

# Principles of Artificial Intelligence and Machine Learning

Subject Code : 21CS54

By Savitha Nagaraju

AIML, ATME

# Course Introduction

Course Code	21CS54	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

# Course Introduction

## Course Learning Objectives

CLO 1. Gain a historical perspective of AI and its foundations

CLO 2. Become familiar with basic principles of AI toward problem solving

CLO 3. Familiarize with the basics of Machine Learning & Machine Learning process, basics of Decision Tree, and probability learning

CLO 4. Understand the working of Artificial Neural Networks and basic concepts of clustering algorithms

# Course Introduction

## Course Outcomes Course Skill Set)

At the end of the course the student will be able to:

- CO 1. Apply the knowledge of searching and reasoning techniques for different applications.
- CO 2. Have a good understanding of machine learning in relation to other fields and fundamental issues and challenges of machine learning.
- CO 3. Apply the knowledge of classification algorithms on various dataset and compare results
- CO 4. Model the neuron and Neural Network, and to analyze ANN learning and its applications.
- CO 5. Identifying the suitable clustering algorithm for different pattern

# Course Introduction

## Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.

The minimum passing mark for the CIE is 40% of the maximum marks (20 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE),

A minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

# Course Introduction

## Continuous Internal Evaluation:

Three Unit Tests each of 20 Marks (duration 01 hour)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

# Course Introduction

## Continuous Internal Evaluation:

Three Unit Tests each of 20 Marks (duration 01 hour)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

# Course Introduction

## Two assignments each of 10 Marks

First assignment at the end of 4th week of the semester

Second assignment at the end of 9th week of the semester



# Course Introduction

**Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for 20 Marks**

**OR**

**Suitable Programming experiments based on the syllabus contents can be given to the students to submit the same as laboratory work( for example; Implementation of concept learning, implementation of decision tree learning algorithm for suitable data set, etc...)**

# Course Introduction

**At the end of the 13th week of the semester**

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be scaled down to 50 marks

# Course Introduction

## Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks Scored out of 100 shall be reduced proportionally to 50 marks

# Course Introduction

## Textbooks

1. Stuart J. Russell and Peter Norvig, Artificial Intelligence, 3rd Edition, Pearson, 2015
2. S. Sridhar, M Vijayalakshmi "Machine Learning". Oxford, 2021

## Reference:

1. Elaine Rich, Kevin Knight, Artificial Intelligence, 3rd edition, Tata McGraw Hill, 2013
2. George F Luger, Artificial Intelligence Structure and strategies for complex, Pearson Education, 5th Edition, 2011
3. Tom Michel, Machine Learning, McGrawHill Publication.



# Module 1

## Introduction

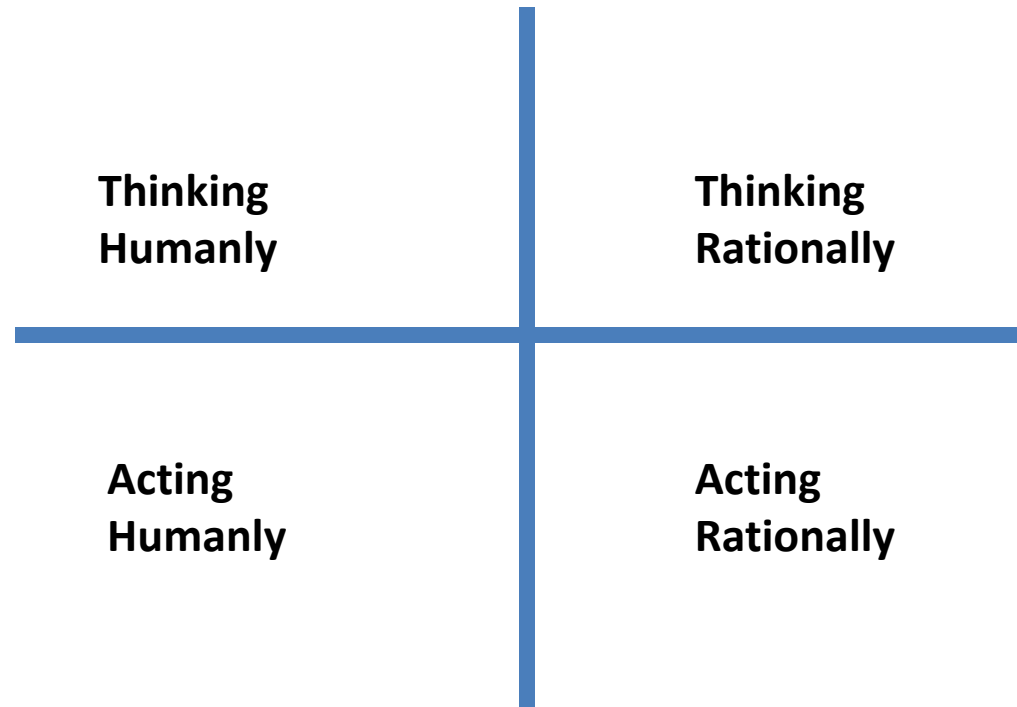
For **Homo Sapiens**, our intelligence is very important to us.

