The Architecture of Autonomous AI Agents

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Abstract
Large Language Models (LLMs) act as the cognitive engine for AI systems, but they are limited by their static training data and lack of external interaction. This paper proposes a comprehensive framework for AI Agents—systems that combine LLMs with planning, memory, and tool execution capabilities. We examine the transition from simple Chain-of-Thought (CoT) reasoning to complex multi-agent orchestration, highlighting the critical role of vector databases in long-term memory retention.

1. Introduction

The paradigm of Artificial Intelligence is shifting from Chat to Action. While a standard LLM can answer questions based on pre-trained knowledge, an AI Agent is defined by its ability to pursue goals. An agent does not just know; it does. This distinction creates the need for a new architectural standard that wraps the LLM in a control loop of observation, reasoning, and execution.

2. The Four Core Modules

A functional AI Agent requires four distinct components working in unison.

2.1 Profiling (The Persona)

Profiling instructs the LLM on who it is. By assigning a specific role, we constrain the solution space and reduce hallucination.

2.2 Memory (The Context)

Memory bridges past and future actions, including sensory memory, short-term memory, and long-term memory via vector databases.

2.3 Planning (The Strategy)

Planning decomposes high-level goals into executable steps using CoT, ReAct, and reflection mechanisms.

2.4 Tools (The Action Space)

Tools extend agent capabilities beyond text generation, including search APIs, code interpreters, and file I/O.

3. Multi-Agent Systems (MAS)

Multi-agent systems deploy specialized agents such as controllers, executors, and reviewers to handle complex or conflicting objectives.

4. Conclusion

The evolution from LLMs to AI Agents marks the rise of Agentic AI. Key challenges remain in loop detection and security.

5. References

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