BAHIRDAR UNIVERSITY INSTITUTE OF TECHNOLOGY

School of Computing and Electrical Engineering Department of Computer Science and Engineering

Course: Artificial Intelligence (AI)

Assignment 1 & 2

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**Assignment # 1:**

1. Read and list out the contribution of various disciplines to the foundation of Artificial Intelligence (AI) to exist as a science?

### The Disciplines of Artificial Intelligence

The subject of artificial intelligence spans a wide horizon. It deals with the various kinds of knowledge representation schemes, different techniques of intelligent search, various methods for resolving uncertainty of data and knowledge, different schemes for automated machine learning and many others.

Among the main application areas of AI, we have Expert systems, Game-playing, and Theorem-proving, Natural language processing, Image recognition, Robotics and many others. The subject of artificial intelligence has been enriched with a wide discipline of knowledge from Philosophy, Psychology, Cognitive Science, Computer Science, Mathematics and Engineering. Thus in fig. , they have been referred to as the parent disciplines of AI

Philosophy: logic, methods of reasoning mind as physical system foundation of learning

Psychology: adaption phenomena of perception and experimental techniques (psychophysics).

Mathematics: formal representation and proof algorithms computation, decidability, tractability, probability

Linguistics: knowledge representation grammars

Control theory: homeostatic systems, stability simple optimal agent designs

Computer engineering:-provided the artifact that makes AI applications possible. AI programs tend to be large, and they could not work without the great advances in speed and memory that the computer industry has provided.

1. What are the potted histories of AI? Read more about the technological evolution related to AI (state of the art)

Evidence of Artificial Intelligence folklore can be traced back to ancient Egypt, but with the development of the electronic computer in 1941, the technology finally became available to create machine intelligence. The term artificial intelligence was first coined in 1956, at the Dartmouth conference, and since then Artificial Intelligence has expanded because of the theories and principles developed by its dedicated researchers. Through its short modern history, advancement in the fields of AI have been slower than first estimated, progress continues to be made. From its birth 4 decades ago, there have been a variety of AI programs, and they have impacted other technological advancements.

In 1941 an invention revolutionized every aspect of the storage and processing of information. That invention, developed in both the US and Germany was the electronic computer. The first computers required large, separate air-conditioned rooms, and were a programmers nightmare, involving the separate configuration of thousands of wires to even get a program running.

The 1949 innovation, the stored program computer, made the job of entering a program easier, and advancements in computer theory lead to computer science, and eventually Artificial intelligence. With the invention of an electronic means of processing data, came a medium that made AI possible.

Although the computer provided the technology necessary for AI, it was not until the early 1950's that the link between human intelligence and machines was really observed. Norbert Wiener was one of the first Americans to make observations on the principle of feedback theory feedback theory. The most familiar example of feedback theory is the thermostat: It controls the temperature of an environment by gathering the actual temperature of the house, comparing it to the desired temperature, and responding by turning the heat up or down. What was so important about his research into feedback loops was that Wiener theorized that all intelligent behavior was the result of feedback mechanisms. Mechanisms that could possibly be simulated by machines. This discovery influenced much of early development of AI.

In late 1955, Newell and Simon developed The Logic Theorist, considered by many to be the first AI program. The program, representing each problem as a tree model, would attempt to solve it by selecting the branch that would most likely result in the correct conclusion. The impact that the logic theorist made on both the public and the field of AI has made it a crucial stepping stone in developing the AI field.

In 1956 [John McCarthy](http://library.thinkquest.org/2705/people.html) regarded as the father of AI, organized a conference to draw the talent and expertise of others interested in machine intelligence for a month of brainstorming. He invited them to Vermont for "The Dartmouth summer research project on artificial intelligence." From that point on, because of McCarthy, the field would be known as Artificial intelligence. Although not a huge success, (explain) the Dartmouth conference did bring together the founders in AI, and served to lay the groundwork for the future of AI research.

1. Read about the following topics and write a note about.

**Computer Vision**: is the field concerned with automated computer based processing of images to extract and interpret information. It is the science and technology of machines that see. Here see means the machine is able to extract information from an image, to solve some task, or perhaps "understand" the scene in either a broad or limited sense.

Applications range from tasks such as industrial machine vision systems which, say, inspect bottles speeding by on a production line, to research into artificial intelligence and computers or robots that can comprehend the world around them. The computer vision and machine vision fields have significant overlap. Computer vision covers the core technology of automated image analysis which is used in many fields. Machine vision usually refers to a process of combining automated image analysis with other methods and technologies to provide automated inspection and robot guidance in industrial applications.

