SEMINAR REPORT ON
on

Artificial Intelligence

Submitted in partial fulfilments of the requirements for seminar in Ist Semester

of

BCA

by

Vinay Kumar

Under the guidance of

Rishi Kumar
((Professor,Computer Applications)
Disha Chahar
(Assistant Professor, Computer Applications)

DEPARTMENT OF COMPUTER APPLICATIONS
GRAPHIC ERA DEEMED TO BE UNIVERSITY
DEHRADUN-248002
INDIA

SESSION (2023-24)

Table of Contents

CERTIFICATE

THIS IS TO CERTIFY THAT Vinay Kumar HAS SATISFACTORY PRESENTED SEMINAR ON THE COURSE TITLE Artificial Intelligence IN PARTIAL FULLFILLMENT OF THE SEMINAR PRESENTATION REQUIREMENT IN Ist SEMESTER OF BCA DEGREE COURSE PRESCRIBED BY GRAPHIC ERA DEEMED TO BE UNIVERSITY DURING THE ACADEMIC SESSION 2023-24.

Rishi Kumar

Pooja Chahar

SIGNATURE

ACKNOWLEDGEMENT

I take this opportunity to express my profound gratitude and deep regards to my guide Mr. Rishi Kumar & Pooja Chahar for his exemplary guidance, monitoring and constant encouragement throughout the course.

The blessing, help and guidance given by him time to time help me throughout the project. The success and final outcome of this course require a lot of guidance and assistance from many people and I am extremely privileged to have got this all along the completion of my report. All the I have done is only due to such supervision and assistance and I would not forget to thank them. I am thankful to and fortunate enough to get constant encouragement, support, and guidance from all people around me which helped me in successfully completing my seminar report.

Since the invention of computers or machines, their capability to perform various tasks went on growing exponentially. Humans have developed the power of computer systems in terms of their diverse working domains, their increasing speed, and reducing size with respect to time.

A branch of Computer Science named *Artificial Intelligence* pursues creating the computers or machines as intelligent as human beings.

What is Artificial Intelligence?

According to the father of Artificial Intelligence John McCarthy, it is "*The science and engineering of making intelligent machines, especially intelligent computer programs*".

Artificial Intelligence is a way of **making a computer, a computer-controlled robot, or a software think intelligently**, in the similar manner the intelligent humans think.

AI is accomplished by studying how human brain thinks, and how humans learn, decide, and work while trying to solve a problem, and then using the outcomes of this study as a basis of developing intelligent software and systems.

Philosophy of AI

While exploiting the power of the computer systems, the curiosity of human, lead him to wonder, "Can a machine think and behave like humans do?"

Thus, the development of AI started with the intention of creating similar intelligence in machines that we find and regard high in humans.

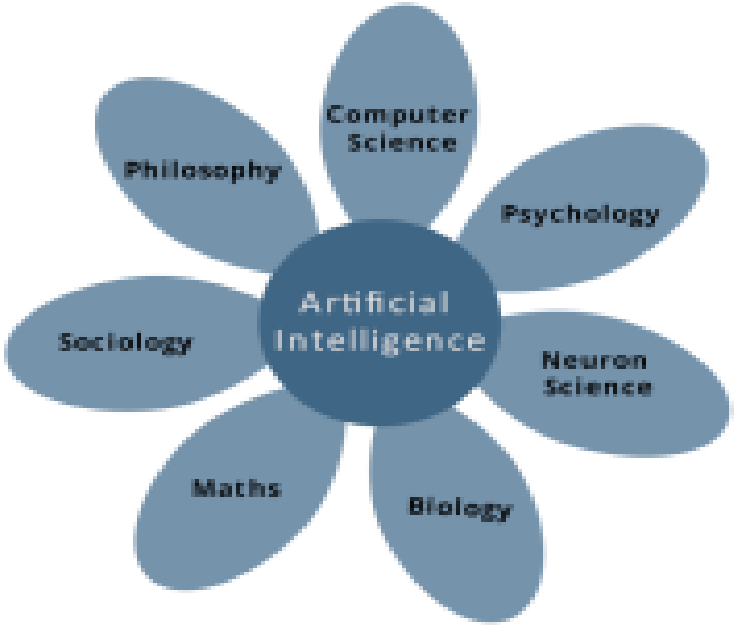
Goals of AI

- **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.

What Contributes to AI?

Artificial intelligence is a science and technology based on disciplines such as Computer Science, Biology, Psychology, Linguistics, Mathematics, and Engineering. A major thrust of AI is in the development of computer functions associated with human intelligence, such as reasoning, learning, and problem solving.

