教育部補助

臺灣大專院校人工智慧學程聯盟

113-1學年度主導課程資料

中華民國 113 年 8 月

目　　錄

主導課程一：人工智慧導論 Introduction to Artificial Intelligence

課程基本資料

開設學校：成功大學

開授教師：朱威達

班級人數：1200人 (保留200人給成大，聯盟學校平均每校約45人)

開課級別：大四課程

同步遠距上課時間：週四 13:10~16:00

課程概述

This course introduces students to the fundamentals, problem-solving methods, and learning paradigms of artificial intelligence. Topics covered include intelligent agents, uninformed and informed searching, adversarial search and games, statistical learning, neural networks, and AI applications.

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參考書目

Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach 4th edition, Pearson, 2020.

課程內容大綱

週次	日期	課程內容	備註
1	9月12日	Introduction, Intelligent Agents	
2	9月19日	Intelligent Agents	hw1公布 (Project分組、主題方向制定）
3	9月26日	Solving Problems by Searching	

4	10月3日	Search in Complex Environments	hw1繳交、hw2公布
5	10月10日	國慶日放假	
6	10月17日	Search in Complex Environments	
7	10月24日	Quantifying Uncertainty	hw2繳交、hw3公布(Project期中報告)
8	10月31日	Learning from Examples	
9	11月7日	Learning from Examples	hw3繳交, hw4公布
10	11月14日	Learning Probabilistic Models	
11	11月21日	Learning Probabilistic Models	hw4繳交, hw5公布(final project short video)
12	11月28日	Deep Learning	
13	12月5日	Final Exam (同時段同步考試)	
14	12月12日	Deep Learning for Natural Language Processing	hw5繳交
15	12月19日	Computer Vision	
16	12月26日	Final project報告 (優選團隊、線上線下同步報告)	

成績評量方式

- Five assignments (40%): Including programing, writing report, and short video

- One exam (30%)

- One final project (30%): Including project proposal, project implementation, writing report, and oral presentation

主導課程二：機器學習 Machine Learning

課程基本資料

開設學校：台灣大學

開授教師：林軒田

班級人數：500人 (保留300人給台大，聯盟學校平均每校約10人)

開課級別：研究所(原則准許大三以上同學修習)

授課語言：英語授課

同步遠距上課時間：星期一 13:20~16:20

課程概述

Machine learning allows computational systems to adaptively improve their performance with experience accumulated from the data observed. This course introduces the basics of learning theories, the design and analysis of learning algorithms, and some applications of machine learning.

The course is designed to prepare junior graduate students with a solid background of machine learning and allow them to use machine learning techniques appropriately in their future research or industry projects.

課程內容大綱

Week	Date	syllabus	todo/done
1	2-Sep	course introduction; **topic 1: when can machines learn?** the learning problem	homework 0 announced
2	9-Sep	learning to answer yes/no; types of learning	homework 1 announced
3	16-Sep	feasibility of learning; **topic 2: why can machines**	

		learn? training versus testing	
4	23-Sep	the VC dimension; noise and error	homework 2 announced
5	30-Sep	**topic 3: how can machines learn?** linear regression; logistic regression	
6	7-Oct	linear models for classification; nonlinear transformation	homework 0 due; homework 1 due; homework 2 due; homework 3 announced
7	14-Oct	**topic 4: how can machines learn better?** hazard of overfitting; regularization	
8	21-Oct	validation; three learning principles	homework 3 due; homework 4 announced; final project announced
9	28-Oct	**topic 5: how can machines learn by embedding numerous features?** linear support vector machine; dual support vector machine	
10	4-Nov	kernel support vector machine; soft-margin support vector machine	homework 4 due; homework 5 announced
11	11-Nov	**topic 6: how can machines learn by combining predictive features?** blending and bagging; adaptive boosting	
12	18-Nov	decision tree; random forest; gradient boosted decision tree	homework 5 due; homework 6 announced
13	25-Nov	**topic 7: how can machines learn by distilling hidden**	

		features? neural network; (preliminary) deep learning	
14	2-Dec	modern deep learning	homework 6 due; homework 7 announced
15	9-Dec	**no class as instructor needs to attend ACML 2024 and NeurIPS 2024**; recording: machine learning for modern artificial intelligence	
16	16-Dec	finale	homework 7 due
17	23-Dec	**no class and winter vacation started (really?)**	final project due

