City University of Hong Kong
Course Syllabus

offered by Department of Systems Engineering & Engineering Management
with effect from Semester A 2019 / 20

Part I Course Overview

Course Title:	Data Mining and Knowledge Discovery
Course Code:	SDSC8009
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)*	Basic Machine Learning Knowledge
Equivalent Courses: *(Course Code and Title)*	Nil
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

This course will offer students advanced algorithms for developing data-driven models, typically models with deep structures. The curriculum will start with the classical data mining concepts and next move into data-driven system modelling with deep learning algorithms. We will review different learning methods and loss functions applied in developing deep models. We will go into recently popular algorithms for developing a variety of deep neural networks, such as recurrent neural networks and LSTM, deep autoencoders and its variants, convolutional neural networks, u-nets, RetinaNet, YOLO, generative adversarial networks, etc.

2. Course Intended Learning Outcomes (CILOs)

No.	CILOs	Weighting	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	Understand classical data mining concepts	15%	✓		
2.	Familiarize the operational steps of formulating data-driven problems	15%	✓		
3.	Understand algorithms for developing deep neural networks introduced in this course.	20%	✓		
4.	Apply algorithms taught in this course into emerging real problems.	20%	✓		
5.	Demonstrate novel knowledge extracted from data of considered real problems through utilizing algorithms taught in this course	30%	✓	✓	
		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
		1	2	3	4	5	
Lecture	- large class activity - questions and discussion	✓	✓	✓	✓	✓	39 hours/sem

4. Assessment Tasks/Activities (ATs)

Assessment Tasks/Activities	CILO No.					Weighting	Remarks
	1	2	3	4	5		
Continuous Assessment: 100 %							
Group Project A collaborative research project based on taught concepts.	✓	✓	✓	✓	✓	40%	
Individual Assignment Four assignments for testing the understanding of a sub-set of taught concepts and their implementation.	✓	✓	✓	✓		30%	
Take-home Test An open book and notes examination aiming at assessing the understanding of the overall materials and some open questions for demonstrating the capability of the further exploration.		✓	✓	✓	✓	30%	
Examination: 0 % (duration: , if applicable)							
						100%	

5. Assessment Rubrics

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Group Project	Application of class materials and teamwork	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Individual Assignment	Application of class materials	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Take-home Test	Understanding of class materials	High	Significant	Moderate	Basic	Not even reaching marginal levels

Part III Other Information

1. Keyword Syllabus

- Data Processing and Data Preparation
- Data-driven System Modelling and Problem Formulations
- Review of Supervised and Unsupervised Learning Methods I
- Review of Supervised and Unsupervised Learning Methods II
- Model Parameter Estimation: Statistical Inference and Optimization Methods
- Neural Networks: From Shallow To Deep
- Loss Functions in Learning
- Transfer Learning Topics
- Recurrent Neural Networks and Long Short Term Memory
- Deep Autoencoders and Its Variants
- Deep Neural Networks in Computer Vision: CNN, U-nets, RetinaNet, YOLO, etc.
- Generative Adversarial Networks
- Selected Deep Learning Applications

2. Reading List

2.1 Compulsory Readings

1.	The Elements of Statistical Learning by Hastie, Tibshirani, and Friedman, Springer
2.	Lecture notes
3.	Journal articles selected by the instructor

2.2 Additional Readings

NIL