Dcs

Year IV
Semester I
2016

SESSION 1

Artificial Intelligence

(CoSc 4142 – 4CrHr)

Prerequisite

Logic in computer science

Department of Computer Science
Assosa University

gechb21@gmail.com

Course slides adopted from notes from the course References and using Search engines.

Assosa University
Collage of Computing and Informatics
Department of Computer Science

Course Code: CoSc 4142
Course Title: Artificial Intelligence
Module Name: Intelligent System
Module No. CoSc- M3141
Course Chair
Office location: CS dep't staff
Instructor name: Getaneh B. (MSc)
Consultation Hours: ECTS 6

Contact Hours	Lecture	Tutorial	Lab/Practical	Home Study	Total
	48	16	48	71	183

Target Group: 4th year Computer Science Students
Year /Semester Year IV, semester I
Status of the Course: Parallel
Course description
The purpose of this course is to give students an understanding of Artificial Intelligence methodologies, techniques, tools and results. Students will use at least one AI-language (Lisp, Prolog). 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.

Course Objective:
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"
- understand the use of heuristics in search problems and games
- 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

Content
CHAPTER 1:

1. Introduction to AI
1.1. Objectives/Goals of AI
1.2. What is 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

CHAPTER 2:

2. Intelligent Agents
2.1. Introduction
2.2. Agents and Environments
2.3. Acting of Intelligent Agents (Rationality)
2.4. Structure of Intelligent Agents
2.5. Agent Types
2.5.1. Simple reflex agent
2.5.2. Model-based reflex agent
2.5.3. Goal-based agent
2.5.4. Utility-based agent
2.5.5. Learning agent
2.6. Important Concepts and Terms

CHAPTER 3:

3. Solving Problems by Searching and Constraint Satisfaction Problem
3.1. Problem Solving by Searching
3.2. Problem Solving Agents
3.3. Problem Formulation
3.4. Search Strategies
3.5. Avoiding Repeated States
3.6. Constraint Satisfaction Search
3.7. Games as Search Problems

CHAPTER 4:

4. Knowledge and Reasoning
4.1. Logical Agents
4.2. Propositional Logic
4.3. Predicate (First-Order) Logic
4.4. Inference in First-Order Logic
4.5. Knowledge Representation
4.6. Knowledge-based Systems

CHAPTER 5. Learning

5.1. Learning from Examples/Observation
5.2. Knowledge in Learning
5.3. Learning Probabilistic Models
5.4. Neural Networks

Assessment Method (Continuous):

- Quizzes and Tests
- Assignments
- Lab exam
- Final exam

Text Book
Russell, S. and P. Norvig (1995) Artificial Intelligence: A Modern Approach Prentice-Hall.
Reference
1. Luger, G. (2002) Artificial Intelligence, 4th ed. AddisonWesley.
2.Bratko, Ivan (1990) PROLOG Programming for Artificial Intelligence, 2nd ed. Addison-Wesley, 1990
Software Requirement: PROLOB, LISP and PYTHON

Dcs

Year IV
Semester I
2016

Learning objectives: at the end of the class, you should be able to:

- **Describe what is Artificial intelligence?**
- **Assess the History of Artificial intelligence**
- **Identify the goals of Artificial intelligence**
- **To know application area of Artificial intelligence**
  - **To know the research area of AI**

Dcs

Year IV
Semester I
2016

- Describe what is Artificial intelligence?
- Assess the History of Artificial intelligence
- Identify the goals of Artificial intelligence
- To know application area of Artificial intelligence
- To know the research area of AI

What is Artificial intelligence?

