

CS4486: ARTIFICIAL INTELLIGENCE

Effective Term

Semester A 2024/25

Part I Course Overview

Course Title

Artificial Intelligence

Subject Code

CS - Computer Science

Course Number

4486

Academic Unit

Computer Science (CS)

College/School

College of Computing (CC)

Course Duration

One Semester

Credit Units

3

Level

B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

CS2310 Computer Programming or
CS2315 Computer Programming or
CS2334 Data Structures for Data Science or
CS2360 Java Programming

Precursors

Nil

Equivalent Courses

Nil

Exclusive Courses

Nil

Part II Course Details

Abstract

This course aims to equip students with the knowledge and skills of problem solving using artificial intelligence (AI) techniques through a demonstrable knowledge in a range problem solving methods and the associated decision making, optimization and machine learning techniques.

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Demonstrate knowledge of the fundamental principles of artificial intelligence.		x		
2	Understand the difference/hybrid of various AI techniques.		x		
3	Analysis of strengths/weaknesses of AI methods.		x	x	
4	Comparison of various AI techniques.		x	x	
5	Design and implement AI problem-solving methods.				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	The lecture will focus on the introduction of the main concepts of AI, and their applications to real world problems.	1, 2, 3, 4, 5	3 hours/week
2	Tutorial	Students will work on a set of problems on the principles and applications of AI, and present their solutions in the class.	1, 2, 3, 4	1 hour/week for 10 weeks

3	Project	There will be one project. In the project, students are expected to implement AI algorithms to solve a real-world problem.	2, 3, 4, 5	
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Assessment Tasks / Activities (ATs)

ATs		CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Assignment 1 (Problem-solving questions and implementation of AI algorithms)	1, 2, 3, 5	10	
2	Assignment 2 (Problem-solving questions and implementation of AI algorithms)	1, 2, 5	10	
3	Project (Application of AI algorithms to real-world problems)	1, 3, 4, 5	20	
4	Weekly quiz	1, 2, 3, 4, 5	10	

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

Additional Information for ATs

For a student to pass the course, at least 30% of the maximum mark for the examination must be obtained.

Assessment Rubrics (AR)**Assessment Task**

Assignments

Criterion

1.1 Capability to effectively demonstrate practical and analytical skills to implement and evaluate AI techniques.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

Assignments

Criterion

1.2 Capacity for judiciously applying AI approaches to solve a specific real-world problem.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

Weekly quiz

Criterion

2.1 Capacity for understanding AI concepts and techniques in depth.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

Weekly quiz

Criterion

2.2 Capacity for formulating real-world problems as AI problems and designing AI methods to solve the problems.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

Examination

Criterion

3.1 Capacity for understanding a range of AI concepts and techniques in depth.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

Examination

Criterion

3.2 Ability to analyse and evaluate a variety of AI problem solving techniques.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Part III Other Information

Keyword Syllabus

Artificial intelligence, Heuristic search, Rule-based systems, Fuzzy inference, Stochastic search algorithms, Artificial neural networks, Learning Processes, Machine Learning.

Syllabus

- Overview
An introduction to the goals and objectives of AI as a discipline and its relationship with other disciplines. Approaches in AI.
- Fuzzy set theory
Binary logic, concept of fuzziness, fuzzy sets, operations on fuzzy sets, fuzzy relations, fuzzy compositions, extension principle, fuzzy numbers, arithmetic operations, approximate reasoning, fuzzy inference, linguistic model of complex systems, construction of knowledge base, fuzzy nonlinear simulations, design of fuzzy systems.
- Search and optimization
Heuristic search methods, A* search, hill-climbing search, simulated annealing, genetic algorithm, schemata theorem, nature-inspired algorithms, multi-objective optimization, hybrid AI techniques.
- Artificial neural networks
Human brain, models of a neuron, network architectures, learning processes, single layer perceptrons, multilayer perceptrons, back-propagation algorithm, approximations of function, time series, other learning networks: radial-basis function networks, deep learning models and algorithms etc.

Reading List**Compulsory Readings**

Title	
1	Nil

Additional Readings

Title	
1	Some freely available web-based resources will be used.
2	D. B. Fogel, D. R. Liu, J. M. Keller (2016), Fundamentals of Computational Intelligence: Neural Networks, Fuzzy Systems, and Evolutionary Computation, IEEE.
3	S. Russell and P. Norvig (2009), Artificial Intelligence: A Modern Approach. Prentice-Hall, 3rd edition.
4	S. Haykin (1999), Neural Networks: A Comprehensive Foundation, Prentice Hall, 2nd edition.
5	D. E. Goldberg (1989), Genetic Algorithms in Searching, Optimization and Machine Learning, Addison-Wesley.
6	G. J. Klir and T. A. Folger (1992), Fuzzy Sets, Uncertainty, and Information, Prentice-Hall.