

# Principles of Artificial Intelligence and Machine Learning

Subject Code : 21CS54

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# Module 1

# The Foundations of Artificial Intelligence

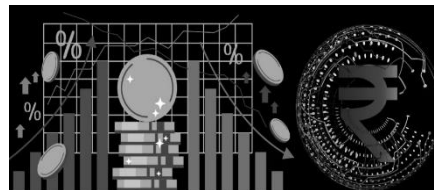
**Philosophy**



**Mathematics**



**Economics**

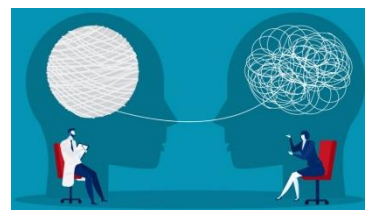


**Neuro Science**



# The Foundations of Artificial Intelligence

**Psychology**



**Computer Engineering**



**Control Theory and Cybernetics**

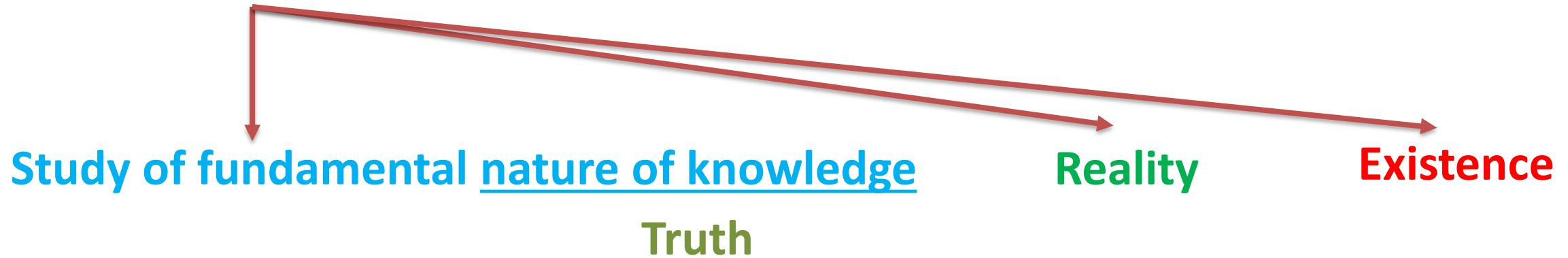


**Linguistics**



# The Foundations of Artificial Intelligence

## Philosophy



These are considered for solving a specific problem is a basic thing in AI

# The Foundations of Artificial Intelligence

## Philosophy

- Philosophy defines how can **formal rules** be used to draw valid **conclusions**.
- Philosophy is needed to answer the following questions:

How does the mind arise from a physical brain?

Where does the knowledge come from?

How does knowledge lead to actions?

# The Foundations of Artificial Intelligence

## Mathematics and Statistics

- AI programming requires **formal logic** and **probability** for planning and learning.
- **Computation** required for **analysing relation** and **implementation**.

In AI, mathematics and statistics are most important for

Proving theorems

Writing Algorithms

Computations



# The Foundations of Artificial Intelligence

## Mathematics and Statistics

Decidability

Tractability

Modelling Uncertainty

Learning from data



# The Foundations of Artificial Intelligence

## Mathematics and Statistics

Using these topics we can answer the following questions:

- What are the formal rules to draw valid conclusions?
- What can be computed?
- How do we reason with uncertain information?

# The Foundations of Artificial Intelligence

## Economics

Deals with **investing the amount of money**, and **maximization of utility** with **minimal investment**

While developing an AI product, we should make decisions for:

- How should we make decisions so as to maximize payoff?
- How should we do this when others may not go along?
- How should we do this when the payoff may be far in the future?

To answer these questions one should have knowledge about **Decision Theory, Game Theory, Operation Research** etc.

# The Foundations of Artificial Intelligence

## Neuroscience

Neuroscience is the study of the **nervous system**, particularly the human brain,