- Is an area of science and engineering that emphasizes the **creation of intelligent machines** that work and react like humans.
    - It is related to the similar task of using computers to understand human intelligence,

- Build and understand **intelligent entities** or agents

Cont'd

- It is a branch of computer science concerned with:
  - The **study** and **creation** of **computer system** exhibit some form of intelligence.
  - System that **learn new concepts and tasks**
  - System can **reason and draw conclusions**
  - Can **understand NLP**

Cont'd

- Artificial Intelligence is the **synthesis** and **analysis** of **computational agents** that act intelligently.
- An agent is something that acts in an environment.
- An agent **acts intelligently if:**
  - **its actions are appropriate** for its goals and circumstances
  - **it is flexible** to changing environments and goals
  - **it learns from experience**
  - **it makes appropriate choices** given perceptual and computational limitations

Cont'd

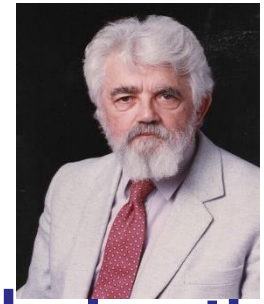
- The concern of AI is to **enable computers behave like human** and **emulate the reasoning power of humans**
  - in order to do tasks that require human intelligence.

– Which task requires intelligence?
  - **Complex arithmetic operations**
    - For instance, Solving $2^{20} * 3^{50}$?
  - **Mundane tasks/routine**
    - Example, Natural language understanding; face recognition
  - **Expert tasks:**
  - which require specialists knowledge
    - Example, Medical diagnosis; computer maintenance

- Describe what is Artificial intelligence?
- **Assess the History of Artificial intelligence**
- Identify the goals of Artificial intelligence
- To know application area of Artificial intelligence
- To know the research area of AI

History of AI

- Formally initiated in 1956 and the name AI was coined by **John McCarthy**.(**Stanford University**)



- Shifts from **procedural to declarative programming paradigm**.
  - Rather than **telling the computer how to compute a solution**, a program consists of a **knowledge base of facts and relationships**.
  - Rather than **running a program to obtain a solution**, the **user asks question** so that **the system searches through the KB** to Simulate **human mind and learning behavior** to **determine the answer.**
  - Simulate human mind and learning behavior (**Neural Network, Belief Network, Hidden Markov Models, etc.**)

History of AI...

- Development of **knowledge-based systems**: **(1969-1979)** the key to power
  - Performance of general-purpose problem solving methods is weak for many complex domains.
  - Use knowledge more suited to make better reasoning in narrow areas of expertise (like human experts do).
  - Early knowledge intensive systems include:
    - **MYCIN** (1976): used for medical diagnosis. etc.
    - The **Dendral program** (1969): solved the problem of inferring molecular structure ($C_6H_{13}NO_2$).**(A chemical analysis expert system)**

History of AI...

- **AI becomes an industry (1980-present)**
  - to build intelligent computers running Prolog.
- **AI becomes a science (1987-Present)**
- **The emergence of intelligent agents (1995-present)**

- Describe what is Artificial intelligence?
- Assess the History of Artificial intelligence
- **Identify the goals of Artificial intelligence**
- To know application area of Artificial intelligence
- To know the research area of AI

