**Session-1:**

**Introduction to AI, Applications of AI**

**Artificial Intelligence:** AI is about teaching the machines to learn, to act, and think as humans would do. We can organize AI definition into 4 categories:

|  |  |
| --- | --- |
| **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) |

A system is **rational** if it does the “right thing,” given what it knows. Rationalist approach involves a combination of mathematics and engineering.

A **rational agent** is one that acts so as to achieve the best outcome or, when there is uncertainty, the best expected outcome.

**Evolution of Artificial Intelligence:**

* **The birth of artificial intelligence 1952–1956**
  + Dartmouth Conference 1956: the birth of AI
* **The golden years 1956–1974**
  + Reasoning as search
  + Natural language
  + The money
  + Robotics
* **The first AI winter 1974–1980** 
  + Reduced Govt. funds
* **Boom 1980–1987**
  + The rise of expert systems
  + The knowledge revolution
  + The money returns: the Fifth Generation project
  + The revival of connectionism
  + Artificial neural network (ANN)
* **Bust: the second AI winter 1987–1993**
  + **AI winter**
  + **The importance of having a body: nouvelle AI and embodied reason**
* **AI 1993–2011**
  + Milestones and Moore's law
  + Intelligent agents
  + AI behind the scenes
  + Predictions
* **Deep learning, big data and artificial general intelligence: 2011–present**

**Types of Artificial Intelligence:**

1. **Weak AI:** Weak AI is also known as narrow AI. It is an AI system that is designed and trained for a specific type of task.

**Eg.** Siri and Alexa are weak AI. This categorization happens with the help of unsupervised programming.

1. **Strong AI:** Strong AI is more like the human brain and is also known as **artificial general intelligence**. It has cognitive abilities that help to perform unfamiliar tasks and commands. It can find the solution to a problem and works beyond a preprogrammed algorithm.

**Eg.** Visual perception, speech recognition, decision making, and translations between languages, are all examples of strong AI.

1. **Super AI:** Super AI is AI that surpasses human intelligence and ability. It’s also known as artificial super intelligence (ASI) or super intelligence.

**Eg.** It’s the best at everything — maths, science, medicine, hobbies, you name it

**Applications of AI:**

1. **Neural networks (NN),** also known as artificial neural networks (ANN), are computational models that mimic human brain, have a unique ability to extract meaning from imprecise or complex data by passing input through various layers of the neural network.

NN are used in various applications such as:

* **Banking:** Credit card attrition, credit and loan application evaluation, fraud and risk

evaluation, and loan delinquencies

* **Business Analytics**: Customer behaviour modelling, customer segmentation, fraud propensity, market research, market mix, market structure, and models for attrition, default, purchase, and renewals
* **Defense:** Counterterrorism, facial recognition, feature extraction, noise suppression, object discrimination, sensors, sonar, radar and image signal processing, signal/image identification, target tracking, and weapon steering
* **Education:** Adaptive learning software, dynamic forecasting, education system analysis and forecasting, student performance modeling, and personality profiling
* **Financial:** Corporate bond ratings, corporate financial analysis, credit line use analysis, currency price prediction, loan advising, mortgage screening, real estate appraisal, and portfolio trading
* **Medical:** Cancer cell analysis, ECG and EEG analysis, emergency room test advisement, expense reduction and quality improvement for hospital systems, transplant process optimization, and prosthesis design
* **Securities:** Automatic bond rating, market analysis, and stock trading advisory systems
* **Transportation:** Routing systems, truck brake diagnosis systems, and vehicle scheduling

1. **Fuzzy Logic:** Fuzzy logic is a form of [many-valued logic](https://en.wikipedia.org/wiki/Many-valued_logic) in which the [truth values](https://en.wikipedia.org/wiki/Truth_value) of variables may be any [real number](https://en.wikipedia.org/wiki/Real_number) between 0 and 1 both inclusive. It is employed to handle the concept of partial truth, where the truth value may range between completely true and completely false. By contrast, in [Boolean logic](https://en.wikipedia.org/wiki/Boolean_algebra), the truth values of variables may only be the integer values 0 or 1.

