

COMP7103C Course Assignment

Code Agent Building

1. Background & Motivation

AI-driven programming paradigms are transforming software development with the rise of Large Language Models (LLMs). Simple code snippet generation is no longer sufficient—the industry is now exploring advanced "Agentic Systems," where AI Agents autonomously understand, plan, code, and deliver complete software projects.

This hands-on project puts you at the forefront of this technological revolution. You will design and build a multi-agent collaborative system capable of creating code repositories from scratch. Through this practical experience, you will develop deep understanding of AI's transformative potential in software engineering while mastering essential skills for building next-generation development tools that are reshaping the industry.

2. Learning Objectives

Upon completing this project, you will be able to:

- **Design Multi-Agent Architectures:** Implement agents with specialized roles and develop effective orchestration systems for seamless collaboration
- **Integrate LLM APIs:** Master engineering best practices for stable API communication with major LLMs (e.g., DeepSeek, Qwen, GPT, Claude).
- **Implement Agent Tools:** Empower agents to interact with environments like local filesystems through advanced function-calling capabilities
- **Architect Advanced Agent Communication:** Design sophisticated instruction protocols that effectively guide the behavior and decision-making of different agent roles
- **Practice Task Decomposition & Collaboration:** Train an agent system to break down high-level objectives into concrete sub-tasks and coordinate their execution among multiple agents.
- **Evaluate AI-Generated Quality:** Assess the structure, readability, and functional completeness of AI-generated software projects.

3. Core Project Description

You are required to build a multi-agent collaborative system that autonomously completes software development from natural language task descriptions. The core challenge is designing

an effective orchestration framework that enables specialized agents to communicate, coordinate, and deliver complete functional software projects. Reference design framework is provided below:

Role-Specific Agents

- **Project Planning Agent:** Handles high-level planning, designs software architecture, and breaks down initial requirements into executable task lists with clear technical specifications and dependencies
- **Code Generation Agent:** Executes concrete development tasks, receives explicit instructions and utilizes programming tools to implement code solutions.
- **Code Evaluation Agent:** Reviews and validates code quality, functionality, and adherence to requirements through automated testing and analysis.

Multi-Agent Orchestrator

For multi-agent interaction and memory management, consider the following components:

- **Task Scheduling:** Task Scheduling: Determining which agent should work next and coordinating task dependencies across the system
- **Communication Management:** Establishing protocols for seamless information exchange and collaboration between specialized agents
- **State Management:** Tracking global project state, maintaining shared memory, and determining final task completion status

Tool Kit

Potential tool kits that may be utilized include:

- **Filesystem Tools:** `create_file`, `write_to_file`, `read_file`, and other file management operations
- **Web Search Tool:** Simulated search functionality to retrieve external knowledge and documentation
- **Code Execution Tool:** Shell command execution capabilities for testing and validation (use with appropriate safety measures)

4. Test Case: Generate an "arXiv CS Daily" Webpage

Task Instruction

Build an "arXiv CS Daily" webpage with three core functionalities to deliver a streamlined experience for tracking daily computer science preprints:

1. Domain-Specific Navigation System

Implement categorized navigation based on arXiv's primary CS fields (cs.AI, cs.AR, cs.SY, etc.). This enables users to quickly filter and switch between major subfields, ensuring easy access to their areas of interest.

2. Daily Updated Paper List

Create a daily updated list displaying the latest papers with essential details only. Each entry may include the paper title (hyperlinked to its detail page), submission time, and the specific arXiv field tag (e.g., [cs.CV]).

3. Dedicated Paper Detail Page

Design a comprehensive detail page that centralizes critical resources: direct PDF link (hosted on arXiv), core metadata (title, authors with affiliations, submission date), and citation generation tools supporting common formats (BibTeX, standard academic citation) with one-click copy functionality.

Example

HomePage:

The screenshot shows the homepage of arXiv CS Daily. At the top, there is a dark header bar with the text "arXiv CS Daily" on the left and "Home All Papers Categories ▾" on the right. Below the header, the main content area has a light gray background. It features the title "arXiv CS Daily" in large bold letters, followed by the subtitle "Track the latest computer science research papers from arXiv.org". A horizontal line separates this from the main content. Below the line, there is a sub-headline "Browse by category or view the most recent submissions across all CS fields." and a blue button labeled "View Latest Papers". Further down, there is a section titled "Computer Science Categories" with the subtext "arXiv's Computer Science (cs) archive is organized into the following subject categories:". This section contains four categories in boxes: "cs.AI" (Artificial Intelligence), "cs.AR" (Hardware Architecture), "cs.CC" (Computational Complexity), and "cs.CE" (Computational Engineering). Each category box has a sub-subtitle and a "Browse Papers" button.

