AI: Introduction

Course Code: **CSC4226** Course Title: **Artificial Intelligence and Expert System**

Dept. of Computer Science
Faculty of Science and Technology

Lecture No:	**Theory-01**	**Week No:**	**1**	**Semester:**	**Summer 21-22**
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About me

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Research Interest
Data Mining
Machine Learning
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Important Links
CS Portal: https://cs.aiub.edu/profile/dr.ashraf
Google Scholar: https://scholar.google.co.in/citations?user=InSi3NcAAAAJ&hl=en
Site: https://sites.google.com/site/ashrafuddininfo/
Course Materials: https://drive.google.com/drive/folders/1tiFcbxGpnrHLi12huLjJEIx5hmKtZ_Mg

To request consulting time: https://form.jotform.com/221405140900439

Lecture Outline

1. Vision and Mission
2. Course Evaluation
3. Class Policies
4. About the Course
5. What is AI?
6. The Foundations of AI.
7. Brief History of AI
8. Course Outline by Topics and Weeks.

Vision & Mission of AIUB

Vision

AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH (AIUB) envisions promoting professionals and excellent leadership catering to the technological progress and development needs of the country.

Mission

AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH (AIUB) is committed to provide quality and excellent computer-based academic programs responsive to the emerging challenges of the time. It is dedicated to nurture and produce competent world class professional imbued with strong sense of ethical values ready to face the competitive world of arts, business, science, social science and technology.

Goals of AIUB

Sustain development and progress of the university

Continue to upgrade educational services and facilities responsive of the demands for change and needs of the society

Inculcate professional culture among management, faculty and personnel in the attainment of the institution's vision, mission and goals

Enhance research consciousness in discovering new dimensions for curriculum development and enrichment

Implement meaningful and relevant community outreach programs reflective of the available resources and expertise of the university

Establish strong networking of programs, sharing of resources and expertise with local and international educational institutions and organizations

Accelerate the participation of alumni, students and professionals in the implementation of educational programs and development of projects designed to expand and improve global academic standards

Vision & Mission of Computer Science Department

Vision

Provides leadership in the pursuit of quality and excellent computer education and produce highly skilled and globally competitive IT professionals.

Mission

Committed to educate students to think analytically and communicate effectively; train them to acquire technological, industry and research-oriented accepted skills; keep them abreast of the new trends and progress in the world of information communication technology; and inculcate in them the value of professional ethics.

Goals of Computer Science Department

Enrich the computer education curriculum to suit the needs of the industry- wide standards for both domestic and international markets

Equip the faculty and staff with professional, modern technological and research skills

Upgrade continuously computer hardware's, facilities and instructional materials to cope with the challenges of the information technology age

Initiate and conduct relevant research, software development and outreach services.

Establish linkage with industry and other IT-based organizations/institutions for sharing of resources and expertise, and better job opportunities for students

Course Evaluation

Mid Term	Class Quizzes	20	
	Laboratory Performance/Viva/Exam	30	
	Class Attendance/Performance	10	
	Midterm Written Exam	40	
	Mid Term Total	**100**	**40%**
Final Term	Class Quizzes	20	
	Laboratory Performance/Viva/Exam	30	
	Class Attendance/Performance	10	
	Midterm Written Exam	40	
	Final Term Total	**100**	**60%**
Grand Total	**Final Grade of the Course**		**100**

Classroom Policies

Must be present inside the class in due time.

Class Break: I would prefer to start the class in due time and leave the class in 5/10 minutes early for theory/Laboratory class respectively, instead of giving a break.

Every class will start with a question-answer session about the last lecture. So, students must be prepared with the contents and exercises from the last lecture.

Students are suggested to ask questions during or after the lecture.

Additional/bonus marks may be given to any *good performances* during the class.

Late in Class:

Student coming after 5 minutes of due time is considered late.

2 late attendances are considered as one absent.

Late during quiz is not given additional time.

Students who are regularly late might have additional deduction of marks.

A late student will be allowed to enter the class. Don't ask permission to enter the class, just get in slowly and silently.

Laboratory Policies

LABORATORY CLASSES:

First 0.5 – 1 hour will be spent explaining the problems/task/experiment to be performed.

Next 1 – 1.5 hour(s) will be spent by the students to complete the experiment.