Fuzzy logic is used in various applications such as:

**Medicine**

* Controlling arterial pressure when providing anaesthesia to patients
* Used in diagnostic radiology  and diagnostic support systems
* Diagnosis of prostate cancer and diabetes

**Transportation systems**

* Handling underground train operations
* Controlling train schedules
* Braking and stopping vehicles based on parameters, such as car speed, acceleration and wheel speed

**Defence**

* Locating and recognizing targets underwater
* Supports naval decision making
* Using thermal infrared images for target recognition
* Used for controlling hypervelocity interceptors

**Industry**

* Controlling water purification plants
* Handling problems in constraint satisfaction in structural design
* Pattern analysis for quality assurance
* Fuzzy Logic is used for tackling sludge wastewater treatment

**Naval control**

* Steer ships properly
* Selecting the optimal or best possible routes for reaching a destination
* Autopilot is based on Fuzzy Logic
* Autonomous underwater vehicles are controlled using Fuzzy Logic

**Washing systems powered by Fuzzy Logic**

Modern washing machines powered by Fuzzy Logic are becoming popular these days. They have sensors that continuously track variations in temperature. It adjusts the controls and operations accordingly. These systems perform well, and are productive and cost efficient.

1. **Expert Systems:** Expert Systems is an interactive and reliable computer-based decision-making system which uses both facts and heuristics to solve complex decision-making problems. It is considered at the highest level of human intelligence and expertise. The purpose of an expert system is to solve the most complex issues in a specific domain.

* **Hospitals and medical facilities**: Diagnosis Systems to deduce cause of disease from observed data, conduction medical operations on humans.
* **Employee performance evaluation**: To evaluate employees based on various key parameters
* **Virus detection:** To predict virus based on the activities performed.
* **Stock market trading**: to predict stock market price
* **Process monitoring and control:** Controlling a physical process based on monitoring.
* **In designing and manufacturing domain:** It can be broadly used for designing and manufacturing physical devices such as camera lenses and automobiles.
* **In the knowledge domain:** These systems are primarily used for publishing the relevant knowledge to the users. The two popular ES used for this domain is an advisor and a tax advisor.
* **In the finance domain:** In the finance industries, it is used to detect any type of possible fraud, suspicious activity, and advise bankers that if they should provide loans for business or not.
* **In the diagnosis and troubleshooting of devices:** In medical diagnosis, the ES system is used, and it was the first area where these systems were used.
* **Planning and Scheduling:** The expert systems can also be used for planning and scheduling some particular tasks for achieving the goal of that task.

1. **NLP**: NLP stands for **Natural Language Processing**, which is a part of **Computer Science, Human language,** and **Artificial Intelligence**. It is the technology that is used by machines to understand, analyse, manipulate, and interpret human's languages.

**Applications of NLP:**

* **Question Answering:** Question Answering focuses on building systems that automatically answer the questions asked by humans in a natural language.
* **Spam Detection:** Spam detection is used to detect unwanted e-mails getting to a user's inbox.
* **Sentiment Analysis:** Sentiment Analysis is also known as **opinion mining**. It is used on the web to analyse the attitude, behaviour, and emotional state of the sender. This application is implemented through a combination of NLP (Natural Language Processing) and statistics by assigning the values to the text (positive, negative, or natural), identify the mood of the context (happy, sad, angry, etc.)
* **Machine Translation:** Machine translation is used to translate text or speech from one natural language to another natural language.
* **Spelling correction:** Microsoft Corporation provides word processor software like MS-word, PowerPoint for the spelling correction.
* **Speech Recognition:** Speech recognition is used for converting spoken words into text. It is used in applications, such as mobile, home automation, video recovery, dictating to Microsoft Word, voice biometrics, voice user interface, and so on.
* **Chatbot:** Implementing the Chatbot is one of the important applications of NLP. It is used by many companies to provide the customer's chat services.
* **Information extraction:** Information extraction is one of the most important applications of NLP. It is used for extracting structured information from unstructured or semi-structured machine-readable documents.