Out of the following areas, one or multiple areas can contribute to build an intelligent system.



Programming Without and With AI

The programming without and with AI is different in following ways:

Programming Without AI	Programming With AI
A computer program without AI can answer the **specific** questions it is meant to solve.	A computer program with AI can answer the **generic** questions it is meant to solve.
Modification in the program leads to change in its structure.	AI programs can absorb new modifications by putting highly independent pieces of information together. Hence you can modify even a minute piece of information of program without affecting its structure.
Modification is not quick and easy. It may lead to affecting the program adversely.	Quick and Easy program modification.

What is AI Technique?

In the real world, the knowledge has some unwelcomed properties:

- Its volume is huge, next to unimaginable.
- It is not well-organized or well-formatted.
- It keeps changing constantly.

AI Technique is a manner to organize and use the knowledge efficiently in such a way that:

- It should be perceivable by the people who provide it.
- It should be easily modifiable to correct errors.
- It should be useful in many situations though it is incomplete or inaccurate.

AI techniques elevate the speed of execution of the complex program it is equipped with.

Applications of AI

AI has been dominant in various fields such as:

- **Gaming**
  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.
- **Natural Language Processing**
  It is possible to interact with the computer that understands natural language spoken by humans.
- **Expert 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**
  These systems understand, interpret, and comprehend visual input on the computer. For example,
  - A spying aeroplane takes photographs which are used to figure out spatial information or map of the areas.
  - Doctors use clinical expert system to diagnose the patient.
  - Police use computer software that can recognize the face of criminal with the stored portrait made by forensic artist.

- **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**

  The handwriting recognition software 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.

- **Intelligent Robots**

  Robots are able to perform the tasks given by a human. They have sensors to detect physical data from the real world such as light, heat, temperature, movement, sound, bump, and pressure. They have efficient processors, multiple sensors and huge memory, to exhibit intelligence. In addition, they are capable of learning from their mistakes and they can adapt to the new environment.

History of AI

Here is the history of AI during 20th century:

Year	Milestone / Innovation
1923	Karel Čapek's play named "Rossum's Universal Robots" (RUR) opens in London, first use of the word "robot" in English.
1943	Foundations for neural networks laid.
1945	Isaac Asimov, a Columbia University alumni, coined the term *Robotics*.
1950	Alan Turing introduced Turing Test for evaluation of intelligence and published *Computing Machinery and Intelligence*. Claude Shannon published *Detailed Analysis of Chess Playing* as a search.
1956	John McCarthy coined the term *Artificial Intelligence*. Demonstration of the first running AI program at Carnegie Mellon University.
1958	John McCarthy invents LISP programming language for AI.
1964	Danny Bobrow's dissertation at MIT showed that computers can understand natural language well enough to solve algebra word problems correctly.
1965	Joseph Weizenbaum at MIT built *ELIZA*, an interactive problem that carries on a dialogue in English.
1969	Scientists at Stanford Research Institute Developed *Shakey*, a robot, equipped with locomotion, perception, and problem solving.

1973	The Assembly Robotics group at Edinburgh University built *Freddy*, the Famous Scottish Robot, capable of using vision to locate and assemble models.
1979	The first computer-controlled autonomous vehicle, Stanford Cart, was built.
1985	Harold Cohen created and demonstrated the drawing program, *Aaron*.
1990	Major advances in all areas of AI: • Significant demonstrations in machine learning • Case-based reasoning • Multi-agent planning • Scheduling • Data mining, Web Crawler • natural language understanding and translation • Vision, Virtual Reality • Games
1997	The Deep Blue Chess Program beats the then world chess champion, Garry Kasparov.
2000	Interactive robot pets become commercially available. MIT displays *Kismet*, a robot with a face that expresses emotions. The robot *Nomad* explores remote regions of Antarctica and locates meteorites.

Robot Locomotion

Locomotion is the mechanism that makes a robot capable of moving in its environment. There are various types of locomotions:

- Legged
- Wheeled
- Combination of Legged and Wheeled Locomotion
- Tracked slip/skid

Legged Locomotion

- This type of locomotion consumes more power while demonstrating walk, jump, trot, hop, climb up or down, etc.
- It requires more number of motors to accomplish a movement. It is suited for rough as well as smooth terrain where irregular or too smooth surface makes it consume more power for a wheeled locomotion. It is little difficult to implement because of stability issues.
- It comes with the variety of one, two, four, and six legs. If a robot has multiple legs then leg coordination is necessary for locomotion.

The total number of possible **gaits** (a periodic sequence of lift and release events for each of the total legs) a robot can travel depends upon the number of its legs.