Next 0.5 – 1 hour will be spent in checking, marking, and discussing the solution.

Students are allowed to discuss with each other (unless instructed not to) in solving problems.

But the checking (executing/viva) & marking will be with individual students only.

LABORATORY EXAM:

Laboratory exams are scheduled in the week before the major exams during the normal laboratory hours.

Generally, students are given one/more problems to be solved of which at least one part is solved using computers.

One hour is given to the students to solve the problem.

Attendance

At least 80% presence is required by the student. Absent classes must be defended by the student through application and proper documentation to the course teacher.

Long absences/irregular presence/absences out of 25% range must go through *application procedures* via department Head (+ probation office, if student is in *probation*) to attend the following classes.

Acceptance of an application for absence only gives permission to attend the following classes. This might still result in deduction of marks (for attendance) which will be judged by the course teacher.

Makeup Evaluation

Makeup for missing evaluations like quizzes/assignment submission date/presentation date/viva date/etc., must go through valid application procedure with supporting document within the deadline of the actual evaluation date.

Makeup for missing Midterm/Final term must go through Set B form along with the supporting document within the 1st working day after exam week. The set B exam is generally scheduled from the 2nd working day after the exam week. Must get signature and exam date from the course teacher and get it approved by the department Head (monetary penalty might be imposed).

The course teacher will be the judge of accepting/rejecting the request for makeup.

Grading Policies

All the evaluation categories & marks will be uploaded to the VUES within one week of the *evaluation process* except the attendance & performance, which will be uploaded along with the major (mid/final term) written exam marks.

Letter grades '**A+**' through '**F**' is counted as grades. Other grades '**I**' and '**UW**' are considered as temporary grades which are counted/calculated as '**F**' grade in the **CGPA**. These grades must/will be converted to the actual grades, i.e. '**A+**' through '**F**'.

'**I: INCOMPLETE**' is given to students who have *missed* at most 30% of *evaluation categories* (quiz/assignment/etc.). Students must contact the course teacher for makeup, through valid application procedures immediately after grade release.

'**UW: UNOFFICIAL WITHDRAW**' is given when the *missing evaluation categories* are too high (more than 30%) to makeup. A student getting 'UW' has no option but to drop the course immediately after grade release

Grading Policies…

Once a student's gets 'I' or 'UW' and unable to fulfill the requirements with the course teacher for makeup, must drop the course within officially *mentioned time period* from the *registration department*.

Students in probation or falls into the probation due to 'I'/'UW' grade are not allowed to drop the course.

Unable to do so will result in the automatic conversion of the grades '**I**'/'**UW**' to '**F**' grade after the 4th week of the following semester.

Any *problem with the mark/grade* must be consulted with the course teacher within *one week of the release of grades*.

Dropping a Course

Must fill up the drop form and get it signed by the course teacher, write an application to the vice chancellor and get it signed by the department Head, and finally submit the form & application to the registration department.

The course teacher must write down the grades (if any) obtained in midterm, final, and grand total on the drop form.

No drop is accepted during the following periods:

One week before midterm exam – grade release date of midterm exam.

One week before final term exam – grade release date of final grade.

Student with 'F' grades in midterm, final term, or grand total cannot drop.
Probation student are not allowed to drop any course.

Contacts

Contact information (email, office phone extension, office location, consulting hours, etc.) of the course teacher must be stored by the students.

It is mandatory to contact/notify (*preferably consulting hour/email*) the course teacher for/of any problems/difficulties at the earliest possible. Late notification might not be considered.

Update & correct your email address & phone number at VUES, as the teacher will contact/notify you of anything regarding the course through these information in VUES.

Finally

For any problems that could not be solved/understood during the lecture, students are advised to contact during the consultation hours and solve the problem.

For any missing evaluation (quiz, assignment, etc.), classes, deadlines, etc. must contact/inform/notify the teacher immediately after missing in the consulting hour, via email, or in unavoidable circumstances – through the guardian or friend.

Probation students must meet the course teacher once a week. So, schedule your time with the teacher.

Any kind of dishonesty, plagiarism, misbehavior, misconduct, etc. will not be tolerated. Might result in deduction of marks, 'F' grade, or reported to the AIUB Disciplinary Committee for drastic punishment.

