香港城市大學
City University of Hong Kong

City University of Hong Kong
Course Syllabus

offered by School of Data Science
with effect from Semester A 2024/25

Part I Course Overview

Course Title:	Deep Learning
Course Code:	SDSC8007
Course Duration:	One Semester
Credit Units:	3
Level:	R8
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	Nil
Precursors: *(Course Code and Title)*	Nil
Equivalent Courses: *(Course Code and Title)*	Nil
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

This course provides students with a systematic study of deep learning. Topics include shallow and deep neural networks, deep fully connected and structured neural networks, universality of approximation, convolutions and Fourier transform, deep convolutional neural networks, deep recursive neural networks, gradient descent and stochastic gradient descent, backpropagation and automatic differentiation, learning ability of deep learning algorithms, design of deep neural network architectures.

2. Course Intended Learning Outcomes (CILOs)

No.	CILOs	Weighting (if applicable)	Discovery-enriched curriculum related learning outcomes		
			A1	*A2*	*A3*
1.	Clearly explain foundational principles, theories, and methods used in deep learning.	20%	✓		
2.	Critically analyze and compare different deep neural network structures in terms of their functionality and performance.	20%	✓		
3.	Apply standard deep learning algorithms to real-world datasets to derive insights and solutions.	40%	✓	✓	✓
4.	Address practical challenges by applying existing deep learning methods and creating innovative algorithms.	20%	✓	✓	✓
		100%			

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to self-life problems.

A3: *Accomplishments*
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

3. Learning and Teaching Activities (LTAs)

LTA	Brief Description	CILO No.						Hours/week (if applicable)
		1	2	3	4			
Lecture	Students will participate in structured lectures that introduce deep learning principles, followed by real-time demonstrations to apply and reinforce these concepts, ensuring students can observe and assess their understanding and application skills.	✓	✓	✓	✓			39 hours in total
Mini-project	Students will tackle a defined deep learning challenge independently, develop a solution, and synthesize findings into a written report. Conclude the project with a presentation that showcases both the process and the outcome, with continuous guided support from the instructor to ensure clarity and effectiveness of learning.	✓	✓	✓	✓			After class

4. Assessment Tasks/Activities (ATs)

Assessment Tasks/Activities	CILO No.						Weighting	Remarks
	1	2	3	4				
Continuous Assessment: _100_%								
Test Administer a test focused on assessing the comprehension of basic concepts, fundamental theories, various neural network architectures, and their applications to datasets, ensuring alignment with the first half of the course content.	✓	✓	✓	✓			50%	
Mini-Project Provide practical experience through a project where students apply learned theories and methods to solve a typical deep learning problem, demonstrating their ability to achieve the course outcomes.	✓	✓	✓	✓			25%	
Mini-Project Presentation Facilitate a presentation session where students articulate their	✓	✓	✓	✓			25%	

project strategy, process, and results, emphasizing their understanding and innovation in the application of deep learning concepts.								
							100%	

5. Assessment Rubrics

Applicable to students admitted from Semester A 2022/23 to Summer Term 2024

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B)	Marginal (B-, C+, C)	Failure (F)
1. Test	Ability to understand and apply the fundamental theory, deep neural network architectures, and deep learning algorithms.	High	Significant	Basic	Not even reaching marginal level
2. Mini-Project Report	Ability to demonstrate the understanding of the basic concepts, fundamental theory, deep learning methods, and applications of deep learning algorithms to some datasets.	High	Significant	Basic	Not even reaching marginal level
3.Mini-Project Presentation	Ability to demonstrate how well the intended learning outcomes are achieved.	High	Significant	Basic	Not even reaching marginal level

Applicable to students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Test	Ability to understand and apply the fundamental theory, deep neural network architectures, and deep learning algorithms.	High	Significant	Moderate	Basic	Not even reaching marginal level
2. Mini-Project Report	Ability to demonstrate the understanding of the basic concepts, fundamental theory, deep learning methods, and applications of deep learning algorithms to some datasets.	High	Significant	Moderate	Basic	Not even reaching marginal level
3.Mini-Project Presentation	Ability to demonstrate how well the intended learning outcomes are achieved.	High	Significant	Moderate	Basic	Not even reaching marginal level

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus

Activation functions including sigmoidal functions and rectified linear unit, shallow neural networks and universality of approximation of functions, deep fully connected neural networks with full connection matrices, convolutions and Fourier transform, deep convolutional neural networks with convolutional matrices, representation and approximation by deep convolutional neural networks, deep recursive neural networks with structured matrices, pooling, gradient descent and stochastic gradient descent, backpropagation and automatic differentiation, learning ability in terms of the number of hidden neurons and depth of deep neural networks, design of deep neural network architectures according to various applications of deep learning.

2. Reading List

2.1 Compulsory Readings

1.	Lecture slides and other related material

2.2 Additional Readings

1.	I. Goodfellow, Y. Bengio, and A. Courville, Deep Learning, MIT Press, 2016.