國立東華大學

課　　綱　Course Outline

資訊工程學系人工智慧與創新應用碩士班

中文課程名稱 Course Name in Chinese	前瞻機器學習原理與技術				
英文課程名稱 Course Name in English	Advanced Machine Learning Principles and Technology				
科目代碼 Course Code	AIIA50080	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

1.本課程將為學生提供當代用於感知、生成、推理的機器學習方法背後的思想和直覺，以及這些方法底下的理論。
The course will give the students the ideas and intuition behind contemporary machine learning methods for perception, generation, and inference tasks as well as the underlying theory of these methods.

2.課程還將討論機器學習的新近研究，例如自我監督學習、注意力機制、對抗學習等
The course will also discuss cutting-edge research in machine learning, such as self-supervised learning, attention mechanism, adversarial learning and so on.

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

1.課程介紹 Course introduction
2.深度學習的數學基礎 Mathematical foundations for Machine Learning
3.數值計算 Numerical Computation
4.機器學習概念 Machine Learning Concepts
5.表示學習 Representation Learning
6.深度網路架構與訓練 Deep Network Architecture and Training
7.深度學習的正則化 Regularization for Deep Learning
8.深度學習的最佳化 Optimization for Training Deep Models
9.典型神經網路模型 Typical Neural Network Models
10.注意力架構 Attention Mechanisms
11.對抗學習 Adversarial Learning
12.自我監督學習 Self-supervised Learning
13.擴散模型 Diffusion Models
14.量子機器學習 Quantum Machine Learning

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.)

師資以具備 機器與 深度學習教與研究經驗為佳。 Teachers with deep learning teaching and research experience are preferred.

課程要求和教學方式之建議
Course Requirements and Suggested Teaching Methods

學生最好有 Python 程式經驗。 課程以面授為主程式經驗。
Students preferably have experience with Python programming. Courses are taught face-to-face.

其他
Miscellaneous