

中正大學 資訊工程研究所 課程大綱

課程名稱(中文) (Chinese Course type)	偵測與追蹤專論	開課單位 (Department)	資訊工程研究所
課程名稱(英文) (English Course name)	Advanced Topics in Detection and Tracking	課程代碼 (Course code)	
授課教師 (Instructor)	盧沛怡	學分數 (Credits)	3
必/選修 (Required/Selected)	☐ 必修 ☒ 選修	開課年級 (Level)	研究所，碩博合開 開放大三大四
課程屬性/類別 (Course type)	☐ 人文關懷課程 ☐ 競賽專題課程 ☐ 問題導向課程 ☐ 專題導向課程 ☐ 總整課程 ☐ 實作課程 ☐ 實習 ☐ 其他		
先修科目或先備能力 (Prerequisites)	Deep Learning		
課程概述 (Course Descriptions)	This course focuses on object detection and tracking in computer vision, covering both foundational concepts and recent advances driven by deep learning. Topics include two-stage and one-stage detectors, Transformer-based detection models, object tracking methods, and the role of semantic segmentation as a complementary visual task. Through paper reading, presentations, and a project-oriented workflow, students will develop the ability to analyze, compare, and apply modern detection and tracking techniques to real-world vision problems.		
學習目標 (Learning Objectives)	1. Understand the core problem formulations and evaluation protocols in object detection and tracking. 2. Identify and compare the design principles of major detection frameworks, including two-stage, one-stage, and transformer-based models. 3. Analyze the trade-offs among different tracking approaches with respect to temporal modeling and data association. 4. Read, present, and critically evaluate research literature related to detection and tracking. 5. Independently conduct a research-oriented or implementation-based project centered on detection or tracking tasks.		
教科書 (Textbooks and Reference)	• Ian Goodfellow, Yoshua Bengio, and Aaron Courville, <i>Deep Learning</i>, MIT Press, 2016. • Richard Szeliski, <i>Computer Vision: Algorithms and Applications</i>, 2nd Edition, Springer, 2022. • Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola, <i>Dive into Deep Learning</i>, Cambridge University		

	Press, 2023. • Instructor-prepared lecture notes. • Paper from top conference
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課程大綱(Course Syllabus)		分配時數 (Number of Hours)				核心能力 (Core Capabilities)	備註 (Remarks)
單元主題 (Topic)	內容綱要 (Content)	講授 (Lecture)	示範 (Demonstration)	習作 (Assignment)	其他 (Others)		
Introduction	Overview of object detection and tracking tasks	3				☒ 1 ☒ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8	
Machine Learning	Concept of Machine Learning	3				☒ 1 ☒ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8	
Conventional Computer Vision	Concept of Computer Vision	3				☒ 1 ☒ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8	
Deep Neural Networks and Convolutional Neural Networks	Multilayer Perceptron, CNN	3				☒ 1 ☒ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6	

						☐ 7 ☐ 8	
Two-stage Object detection/Pap er presentation	tradition al methods, Faster R- CNN family	3			3	☒ 1 ☒ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8	
One-stage Object detection/Pap er presentation	YOLO family	3			3	☒ 1 ☒ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8	
Transformer- based detection/Pap er presentation	Vit, DETR	3			3	☒ 1 ☒ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8	
Object tracking Fundamentals /Paper presentation	Tracking -by- detection , temporal modelin g, and motion estimatio n	3			3	☒ 1 ☒ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8	
Graph-based and Learning- based Tracking/Pap er presentation	GNN- based tracking, data associati on, and	3			3	☒ 1 ☒ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6	

	spatio-temporal reasoning					☐ 7 ☐ 8	
Advanced Tracking	Other applications in detection and tracking	2			1	☒ 1 ☒ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8	
Project presentation	Final project				3	☒ 1 ☒ 2 ☐ 3 ☒ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8	

教育目標

1. 具獨立從事學術研究或產品創新研發之人才
2. 具團隊合作精神及科技整合能力，並在團隊中扮演領導、規劃、管理之角色
3. 具創新研發、自我挑戰與終身學習能力之人才
4. 具有學術倫理、工程倫理、國際觀之人才

