

COURSE SYLLABUS

MACHINE LEARNING

Course code: 2200144

1. General information

<i>Course type</i>		<i>Number of credits</i>	<i>Number of learning periods</i>
General	<input type="checkbox"/>	Theory: 02 Exercise: Practice: 01	Theory: 30 Exercise: Practice: 30
Basic	<input type="checkbox"/>		
Specialized	<input checked="" type="checkbox"/>		
Required	<input type="checkbox"/>		
Elective	<input checked="" type="checkbox"/>		

Learners:

Level	Bachelor
Discipline	Information Technology

Course requirements:

Prerequisites	Programming Techniques
Parallels	None
Other requirements	None

2. Learning resources

Books	[1] Marsland, S. (2015). <i>Machine learning: an algorithmic perspective</i> . CRC press.
References	[2] Alpaydin, E. (2020). <i>Introduction to machine learning</i> . MIT press. [3] Kelleher, J. D., Mac Namee, B., & D'arcy, A. (2015). <i>Fundamentals of machine learning for predictive data analytics: algorithms, worked examples, and case studies</i> . MIT press.
Other learning materials	[4] Websites: 1. https://machinelearningcoban.com

	2. https://machinelearningmastery.com/ 3. https://www.kaggle.com/ 4. https://scikit-learn.org/
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3. Course description

The course provides students basic knowledge of basic concepts of machine learning and machine learning algorithms. The course also aims to provide opportunities to practice professional skills for solving problems of applying machine learning from simple to advanced. Additionally, the course develops students' appropriate awareness and attitudes on teamwork skills, public speaking skills.

4. Course learning outcomes (CLOs)

After finishing the course, students will be able to:

		<i>Satisfy LOs of the program</i>	<i>Satisfy LOs of the ABET</i>
❖ Topic 1: Disciplinary Knowledge and Reasoning			<i>B.1.1</i>
L1.	Describe types of machine learning and machine learning process	<i>1.3.7</i>	<i>B.1.2</i>
L2.	Classify Supervised learning and Unsupervised learning		<i>B.1.3</i>
L3.	Utilize popular machine learning algorithms		<i>B.1.4</i>
L4.	Describe the architectures of Neural networks, Deep Learning, and Ensemble learning		<i>B.1.5</i>
L5.	Utilize Dimensionality Reduction, Supervised learning, Unsupervised learning, Neural networks, Ensemble Learning, and Deep Learning to solve real-world problems		<i>B.1.6</i>
❖ Topic 2: Personal and Professional Skills and Attributes			
L6.	Problem Identification and Formulation	<i>2.1.1</i>	
L7.	Modeling	<i>2.1.2</i>	
L8.	Estimation and Qualitative Analysis	<i>2.1.3</i>	
❖ Topic 3: Interpersonal Skills: Teamwork and Communication			
L9.	Forming Effective Teams	<i>3.1.1</i>	

L10.	Team Operation	3.1.2	
L11.	Technical and Multidisciplinary Teaming	3.1.5	
L12.	Using English for Computer Science	3.3.1	
❖ Topic 4: Conceiving, Designing, Implementing and Operating Systems in The Enterprise, Societal and Environmental Context – The Innovation Process			
L13.	Roles and Responsibility of IT Engineers	4.1.1	
L14.	Understanding Needs and Setting Goals	4.2.1	

5. Course content

<i>Course content</i>	<i>CLOs</i>	<i>Number of learning periods</i>		
		<i>Theor y</i>	<i>Practi ce</i>	<i>Other s</i>
Chapter 1. Introduction	L1, L2	3	0	
1.1. Introduction				
1.2. Learning				
1.3. Type of machine learning				
1.4. Supervised Learning				
1.5. The machine learning process				
<input checked="" type="checkbox"/> Personal and Professional Skills and Attributes	L6(U) L7(U) L8(U)			
<input checked="" type="checkbox"/> Interpersonal Skills: Teamwork and Communication	L9(U) L10(U) L11(U) L12(U)			

