COURSE SYLLABUS
CSC14005 – Machine Learning

1. GENERAL INFORMATION

Course name:	Machine Learning
Course name (in Vietnamese):	Nhập môn học máy
Course ID:	CSC14005
Knowledge block:	Required knowledge
Number of credits:	4
Credit hours for theory:	45
Credit hours for practice:	30
Credit hours for self-study:	90
Prerequisite:	Linear algebra, Statistics, Calculus
Prior-course:	Data Structures and Algorithms, Artificial Intelligence
Instructors:	Bui Tien Len

2. COURSE DESCRIPTION

The course is designed to provide students with a foundational knowledge of the field of machine learning. The main content would answers the questions: What is machine learning? Can the machine learn or not? How can the machine learn? How can the machine learn well? In practice, students will learn a high-level programming language such as Python to design, implement and deploy learning models easily and quickly.

3. COURSE GOALS

At the end of the course, students are able to

ID	Description	Program LOs

G1	Understand what machine learning is.	1.1.1, 1.4
G2	Explain why machines can learn.	1.1.1, 1.4
G3	Understand and implement the learning models by the high-level languages such as Python or MATLAB	1.1.1, 1.2.1, 1.4
G4	Analyze and evaluate the results when applying a specific machine learning model to a specific dataset, then propose solutions to improve.	1.1.1, 1.4, 4.1
G5	Use the skill of reading technical documents about machine learning in English	2.1.8, 2.4.2, 2.4.3, 2.4.5

4. COURSE OUTCOMES

CO	Description	I/T/U
G1.1	Recognize which problems are appropriate for applying machine learning; distinguish supervised learning, unsupervised learning, and reinforcement learning.	T
G1.2	Represent the components of the supervised learning.	U, T
G2.1	Understand the Hoeffding inequality.	U, T
G2.2	Understand the VC inequality.	U, T
G2.3	Distinguish between training and testing tasks.	U, T
G3.1	Understand and implement the learning models by the high-level languages such as Python or MATLAB	U, T
G4.1	Analyze and evaluate the results when applying a specific machine learning model to a specific dataset, then propose solutions to improve.	U, T
G5.1	Use the skill of reading technical documents about machine learning in English	I, T

5. TEACHING PLAN

THEORY

ID	Topic	Course outcomes	Teaching/Learning Activities (samples)	Assessments
1	Introduction to Machine Learning and the programming language (Python)	G1.1, G1.2, G3.1, G5.1	Lecturing Demonstration Discussion	HW1
2	The feasibility of learning models	G1.2, G2.1, G5.1	Lecturing Demonstration Discussion	HW1
3	Linear model I	G3.1, G5.1	Lecturing Demonstration Discussion	HW2
4	Error and Noise	G1.2, G5.1	Lecturing Demonstration Discussion	HW2
5	Training and Testing	G2.3, G5.1	Lecturing Demonstration Discussion	HW2
6	VC inequality	G2.2, G5.1	Lecturing Demonstration Discussion	HW3
7	VC dimension	G2.2, G5.1	Lecturing Demonstration Discussion	HW3
8	Bias, Variance and Tradeoff	G2.4, G5.1	Lecturing Demonstration Discussion	HW3

9	Linear Model II	G3.1, G5.1	Lecturing Demonstration Discussion	HW4
10	Neural Network Model	G3.1, G5.1	Lecturing Demonstration Discussion	HW5
11	Overfitting and Underfitting	G4.1, G5.1	Lecturing Demonstration Discussion	HW6
12	Regularization	G4.1, G5.1	Lecturing Demonstration Discussion	HW6
13	Validation	G4.1, G5.1	Lecturing Demonstration Discussion	HW6
14	Support Vector Machine	G3.1, G5.1	Lecturing Demonstration Discussion	HW7
15	Final Project & Review	G3.1, G4.1, G5.1	Case study, Project Assignment, Q&A	Project

LABORATORY

Students will not have weekly laboratory works because they are integrated into homework.

The teaching assistants are responsible for
- Consolidating students' comprehension by giving tutorials in office hours (on demand)
- Organizing review sessions for midterm and/or final examinations
- Giving, correcting, and grading homework

The lab instructors are responsible for
- Consolidating students' problem-solving and programming skills
- Organizing one Q&A session (or more) for each project announcement
- Giving, correcting, and grading lab works and projects

6. ASSESSMENTS

ID	Topic	Description	Course outcomes	Ratio (%)
A1	**Assignments**			**30%**
A11	HW1-HW7	Each homework consists of questions, which are from easy to difficult, from theory to programming.	G1.1, G1.2, G2.1, G2.2, G2.3, G2.4, G3.1, G4.1, G5.1	30%
A2	**Projects**			**20%**
A21	Final Project	Apply a learning model to a specific problem	G3.1, G4.1, G5.1	20%
A3	**Exams**			**40%**
A31	Midterm exam	Closed book exam. Describe the understanding of different topics, analyze & program to solve problems	G1.1, G1.2, G2.1, G2.2, G2.3, G2.4	10%
A32	Final exam	Closed book exam. Describe the understanding of different topics, analyze & program to solve problems	G1.1, G1.2, G2.1, G2.2, G2.3, G2.4	30%

7. RESOURCES

Textbooks

- "Deep learning", 2016, Goodfellow, I., Bengio, Y., and Courville, A.
- "Artificial intelligence: a modern approach", 2020, Russell, S. and Norvig, P.

Others

MOOC courses

- "Learning from data", 2022, Yaser Abu-Mostafa, http://work.caltech.edu/telecourse.html
- "Machine learning", 2022, Google, https://developers.google.com/machine-learning/crash-course

Programming languages and tools:

- Python
- VS Code, Google Colab

8. GENERAL REGULATIONS & POLICIES

- All students are responsible for reading and following strictly the regulations and policies of the school and university.
- Students who are absent for more than 3 theory sessions are not allowed to take the exams.
- For any kind of cheating and plagiarism, students will be graded 0 for the course. The incident is then submitted to the school and university for further review.
- Students are encouraged to form study groups to discuss on the topics. However, individual work must be done and submitted on your own.