Sub-Pages:

Artificial Intelligence Papers

Showing the latest papers from arXiv in the category

Publication Date:

2025-11-13

Black-Box On-Policy Distillation of Large Language Models

Tianzhu Ye, Li Dong, Zewen Chi, Xun Wu, Shaohan Huang, Furu Wei

Black-box distillation creates student large language models (LLMs) by learning from a proprietary teacher model's text outputs alone, without access to its internal logits or parameters. In this work, we introduce...

2025-11-13

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Instella: Fully Open Language Models with Stellar Performance

Jiang Liu, Jialian Wu, Xiaodong Yu, Yusheng Su, Prakamya Mishra, Gowtham Ramesh, Sudhanshu Ranjan, Chaitanya Manem, Ximeng Sun, Ze Wang, Pratik Prabhanjan Brahma, Zicheng Liu, Emad Barsoum

Large language models (LLMs) have demonstrated remarkable performance across a wide range of tasks, yet the majority of high-performing models remain closed-source or partially open, limiting transparency and...

2025-11-13

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Querying Labeled Time Series Data with Scenario Programs

Edward Kim, Devan Shankar Varma Bharadwaj, Hanchuan Park, Tianshi Kim

arXiv CS Daily

Home All Papers Categories ▾

Hardware Architecture Papers

Showing the latest papers from arXiv in the category

Publication Date:

2025-11-10

FractalCloud: A Fractal-Inspired Architecture for Efficient Large-Scale Point Cloud Processing

Yuzhe Fu, Changchun Zhou, Hancheng Ye, Bowen Duan, Qiyu Huang, Chiye Wei, Cong Guo, Hai "Helen" Li, Yiran Chen

Three-dimensional (3D) point clouds are increasingly used in applications such as autonomous driving, robotics, and virtual reality (VR). Point-based neural networks (PNNs) have demonstrated strong performance in point...

2025-11-10

[cs.AR - Hardware Architecture](#)

[PDF](#)

[Details](#)

ZeroSim: Zero-Shot Analog Circuit Evaluation with Unified Transformer Embeddings

Xiaomeng Yang, Jian Gao, Yanzhi Wang, Xuan Zhang

Although recent advancements in learning-based analog circuit design automation have tackled tasks such as topology generation, device sizing, and layout synthesis, efficient performance evaluation remains a major...

2025-11-10

[cs.LG - cs.LG](#)

[PDF](#)

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FPGA-Accelerated RISC-V ISA Extensions for Efficient Neural Network Inference on Edge Devices

Arya Parameshwara, Santosh Hanamappa Mokashi

Optimizing GEMM for Energy and Performance on Versal ACAP Architectures

Ilias Papalamprou, Dimosthenis Masouros, Ioannis Loudarios, Francky Catthoor, Dimitrios Soudris

5. Deliverables

- Git Repository Link: Complete source code of your agent system with a detailed README.md file explaining project architecture, setup instructions, and key execution examples.
- Project Report (PDF): Comprehensive documentation detailing system design, key challenges and solutions, results analysis, and reflections.

- In-person Meeting with TAs: Live demonstration showcasing your coding agent's performance on practical tasks.

6. Hints & Suggestions

- Start Small: Begin by implementing a single agent that creates one file, then gradually scale up functionality.
- Leverage Logging: Implement detailed logs of agent thoughts and actions for effective debugging and system analysis.
- Iterate on Prompts: Continuously refine your system prompts based on observed agent behavior and performance.
- Manage Costs: Use lower-cost models during development phase and switch to high-performance models for final testing.
- Learn From, But Do Not Copy: Study existing frameworks like AutoGen or ChatDev for insights, but ensure your implementation is original.

LLM API you may consider using:

- DeepSeek: DeepSeek V3.1: deepseek/deepseek-chat-v3.1
- Z.AI: GLM 4.5 Air: z-ai/glm-4.5-air
- DeepSeek: R1 0528: deepseek/deepseek-r1-0528
- Qwen: Qwen3 Coder 480B A35B: qwen/qwen3-coder
- Qwen: Qwen3 235B A22B: qwen/qwen3-235b-a22b
- Meta: Llama 3.3 70B Instruct: meta-llama/llama-3.3-70b-instruct
- OpenAI: gpt-oss-20b: openai/gpt-oss-20b
- MoonshotAI: Kimi K2 0711: moonshotai/kimi-k2

Web Search tools you may consider using:

- Brave_Search: <https://github.com/modelcontextprotocol/servers-archived/tree/main/src/brave-search>
- Fetch: <https://github.com/modelcontextprotocol/servers/tree/main/src/fetch>

Code Execution tools you may consider using:

- Code_Executor: https://github.com/bazinga012/mcp_code_executor
- Commands: <https://github.com/g0t4/mcp-server-commands>

TA Contact Information

For questions and support, please contact:

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