Tamkang University Academic Year 111, 2nd Semester Course Syllabus

Course Title ONLINE LEARNING ALGORITHMS		Instructor	CHUANG-CHIEH LIN		
Course Class MASTER'S PROGRAM, DEPARTMENT OF COMPUTER SCIENCE AND INFORMATION ENGINEERING (ENGLISH-TAUGHT PROGRAM),		Details	 General Course Selective One Semester 		
Relevance to SDGs	1A SDG4 Quality education Relevance				
	Departmental Aim of Educ	ation			
I. Cultiva	te the ability to conduct independent research and problem sol	ving.			
П. Streng	then creativity and research capacity.				
Ⅲ. Build p	rofound professional knowledge in computer science and inform	mation engine	eering.		
IV. Engage	e in self-directed lifelong learning.				
	Subject Departmental core competence	es			
A. Indepen	dent problem solving ability.(ratio:20.00)				
B. Indepen	dent innovative thinking ability.(ratio:20.00)				
C. Research	n paper writing and presentation ability.(ratio:20.00)				
D. Research	n & development (R&D) ability in information engineering.(ratio	:20.00)			
E. Project e	execution and control ability.(ratio:10.00)				
F. Lifelong	F. Lifelong self-directed learning ability.(ratio:10.00)				
	Subject Schoolwide essential virtues				
1. A global perspective. (ratio:10.00)					
2. Information literacy. (ratio:20.00)					
3. A vision for the future. (ratio:20.00)					
4. Moral integrity. (ratio:10.00)					
5. Indeper	5. Independent thinking. (ratio:10.00)				
6. A cheer	6. A cheerful attitude and healthy lifestyle. (ratio:10.00)				
7. A spirit	7. A spirit of teamwork and dedication. (ratio:10.00)				
8. A sense	8. A sense of aesthetic appreciation. (ratio:10.00)				

Ir	Often, forecasting a stochastic process that providing different outcome each time might not be easy to handle with tolerable loss. In this course, we aim at the concept of "regret" and focus on the design of online algorithms that can minimize the regret in terms of minimizing the difference between algorithm outputs and best decisions in the hindsight. We will go over well-known no-regret online learning algorithms as well as state-of-the-art approaches in this field and also have students to read SOTA literatures and implement such algorithms for specific problems.					
do	The correspondences between the course's instructional objectives and the cognitive, affective, and psychomotor objectives. Differentiate the various objective methods among the cognitive, affective and psychomotor domains of the course's instructional objectives.					
II.	 I. Cognitive : Emphasis upon the study of various kinds of knowledge in the cognition of the course's veracity, conception, procedures, outcomes, etc. II.Affective : Emphasis upon the study of various kinds of knowledge in the course's appeal, morals, attitude, conviction, values, etc. III.Psychomotor: Emphasis upon the study of the course's physical activity and technical manipulation. 					
No.	Teaching Objectives objective methods					
1	Understanding	nding the concept of online learning Cognitive				
2	Online Convex (onvex Optimization Cognitive				
3	No Regret Dyna	No Regret Dynamics Cognitive				
4	Understanding	erstanding gradient descent or ascent based approaches Cognitive				
5	Understanding	nderstanding multiplicative weight update algorithms Cognitive				
6	Follow The Regularized Leader Algorithms Cognitive					
7	Understanding mirror descent algorithms Cognitive					
8	Understanding bandit problems and algorithms Cognitive					
9	Understanding Follow the Perturbed Leader Algorithms Cognitive					
10	Knowing Bandit Problems and Understanding Bandit Algorithms Cognitive					
The correspondences of teaching objectives : core competences, essential virtues, teaching methods, and assessment						
No.	Core Competen	ces	Essential Virtues	Teaching Methods	Assessment	
1	ABCDEF		12345678	Lecture, Discussion	Study Assignments, Discussion(including classroom and online)	

2 ABCDEF 12345678 Lecture: Discussion Study Assignments, Discussion(including classroom and online) 3 ABCDEF 12345678 Lecture, Discussion Study Assignments, Discussion and online) 4 ABCDEF 12345678 Lecture, Discussion Study Assignments, Discussion and online) 5 ABCDEF 12345678 Lecture, Discussion Study Assignments, Discussion and online) 6 ABCDEF 12345678 Lecture, Discussion Study Assignments, Discussion and online), Report (including on and writter) 7 ABCDEF 12345678 Lecture, Discussion Study Assignments, Discussion (including on and writter) 8 ABCDEF 12345678 Lecture, Discussion Study Assignments, Discussion (including on and writter) 9 ABCDEF 12345678 Lecture, Discussion Study Assignments, Discussion (including on and writter) 9 ABCDEF 12345678 Lecture, Discussion Study Assignments, Discussion (including classroom and online), Report (including on and writter) 9 ABCDEF 12345678 Lecture, Discussion Discussion (including classroom and online), Report (including on and writter) 10 ABCDEF 12345678 Lecture, Discussion Discussion (including classroom and online), Report (including on and writter) 11 Discussion (including							
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6 Multiplicative weight Update Algorithms	5		Gradient Descent/Ascent Algorithms				
	6		Multiplicative Weight Update Algorithms				

7	112/03/27 ~	Follow The Regularized Leader Algorithms
	112/04/02 112/04/03~	
8	112/04/09	Follow The Perturbed Leader Algorithms
9	112/04/10~ 112/04/16	Mirror Descent Algorithms
10	112/04/17 ~ 112/04/23	Mirror Descent Algorithms
11	112/04/24 ~ 112/04/30	Multi-Armed Bandit and Algorithms
12	112/05/01~ 112/05/07	Multi-Armed Bandit and Algorithms
13	112/05/08~ 112/05/14	Extra-Gradient and Optimistic Gradient Methods
14	112/05/15~ 112/05/21	Extra-Gradient and Optimistic Gradient Methods
15	112/05/22 ~ 112/05/28	Literature Study (Paper Presentations)
16	112/05/29~ 112/06/04	Literature Study (Paper Presentations)
17	112/06/05~ 112/06/11	Literature Study (Paper Presentations)
18	112/06/12~ 112/06/18	Literature Study (Paper Presentations)
Re	equirement	Basic probability theory and calculus background knowledge. Basic Python/PyTorch Programming skill is a plus.
Tea	aching Facility	Computer, Projector
	ooks and ing Materials	A Modern Introduction to Online Learning. Francesco Orabona. Boston University. Monograph. 2022. Introduction to Online Convex Optimization. Elad Hazan. 2017.
F	References	
	Number of signment(s)	5 (Filled in by assignment instructor only)
Grading Policy		 ◆ Attendance: 20.0 % ◆ Mark of Usual: 40.0 % ◆ Midterm Exam: % ◆ Other < >: %
Note		This syllabus may be uploaded at the website of Course Syllabus Management System at <u>http://info.ais.tku.edu.tw/csp</u> or through the link of Course Syllabus Upload posted on the home page of TKU Office of Academic Affairs at <u>http://www.acad.tku.edu.tw/CS/main.php</u> . ※ Unauthorized photocopying is illegal. Using original textbooks is advised. It is a crime to improperly photocopy others' publications.
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