

ACS: Advanced AI Computing and Systems

Lecture 0: Course Introduction and Basics

Prof. Kai Chen

The Course Instructor

- Prof. Kai Chen



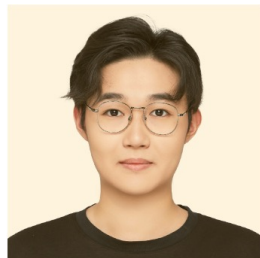
- Personal Website
 - <https://www.cse.ust.hk/~kaichen/>
 - Prof. Kai Chen's lab: <https://ising.cse.ust.hk/>
- Email
 - kaichen@cse.ust.hk (the best way to reach me)
- Office
 - CYT-3005 (Lift 35/36)
- Office Hour: By appointment
- Research and Teaching in:
 - Computer network, operating system, computer architecture
 - Data center networking
 - High-performance networking
 - AI-centric network systems

Our Teaching Assistants (TAs)

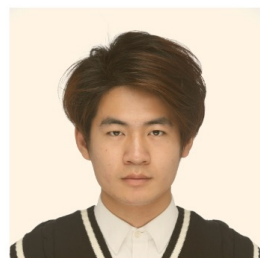
- We are lucky to have some nice TAs for this course:
 - HUANG Xinyang, xhuangci@connect.ust.hk
 - SUN Yijun, ysuneb@connect.ust.hk
 - ZHANG Daoping, dzhangce@connect.ust.hk
 - CHEN Zhuo, zchenkv@connect.ust.hk
 - XIE Songrun, songrun.xie@connect.ust.hk
 - YANG Xinyu, xinyu.yang@connect.ust.hk



Xinyang Huang



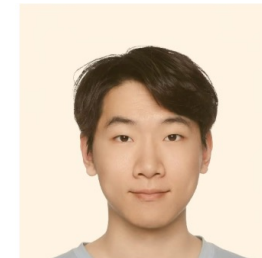
Yijun Sun



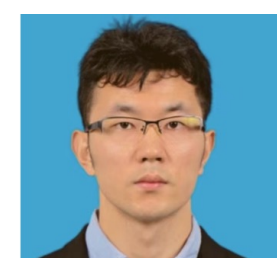
Daoping Zhang



Zhuo Chen



Songrun Xie



Xinyu Yang

- Different TAs are responsible for different aspects of the course. If you need assistance, please feel free to email the relevant TA.

Course Overview

- **THIS IS A CSE 5000-LEVEL, PG-LEVEL COURSE**
- Introduction to state-of-the-art **computer architectures, networks, and distributed systems** for AI computing.
- **Topics:**
 - Lecture 01 --- Processor Evolution: from CPU to GPU
 - Lecture 02 --- Memory Evolution: Memory Hierarchy and SOTA Technics
 - Lecture 03 --- Network Evolution: From Kernel TCP/IP to RDMA and Scale-Out/Up
 - Lecture 04 --- LLM Era:Transformer and Its Application
 - Lecture 05 --- Constructing LLM Systems
- **Tutorials**
 - In addition to lectures, the tutorials develop practical skills for AI computing research and industry, including parallel programming, commonly used AI algorithms, and parallel algorithm design.
- **Putting Together and Project: Customizing Your Own Agents and Deployment**

(Soft) Prerequisites

- COMP3511 (Operating Systems) or,
- COMP4611 (Design and Analysis of Computer Architectures) or,
- COMP4621 (Computer and Communication Networks) or,
- Basic C++ knowledge and machine learning knowledge
- A passion for understanding deeper knowledge of computer architectures, networks and LLM systems

This Course Does Not Do the Below

- **We do not teach a specific programming language.** You are expected to learn or review the necessary programming skills independently.
- **We do not provide software-development support for commercial projects, internships, or part-time jobs.** The course project is intended solely for learning and assessment. We will provide guidance and feedback, but you are responsible for designing and implementing your own system.
- **We cannot cover every topic in complete detail.** We will explain the key concepts as clearly as possible, but some details will require independent study. If anything remains unclear after a lecture, we encourage you to:
 - Search for relevant resources using Google, ChatGPT, or other appropriate tools.
 - Email us with specific questions, together with the resources you have consulted and your current understanding.