參考書目

- Learning from Data, by Yaser Abu-Mostafa, Malik Magdon-Ismail and Hsuan-Tien Lin, Language: English teaching

成績評量方式

- 70% homework

- 30% project (tentative)

主導課程三：金融科技導論 Introduction to FinTech

課程基本資料

開設學校：台灣大學

開授教師：張智星、陳君明

班級人數：1200人 (保留200人給台大，聯盟學校平均每校約45人)

開課級別：研究所課程

先備條件：以翻轉教學為止，學生在上課前必須看完 pre-class reading，老師在上課時只負責回答學生問題，或是提供補充教材或習題。

先備知識：Calculus, Linear Algebra, Probability；Machine Learning：你必須知道如何以程式碼來實做基本機器學習的任務；Python programming： 本課程以方法論為主，不會實際教授程式語言，但會提供相關線上教材讓同學自行學習

同步遠距上課時間：星期三 9:10~12:10

課程概述

金融科技(Financial Technology, FinTech)是目前全球金融業與科技業的焦點，它所引發的破壞式創新，正挑戰既有金融服務的供給方式和消費行為。本課程由資工、數學教授群共同開設，旨在釐清 FinTech 本質、相關的創新科技、以及關鍵的趨勢。同時我們也會在課程當中邀請相關學者專家進行演講，並在金融機構（或金融科技新創公司）的協助之下完成期末的 AI 程式競賽。歡迎想參與或是有志於跨金融與科技領域的同學們，來共同探索此新興領域 - FinTech。

課程內容大綱

週次	日期	課程內容	備註
1	2024/09/04	Intro to the course	
2	2024/09/11	Math for fintech	張智星授課
3	2024/09/18	Technical indicators, quantitative trading, backtest, dynamic programming	張智星授課

4	2024/09/25	Intro to bitcoin and blockchain	陳君明授課
5	2024/10/02	Hash function and elliptic curve digital signature algorithm (ECDSA)	陳君明授課
6	2024/10/09	Portfolio optimization	張智星授課
7	2024/10/16	Ethereum and Other Blockchain/Cryptocurrency	陳君明授課
8	2024/10/23	Performance indices, feature selection for ML	張智星授課
9	2024/10/30	Missing data imputation in ML	張智星授課
10	2024/11/06	Imbalanced dataset, cost-sensitive classification	張智星授課
11	2024/11/13	Advanced Functions and Post-Quantum Cryptography for Blockchain	陳君明授課
12	2024/11/20	Intro to the final project	張智星授課
13	2024/11/27	Invited talk by guest speaker	張智星授課
14	2024/12/04	Invited talk by guest speaker	張智星授課
15	2024/12/11	AI/ML applications in finance	張智星授課
16	2024/12/18	Heads-up for final project	同時段同步考試

成績評量方式

- Homework: ~30%
- Midterm exam: ~35%
- Final project: ~35%

主導課程四：資料探勘與應用 Data Mining: Concepts, Techniques, and Applications

課程基本資料

開設學校：清華大學

開授教師：陳宜欣

班級人數：1200人 (保留200人給清大，聯盟學校平均每校約45人)

開課級別：研究所課程（開放全校大三(含)以上選課）

授課語言：英語授課　　同步遠距上課時間：星期一 9:00~12:00

課程概述

Data mining serves as a crucial field that leverages advanced algorithms to reveal hidden, yet invaluable insights buried within extensive datasets. These algorithms are drawn from a multitude of areas such as machine learning, artificial intelligence, pattern recognition, statistics, and database systems, working together to facilitate a deeper understanding and analysis of data.

This course is designed to equip you with the foundational knowledge and hands-on experience needed to delve into the expansive world of data mining. Whether you are looking to enhance your skill set or embark on a new career path, this course will serve as a stepping stone to achieving your goals. The curriculum encompasses a range of topics that will introduce you to the core concepts and techniques prevalent in the field of data mining. These include:

- Association Rules: Understand the principles behind identifying rules that highlight relationships between seemingly independent data in a database.