As a scientific discipline, computer vision is concerned with the theory behind artificial systems that extract information from images. The image data can take many forms, such as video sequences, views from multiple cameras, or multi-dimensional data from a medical scanner.

As a technological discipline, computer vision seeks to apply its theories and models to the construction of computer vision systems. Examples of applications of computer vision include systems for:

* Controlling processes (e.g., an industrial robot).
* Navigation (e.g. by an autonomous vehicle or mobile robot.
* Detecting events (e.g., for visual surveillance or people counting).
* Organizing information (e.g., for indexing databases of images and image sequences).
* Modeling objects or environments (e.g.,medical image analysis or topographical modeling).
* Interaction (e.g., as the input to a device for computer-human interaction).
* Automatic inspection, e.g. in manufacturing applications

Sub-domains of computer vision include scene reconstruction, event detection, video tracking, object recognition, learning, indexing, motion estimation, and image restoration.

**Robotics** : is the branch of technology that deals with the design, construction, operation, structural disposition, manufacture and application of robots. Robotics is related to the sciences of electronics, engineering, mechanics mechatronics, and software.

 The concept and creation of machines that could operate autonomously dates back to classical times, but research into the functionality and potential uses of robots did not grow substantially until the 20th century. Today, robotics is a rapidly growing field, as we continue to research, design, and build new robots that serve various practical purposes, whether domestically, commercially, or militarily.

Robotics is a challenging AI application because the software has to deal with real objects in real time. An example of a robot guided by humans is the Sojourner surface rover that explored the area of the Red Planet where the Mars Pathfinder landed in 1997. It was guided in real time by NASA controllers. Larry Long and Nancy Long (2000) suggest that other robots can act autonomously, reacting to changes in their environment without human intervention. Military cruise missiles are an example of autonomous robots that have intelligent navigational capabilities.

**Expert Systems** (knowledge based systems): In artificial intelligence, an expert system is a computer system that emulates the decision-making ability of a human expert. Expert systems are designed to solve complex problems by reasoning about knowledge, like an expert, and not by following the procedure of a developer as is the case in conventional programming. The first expert systems were created in the 1970s and then proliferated in the 1980s. Expert systems were among the first truly successful forms of AI software.

 An expert system has a unique structure, different from traditional programs. It is divided into two parts, one fixed, independent of the expert system: the inference engine, and one variable: the knowledge base. To run an expert system, the engine reasons about the knowledge base like a human. In the 80's a third part appeared: a dialog interface to communicate with users. This ability to conduct a conversation with users was later called "conversational". Expert systems are designed to solve complex problems by reasoning about knowledge, like an expert, and not by following the procedure of a developer as is the case in conventional programming.

 Knowledge-based systems are systems based on the methods and techniques of [Artificial Intelligence](http://en.wikipedia.org/wiki/Artificial_Intelligence). Their core components are:

* [knowledge base](http://en.wikipedia.org/wiki/Knowledge_base)
* acquisition mechanisms
* inference mechanisms

**Natural Language Processing(NLP)** : is a field of computer science and linguistics concerned with the interactions between computers and human (natural) languages; it began as a branch of artificial intelligence. In theory, natural language processing is a very attractive method of human–computer interaction. Natural language understanding is sometimes referred to as an AI-complete problem because it seems to require extensive knowledge about the outside world and the ability to manipulate it.

Whether NLP is distinct from, or identical to, the field of computational linguistics is a matter of perspective. The Association for Computational Linguistics defines the latter as focusing on the theoretical aspects of NLP. On the other hand, the open-access journal "Computational Linguistics", styles itself as "the longest running publication devoted exclusively to the design and analysis of natural language processing systems" (Computational Linguistics (Journal))

Modern NLP algorithms are grounded in machine learning, especially statistical machine learning. Research into modern statistical NLP algorithms requires an understanding of a number of disparate fields, including linguistics, computer science, and statistics. For a discussion of the types of algorithms currently used in NLP, see the article on pattern recognition.

 **Knowledge representation (KR)** (knowledge management): is an area of artificial intelligence research aimed at representing knowledge in symbols to facilitate inferencing from those knowledge elements, creating new elements of knowledge. The KR can be made to be independent of the underlying knowledge model or knowledge base system (KBS) such as a semantic network. Machine Learning: a branch of artificial intelligence, is a scientific discipline concerned with the design and development of algorithms that allow computers to evolve behaviors based on empirical data, such as from sensor data or databases.

