

From Prompts to Autonomous Systems: Building and Testing Agentic AI Architectures

Initial Position

The field of AI is rapidly evolving beyond simple "chat" models to encompass **AI Agents**: sophisticated systems designed to autonomously pursue goals. These agents can use tools, access information, and execute multi-step plans, representing a significant new paradigm for data science. As this technology is still emerging, there is a critical need to establish robust "best practices" for designing agents that are reliable, effective, and predictable.

This thesis offers a timely opportunity to gain hands-on experience at the forefront of applied AI. The work is structured as a portfolio of three distinct projects, progressing from foundational concepts to an advanced, collaborative system and offers the student to learn essential, in-demand skills for architecting the next generation of intelligent systems.

Objectives and Procedure

Project 1: The Active Agent. The initial phase focuses on building an "Active Agent." The objective is to learn how to equip an LLM with external tools (e.g., a calculator or a web search API) and validate its ability to select and use them correctly.

Project 2: The Thoughtful Agent. This project advances the agent's capabilities by integrating **planning** and **persistent memory**. The agent will be designed to tackle complex, multi-step research tasks by autonomously creating a plan and storing its findings for later use.

Project 3: The Collaborative Agent Team. This project involves designing a **collaborative team of AI agents**. The goal is to architect a multi-agent system where "specialist" agents (e.g., a Planner, a Data Analyst, a Reviewer) communicate and work together to solve a complex data problem that a single agent could not manage alone.

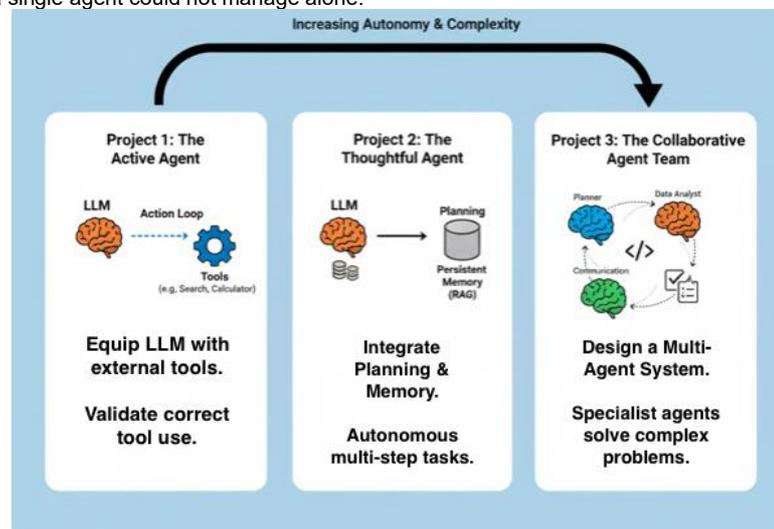


Figure 1: Envisioned Thesis Flow

Required skills: Programming skills, Basic DS skills, General familiarity with LLMs, curious and proactive learner

References:

ReAct: Synergizing Reasoning and Acting in Language Models. (Yao et al., 2023)
Retrieval-Augmented Generation for Knowledge-Intensive NLP Tasks. (Lewis et al., 2020)

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Advisor: Prof. Dr. Jelena Milosevic