For thousands of years, we have tried to understand how we think, perceive and manipulate a world around us.

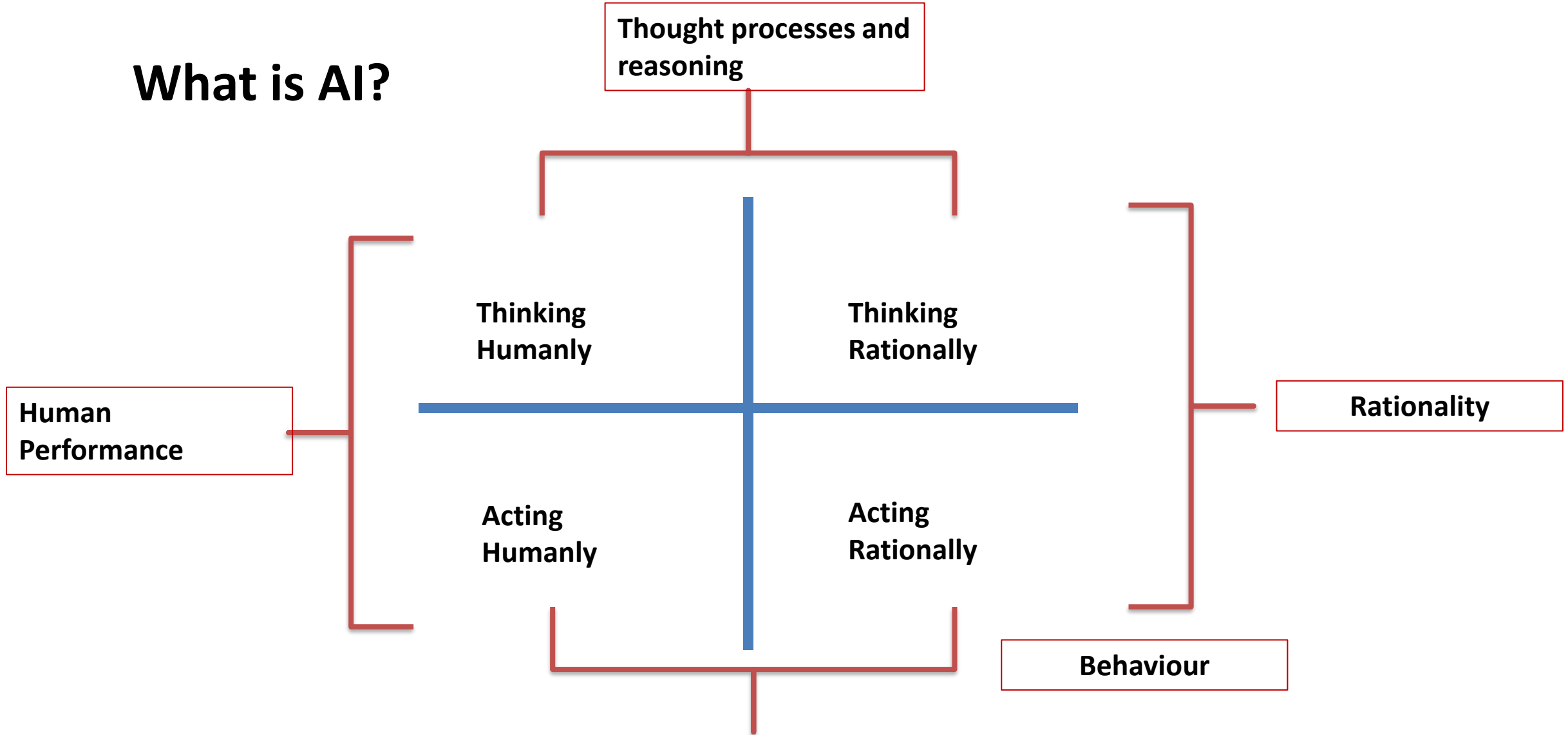
The field of **Artificial Intelligence** not only attempts understand, but also build **intelligent entities**.