Always check/visit the AIUB home page for notices, rules & regulations of academic/university policies and important announcement for deadlines (Course drop, Exam permit, Exam Schedule, etc.).

Course Prerequisite

- Representing information in computers, Binary Number Systems, Conversions.
- Programming Languages (C/C++/**Python**)
- Using C/C++/Python editors, debugging
- Data Storage Concept & Data types in Programming languages,
- Variable, Array (single & multidimensional), Pointers, String
- Functions, Recursion, Scope of variable & function
- Design and Analysis of Algorithms

Course Objectives

- Get an overview of artificial intelligence (AI) principles and approaches.
- Develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic, learning.
- Develop a brief overview of AI applications: Expert Systems and Planners.
- Follow AI literature with the ability to go on to independent work in the field.

Importance of the course

Studying artificial intelligence opens a world of opportunities.

At a basic level, you'll better understand the systems and tools that you interact with daily. And if you stick with the subject and study more, you can help create cutting edge AI applications, like the Google Self Driving Car, or IBM's Watson.

In the field of artificial intelligence, the possibilities are truly endless.

Studying AI now can prepare you for a job as a researching neural networks, human-machine interfaces, and quantum artificial intelligence.

Or you could work as a software engineer in industry working for companies like Amazon to shopping list recommendation engines or Facebook analyzing and processing big data.

You could also work as a hardware engineer developing electronic parking assistants or home assistant robots.

Course Contents

Introduction to Artificial Intelligence

Intelligent Agent

Problem Solving, Search and Control Strategies

Knowledge Representation Issues, Predicate Logic, Rules

Reasoning System: Symbolic, Statistical

Learning Systems

Expert System

Neural Networks: Fundamental

Genetic Algorithms: Fundamental

What is Artificial Intelligence ?

- John McCarthy, who coined the term Artificial Intelligence in 1956, defines it as "the science and engineering of making intelligent machines", especially intelligent computer programs.
- Artificial Intelligence (AI) is the intelligence of machines and the branch of computer science that aims to create it.
- Intelligence is the computational part of the ability to achieve goals in the world. Varying kinds and degrees of intelligence occur in people, many animals and some machines.
- AI is the study of the mental faculties through the use of computational models.
- AI is the study of : How to make computers do things which, at the moment, people do better.
- AI is the study and design of intelligent agents, where an intelligent agent is a system that perceives its environment and takes actions that maximize its chances of success.

Definitions of AI

Thinking Humanly	Thinking Rationally
"The exciting new effort to make computers think . . . *machines with minds*, in the full and literal sense." (Haugeland, 1985) "[The automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning . . ." (Bellman, 1978)	"The study of mental faculties through the use of computational models." (Charniak and McDermott, 1985) "The study of the computations that make it possible to perceive, reason, and act." (Winston, 1992)
Acting Humanly	**Acting Rationally**
"The art of creating machines that perform functions that require intelligence when performed by people." (Kurzweil, 1990) "The study of how to make computers do things at which, at the moment, people are better." (Rich and Knight, 1991)	"Computational Intelligence is the study of the design of intelligent agents." (Poole *et al.*, 1998) "AI . . . is concerned with intelligent behavior in artifacts." (Nilsson, 1998)

Types of AI

Hard or Strong AI

- Generally, artificial intelligence research aims to create AI that can **replicate human intelligence** completely.
- Strong AI refers to a machine that approaches or supersedes human intelligence,
  - If it can do typically human tasks,
  - If it can apply a wide range of background knowledge and
  - If it has some degree of self-consciousness.
- Strong AI aims to build machines whose overall intellectual ability is indistinguishable from that of a human being.

Types of AI

Soft or Weak AI

- Weak AI refers to the use of software to study or accomplish specific problem solving or reasoning tasks that do not encompass the full range of human cognitive abilities.

- Example : a chess program such as **Deep Blue**.

- Weak AI does not achieve self-awareness; it demonstrates wide range of human-level cognitive abilities; it is merely an intelligent, a specific problem-solver.