<input checked="" type="checkbox"/> <i>CDIO in the enterprise, societal and environmental context</i>	L13(U) L14(U)			
Chapter 2. Preliminaries	L2	2	0	
2.1. Terminology				
2.2. Testing machine learning algorithms				
2.3. Basic statistics				
<input checked="" type="checkbox"/> <i>Personal and Professional Skills and Attributes</i>	L6(U) L7(U) L8(U)			
<input checked="" type="checkbox"/> <i>Interpersonal Skills: Teamwork and Communication</i>	L9(U) L10(U) L11(U) L12(U)			
<input checked="" type="checkbox"/> <i>CDIO in the enterprise, societal and environmental context</i>	L13(U) L14(U)			
Chapter 3. Neurons, Neural Networks, and Linear Discriminants	L3 L4 L5	3	2	
3.1. The brain and the neuron				
3.2. Neural networks				
3.3. The perception				
3.4. Linear regression				
<input checked="" type="checkbox"/> <i>Personal and Professional Skills and Attributes</i>	L6(U) L7(U) L8(U)			
<input checked="" type="checkbox"/> <i>Interpersonal Skills: Teamwork and Communication</i>	L9(U) L10(U) L11(U) L12(U)			

<input checked="" type="checkbox"/> <i>CDIO in the enterprise, societal and environmental context</i>	L13(U) L14(U)			
Chapter 4. The Multi-layer Perceptron	L3 L4 L5	3	3	
4.1. Going forwards				
4.2. Going backwards: Back-propagation of error				
4.3. The multi-layer perception in practice				
<input checked="" type="checkbox"/> <i>Personal and Professional Skills and Attributes</i>	L6(U) L7(U) L8(U)			
<input checked="" type="checkbox"/> <i>Interpersonal Skills: Teamwork and Communication</i>	L9(U) L10(U) L11(U) L12(U)			
<input checked="" type="checkbox"/> <i>CDIO in the enterprise, societal and environmental context</i>	L13(U) L14(U)			
Chapter 5. Dimensionality Reduction	L5	5	3	
5.1. Linear discriminant analysis (LDA)				
5.2. Principal components analysis (PCA)				
5.3. Factor analysis				
5.4. Independent components analysis (ICA)				
<input checked="" type="checkbox"/> <i>Personal and Professional Skills and Attributes</i>	L6(U) L7(U) L8(U)			
<input checked="" type="checkbox"/> <i>Interpersonal Skills: Teamwork and Communication</i>	L9(U) L10(U) L11(U) L12(U)			

<input checked="" type="checkbox"/> <i>CDIO in the enterprise, societal and environmental context</i>	L13(U) L14(U)			
Chapter 6. Support Vector Machines	L3	2	2	
6.1. Optimal separation				
6.2. Kernels				
6.3. The support vector machine algorithm				
<input checked="" type="checkbox"/> <i>Personal and Professional Skills and Attributes</i>	L6(U) L7(U) L8(U)			
<input checked="" type="checkbox"/> <i>Interpersonal Skills: Teamwork and Communication</i>	L9(U) L10(U) L11(U) L12(U)			
<input checked="" type="checkbox"/> <i>CDIO in the enterprise, societal and environmental context</i>	L13(U) L14(U)			
Chapter 7. Reinforcement Learning	L3	2	2	
7.1. Overview				
7.2. Markov decision processes				
7.3. Using reinforcement learning				
<input checked="" type="checkbox"/> <i>Personal and Professional Skills and Attributes</i>	L6(U) L7(U) L8(U)			
<input checked="" type="checkbox"/> <i>Interpersonal Skills: Teamwork and Communication</i>	L9(U) L10(U) L11(U) L12(U)			
<input checked="" type="checkbox"/> <i>CDIO in the enterprise, societal and environmental context</i>	L13(U) L14(U)			

Chapter 8. Learning with Trees	L3	2	3	
8.1. Using decision trees				
8.2. Constructing decision trees				
8.3. Classification and regression trees (CART)				
<input checked="" type="checkbox"/> <i>Personal and Professional Skills and Attributes</i>	L6(U) L7(U) L8(U)			
<input checked="" type="checkbox"/> <i>Interpersonal Skills: Teamwork and Communication</i>	L9(U) L10(U) L11(U) L12(U)			
<input checked="" type="checkbox"/> <i>CDIO in the enterprise, societal and environmental context</i>	L13(U) L14(U)			
Chapter 9. Ensemble Learning	L4 L5	2	3	
9.1. Boosting, AdaBoost				
9.2. Random forests				
<input checked="" type="checkbox"/> <i>Personal and Professional Skills and Attributes</i>	L6(U) L7(U) L8(U)			
<input checked="" type="checkbox"/> <i>Interpersonal Skills: Teamwork and Communication</i>	L9(U) L10(U) L11(U) L12(U)			
<input checked="" type="checkbox"/> <i>CDIO in the enterprise, societal and environmental context</i>	L13(U) L14(U)			
Chapter 10. Unsupervised Learning	L3	2	3	
10.1. The k-means algorithm				