Goals of artificial intelligence

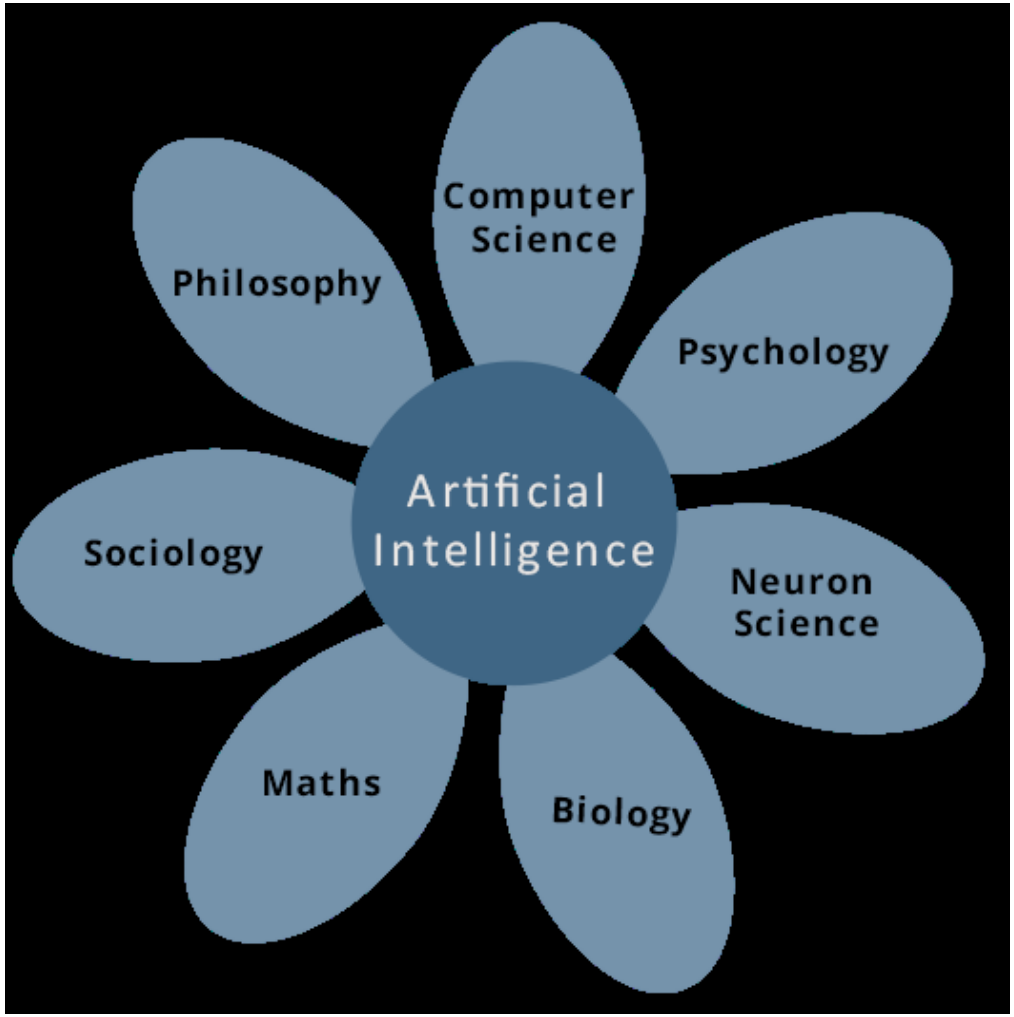
- **To Create Expert Systems:** The systems which exhibit intelligent behavior, learn, demonstrate, explain, and advice its users.

- **To Implement Human Intelligence in Machines:** Creating systems that **understand, think, learn,** and **behave** **like humans.**

The foundation of AI

With different disciplines:

- Philosophy
- Mathematics
- Law
- Economics
- Computer engineering



Views of AI

- **AI is found on the premise that:**
  - **workings of human mind** can be explained in terms of computation, and
  - computers can do the right thing **given correct premises** and **reasoning rules to achieve a specified goal.**

Views of AI fall into four categories:

Thinking humanly	Thinking rationally
Acting humanly	Acting rationally

Thinking humanly: The Cognitive Modeling

- **Reasons like humans do**
  - ***Programs that behave like humans***
- Requires understanding of the internal activities of the brain

- **Cognitive modeling** is an area of computer science that deals with **simulating human problem solving and mental task processes** **in a computerized model.**

- AI can develop automated intelligent machine **which can perform different activities which associated with human thinking activities** such as decision making, problem solving, adapt new env't and learning new things.

Example. write a program that plays chess.

- Instead of making the best possible chess-playing program, you would make one that play chess like people do.

Acting humanly: The Turing Test

Can machines act like human do? Can machines behave intelligently?

- **Turing Test**: Operational test for intelligent behavior
- Suggested major components required for AI:

knowledge, reasoning, language/ image understanding, learning

How to make computers act like humans?

- **Natural Language processing** (enable computers communicate in human language, English, Amharic, Oromifa..)
- **Knowledge representation** (schemes to store information, **both facts and inferences,** before and during interrogation)
- **Automated reasoning** (use stored information to answer questions and to draw new conclusions)
- **Machine learning** (adapt to new circumstances and to detect & extrapolate patterns)
- **Computer vision** (recognize objects based on patterns in the same way as the human visual system does)
- **Robotics** (produce mechanical device capable of controlled motion; which enable computers to see, hear & take actions)

Thinking Rationally: The Laws of Thought

- A system is **rational** **if it thinks/does the right thing through correct reasoning.**
- **The AI system should represent facts and concepts about the world via logic**
- **Aristotle**: provided the correct arguments/ thought structures that always **gave correct conclusions given correct premises**.
  - Aleazar is a man; all men are mortal; therefore Aleazar is mortal
  - These Laws of thought governed the operation of the mind and initiated the field of **Logic**.

