

Principles of Artificial Intelligence and Machine Learning

Subject Code : 21CS54

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Module 1

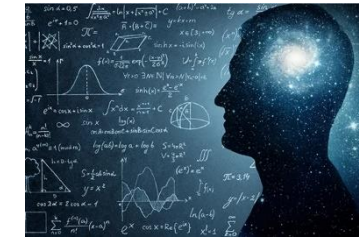
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The Foundations of Artificial Intelligence

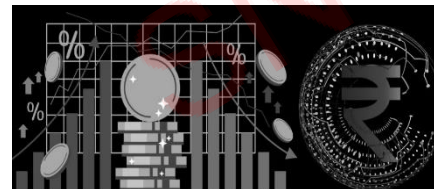
Philosophy



Mathematics



Economics

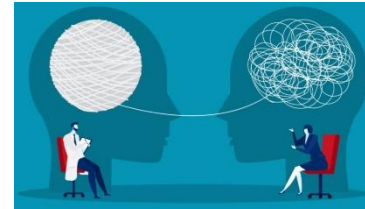


Neuro Science



The Foundations of Artificial Intelligence

Psychology



Computer Engineering



Control Theory and Cybernetics

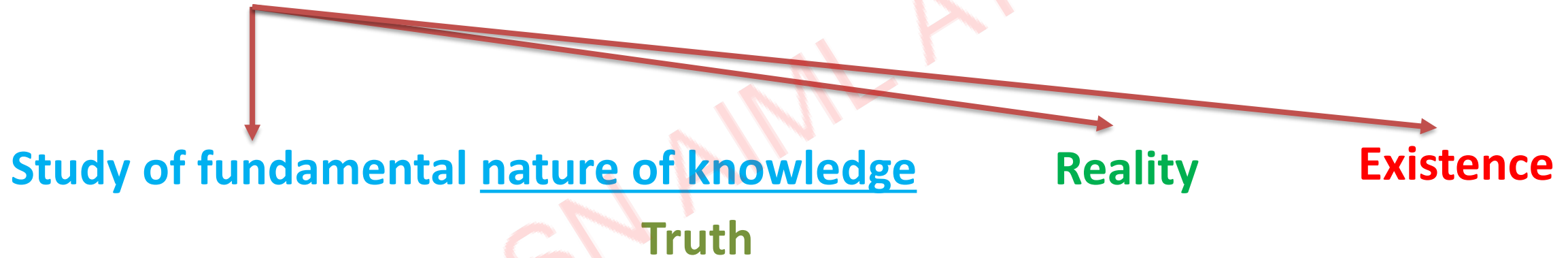


Linguistics



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Philosophy



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

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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?

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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

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Mathematics and Statistics

Decidability

Tractability

Modelling Uncertainty

Learning from data

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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?

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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.

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Neuroscience

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

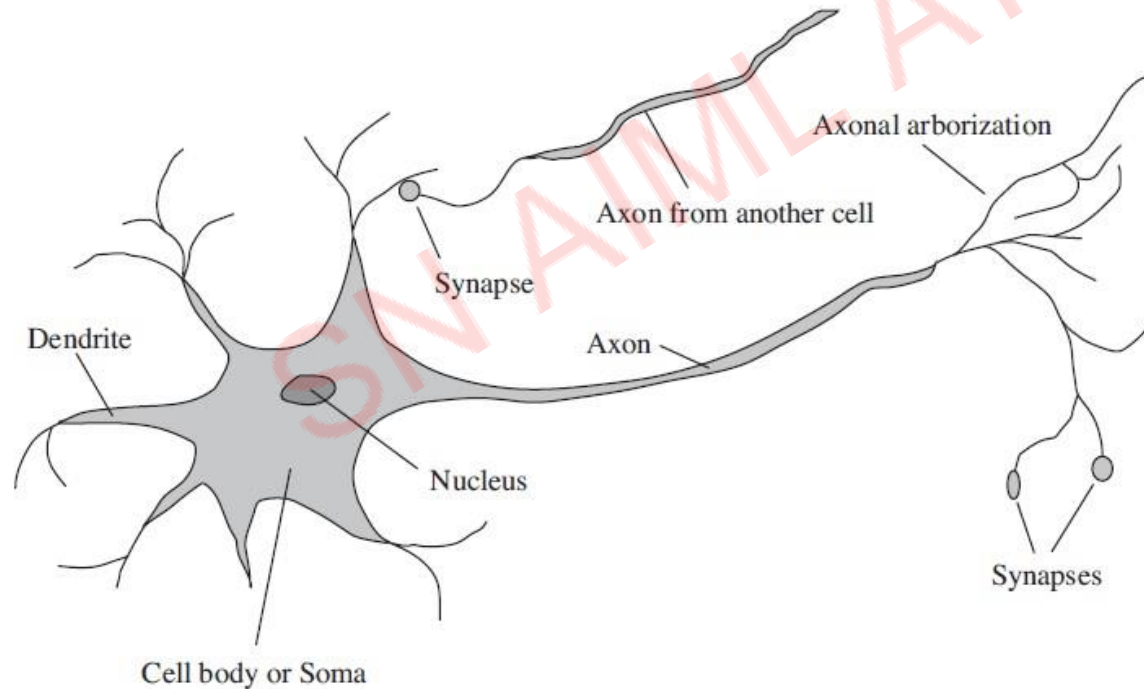
Human brains are somehow different, when compared to other creatures, **man has the largest brain in proportion to the size.**

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?

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Neuroscience



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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?

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Computer Science and Engineering

Logic and inference theory

Algorithms

Programming languages

System building

Are important parts of Computer Science

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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**.

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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

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Computer Science and Engineering

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

How can we build fast and efficient computer?

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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.

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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?

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Control Theory



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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?