10.2. The self-organizing feature map				
10.3. Classification and regression trees (CART)				
<input checked="" type="checkbox"/> <i>Personal and Professional Skills and Attributes</i>	L6(U) L7(U) L8(U)			
<input checked="" type="checkbox"/> <i>Interpersonal Skills: Teamwork and Communication</i>	L9(U) L10(U) L11(U) L12(U)			
<input checked="" type="checkbox"/> <i>CDIO in the enterprise, societal and environmental context</i>	L13(U) L14(U)			
Chapter 11. Deep Learning	L4 L5	4	9	
11.1. Introduction				
11.2. Convolutional Neural Networks (CNN)				
11.3. Recurrent Neural Networks (RNN)				
<input checked="" type="checkbox"/> <i>Personal and Professional Skills and Attributes</i>	L6(U) L7(U) L8(U)			
<input checked="" type="checkbox"/> <i>Interpersonal Skills: Teamwork and Communication</i>	L9(U) L10(U) L11(U) L12(U)			
<input checked="" type="checkbox"/> <i>CDIO in the enterprise, societal and environmental context</i>	L13(U) L14(U)			
Summary of skills in course level				
<input checked="" type="checkbox"/> <i>Personal and Professional Skills and Attributes</i>	L6(U) L7(U) L8(U)			

<input checked="" type="checkbox"/> <i>Interpersonal Skills: Teamwork and Communication</i>	L9(U) L10(U) L11(U) L12(U)
<input checked="" type="checkbox"/> <i>CDIO in the enterprise, societal and environmental context</i>	L13(U) L14(U)

6. Teaching and learning methods

ID	Teaching method/technique		Description
M1.	Lecturing	<input checked="" type="checkbox"/>	
M2.	Questions – Answers	<input checked="" type="checkbox"/>	
M3.	Group-based Learning	<input checked="" type="checkbox"/>	
M4.	Problem-based Learning	<input type="checkbox"/>	
M5.	Project-based Learning	<input checked="" type="checkbox"/>	
M6.	Case studies	<input checked="" type="checkbox"/>	
M7.	Roleplay	<input type="checkbox"/>	
M8.	Demo	<input checked="" type="checkbox"/>	
M9.	Simulations	<input checked="" type="checkbox"/>	
M10.	Debate	<input type="checkbox"/>	
M11.	Game	<input type="checkbox"/>	
M12.	Brainstorming	<input checked="" type="checkbox"/>	
M13.	Think-Pair-Share	<input type="checkbox"/>	

7. Course assessment

ID	Assessment activity		Quantity	Weight	LOs assessed
T1.	Text-based midterm exam	<input checked="" type="checkbox"/>	01	20%	L1-L3

ID	Assessment activity		Quantity	Weight	LOs assessed
T2.	Text-based final exam	<input type="checkbox"/>			
T3.	Practice midterm exam	<input type="checkbox"/>			
T4.	Practice final exam	<input type="checkbox"/>			
T5.	Report	<input type="checkbox"/>			
T6.	In-class exercises	<input type="checkbox"/>			
T7.	Homework assignments	<input checked="" type="checkbox"/>	03	30%	L2-L5
T8.	Question – Answer	<input type="checkbox"/>			
T9.	Term Project	<input checked="" type="checkbox"/>	01	50%	L1-L5
T10.	Final Exam	<input type="checkbox"/>			
Formula for Overall score		$T1*0.2+T7*0.3+T9*0.5$			

8. Course requirements and expectations

8.1. Requirements on attendance

- Students are responsible for attending in all classes. In case of absence due to force majeure circumstances, there must be sufficient and reasonable evidence.
- Students who do not attend more than 20% of the class sections, whether for reason or not, are deemed not to have completed the course and must re-enroll in the following semester.

8.2. Requirements and expectations on student behaviors

- Students must show their respects for teachers and other learners.
- Students must be on time. Students who are late more than five minutes will not be allowed to attend the class.
- Students should not make noise and interfere with others in the learning process.
- Students should not eat, chew gum, and use devices such as cell phones, music players during class hours.
- Laptops and tablets can only be used in class for the purpose of learning.
- Students who violate the above principles will be asked to leave the class and considered absent from the class.

8.3. Requirements on learning issues

Issues related to applying for score reservation, scoring complaints, scoring, exam disciplines are done according to the Learning Regulation of Tra Vinh University.

9. Tentative course instructor

Nguyen Nhut Lam

DEAN

DEPARTMENT HEAD

LECTURER

Nguyen Nhut Lam