CS4486: ARTIFICIAL INTELLIGENCE

Effective Term
Semester A 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)

<table>
<thead>
<tr>
<th>CILOs</th>
<th>Weighting (if app.)</th>
<th>DEC-A1</th>
<th>DEC-A2</th>
<th>DEC-A3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Demonstrate knowledge of the fundamental principles of artificial intelligence.</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Understand the difference/hybrid of various AI techniques.</td>
<td>x</td>
<td></td>
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<tr>
<td>3</td>
<td>Analysis of strengths/weaknesses of AI methods.</td>
<td>x</td>
<td>x</td>
<td></td>
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<tr>
<td>4</td>
<td>Comparison of various AI techniques.</td>
<td>x</td>
<td>x</td>
<td></td>
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<tr>
<td>5</td>
<td>Design and implement AI problem-solving methods.</td>
<td></td>
<td></td>
<td>x</td>
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</table>

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)

<table>
<thead>
<tr>
<th>TLAs</th>
<th>Brief Description</th>
<th>CILO No.</th>
<th>Hours/week (if applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lecture</td>
<td>The lecture will focus on the introduction of the main concepts of AI, and their applications to real world problems.</td>
<td>1, 2, 3, 4, 5</td>
</tr>
<tr>
<td>2</td>
<td>Tutorial</td>
<td>Students will work on a set of problems on the principles and applications of AI, and present their solutions in the class.</td>
<td>1, 2, 3, 4</td>
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</table>
There will be two projects. In the first project, students will implement selected AI algorithms using a high-level programming language. In the second project, students will judiciously select/combine different AI algorithms to solve a real world problem.

<table>
<thead>
<tr>
<th>ATs</th>
<th>CILO No.</th>
<th>Weighting (%)</th>
<th>Remarks (e.g. Parameter for GenAI use)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignment 1 (Problem-solving questions and implementation of AI algorithms.)</td>
<td>1, 2, 3, 5</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Assignment 2 (Problem-solving questions and implementation of AI algorithms)</td>
<td>1, 2, 5</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Assignment 3 and presentation (Application of AI algorithms to different domains.)</td>
<td>1, 3, 4, 5</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Mid-term quiz</td>
<td>1, 2, 3, 4, 5</td>
<td>20</td>
<td></td>
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</tbody>
</table>

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 / presentation

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
**Assessment Task**
Assignments / presentation

**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

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**Assessment Task**
Mid-term 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

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Assessment Task
Mid-term 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

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

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<th>Title</th>
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<tr>
<td>Nil</td>
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Additional Readings

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<td>1 Some freely available web-based resources will be used.</td>
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