SDSC6001: STATISTICAL MACHINE LEARNING II

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Statistical Machine Learning II

Subject Code
SDSC - Data Science
Course Number
6001

Academic Unit
Data Science (DS)

College/School
College of Computing (CC)

Course Duration
One Semester

Credit Units
3

Level
P5, P6 - Postgraduate Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
SDSC5001 Statistical Machine Learning I

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

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.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Articulate fundamental principles, ideas, theories, and methods of machine learning and deep learning, emphasizing precision and depth of understanding.	20	x		
2	Evaluate and contrast different machine learning and deep learning models based on their structure, functionality, and applicability.	20	x		
3	Implement common machine learning and deep learning techniques to analyze and interpret datasets, demonstrating proficiency with various algorithms.	40	x	x	x
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	x	x	x

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.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	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.	1, 2, 3, 4	39 hours in total

2	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.	1, 2, 3, 4	After class

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Test: 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.	1, 2, 3, 4	50	take-home test	Yes

2	Mini-Project: 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.	1, 2, 3, 4	25	-	Yes

3	Mini-Project Presentation: 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.	1, 2, 3, 4	25	-	Yes

Continuous Assessment (%)

100

Assessment Rubrics (AR)

Assessment Task

Test (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Ability to understand and apply the fundamental theory of machine learning and deep learning

Excellent

(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair

(C+, C, C-) Moderate

Marginal

(D) Basic

Failure

(F) Not even reaching marginal level

Assessment Task
Mini-Project Report (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
Ability to demonstrate the understanding of the basic concepts, fundamental theory, deep learning methods, and their applications to some datasets.

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal level

Assessment Task
Mini-Project Presentation (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
Ability to demonstrate how well the intended learning outcomes are achieved.

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal level

Assessment Task
Test (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Ability to understand and apply the fundamental theory of machine learning and deep learning

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Basic

Failure
(F) Not even reaching marginal level

Assessment Task
Mini-Project Report (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Ability to demonstrate the understanding of the basic concepts, fundamental theory, deep learning methods, and their applications to some datasets.

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Basic

Failure
(F) Not even reaching marginal level

Assessment Task
Mini-Project Presentation (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Ability to demonstrate how well the intended learning outcomes are achieved.

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Basic

Failure
(F) Not even reaching marginal level

Part III Other Information

Keyword Syllabus

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;

Reading List

Compulsory Readings

	Title
1	The Elements of Statistical Learning by Hastie, Tibshirani, and Friedman, Springer
2	Lecture Notes

Additional Readings

	Title
1	Nil