City University of Hong Kong
Course Syllabus

offered by School of Data Science
with effect from Semester A 2022/23

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:	Nil
Precursors:	Nil
Equivalent Courses:	Nil
Exclusive Courses:	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 (please tick where appropriate)		
			A1	*A2*	*A3*
1.	State rigorously fundamental principles, ideas, theories, and methods of deep learning	20%	✓		
2.	Distinguish and compare various deep neural network architectures	20%	✓		
3.	Apply common deep learning methods and algorithms to datasets	40%	✓	✓	✓
4.	Solve some practical problems by existing deep learning methods and designing new 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. Teaching and Learning Activities (TLAs)

TLA	Brief Description	CILO No.						Hours/week (if applicable)
		1	2	3	4			
Lecture	Learning through **teaching** is primarily based on lectures and demonstrations.	✓	✓	✓	✓			39 hours in total
Mini-project	A typical deep learning problem will be given to students to solve. The students are expected to tackle the given problem, write a report and give a presentation. This learning activity will be mainly student-led but with instructor's structural guidance.	✓	✓	✓	✓			After class

4. Assessment Tasks/Activities (ATs)

Assessment Tasks/Activities	CILO No.						Weighting*	Remarks
	1	2	3	4				
Continuous Assessment: 100 %								
Test Questions are designed for the first part of the course to see how well the students have learned the basic concepts, fundamental theory, deep neural network architectures, deep learning methods and algorithms, and applications of deep learning algorithms to some datasets.	✓	✓	✓	✓			40%	
Mini-Project The project provides students chances to demonstrate how well they have achieved their intended learning outcomes.	✓	✓	✓	✓			30%	
Mini-Project Presentation The project provides students chances to demonstrate how well they have achieved their intended learning outcomes.	✓	✓	✓	✓			30%	
							100%	

5. Assessment Rubrics

Applicable to students admitted in Semester A 2022/23 and thereafter

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

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

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.