課程資訊 (Course Information)

科號 Course Number	11220CS 565800	學分 Credit	3	人數限制 Class Size	30
中文名稱 Course Title	機器學習於異常偵測之應用				
英文名稱 Course English Title	Machine Learning for Anomaly Detection				
任課教師 Instructor	賴尚宏(LAI, SHANG-HONG) *more information*				
上課時間 Time	T3R3R4	上課教室 Room	DELTA台達102		

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Please respect the intellectual property rights, do not use illegal copies of textbooks.

此科目對應之系所課程規畫所欲培養之核心能力 Core capability to be cultivated by this course	■ 具有活用資訊、數學及科學知識的能力。(20%) To have the ability to apply knowledge of computer science, mathematics, and science to daily life. (20%) ■ 具有創新及批判性思考，能發現、定義、及解決問題的能力。(15%) To be able to think creatively and critically as well as discover, define, and solve problems. (15%) ■ 具有分析、設計、開發、整合、測試、與評估資訊系統、元件、或演算法的能力。(20%) To be able to analyze, design, develop, integrate, test, and evaluate systems, components, and algorithms of computer science. (20%) ■ 具備良好的溝通技巧與跨領域團隊合作的能力。(10%) To have good communication skills and be able to cooperate with others in interdisciplinary teams. (10%) ■ 具備檢索文獻、閱讀論文、與撰寫論文的能力。(10%) To be able to search literatures, read and write academic papers. (10%) ■ 具有策劃及執行研究計畫、撰寫研究報告及簡報研究成果的能力。(10%) To be able to plan and execute research projects, write research reports, and present research results. (10%) ■ 能分析評估與資訊相關之產業脈動與最新的資訊科技進展。(5%) To be able to analyze and evaluate the most recent technological and industrial advancements regarding computer science. (5%) □ 瞭解資訊科技對於全球性社會、經濟、文化等層面的影響與責任。 To understand the social, economical, cultural effects of computer science and related technologies on the global level. ■ 瞭解國際視野及終身學習的重要性。(5%) To understand the importance of international view as well as lifelong education. (5%) ■ 尊重學術、工程倫理、及智慧財產權。(5%) To respect academics, engineering ethics, and intellectual property. (5%)

課程簡述 (Brief course description)

This course aims to provide an introduction of various machine learning techniques to detect anomalies in data for several different kinds of applications. The course will cover three types of anomaly detection problems, time-series signal, image, and video anomaly detections. We will start with introducing traditional machine learning techniques for anomaly detection, and the latter part of the course will focus on deep learning approaches to anomaly detection. We will discuss the recent advances of deep learning techniques for anomaly detection. This course will focus on the application of anomaly detection in smart manufacturing, video surveillance, and cybersecurity.

Course keywords:
Anomaly Detection, Anomaly Localization, Machine Learning, Deep Learning, Deep Neural Network, Outlier Detection

一、課程說明 (Course Description)

This course aims to provide an introduction of various machine learning techniques to detect anomalies in data for several different kinds of applications. The course will cover three types of anomaly detection problems, time-series signal, image, and video anomaly detections. We will start with introducing traditional machine learning techniques for anomaly detection, and the latter part of the course will focus on deep learning approaches to anomaly detection. We will discuss the recent advances of deep learning techniques for anomaly detection. This course will focus on the application of anomaly detection in smart manufacturing, video surveillance, and cybersecurity.

二、指定用書 (Text Books)

1. Anomaly Detection Principles and Algorithms, Kishan G. Mehrotra, Chilukuri K. Mohan, and HuaMing Huang, Springer Publisher, 2017
2. some recent papers assigned for reading
3. Lecture slides

三、教學進度 (Syllabus)

1. Introduction to Anomaly Detection
2. Distance-based Anomaly Detection
3. Clustering-based Anomaly Detection
4. Model-based Anomaly Detection
5. Anomaly Detection for Time-Series Data
6. Introduction to Deep Learning
7. Practical DNN training techniques
8. Generative Models
9. Deep Learning for Image Anomaly Detection
10. Deep Learning for Video Anomaly Detection
11. Deep Learning for Time-Series Anomaly Detection
12. Zero-shot and Few-shot Anomaly Detection
13. Guest lectures
14. Final Project Presentation

四、教學方式 (Teaching Method)

Lectures (instructors and guest speakers) and interactive discussion

五、參考書籍 (References)

Beginning Anomaly Detection Using Python-based Deep Learning: With Keras and PyTorch, Sridhar Alla and Suman Kalyan Adari, 2019

六、成績考核 (Evaluation)

Homeworks 30%
Midterm Exam 30%
Term project (team-based) 30%
Class Attendance 5%
Class Participation 5%

七、可連結之網頁位址:
eeclass: https://eeclass.nthu.edu.tw/