



課 綱 Course Outline
資訊工程學系國際組

中文課程名稱 Course Name in Chinese	大語言模型及應用				
英文課程名稱 Course Name in English	Large Language Models and Applications				
科目代碼 Course Code	CSIEM0680	班 別 Degree	碩士班 Master' s		
修別 Type	選修 Elective	學分數 Credit(s)	3.0	時 數 Hour(s)	3.0
先修課程 Prerequisite					
課程目標 Course Objectives					
Understand and implement core architectures of LLMs such as Transformers, BERT, and GPT, and acquire the capability to develop Retrieval-Augmented Generation (RAG) systems and to utilize PEFT for model fine-tuning.					
Master the concept of Code Evolution and be able to design LLM-based Evolutionary Coding Agents to solve complex optimization problems.					
Comprehend the development trajectory of World Models and cultivate a forward-looking research perspective on next-generation Artificial General Intelligence (AGI).					
系教育目標 Dept.' s Education Objectives					
1	探究學科知識，善用專業技能 Explore academic knowledge, utilize professional skills.				
2	訓練評析思考，創新解決問題 Exercise analytical thinking, enhance creative problem solving skills.				
3	學習團隊分工，強化溝通表達 Participate in teamwork, strengthen communication skills.				
系專業能力 Basic Learning Outcomes				課程目標與系專業能力相關性 Correlation between Course Objectives and Dept.' s Education Objectives	
A	統合資工知識技術之能力 Ability to integrate knowledge and technologies of computer science and information engineering.			●	

B	設計技術理論驗證實驗之能力 Ability to design and conduct science experiments and to validate hypotheses.	●
C	資訊軟硬體設計開發之能力 Ability to design and develop computer software and hardware.	●
D	團隊專案開發之能力 Ability to design and develop team projects.	●
E	批判性思考與創新研發之能力 Ability of analytical thinking, creative research planning, and innovative development.	●

圖示說明 Illustration : ● 高度相關 Highly correlated ○ 中度相關 Moderately correlated

課程大綱 Course Outline

Module 1 - Foundation & Hands-On

1. Introduction to Language Models
2. Thinking in Vectors (1): Tokenization, Word Embeddings, Next-Token Prediction.
3. Context Engineering and In-Context Learning
4. RAG (Retrieval-Augmented Generation) approaches: Vector Database and Semantic Search
5. Advanced RAG Approaches
6. Thinking in Vectors (1): Attention Mechanism and Transformer
7. Efficient Fine-Tuning: PEFT/LoRA
8. RLHF & Alignment
9. AI Agents & Tool Use

Module 2 - LLM-Driven Algorithm Discovery (AlphaEvolve)

10. Evolutionary Computation Meets LLMs
11. AlphaEvolve Architecture
12. AlphaEvolve Case Study: System Optimization
13. AlphaEvolve Case Study: Math Frontiers

Module 3 - World Models

14. Introduction to World Models
15. Video Generation as Simulation: Genie 3 & V-JEPA
16. Agents in World Models

資源需求評估 (師資專長之聘任、儀器設備的配合 . . . 等)

Resources Required (e.g. qualifications and expertise, instrument and equipment, etc.)

Faculty expertise: Large Language Models, Machine Learning

Equipment: Computer classroom (GPU support recommended)

課程要求和教學方式之建議

Course Requirements and Suggested Teaching Methods

This course adopts a balanced approach between theory and practice. The curriculum is organized into three modules: Hands-On LLM Engineering, LLM-Driven Algorithm Discovery, and World Models. Teaching methods include lectures, group discussions, and hands-on labs. Students are required to complete a final project to demonstrate their ability to integrate and apply what they have learned.

其他

Miscellaneous

Recommended Prerequisites: Python Programming, Machine Learning (Recommended)