

Subject Description Form

Subject Code	AMA564
Subject Title	Deep Learning
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: AMA563 Principles of Data Science
Objectives	To provide a comprehensive introduction to machine learning and deep learning. To present fundamental concepts and algorithms for selected topics of deep learning, to provide the students with the necessary background for the application of deep learning to real problems, and to provide a starting point for students who are interested in pursuing research in deep learning or related fields.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) Demonstrate mastery of the principles of machine learning and deep learning (b) Develop quantitative skills of deep learning and interpret the outcomes of deep learning algorithms. (c) Identify, define, and formulate problems of deep learning in real applications and generate workable solutions to problems.
Subject Synopsis/ Indicative Syllabus	Deep Learning: Artificial neural networks (ANN), back-propagation; deep learning for computer vision, convolutional neural networks (CNN), dropout; deep learning for text and sequences, recurrent neural networks (RNN), word embeddings; Advanced topics. Python for deep learning via <i>Pytorch</i> . Preliminary Statistical Learning Theory: Fundamentals of algebra, optimization and probability in (machine, deep) learning, Function spaces, matrix analysis in learning, norms, universality of neural networks; bias-variance trade-off; VC dimension; AUC scores.
Teaching/Learning Methodology	The subject will mainly be delivered through lectures and tutorials in computer lab. The theoretical background and the real applications of learning algorithms are both emphasized.

Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
			a	b	c	
	1. Assignments	20%	✓	✓	✓	
	2. Projects	20%	✓	✓	✓	
	3. Midterm test	20%	✓	✓	✓	
	4. Examination	40%	✓	✓	✓	
Total	100%					
<p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Assignments: used to help students review basic mathematics and the details of the algorithms.</p> <p>Projects: training students' ability to organize learned algorithms for real problems, and skills of presentation</p> <p>Midterm test: a part of continuous assessment for theory.</p> <p>Examination: an overall examination of the mathematics and algorithms studied in the whole semester.</p>						
Student Study Effort Required	Class contact:					
	▪ Lecture	26 Hrs.				
	▪ Tutorial	13 Hrs.				
	Other student study effort:					
	▪ Assignments/Projects	58 Hrs.				
	▪ Self-study	30 Hrs.				
	Total student study effort		127 Hrs.			
Reading List and References	<p><u>Textbooks:</u></p> <p>Goodfellow I., Bengio Y., Courville A. Deep Learning, The MIT Press 201</p>					

References:

Francois Chollet with J. J. Allaire Deep Learning with Python Manning Publications Co.2018

Hastie, T., Tibshirani, R, and Friedman, J. The Elements of Statistical Learning Springer 2009

Mohri, M., Rostamizadeh, A., & Talwalkar, A Foundations of Machine Learning The MIT Press 2018

Bubeck, S. Convex optimization: Algorithms and complexity Now Publishers Inc.2015