If a robot has *k* legs, then the number of possible events $N = (2k-1)!$.

In case of a two-legged robot ($k=2$), the number of possible events is $N = (2k-1)!$

$= (2*2-1)! = 3! = 6$.

Hence there are six possible different events:

1. Lifting the Left leg
2. Releasing the Left leg
3. Lifting the Right leg
4. Releasing the Right leg
5. Lifting both the legs together
6. Releasing both the legs together.

In case of $k=6$ legs, there are 39916800 possible events. Hence the complexity of robots is directly proportional to the number of legs.

Components of a Robot

Robots are constructed with the following:

- **Power Supply**: The robots are powered by batteries, solar power, hydraulic, or pneumatic power sources.
- **Actuators**: They convert energy into movement.
- **Electric motors (AC/DC):** They are required for rotational movement.
- **Pneumatic Air Muscles**: They contract almost 40% when air is sucked in them.
- **Muscle Wires**: They contract by 5% when electric current is passed through them.
- **Piezo Motors and Ultrasonic Motors**: Best for industrial robots.
- **Sensors**: They provide knowledge of real time information on the task environment. Robots are equipped with vision sensors to be to compute the depth in the environment. A tactile sensor imitates the mechanical properties of touch receptors of human fingertips.

Wheeled Locomotion

It requires fewer number of motors to accomplish a movement. It is little easy to implement as there are less stability issues in case of more number of wheels. It is power efficient as compared to legged locomotion.

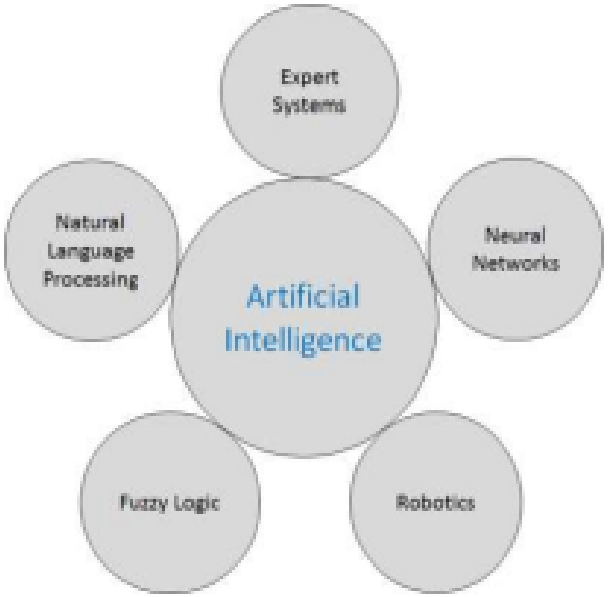
- **Standard wheel:** Rotates around the wheel axle and around the contact
- **Castor wheel:** Rotates around the wheel axle and the offset steering joint
- **Swedish 45° and Swedish 90° wheels:** Omni-wheel, rotates around the contact point, around the wheel axle, and around the rollers.
- **Ball or spherical wheel:** Omnidirectional wheel, technically difficult to implement.

Slip/Skid Locomotion

In this type, the vehicles use tracks as in a tank. The robot is steered by moving the tracks with different speeds in the same or opposite direction. It offers stability because of large contact area of track and ground.

3. Research Areas of AI

The domain of artificial intelligence is huge in breadth and width. While proceeding, we consider the broadly common and prospering research areas in the domain of AI:



Speech and Voice Recognition

These both terms are common in robotics, expert systems and natural language processing. Though these terms are used interchangeably, their objectives are different.

Speech Recognition	Voice Recognition
The speech recognition aims at understanding and comprehending WHAT was spoken.	The objective of voice recognition is to recognize WHO is speaking.
It is used in hand-free computing, map or menu navigation	It analyzes person's tone, voice pitch, and accent, etc., to identify a person.
Machine does not need training as it is not speaker dependent.	The recognition system needs training as it is person-oriented.

7. Natural Language Processing

Natural Language Processing (NLP) refers to AI method of communicating with an intelligent systems using a natural language such as English.

Processing of Natural Language is required when you want an intelligent system like robot to perform as per your instructions, when you want to hear decision from a dialogue based clinical expert system, etc.

The field of NLP involves making computers to perform useful tasks with the natural languages humans use. The input and output of an NLP system can be:

- Speech
- Written Text

Components of NLP

There are two components of NLP as given:

Natural Language Understanding (NLU)

Understanding involves the following tasks:

- Mapping the given input in natural language into useful representations.
- Analyzing different aspects of the language.

