DSC8007: DEEP LEARNING

Effective Term
Semester A 2026/27

Part I Course Overview

Course Title
Deep Learning

Subject Code
DSC - Data Science
Course Number
8007

Academic Unit
Data Science (DS)

College/School
College of Computing (CC)

Course Duration
One Semester

Credit Units
3

Level
R8 - Research Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
SDSC8007 Deep Learning

Exclusive Courses
Nil

Part II Course Details

Abstract
This course provides students with a systematic study of deep learning. Topics include shallow and deep neural networks, deep fully connected and structured neural networks, universality of approximation, convolutions and Fourier transform,

deep convolutional neural networks, deep recursive neural networks, gradient descent and stochastic gradient descent, backpropagation and automatic differentiation, learning ability of deep learning algorithms, design of deep neural network architectures.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Clearly explain foundational principles, theories, and methods used in deep learning.	20	x		
2	Critically analyze and compare different deep neural network structures in terms of their functionality and performance.	20	x		
3	Apply standard deep learning algorithms to real-world datasets to derive insights and solutions.	40	x	x	x
4	Address practical challenges by applying existing deep learning methods and creating innovative algorithms.	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	Students will participate in structured lectures that introduce deep learning principles, followed by real-time demonstrations to apply and reinforce these concepts, ensuring students can observe and assess their understanding and application skills.	1, 2, 3, 4	39 hours in total

2	Mini-project	Students will tackle a defined deep learning challenge independently develop a solution, and synthesize findings into a written report. Conclude the project with a presentation that showcases both the process and the outcome, with continuous guided support from the instructor to ensure clarity and effectiveness of learning.	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 test focused on assessing the comprehension of basic concepts, fundamental theories, various neural network architectures, and their applications to datasets, ensuring alignment with the first half of the course content.	1, 2, 3, 4	50	take-home test	Yes
2	Mini-Project Provide practical experience through a project where students apply learned theories and methods to solve a typical deep learning problem, demonstrating their ability to achieve the course outcomes.	1, 2, 3, 4	25	-	Yes

3	Mini-Project Presentation Facilitate a presentation session where students articulate their project strategy, process, and results, emphasizing their understanding and innovation in the application of deep learning concepts.	1, 2, 3, 4	25	-	Yes

Continuous Assessment (%)

100

Examination (%)

0

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, deep neural network architectures, and deep learning algorithms.

Excellent

A+, A, A-

Good

B+, B, B-

Fair

C+, C, C-

Marginal

D

Failure

F

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 applications of deep learning algorithms to some datasets.

Excellent

A+, A, A-

Good
B+, B, B-

Fair
C+, C, C-

Marginal
D

Failure
F

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-

Good
B+, B, B-

Fair
C+, C, C-

Marginal
D

Failure
F

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

Criterion
Ability to understand and apply the fundamental theory, deep neural network architectures, and deep learning algorithms.

Excellent
A+, A, A-

Good
B+, B

Marginal
B-, C+, C

Failure
F

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 applications of deep learning algorithms to some datasets.

Excellent
A+, A, A-

Good
B+, B

Marginal
B-, C+, C

Failure
F

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-

Good
B+, B

Marginal
B-, C+, C

Failure
F

Part III Other Information

Keyword Syllabus
Activation functions including sigmoidal functions and rectified linear unit, shallow neural networks and universality of approximation of functions, deep fully connected neural networks with full connection matrices, convolutions and Fourier transform, deep convolutional neural networks with convolutional matrices, representation and approximation by deep convolutional neural networks, deep recursive neural networks with structured matrices, pooling, gradient descent and stochastic gradient descent, backpropagation and automatic differentiation, learning ability in terms of the number of hidden neurons and depth of deep neural networks, design of deep neural network architectures according to various applications of deep learning.

Reading List

Compulsory Readings

	Title
1	Lecture slides and other related material

Additional Readings

	Title
1	I. Goodfellow, Y. Bengio, and A. Courville, Deep Learning, MIT Press, 2016.