Engineering Universe for Scientific Research and Management
ISSN (Online): 2319-3069
Vol. XVIII Issue II
February 2026

A Comparative Study on Generative AI and Agentic AI

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Abstract

This paper presents a comparative study of Generative AI and Agentic AI. Generative AI focuses on creating new content such as text, images, code, audio, and video from learned patterns in data. Agentic AI extends these capabilities by enabling autonomous planning, reasoning, tool use, memory, and multi-step task execution to achieve user-defined goals. The paper discusses architectures, characteristics, applications, advantages, limitations, ethical issues, and future research directions. A comparative analysis highlights key differences in autonomy, decision-making, adaptability, and enterprise use.

Keywords

Generative AI, Agentic AI, Large Language Models, Autonomous Agents, Artificial Intelligence.

1. Introduction

Artificial Intelligence has evolved from rule-based systems to machine learning and foundation models. Generative AI has transformed content creation, while Agentic AI introduces autonomous systems capable of planning and executing tasks with minimal human intervention.

2. Generative AI

Generative AI relies on foundation models such as transformers, diffusion models, and GANs to generate human-like outputs. Typical applications include chatbots, coding assistants, image synthesis, document summarization, and content generation.

3. Agentic AI

Agentic AI combines large language models with planning, memory, reasoning, external tools, APIs, and feedback loops. Agentic systems decompose complex goals into subtasks, execute them, monitor outcomes, and revise plans when required.

4. Comparative Analysis

Generative AI primarily generates content in response to prompts. Agentic AI performs autonomous multi-step workflows, interacts with software tools, maintains context, and makes decisions to accomplish objectives.

5. Applications

Generative AI: content creation, software development, education, healthcare documentation. Agentic AI: autonomous customer support, research assistants, cybersecurity, workflow automation, robotics, scientific discovery.

6. Challenges

Challenges include hallucinations, bias, privacy, security, explainability, governance, and human oversight. Agentic AI additionally requires robust planning, safety constraints, and monitoring due to higher autonomy.

7. Future Scope

Future systems are expected to combine multimodal generative capabilities with trustworthy autonomous agents, improved reasoning, long-term memory, and responsible AI governance.

8. Conclusion

Generative AI and Agentic AI are complementary technologies. Generative AI excels at producing high-quality content, whereas Agentic AI extends these capabilities through autonomous decision-making and task execution. Together they represent the next generation of intelligent systems.

Parameter	Generative AI	Agentic AI
Primary Goal	Content generation	Goal completion
Autonomy	Low	High
Planning	Limited	Advanced
Memory	Context window	Persistent memory
Tool Use	Optional	Core capability
Examples	ChatGPT, Gemini	AI research agents, coding agents

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