核心能力

1. 具有資訊工程與科學領域之專業知識(Competence in computer science and computer engineering.)
2. 具有創新思考、問題解決、獨立研究之能力(Be creative and be able to solve problems and to perform independent research.)
3. 具有撰寫中英文專業論文及簡報之能力(Demonstrate good written, oral, and communication skills, in both Chinese and English.)
4. 具策劃及執行專題研究之能力(Be able to plan and execute projects.)
5. 具有溝通、協調、整合及進行跨領域團隊合作之能力(Have communication, coordination, integration skills and teamwork in multi-disciplinary settings.)

6. 具有終身學習與因應資訊科技快速變遷之能力(Recognize the need for, and have the ability to engage in independent and life-long learning.)
7. 認識並遵循學術與工程倫理(Understand and commit to academic and professional ethics.)
8. 具國際觀及科技前瞻視野(Have international view and vision of future technology.)

教學要點概述	
教材編選 (Teaching Materials)	☒ 自製簡報(ppt) ☐ 課程講義 ☐ 自編教科書 ☒ 教學程式 ☒ 自製教學影片 ☐ 其他
教學方法 (Teaching Methods)	☒ 講述 ☒ 小組討論 ☒ 學生口頭報告 ☐ 問題導向學習 ☐ 個案研究 ☐ 其他
評量工具 (Evaluation Tools)	☐ 上課點名 0% ☒ 隨堂測驗 20% ☐ 作業 0% ☒ 程式實作 20% ☐ 實習報告 0% ☐ 期中報告 0% ☒ 期末報告 25% ☒ 專題報告 25% ☐ 期中考 0% ☐ 期末考 0% ☐ 評量尺規 0% ☒ 其他(課堂互動) 10%
教學資源 (Teaching Resources)	☒ 課程網站 ☒ 教材電子檔供下載 ☐ 實習網站
教師 相關訊息 (Instructor's Information)	peggylu@cs.ccu.edu.tw
教學相關配合 事項 (Course relative information)	

課程目標與教育核心能力相關性	
請勾選： ☒ 1 ☒ 2 ☒ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8	
1	具有資訊工程與科學領域之專業知識(Competence in computer science and computer engineering)
	為何有關：This course focuses on advanced topics in detection and tracking, which are core research areas in computer science and computer engineering, particularly within computer vision and deep learning.

	達成指標：Students are expected to develop a comprehensive understanding of state-of-the-art detection and tracking techniques and their underlying principles.
	評量方法：Assignments, paper presentation, final project
2	具有創新思考、問題解決、獨立研究之能力(Be creative and be able to solve problems and to perform independent research)
	為何有關：The course introduces diverse and innovative detection and tracking methods, encouraging students to analyze design choices and address practical research problems.
	達成指標：Students are able to apply course concepts to solve open-ended problems and complete assignments using appropriate detection or tracking methods.
	評量方法：Assignments, final project
3	具有創新思考、問題解決、獨立研究之能力(Be creative and be able to solve problems and to perform independent research)
	為何有關：Students are required to read, analyze, and independently present research papers related to detection and tracking.
	達成指標：Students can clearly present technical content, explain methodological contributions, and respond to questions during paper presentations.
	評量方法：final project, presentation performance and clarity
4	具策劃及執行專題研究之能力(Be able to plan and execute projects.)
	為何有關：The course includes a project-oriented component in which students must design and implement a detection- or tracking-based system or study.
	達成指標：Students are able to plan a project pipeline, modify existing codebases, and explore different model architectures or loss designs.
	評量方法：Project novelty, completeness, and model performance
5	具有溝通、協調、整合及進行跨領域團隊合作之能力(Have communication, coordination, integration skills and teamwork in multi-disciplinary settings.)
	為何有關：Course projects may involve collaboration, discussion, and integration of knowledge from machine learning, computer vision, and application domains.
	達成指標：Students demonstrate effective collaboration, task coordination, and technical communication during group discussions or project development.
	評量方法：Project participation, teamwork performance, and presentation