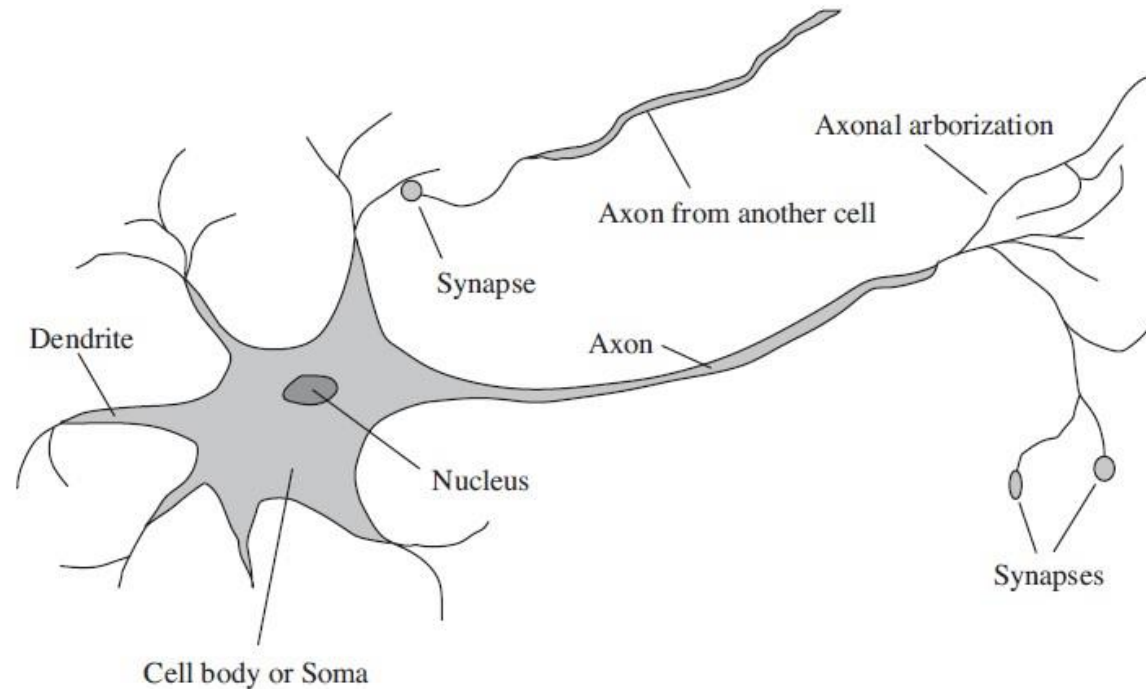
Human brains are somehow different, when compared to other creatures, **man has the largest brain in proportion to the size.**

The brain consisted largely of **nerve cells**, or **neurons** and the **observation of individual neurons** can lead to thought, action and **consciousness of one's brain.**

How do **brain** process information?

# The Foundations of Artificial Intelligence

## Neuroscience



# The Foundations of Artificial Intelligence

## Psychology/Cognitive Science

- The scientific method to study of human **mental ability** and **thinking**.
- Problem solving skills
- How do people behave?
- Perceive
- Process cognitive information
- Represent Knowledge

How do humans and animals think and act?

# The Foundations of Artificial Intelligence

## Computer Science and Engineering

Logic and inference theory

Algorithms

Programming languages

System building

Are important parts of Computer Science

# The Foundations of Artificial Intelligence

## Computer Science and Engineering

- Computer hardware gradually changed for AI applications, such as **graphic processing unit (GPU)**, **tensor processing unit(TPU)**, and **wafer scale engine(WSE)**.
- The amount of **computing power** used to train top machine learning applications and the utilization **doubled every 100 days**.
- The super **computer and quantum** computers can solve very complicated AI problems.
- The software side of computer science, supplied the **operating system, programming languages, and tools needed to write modern programs**.



# The Foundations of Artificial Intelligence

## Computer Science and Engineering

- AI has founded many ideas in modern and mainstream computer science including
  - Time sharing
  - Interactive interpreters
  - Personal Computers
  - Rapid Development Environments
  - The linked-list datatype
  - Automatic storage management

# The Foundations of Artificial Intelligence

## Computer Science and Engineering

Key concepts of **symbolic programming**, **functional programming**, **declarative programming**, **object-oriented programming**.

How can we build fast and efficient computer?

# The Foundations of Artificial Intelligence

## Control Theory

Control Theory helps the system to **analyse define, debug and fix errors by itself**.

Developing **self-controlling machine, self regulating feedback control systems** and **submarines** are some examples of control theory

**Calculus and matrix algebra, and the tools of control theory**, provide themselves to systems that are desirable by fixed sets of continuous variables.

# The Foundations of Artificial Intelligence

## Control Theory

**Knowledge Representation, Grammars, Computational Linguistics or Natural Language Processing(NLP)** are significant to developing AI applications.

How can artifacts operate under their own control?

# The Foundations of Artificial Intelligence

## Control Theory



# The Foundations of Artificial Intelligence

## Linguistics

**Speech Recognition** is a technology which enables a machine to understand the spoken language and translate into a machine readable format.

It is a way to talk with a computer, and on the basis of that command, a computer can perform a specific task.

It includes Speech to Text, Text to Speech

How does language relate to thought?