- Clustering: Learn about grouping a set of objects in such a way that objects in the same group are more similar to each other than to those in other groups.

- Classification: Gain knowledge on the procedures for identifying the predefined class of a new observation.

- Text Mining: Equip yourself with the skills needed to analyze and interpret large collections of text data to extract meaningful information.

- Data Mining Applications: Explore the various practical applications of data mining across different industries and sectors.

參考書目

Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, Addison Wesley

課程內容大綱

Week	Date	DM (16-Week Fashion)
1	2-Sep	Introduction
2	9-Sep	Overview and Data
3	16-Sep	Overview and Data
4	23-Sep	Lab 1
5	30-Sep	Classification
6	7-Oct	Classification
7	14-Oct	Text Mining
8	21-Oct	Text Mining
9	28-Oct	Lab 2
10	4-Nov	DM Clustering & Project Progress Report
11	11-Nov	DM Clustering
12	18-Nov	Association & Project Progress Report
13	25-Nov	Association
14	2-Dec	Final Exam (同時段同步考試)
15	9-Dec	Student Paper Presentation (同時段同步報告)
16	16-Dec	Final Demo Presentation

成績評量方式

- Two assignments: 20%

- One short presentation: 10%

- One project: 25%

- One exam: 35%

- Class participation (in or after class): 10%

主導課程五：自然語言處理 Natural Language Processing

課程基本資料

　　開設學校：清華大學

　　開授教師：高宏宇

　　班級人數：1200人 (保留100人給清大，聯盟學校平均每校約50人)

　　開課級別：研究所課程

　　同步遠距上課時間：星期二 13:20~15:10 星期四 13:20-14:10

課程概述

　　本課程旨在介紹自然語言處理（NLP）和大型語言模型（LLM）的基礎知識和前瞻技術，適合對自然語言技術感興趣的學生。隨著生成式人工智慧技術的快速發展，NLP在各個領域中的應用日益廣泛。

　　本課程將提供學生NLP理論基礎，並結合實際應用，幫助學生掌握最新的NLP與LLM技術。課程內容主要分為以下幾個部分：

　　1. 文字處理基礎：介紹NLP的基本概念和常用技術。教學基本的文字處理技術，如分詞、詞性標註、命名實體識別等。

　　2. 機器學習模型：機器學習基本概念和算法，如線性回歸、決策樹、隨機森林等。介紹如何將機器學習應用於NLP，包括文本分類、情感分析等。

　　3. 語言模型：語言模型的基本概念與原理，如N-gram模型、Word2Vec等。深度學習在語言模型中的應用，如RNN、LSTM、Transformer等架構。詳細講解BERT、GPT等先進語言模型，並探討其在不同NLP任務中的應用。

　　4. 前瞻大語言模型技術：介紹大型語言模型的發展歷程與最新研究進展，如GPT-3等。探討這些模型的訓練方法、大規模資料集的使用，以及在不同領域中的能力。介紹輕量化微調技術（PEFT），如LoRA，並說明其在提高訓練效率和效果方面的優勢。

課程內容大綱

Week	Date	DM (16-Week Fashion)
1	9/3, 9/5	Introduction to NLP & applications
2	9/9, 9/11	Introduction to NLP & applications, word vector
3	9/17, 9/19	Introduction to AI & Python - Neural Network, Deep learning
4	9/24, 9/26	Introduction to AI & Python - Numpy, Panda, Scikit Learn, PTorch
5	10/1, 10/3	NLP with NN - RNN, LSTM
6	10/8, 10/10	NLP with NN - Word Embedding
7	10/15, 10/17	Introduction to Generative AI
8	10/22, 10/24	Introduction to Generative AI - Seq2Seq
9	10/29, 10/31	Introduction to Generative AI - BERT, GPT, T5
10	11/5, 11/7	Introduction to Generative AI - Transformer
11	11/12, 11/14	Large Language Model
12	11/19, 11/21	Large Language Model
13	11/26, 11/28	Training in PM (pre-trained models) - In context learning
14	12/3, 12/5	Training in PM (pre-trained models) - PEFT / LoRA
15	12/10, 12/12	Application Implementation & Challenges
16	12/17, 12/19	Application Implementation & Challenges

成績評量方式

- Homework x 5 75%

- Term Project x1 25%