

**City University of Hong Kong  
Course Syllabus**

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

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**Part I Course Overview**

<b>Course Title:</b>	Statistical Machine Learning II
<b>Course Code:</b>	SDSC6001
<b>Course Duration:</b>	One Semester
<b>Credit Units:</b>	3
<b>Level:</b>	P6
<b>Medium of Instruction:</b>	English
<b>Medium of Assessment:</b>	English
<b>Prerequisites:</b> <i>(Course Code and Title)</i>	SDSC5001 Statistical Machine Learning I
<b>Precursors:</b> <i>(Course Code and Title)</i>	Nil
<b>Equivalent Courses:</b> <i>(Course Code and Title)</i>	Nil
<b>Exclusive Courses:</b> <i>(Course Code and Title)</i>	Nil

## Part II Course Details

### 1. Abstract

This course focuses on the theoretical foundation and fundamental methods in unsupervised and supervised learning, and Deep learning methods as well as the discipline of applying Python to program and implement aforementioned algorithms and 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.	Articulate fundamental principles, ideas, theories, and methods of machine learning and deep learning, emphasizing precision and depth of understanding.	20%	✓		
2.	Evaluate and contrast different machine learning and deep learning models based on their structure, functionality, and applicability.	20%	✓		
3.	Implement common machine learning and deep learning techniques to analyze and interpret datasets, demonstrating proficiency with various algorithms.	40%	✓	✓	✓
4.	Develop solutions for practical problems using existing machine learning and deep learning methods and by innovating new algorithms, demonstrating both application and creativity.	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 real-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)

(LTAs designed to facilitate students' achievement of the CILOs.)

LTA	Brief Description	CILO No.					Hours/week (if applicable)
		1	2	3	4		
Lecture	Engage in interactive lectures and demonstrations where you will explore and understand the core concepts and methodologies of statistical machine learning. The lectures aim to facilitate your critical thinking and application skills through question-driven discussions and practical examples.	✓	✓	✓	✓		39 hours in total
Mini-project	Conduct a comprehensive analysis of a typical machine learning problem, provided by the instructor. You will be responsible for developing a solution, documenting your process and findings in a written report, and presenting your results to the class. This project is designed to foster your independent learning skills, supported by structured guidance from the instructor.	✓	✓	✓	✓		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: <u>100</u> %							
<u>Test</u> Administer a comprehensive test to evaluate students' understanding of fundamental theories, principles, and applications in machine learning and deep learning. The test will consist of both theoretical questions and practical problems, assessing students' ability to apply learned concepts to real-world datasets.	✓	✓	✓	✓		50%	
<u>Mini-Project</u> Undertake a mini-project that requires you to apply machine learning and deep learning methods to a specific problem. This project will assess your analytical skills, your ability to integrate different concepts and techniques, and your proficiency in designing and executing a structured analysis. You will need to demonstrate how the project's outcomes align with the intended learning outcomes, particularly in terms of innovation and practical application.	✓	✓	✓	✓		25%	
<u>Mini-Project Presentation</u> Present your mini-project to the class, focusing on your methodology, findings, and the implications of your work. This presentation is designed to assess your ability to communicate complex ideas effectively and defend your approach and results in a professional context. It will also evaluate your engagement with critical feedback and your responsiveness to questions from peers and instructors.	✓	✓	✓	✓		25%	
						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 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 of machine learning and deep learning	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 their applications 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

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 of machine learning and deep learning	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 their applications 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

**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.)*

Classic Theory of Machine Learning:

Supervised Learning: Support Vector Machine; regularizations; Tree; Matrix Factorization

Unsupervised Learning: Clustering; Principal Component Analysis; Factor Analysis

Deep Neural Networks:

Feed-forward Neural Networks;

Convolutional Neural Networks;

Recurrent Neural Networks;

Autoencoders;

Generative Adversarial Networks;

Self-attention;

Transformer;

Deep Reinforcement Learning;

Graph Neural Networks

Other technologies of Machine Learning and Deep Learning:

Explainable AI;

Model Selection;

Transfer Learning;

Model Selection;

**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 Elements of Statistical Learning by Hastie, Tibshirani, and Friedman, Springer
2.	Lecture Notes

**2.2 Additional Readings**

*(Additional references for students to learn to expand their knowledge about the subject.)*

NIL