Logistics

■ Course Web Material

- Slides at the course web: acs.ising.cse.ust.hk
 - We will upload the resources after the lecture
 - Extra files also at the course web
- Canvas is used to release scores, it is not the main venue of this course

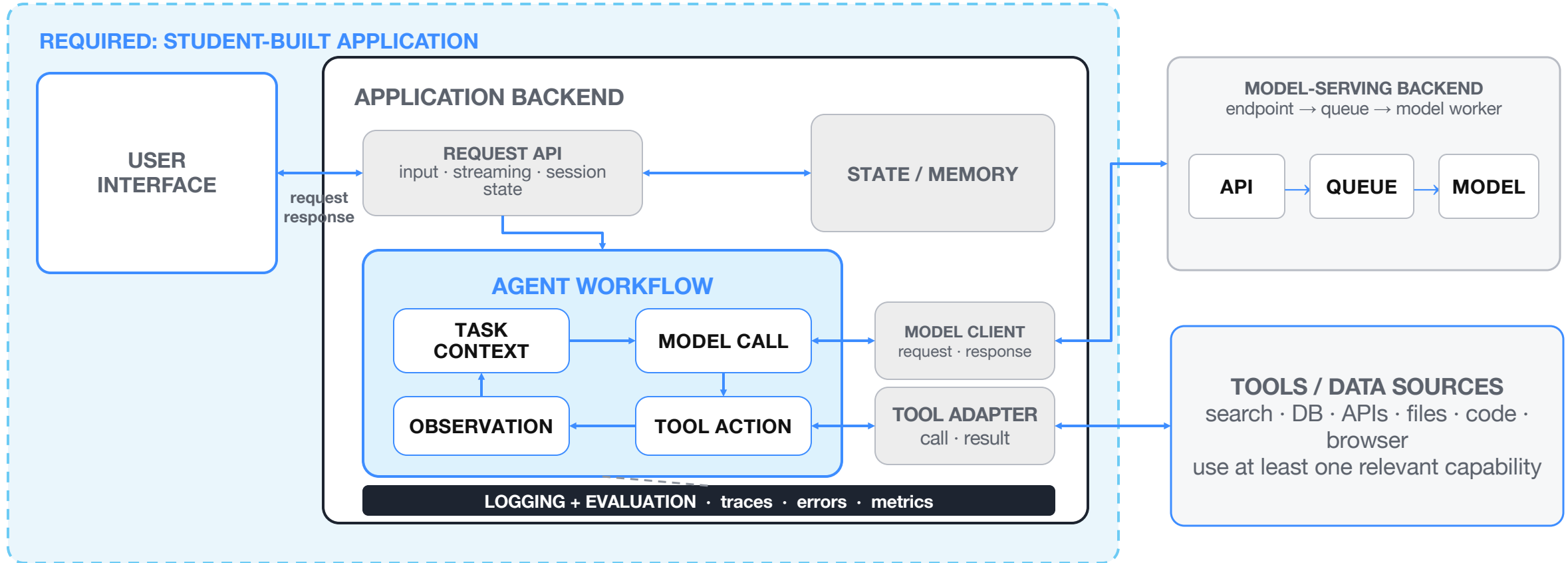
■ Grading

- Four Individual Coding Assignments: 40%
 - The assignments involve popular programs in AI computing, such as MPI, CUDA, algorithms, and parallelism.
- One Course Project: 60%
 - Code repository accounts for 30%, we focus on the completeness and easy-to-use of your project.
 - Presentation accounts for 30%, we focus on the critical thinking behind your project. You are encouraged to apply the knowledge gained in this course to enhance its originality and technical depth.

■ There are no exams in this course

- You are therefore expected to spend more time and effort to the course project.

Course Project: build an Agent System on TACC



Project Milestones

1. Team Formation

Form a project team and confirm all members. Align on shared interests and working expectations.

2. Topic Selection and Proposal

Choose a focused task or scenario and submit a short proposal covering the motivation, planned system, and evaluation plan.

3. Project Development

Implement and evaluate the proposed system. Refine the scope and approach based on progress and feedback.

4. Final Presentation

Present the completed system and evaluation results, give a short demo, and submit the final code repository.

Homework and Project Submissions

 THE HONG KONG
UNIVERSITY OF SCIENCE
AND TECHNOLOGY

ACADEMIC REGISTRY

RESOURCE LIBRARY

TOOLS & U



[< Undergraduate Student Guide](#)

Academic Integrity

Academic integrity and honesty are key values at HKUST.

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All students are required to uphold the University's [Academic Honor Code](#).

Some kinds of academic misconduct are obvious but others are not so clear. It is your responsibility to learn where the University draws the line between academic honesty and cheating.

- **Double check what you submitted**
 - Download it and test it after submitting
 - We will grade the homework/project zero if:
 - It does not follow exactly the specified format, including file name
 - It does not work at all
- **Do Not Cheat**
 - Homework must be done individually
 - Sharing answer/code (even one line) is cheating
 - Asking someone else to do your homework is cheating
 - You will automatically fail the course if you are caught cheating

Major High-Level Goals of This Course

- Understand widely used and state-of-the-art techniques in AI infrastructure.
- Design and build an end-to-end infrastructure stack for large language models.
- Develop practical skills in multithreaded programming and AI algorithms that are valuable for research and industry careers.
- Takeaways
 - Becoming a good system architect is challenging.
 - Designing a new system requires considering many interconnected factors and developing strong intuition about design choices and trade-offs.
 - But, it is fun and can be very technically rewarding
- **We hope that all of you will benefit greatly from this course!**