Goals of AI

- The definitions of AI gives four possible goals to pursue :

  1. Systems that think like humans.
  2. Systems that think rationally.
  3. Systems that act like humans
  4. Systems that act rationally

- Traditionally, all four goals have been followed and the approaches were:

	Human-like	Rationally
Think	(1) Cognitive science Approach	(2) Laws of thought Approach
Act	(3) Turing Test Approach	(4) Rational agent Approach

- Most of AI work falls into category (2) and (4).

Goal of AI

Continued…

General AI Goal

- Replicate human intelligence : still a distant goal.
- Solve knowledge intensive tasks.
- Make an intelligent connection between perception and action.
- Enhance human-human, human-computer and computer to computer interaction / communication.

Engineering based AI Goal

- Develop concepts, theory and practice of building intelligent machines
- Emphasis is on system building.

Science based AI Goal

- Develop concepts, mechanisms and vocabulary to understand biological intelligent behavior.
- Emphasis is on understanding intelligent behavior.

AI Approaches

Cognitive Science : Think Humanly

- An exciting new effort to make computers think; that it is, the machines with minds, in the full and literal sense.
- Focus is not just on behavior and I/O, but looks at reasoning process.
- Computational model as to how results were obtained.
- Goal is not just to produce human-like behavior but to produce a sequence of steps of the reasoning process, similar to the steps followed by a human in solving the same task.

AI Approaches

Laws of Thought: Think Rationally

- The study of mental faculties through the use of computational models; that it is, the study of the computations that make it possible to perceive, reason, and act.
- Focus is on inference mechanisms that are provably correct and guarantee an optimal solution.
- Develop systems of representation to allow inferences to be like *"Socrates is a man. All men are mortal. Therefore Socrates is mortal."*
- Goal is to formalize the reasoning process as a system of logical rules and procedures for inference.
- The issue is, not all problems can be solved just by reasoning and inferences.

AI Approaches

Turing Test: Act Humanly

- The art of creating machines that perform functions requiring intelligence when performed by people; that it is the study of, how to make computers do things which at the moment people do better.
- Focus is on action, and not intelligent behavior centered around representation of the world.
- A Behaviorist approach, is not concerned with how to get results but to the similarity to what human results are.

AI Approaches

Turing Test

- 3 rooms contain: a person, a computer, and an interrogator.
- The interrogator can communicate with the other 2 by teletype (to avoid the machine imitate the appearance or voice of the person).
- The interrogator tries to determine which is the person and which is the machine.
- The machine tries to fool the interrogator to believe that it is the human, and the person also tries to convince the interrogator that it is the human.
- If the machine succeeds in fooling the interrogator, then conclude that the machine is intelligent.

AI Approaches

Turing Test : Capabilities Required to Pass Complete Turing Test

- **natural language processing** to enable it to communicate successfully in English;
- **knowledge representation** to store what it knows or hears;
- **automated reasoning** to use the stored information to answer questions and to draw new conclusions;
- **machine learning** to adapt to new circumstances and to detect and extrapolate patterns.
- **computer vision** to perceive objects, and
- **robotics** to manipulate objects and move about.

AI Approaches

Rational Agent: Act Rationally

- Tries to explain and emulate intelligent behavior in terms of computational processes; that it is concerned with the automation of intelligence.
- Focus is on systems that act sufficiently if not optimally in all situations;
- It is passable to have imperfect reasoning if the job gets done.
- Goal is to develop systems that are rational and sufficient.

The Foundations of AI

- Philosophy
- Mathematics
- Economics
- Neuroscience
- Psychology
- Computer engineering
- Control theory and cybernetics
- Linguistics

The History of AI

- The inception of artificial intelligence (1943-1956)- Artificial Neuron, Hebbian Learning
- Early enthusiasm, great expectations (1952-1969)- Physical Symbol System, Lisp
- A dose of reality (1966-1973)
- Expert systems (1969-1986)
- The return of neural networks (1986-present)
- Probabilistic reasoning and machine learning (1987-present)- HMM, Bayesian Network
- Big data (2001-present)
- Deep learning (2011-present)

Course Outline

- A separate pdf file has been shared on Google Drive: https://drive.google.com/drive/folders/1tiFcbxGpnrHLi12huLjJEIx5hmKtZ_Mg

References

1. Chapter 1: Introduction , Pages 1-29
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Books

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5. “Programming for machine learning,” by J. Ross Quinlan,
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