CS4486: ARTIFICIAL INTELLIGENCE

Effective Term
Semester B 2023/24

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 Engineering (EG)

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.

Teaching and Learning Activities (TLAs)

	TLAs	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	

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.