Acting rationally: The rational agent

- **Doing the right thing** so as to achieve one's goal, given one's beliefs.
  - **AI** is the study and construction of rational agents (an agent that perceives and acts)
- Rational action requires the **ability to represent knowledge** and **reason** with it so as to reach good decision.
  - Learning for better understanding of how the world works

Strong AI vs. Weak AI

- Artificial Intelligence (or AI) is the concept that it is possible for **a computer to think in the same sense as humans do.**
- **Week AI-**

- Thinking focused towards the dev't of technology capable of **caring out pre-planned moves based on some rules** and applying these to achieve a certain goal.
    - **Uses models** of its problem domain **given to it by programmer**.
    - **A system that uses a set of pre-programmed rules to apply them to any task to reach a successful completion.**

- argues that computers can only appear **to think and are not actually conscious in the same way as human brains are**.

- For example, weak AI researchers see their contribution as things like expert systems used for medical diagnosis, speech recognition and data mining, which use "intelligent" models, **but they do not help create a conscious agent**

Strong AI vs. Weak AI…

- **Strong AI**
  - **Developing technology that can think and functions** similar to humans, not just mimicking behavior in a certain domain.
  - Machines the ability to reason, think and do all functionality that a human is capable of.
  - **Figure out its own model based on raw inputs.**
  - **aims to create an agent that can replicate humans intelligence completely**; i.e.., it can **think, reason, imagine**, etc., and **do all the things** that we currently associate with the human brain.
  - ***Have self awareness, feel emotions, dream, consciousness, think*** etc.

- Describe what is Artificial intelligence?
- Assess the History of Artificial intelligence
- Identify the goals of Artificial intelligence
- **To know application area of Artificial intelligence**
- To know the research area of AI

Application of AI

- **Playing Games**

- AI plays crucial role in strategic games such as chess, poker, tic-tac-toe, etc., where **machine can think of large number of possible positions** based on heuristic knowledge.

- **Expert Systems**

Eg Flight-tracking systems, Clinical systems

- There are some applications which **integrate machine, software**, and **special information** to impart **reasoning and advising.** They **provide explanation and advice** to the users.

- **Vision Systems**

- Systems that **recognize objects based on patterns** in the same way as the human visual system does.

- **Natural Language Processing**

- It is possible to interact with the computer that understands natural language spoken by humans.

Eg. Machine Translation, text- to-speech, summarization of text,

Eg Automatic voice output

- **Speech Recognition**

- Some intelligent systems are capable of hearing and comprehending the language in terms of sentences and their meanings while a human talks to it. It can handle different accents, slang words, noise in the background, change in human's noise due to cold, etc.

- **Handwriting Recognition**

Software **that reads the text written on paper by a pen or on screen by a stylus**. It can **recognize the shapes of the letters** and **convert it into editable text.**

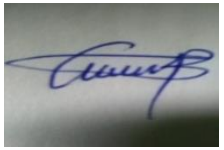
Cont'd

- **Classification of text** (Politics, Economic, Social, Sports, etc,)

