Wolkite University

College of Computing and Informatics

Department of Computer Science

Course outline

Course Title: Introduction to Artificial Intelligence **Instructor**: Adem M

Course code: CoSc 4111 **Email:**adem.se2010@gmail.com

Course ECTS: 5 **Office:** B-145, 2nd floor

Prerequisites: CoSc2091-Data Structures and Algorithms

Program: Weekend

Year/semester: 4th year/ 1st semester

1. Course Description

The purpose of this course is to give students an understanding of Artificial Intelligence methodologies, techniques, tools and results. Students will use python programming language to demonstrate laboratory exercises. Students will learn the theoretical and conceptual components of this discipline and firm up their understanding by using AI and Expert System tools in laboratory sessions, projects and home assignments.

2. Course objectives

At the end of this course the students will be able to:

- Understand reasoning, knowledge representation and learning techniques of artificial intelligence
- Evaluate the strengths and weaknesses of these techniques and their applicability to different tasks
- Assess the role of AI in gaining insight into intelligence and perception
- Know classical examples of artificial intelligence
- Know characteristics of programs that can be considered "intelligent"
- Know a variety of ways to represent and retrieve knowledge and information

- ❖ Know the fundamentals of artificial intelligence programming techniques in a modern programming language
- ❖ Consider ideas and issues associated with social technical, and ethical uses of machines that involve artificial intelligence
- ❖ Introduce students for powerful learning algorithms and their applications.
- ❖ Letting students to develop simple AI powered applications either in robotics, NLP or games.

3. Course Outline

Chapter 1: Introduction to AI

1.1. Objectives/Goals of AI
1.2. Types of AI (General and Specific AI)
1.3. Approaches to AI – making computer:
  1.3.1 Think like a human (Thinking humanly)
  1.3.2 Act like a human (Acting humanly)
  1.3.3 Think rationally (Thinking rationally)
  1.3.4 Act rationally (Acting rationally)
1.4 The Foundations of AI
1.5 Bits of History and the State of the Art
1.6 Proposing and evaluating Application of AI

Chapter 2: Intelligent Agents

2.1 Foundation of Agents
2.2 Agents and Environments
2.3 Acting of Intelligent Agents (Rationality)
2.4 Structure of Intelligent Agents
  2.4.1 Agent Types
  2.4.2 Simple reflex agent
  2.4.3 Model-based reflex agent
  2.4.4 Goal-based agent
  2.4.5 Utility-based agent
2.5 Multi agent systems
2.6 Learning agent

Chapter 3: Searching

3.1. Problem Solving by Searching
3.2. Problem Solving Agents
3.3. Problem spaces and search

3.4. Knowledge and rationality

3.5. Heuristic search strategies

3.6. Avoiding Repeated States

3.7. Constraint Satisfaction Search

3.8. Search and optimization (gradient descent)

3.9. Adversarial search

3.10. Planning and scheduling

3.11 .Dynamic game theory

Chapter 4: Knowledge Representation and Reasoning

4.1 Logic and Inference

4.2 Logical Agents

4.3 Propositional Logic

4.4 Predicate (First-Order)Logic

4.5 Inference in First-Order Logic

4.6 Knowledge Representation

4.7 Knowledge Reasoning

4.8 Bayesian reasoning

4.9 Probabilistic reasoning

4.10 Temporal reasoning

4.11 Knowledge-based Systems

4.12 Case study: Medical diagnosis

Chapter 5: Machine Learning Basics

5.1 Knowledge in Learning

5.2 Learning Probabilistic Models

5.3 Supervised learning

5.3.1 Linear classification models

5.3.2 Probabilistic models

5.4 Unsupervised learning

5.4.1 Clustering models

5.5 Reinforcement learning

5.6 Deep Learning

5.6.1 Neural networks and back-propagation

5.6.2 Convolution neural networks

5.6.3 Recurrent neural networks and LSTMs

Chapter 6: Natural Language Processing (NLP) Basics

6.1 Intro to Natural Language Processing

6.2 Machine learning Application in NLP

6.3 Natural language interaction

6.4 Computer vision and Image processing

6.5 Case study: Sentiment Analysis, speech recognition, Chabot

Chapter 7: Robotic Sensing and Manipulation

7.1. Introduction to robotics

7.1.1 Sensing

7.1.2 Manipulation

7.1.3 Human-robot interaction

7.2 Navigation and path planning

7.2.1 Autonomous robotic systems

Chapter 8: Ethical and Legal Considerations in AI

8.1. Privacy

8.2. Bias

8.3. AI and the future of work

8.4. Appropriate uses of AI

Lab contents: With python or prolog

Lab 1: Tool installation and configuration, introduction to the tool

Lab 2: Implementing search strategies

Lab 3: Knowledge representation

Lab 4: Knowledge Reasoning

Lab 5: Implementing knowledge base system

Lab 6: Implementing neural network

4. Required Texts:

Text Book; Russell, S. and P. Norvig (1995) Artificial Intelligence: A Modern Approach Prentice-Hall.

5. Reference

1. Luger, G. (2002) Artificial Intelligence, 4th ed. Addison-Wesley.
2. Bratko, Ivan (1990) PROLOG Programming for Artificial Intelligence, 2nd ed. Addison-Wesley, 1990
3. Winston, P.H. (1992) Artificial Intelligence Addison-Wesley.
4. Ginsberg, M.L. (1993) Essentials of Artificial Intelligence. Morgan Kaufman.

6. Summary of Teaching Learning Methods:

The learning–teaching methodology will be student-centered with appropriate guidance of instructor/s during the students' activities .There will be Lecture, Demonstrations, Tutorials, Reading assignments and Group Discussions

1. **Summary of Assessment Methods:**

   The course will be assessed using the different assessment methods like: Quizzes, Reading assessments, Assignments, Project, Lab exam and Final exam

2. ***Policies on incomplete grade and late assignments:***

   Homework and project deadlines will be strict. Late homework will be accepted with a 10% reduction in grade for each class period they are late by. However, once a homework assignment is discussed in class or the solution is posted, submissions will no longer be accepted. All assignments must be turned in before the start of class on the due date.

Method of Assessment:

- Continue Assessments 50% (Test1=10%, Test 2=10%, Quizzes=10%, Individual Assignment 5% LAB=15%)
- Final Exam :50%

3. **Student Workload:** Taking into consideration that 1ECTS accounts for 27 hours of student work, the course Fundamental of Software Engineering has 5*25hr=125 hrs the split up is as shown below:-:

Lecture Lab	**32**
Home studies	**48**
	55