Course Syllabus

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

Part I Course Overview

Course Title:	Topics in Statistical Machine Learning
Course Code:	MA8019
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)*	Nil
Equivalent Courses: *(Course Code and Title)*	Nil
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

This course introduces the theory, methodology and applications of statistical machine learning. It will help students develop a solid and systematic understanding of the core materials, explore cutting-edge development of machine learning, apply machine learning techniques to a variety of real applications in science and engineering.

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.	explain the fundamentals in the theory of statistical machine learning	20%	✓		
2.	develop a solid and systematic understanding of the classical and model techniques for regression, classification, and clustering	30%	✓	✓	
3.	conduct literature search, review and explore the cutting-edge development of statistical machine learning	30%	✓	✓	
4.	implement a number of popular machine learning techniques	10%		✓	✓
5.	apply machine leaning techniques to analyse a variety of real life applications	10%	✓	✓	✓
		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	5		
Lectures	Learning through teaching is primarily based on lectures	✓	✓	✓	✓	✓		3 hours/week
Assignments	Learning through take-home assignments helps students understand basic mathematical concepts and fundamental theory of linear algebra, and develop the ability of proving mathematical statements rigorously.		✓		✓	✓		After-class
Final project	Learning through final projects helps students explore cutting-	✓	✓	✓	✓	✓		After-class

	edge development of the current research in statistical machine learning							

4. Assessment Tasks/Activities (ATs)

Assessment Tasks/Activities	CILO No.						Weighting*	Remarks
	1	2	3	4	5			
Continuous Assessment: 50%								
Hand-in assignments		✓		✓	✓		50%	These are skills based assessment to enable students to demonstrate the basic concepts and fundamental theory of statistical machine learning.
Final project presentation	✓	✓	✓	✓	✓		50%	Final project presentation provides students chances to demonstrate their exploration and understanding of the cutting-edge development of the current research in statistical machine learning
							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. Hand-in assignments	DEMONSTRATION of the understanding of the basic materials	High	Significant	Basic	Not even reaching marginal levels
2. Final project presentation	DEMONSTRATION of the exploration and understanding of the modern research	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	DEMONSTRATION of the understanding of the basic materials	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Final project presentation	DEMONSTRATION of the exploration and understanding of the modern research	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

Linear and nonlinear models, model assessment and selection, discriminant analysis, logistic regression, support vector machine, boosting, classification and regression trees, clustering, high-dimensional data.

2. Reading List

2.1 Compulsory Readings

The Elements of Statistical Learning, 2nd edition, by Hastie, Tibshirani, and Friedman, Springer, 2009.

2.2 Additional Readings