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Machine learning is concerned with the development of algorithms allowing the machine to learn via inductive inference based on observing data that represents incomplete information about statistical phenomenon and generalize it to rules and make *predictions* on missing attributes or future data. An important task of machine learning is classification, which is also referred to as pattern recognition, in which machines "learn" to automatically recognize complex patterns, to distinguish between exemplars based on their different patterns, and to make intelligent predictions on their class.

**Neural Networks** : The term neural network was traditionally used to refer to a network or circuit of biological neurons. The modern usage of the term often refers to artificial neural networks, which are composed of artificial neuron or nodes. Thus the term has two distinct usages:

1. [Biological neural networks](http://en.wikipedia.org/wiki/Biological_neural_network) are made up of real biological neurons that are connected or functionally related in a [nervous system](http://en.wikipedia.org/wiki/Nervous_system). In the field of [neuroscience](http://en.wikipedia.org/wiki/Neuroscience), they are often identified as groups of neurons that perform a specific physiological function in laboratory analysis.
2. [Artificial neural networks](http://en.wikipedia.org/wiki/Artificial_neural_network) are composed of interconnecting artificial neurons. Artificial neural networks may either be used to gain an understanding of biological neural networks, or for solving artificial intelligence problems without necessarily creating a model of a real biological system. The real, biological nervous system is highly complex: artificial neural network algorithms attempt to abstract this complexity and focus on what may hypothetically matter most from an information processing point of view. Good performance or performance mimicking animal or human error patterns, can then be used as one source of evidence towards supporting the hypothesis that the abstraction really captured something important from the point of view of information processing in the brain. Another incentive for these abstractions is to reduce the amount of computation required to simulate artificial neural networks, so as to allow one to experiment with larger networks and train them on larger data sets.
3. What an AI system can and cannot do?

Here are some example applications

* Computer vision: face recognition from a large set
* Robotics: autonomous (mostly) automobile
* Natural language processing: simple machine translation
* Expert systems: medical diagnosis in a narrow domain
* Spoken language systems: ~1000 word continuous speech
* Planning and scheduling: Hubble Telescope experiments
* Learning: text categorization into ~1000 topics
* User modeling: Bayesian reasoning in Windows help (the infamous paper clip…)
* Games: Grand Master level in chess (world champion), checkers, etc.

 What can’t AI systems do yet?

* Understand natural language robustly (e.g., read and understand articles)
* Surf the web
* Interpret an arbitrary visual scene
* Learn a natural language
* Play Go well
* Construct plans in dynamic real-time domains
* Refocus attention in complex environments
* Perform life-long learning

**Assignment # 2:**

* We need to study about the human characterstics in order to develop a system to think and act as human being and have more advanced system that can communicate with human.
* AI mostly studies designing agents which simulates the characteristics of humans to enable a system or an applicaion to act and think like human and can serve a human as good as a human wants a service to be.
* To make a machine act intelligently, meaning think like human and so some action for some changes or knowledge be reasoning from the knowledge it can get from the surrounding or environment.
* To solve any problem that a person would solve,to develop a system or application that will solve human problems with an enough reasoning as the rules given by the programmer.
* Provided the correct arguments/ thought structures intelligence machine must provide the correct answer unless the inputs are invalid or wrong. 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.
* The two main advantages of studying AI as rational agent are:
1. First, it is more general than the ``laws of thought'' approach, because correct inference is only a useful mechanism for achieving rationality, and not a necessary one.
2. Second, it is more amenable to scientific development than approaches based on human behavior or human thought, because the standard of rationality is clearly defined and completely general. Human behavior, on the other hand, is well-adapted for one specific environment and is the product, in part, of a complicated and largely unknown evolutionary process that still may be far from achieving perfection.

All artificial intelligence designs are at least superficially inspired by the human brain, as by definition artificial intelligence is about mimicking some aspect of intelligence. AIs have to build concepts of the things they manipulate or work with, and store those concepts as chunks of data. Sometimes these chunks are dynamic and frequently updated, sometimes static. Generally an AI is concerned with exploiting relationships between data to achieve some goal.

e.g. chess game need a complete rationality in order to act as human and think like human to compete a human and play by reasoning like the player human.