Natural Language Generation (NLG)

It is the process of producing meaningful phrases and sentences in the form of natural language from some internal representation.

It involves:

- **Text planning:** It includes retrieving the relevant content from knowledge base.
- **Sentence planning:** It includes choosing required words, forming meaningful phrases, setting tone of the sentence.
- **Text Realization:** It is mapping sentence plan into sentence structure.

The NLU is harder than NLG.

Difficulties in NLU

- NL has an extremely rich form and structure.
- It is very ambiguous. There can be different levels of ambiguity:
    - **Lexical ambiguity:** It is at very primitive level such as word-level.

8. Expert Systems

Expert systems (ES) are one of the prominent research domains of AI. It is introduced by the researchers at Stanford University, Computer Science Department.

What are Expert Systems?

The expert systems are the computer applications developed to solve complex problems in a particular domain, at the level of extra-ordinary human intelligence and expertise.

Characteristics of Expert Systems

- High performance
- Understandable
- Reliable
- Highly responsive

Capabilities of Expert Systems

The expert systems are capable of:

- Advising
- Instructing and assisting human in decision making
- Demonstrating
- Deriving a solution
- Diagnosing
- Explaining
- Interpreting input
- Predicting results
- Justifying the conclusion
- Suggesting alternative options to a problem

They are incapable of:

- Substituting human decision makers
- Possessing human capabilities
- Producing accurate output for inadequate knowledge base
- Refining their own knowledge

9. Robotics

Robotics is a domain in artificial intelligence that deals with the study of creating intelligent and efficient robots.

What are Robots?

Robots are the artificial agents acting in real world environment.

Objective

Robots are aimed at manipulating the objects by perceiving, picking, moving, modifying the physical properties of object, destroying it, or to have an effect thereby freeing manpower from doing repetitive functions without getting bored, distracted, or exhausted.

What is Robotics?

Robotics is a branch of AI, which is composed of Electrical Engineering, Mechanical Engineering, and Computer Science for designing, construction, and application of robots.

Aspects of Robotics

- The robots have **mechanical construction**, form, or shape designed to accomplish a particular task.
- They have **electrical components** which power and control the machinery.
- They contain some level of **computer program** that determines what, when and how a robot does something.

Difference in Robot System and Other AI Program

Here is the difference between the two:

AI Programs	Robots
They usually operate in computer-stimulated worlds.	They operate in real physical world
The input to an AI program is in symbols and rules.	Inputs to robots is analog signal in the form of speech waveform or images
They need general purpose computers to operate on.	They need special hardware with sensors and effectors.

11. AI Issues

AI is developing with such an incredible speed, sometimes it seems magical. There is an opinion among researchers and developers that AI could grow so immensely strong that it would be difficult for humans to control.

Humans developed AI systems by introducing into them every possible intelligence they could, for which the humans themselves now seem threatened.

Threat to Privacy

An AI program that recognizes speech and understands natural language is theoretically capable of understanding each conversation on e-mails and telephones.

Threat to Human Dignity

AI systems have already started replacing the human beings in few industries. It should not replace people in the sectors where they are holding dignified positions which are pertaining to ethics such as nursing, surgeon, judge, police officer, etc.

Threat to Safety

The self-improving AI systems can become so mighty than humans that could be very difficult to stop from achieving their goals, which may lead to unintended consequences.

12. AI Terminology

Here is the list of frequently used terms in the domain of AI:

Term	Meaning
Agent	Agents are systems or software programs capable of autonomous, purposeful and reasoning directed towards one or more goals. They are also called assistants, brokers, bots, droids, intelligent agents, and software agents.
Autonomous Robot	Robot free from external control or influence and able to control itself independently.
Backward Chaining	Strategy of working backward for Reason/Cause of a problem.
Blackboard	It is the memory inside computer, which is used for communication between the cooperating expert systems.
Environment	It is the part of real or computational world inhabited by the agent.
Forward Chaining	Strategy of working forward for conclusion/solution of a problem.
Heuristics	It is the knowledge based on Trial-and-error, evaluations, and experimentation.
Knowledge Engineering	Acquiring knowledge from human experts and other resources.
Percepts	It is the format in which the agent obtains information about the environment.
Pruning	Overriding unnecessary and irrelevant considerations in AI systems.
Rule	It is a format of representing knowledge base in Expert System. It is in the form of IF-THEN-ELSE.
Shell	A shell is a software that helps in designing inference engine, knowledge base, and user interface of an expert system.
Task	It is the goal the agent is tries to accomplish.
Turing Test	A test developed by Allan Turing to test the intelligence of a machine as compared to human intelligence.