personalization and continuity of complex tasks.
Dynamic Planning	Adjusting plans based on new data.	Allows the agent to deal with unforeseen events during execution.

Table 3: Technical Capabilities of Modern Agents *Adapted from Google Cloud (2025)*.

- **Advanced Conversational Agents:** Chatbots that use generative AI to provide more contextualized, secure, and efficient responses, with growing applications in the financial sector [6].

This evolution promises to transform the way companies operate, increasing productivity and efficiency in several areas [7].

Practical Applications of AI Agents

AI agents are finding applications in a wide range of sectors, demonstrating their transformative potential:

- **Financial Sector:** Conversational agents based on generative AI are used to respond to natural language queries to structured databases, reducing information overload and supporting operational efficiency in financial institutions [6].
- **Public Governance:** Agentic AI agents in multicloud environments can optimize process automation and governance in the public sector, improving service delivery and data management [5].
- **Software Development:** AI agents assist in code generation, test au-

tomation, and predictive monitoring, accelerating the software development lifecycle.

- **Digital Games:** Intelligent agents are used in modeling non-playable characters (NPCs) with more realistic and adaptive behaviors, enriching the player experience.
- **Risk Management:** In the customs area, AI acts as an instrument and control agent in the risk management of import clearance, increasing security and efficiency [4].

Ethical and Governance Challenges

As AI agents become more autonomous and influential, significant challenges related to ethics and governance arise. The ability to make decisions and execute actions without human intervention raises questions about accountability, transparency, and algorithmic biases. The need for regulation and the formation of “morally responsible agents” are crucial issues to ensure that AI is developed and used in a way that benefits society [1].

AI governance must address the creation of clear guidelines for the design, development, and deployment of agents, ensuring that they operate within ethical and legal boundaries. Transparency in the decision-making processes of agents and the ability to audit them are fundamental to building trust and mitigating risks.

Final Considerations

The evolution of artificial intelligence agents, especially with the rise of agentic AI and integration with LLMs, represents a significant milestone in the field of artificial intelligence. The ability of these agents to reason, plan, and execute tasks autonomously is redefining automation and human-machine interaction, promising substantial gains in productivity and efficiency across a range of industries.

Trends for 2025 point to a future where AI agents will be increasingly proactive, orchestrated, and integrated into complex environments, from the financial sector to public governance. However, this transformation is not without challenges. Ethical, liability, and governance issues require ongoing attention to ensure that the development and deployment of these agents occurs in a manner that is safe and beneficial to society.

Continued research and development in agent architectures, coupled with a strong focus on ethical and regulatory guidelines, will be crucial to maximizing the potential of AI agents and navigating the challenges inherent in this revolutionary technology. The “Age of Agents” is just beginning, and its impact will be profound and lasting.

References

- [1] BELCIC, Ivan; STRYKER, Cole. **AI agents in 2025: Expectations vs. reality**. IBM Think, 2025. Disponível em: <https://www.ibm.com/think/insights/ai-agents-2025-expectations-vs-reality>. Acesso em: 11 fev. 2026.
- [2] GOOGLE CLOUD. **What are AI agents? Definition, examples, and types**. 2025. Disponível em: <https://cloud.google.com/discover/what-are-ai-agents>. Acesso em: 11 fev. 2026.
- [3] MICROSOFT. **Microsoft Build 2025: The age of AI agents and building the open agentic web**. 2025. Disponível em: <https://blogs.microsoft.com/blog/2025/05/19/microsoft-build-2025-the-age-of-ai-agents-and-building-the-open-agentic-web/>. Acesso em: 11 fev. 2026.
- [4] REIS, Raquel Segalla. **Gestão de riscos no despacho aduaneiro de importação: inteligência artificial como instrumento e agente de controle**. 2024. Dissertação (Mestrado) - Biblioteca Digital Brasileira de Teses e Dissertações (BDTD), Instituto Brasileiro de Informação em Ciência e Tecnologia (IBICT). Disponível em: <https://bdtd.ibict.br/vufind/Search/Results?lookfor=Agentes+de+Inteligencia+Artificial&type=AllFields>. Acesso em: 11 fev. 2026.
- [5] SANTOS, Marco Túlio Gonçalves dos. **Inteligência artificial agêntica em ambientes multicloud: framework de automação e governança para o setor público**. 2025. Dissertação (Mestrado) - Biblioteca Digital Brasileira de Teses e Dissertações (BDTD), Instituto Brasileiro de Informação em Ciência e Tecnologia (IBICT). Disponível em: https://bdtd.ibict.br/vufind/Record/IBICT-1_8fe7e4198a-51b09491be18c697a2d8d6. Acesso em: 11 fev. 2026.

[6] SILVA, Vanessa da; HÖLBIG, Carlos Amaral. Agente conversacional baseado em inteligência artificial generativa aplicado ao setor financeiro. **Anais da I Escola Regional de Aprendizado de Máquina e Inteligência Artificial da Região Sul (ERAMIA-RS)**. Porto Alegre: Sociedade Brasileira de Computação, 2025. DOI: 10.5753/eramars.2025.16658. Disponível em: <https://sol.sbc.org.br/index.php/eramars/article/view/39385>. Acesso em: 11 fev. 2026.

[7] LINKEDIN. **AI Agent trends for 2025: Agentic RAG, Voice Agents, more**. 2025. Disponível em: https://www.linkedin.com/posts/rakeshgohel01_ai-agent-trends-have-dramatically-changed-activity-7343981787842297858-PJkS. Acesso em: 11 fev. 2026.

[8] YOUTUBE. **TOP 5 Tendências de IA Para 2025 (O Ano da Inteligência Artificial)**. 2025. Disponível em: <https://www.youtube.com/watch?v=SoPmOcezqC8>. Acesso em: 11 fev. 2026.

[9] O-MEGA.AI. **LangGraph vs CrewAI vs AutoGen: Top 10 AI Agent Frameworks**. 2026. Disponível em: <https://o-mega.ai/articles/langgraph-vs-crewai-vs-autogen-top-10-agent-frameworks-2026>. Acesso em: 11 fev. 2026.