- **Automated fraud detection**

- **Automated face recognition**

- **Signature Recognition**



- **Intelligent Robots**

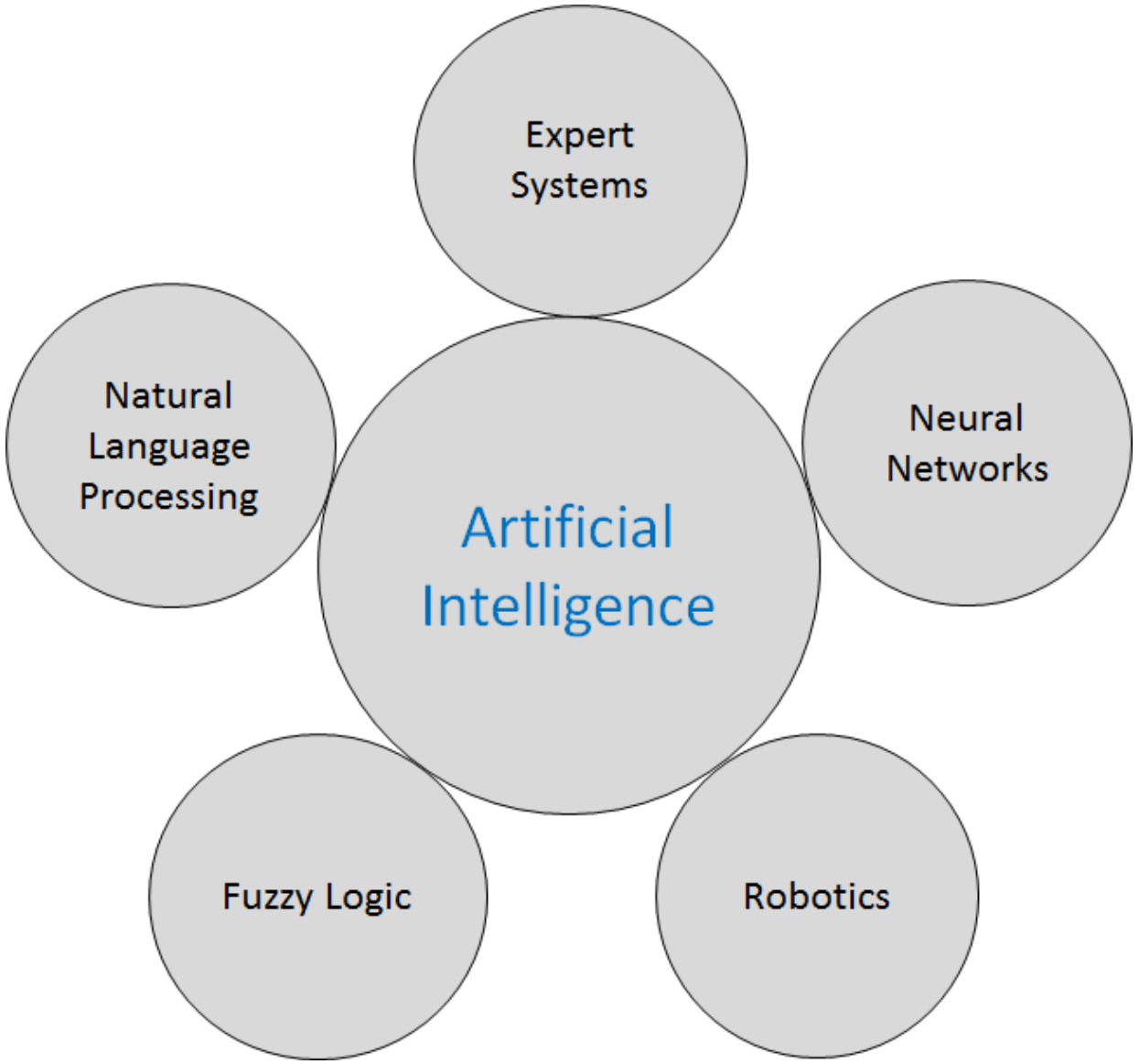
Industrial robots for moving, spraying, painting, precision checking, drilling, cleaning, coating, carving etc.

- produce mechanical device capable of controlled motion; which enable computers to see, hear & take actions

- In addition, they are capable of **learning from their mistakes** and they can **adapt to the new environment**.

- Describe what is Artificial intelligence?
- Assess the History of Artificial intelligence
- Identify the goals of Artificial intelligence
- To know application area of Artificial intelligence
- **To know the research area of AI**

Research Areas of AI



Assignment I (due: 5 days)

- Discuss one of the following concepts. Refer **at least five sources (books,** articles). present in class and send via email.
- **Application areas (answer questions like what; how; challenges; application)**
  - Natural Language Processing **[1]**
  - Natural Language Generation **[2]**
  - Speech Recognition; Speech synthesis ; Speaker Identification **[3]**
  - Optical Character Recognition (OCR),Writer identification **[8]**
  - Face recognition; script recognition **[4]**
  - Knowledge discovery in databases **[5]**
  - Computer vision and robotics**[6]**

አመሰግናለሁ !!!