City University of Hong Kong
Course Syllabus

offered by College/School/Department of Mathematics
with effect from Semester A 2022 / 23

Part I   Course Overview

Course Title:	Introduction to Statistical Learning
Course Code:	MA6630
Course Duration:	1 semester
Credit Units:	3 CUs
Level:	P6
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	MA5617 Statistical Data Analysis; OR a pass in all of the following courses PH5102 Introduction to Biostatistics in One Health BIOS5800 Probability BIOS5801 Statistical Computing
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

Statistical learning is a new interdisciplinary area, which has connections to a variety of subjects including statistics, applied mathematics and computer sciences. It has been successfully applied in pattern recognition, signal processing, data mining, bioinformatics and financial engineering, etc. This course presents an overview of many cutting-edge techniques and algorithms in statistical learning. The covered topics include linear and nonlinear classification and regression, support vector machine, kernel methods, model averaging, boosting, as well as high-dimensional data. This course will provide the students the fundamental ideas and intuition behind modern statistical learning methods.

2.   Course Intended Learning Outcomes (CILOs)
(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs	Weighting (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	Understanding of basic concepts of statistical learning, and classic algorithms such as Support Vector Machines and Neural Networks, as well as modern tools such as Probabilistic Graphical Models (PGMs) and Deep Learning.	25	✓	✓	
2.	Understanding of basic principles and theory of statistical learning, which may guide students to invent their own algorithms in future.	25	✓	✓	
3.	Ability to program the algorithms in the course.	25	✓	✓	
4.	Ability to do mathematical derivation of the algorithms in the course.	25	✓	✓	✓
		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)
(TLAs designed to facilitate students' achievement of the CILOs.)

TLA	Brief Description	CILO No.						Hours/week (if applicable)
		1	2	3	4			
Teaching	Learning through teaching is primarily based on lectures	✓	✓	✓	✓			3 hours/week
Take-home assignments	Learning through take-home assignments helps students implement advanced theory for better understanding	✓	✓	✓	✓			After-class

4. Assessment Tasks/Activities (ATs)
(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.						Weighting	Remarks
	1	2	3	4				
Continuous Assessment: 40%								
Hand-in assignments	✓	✓	✓	✓			20	
Project	✓	✓	✓	✓			20	
Examination (duration: 3 hours)	✓	✓	✓	✓			60	
Examination: ____% (duration: , if applicable)								
							100%	

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following 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. Hand-in assignments	Comprehensive understanding	High	Significant	Basic	Not even reaching marginal levels
2. Project	Real data analytic ability	High	Significant	Basic	Not even reaching marginal levels
3. Examination	Creativity and problem solving ability based on comprehensive understanding	High	Significant	Basic	Not even reaching marginal levels

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. Hand-in assignments	Comprehensive understanding	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Project	Real data analytic ability	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Examination	Creativity and problem solving ability based on comprehensive understanding	High	Significant	Moderate	Basic	Not even reaching marginal levels

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

1. **Keyword Syllabus**
   (An indication of the key topics of the course.)

   parametric and nonparametric models; support vector machine; kernel machines; regularization; model averaging and aggregation; unsupervised learning; high-dimensional data

2. **Reading List**
2.1 **Compulsory Readings**
   (Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

1.	The Element of Statistical Learning by Hastie, Tibshirani and Friedman, Springer; 2nd edition
2.	
3.	
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2.2 **Additional Readings**
   (Additional references for students to learn to expand their knowledge about the subject.)

1.	An Introduction to Statistical Learning: with Application in R by James, Springer; 1st ed. 2013, Corr. 7th printing 2017 edition
2.	Pattern Recognition and Machine Learning by Bishop, Springer, 2006
3.	
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