# What is AI?

AI is divided into 4 broad units on the basis of **thought processes and reasoning** , **behaviour** , **human performance** and **rationality**.



# What is AI?





## Acting Humanly

The art of creating machines that perform functions that require intelligence when performed by people.

It is a study of how to make computers do things at which, at the moment people do better.

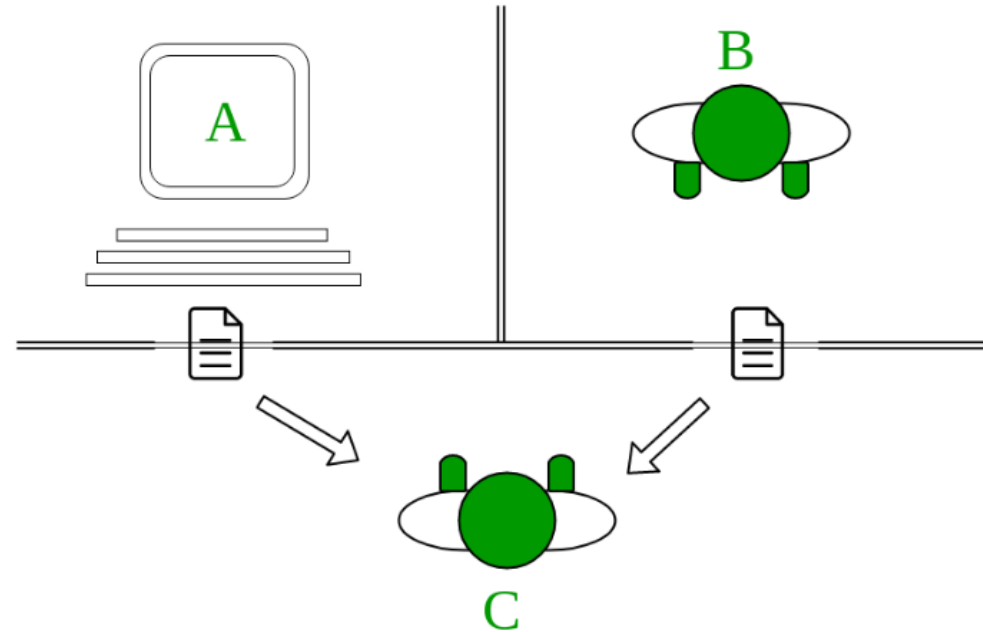
# Acting Humanly: The Turing Test Approach

## The Turing Test Approach

The **Turing Test** is a widely used measure of a machine's ability to demonstrate human like intelligence.

A computer passes the test if a human interrogator after posing some written questions, cannot tell whether the written responses come from a person or from a computer.

# Acting Humanly: The Turing Test Approach



# Acting Humanly: The Turing Test Approach

The computer would need to possess the following capabilities:

**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.

# Acting Humanly: The Turing Test Approach

**Total Turing Test** includes a video signal, so that the interrogator can test the subjects perceptual abilities.

The computer will need:

- **Computer Vision** to perceive objects.
- **Robotics** to manipulate objects and move about

## Thinking Humanly

The effort to make computers think, of the activities associated with human thinking such as decision making, problem solving, learning, etc.

# Thinking Humanly: The cognitive modelling approach

To understand the working of human minds. There are three ways to do this:

- **Through Introspection**  
Trying to catch our own thoughts as they go by.
- **Through Psychological Experiments**  
Observing a person in action.
- **Brain Imaging**  
Observing the brain in action.

## Thinking Humanly: The cognitive modelling approach

Now we express this understanding of the theory as computer programs.  
If the program's input-output behaviour matches corresponding human behaviour,  
That is evident that some of the program mechanisms could also be operating in humans.



## Thinking Rationally

Studying the human faculties using computational models.  
The computation that make it possible to perceive, reason and act.

# Thinking Rationally: the laws of thought approach

The laws of thought were suppose to govern the operation of mind;  
Their study is initiated in the field of **logic**.

By 1965, programs existed that could, in principle, solve any solvable problem described in **logical notation**.

A famous example, “Socrates is a man; all men are mortal; therefore, Socrates is mortal.”

Another example – All TVs use energy; Energy always generates heat; therefore, all TVs generate heat.”

# Thinking Rationally: the laws of thought approach

## Logical notation:

Socrates is a man;

All men are mortal;

therefore, Socrates is mortal.

## Mathematical notation:

$P_s$  is the statement "Socrates is a man."

$Q_s$  is the statement "Socrates is mortal."

$\forall x [P_x \rightarrow Q_x]$

$P_s$

—————

$\therefore Q_s$

# Thinking Rationally: the laws of thought approach

**Programming notation:**

**Fact Statement:** Socrates is a man

**Rule Statement:** All men are mortal.

**Goal or Query Statement:** Is Socrates mortal?

# Thinking Rationally: the laws of thought approach

**There are two limitations to this approach:**

1. It is not easy to take informal knowledge to use logical notation when there is not enough certainty on the knowledge.
2. Solving in principle and solving in practice varies hugely.

## Acting Rationally

Study of design of intelligent agent.

Rationalist approach involves a combination of mathematics and engineering.

# Acting Rationally: The rational agent approach

A traditional computer program blindly executes the code that we write.  
Neither it acts on its own nor it adapts to change itself based on the outcome.

The agent program that we refer to here is expected to do more than the traditional computer program.  
It is expected to create and pursue the goal, change state, and operate autonomously.

**A rational agent is an agent that acts to achieve its best performance for a given task.**

# Acting Rationally: The rational agent approach

The rational agent approach to AI has a couple of advantage over other approaches:

- A correct inference is considered a possible way to achieve rationality but is not always required to achieve rationality.
- It is a more manageable scientific approach to define rationality than others that are based on human behavior or human thought.

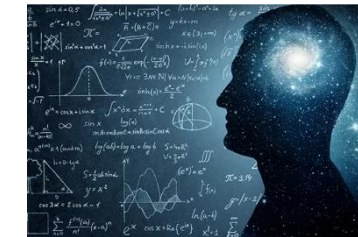


# The Foundations of Artificial Intelligence

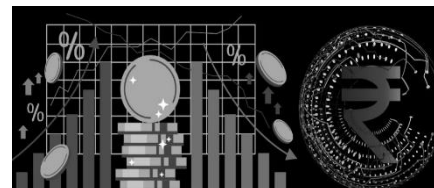
**Philosophy**



**Mathematics**



**Economics**



**Neuro Science**



# The Foundations of Artificial Intelligence

**Psychology**



**Computer Engineering**



**Control Theory and Cybernetics**



**Linguistics**

