Introduction

06/01/2025

Koustav Rudra

General Information

- Class Timings
  - Monday: 8-10 AM
  - Monday: 5-6 PM
  - Tuesday: 12-1 PM

- Venue
  - NR 213

- Study Materials, Assignments, Class Schedule and other Information will be shared through *teams*
  - Link to be provided by this week

General Information

- Head TAs
  - Mr. Sayantan Saha (sayantan.saha@kgpian.iitkgp.ac.in)
  - Mr. Deepayan Chakraborty (deepayan504@gmail.com)

- References
  - Artificial Intelligence – A Modern Approach
    - Stuart Russell and Peter Norvig
  - Principles of Artificial Intelligence
    - N J Nilsson

Assessment/ Evaluation

- Overall Assessment
  - Assignment1
  - Assignment2

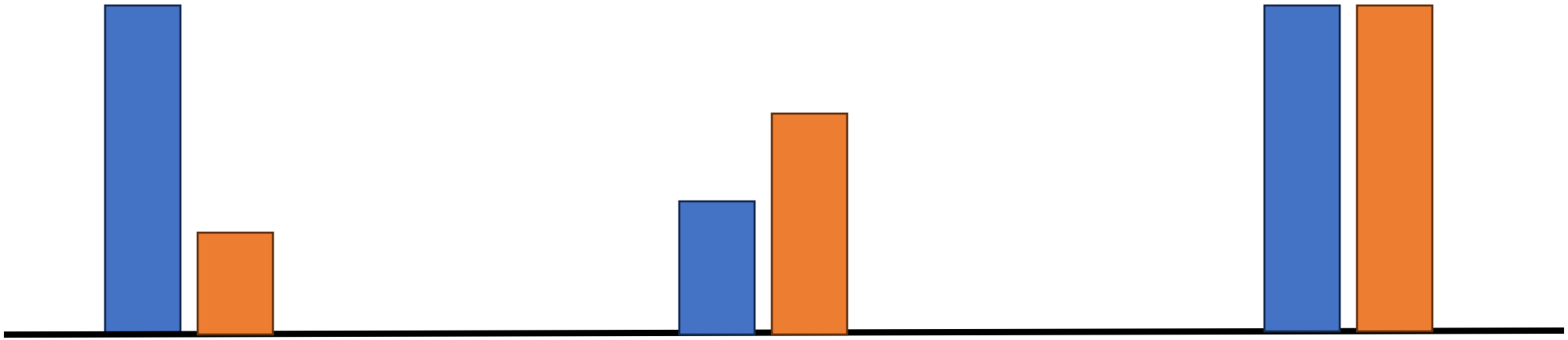
Tentative 15-20%

- Mid Sem
- End Sem

Tentative 80-85%

- Discounting factor: Attendance

Progress



- Lots of AI Hype
- Limited Hardware

- Mostly known what could be done or not done
- Hardware support improves

- AI Hype
- Hardware Support

What is an AI?

- An attempt to replicate human intelligence

- Think like a human or act like a human?

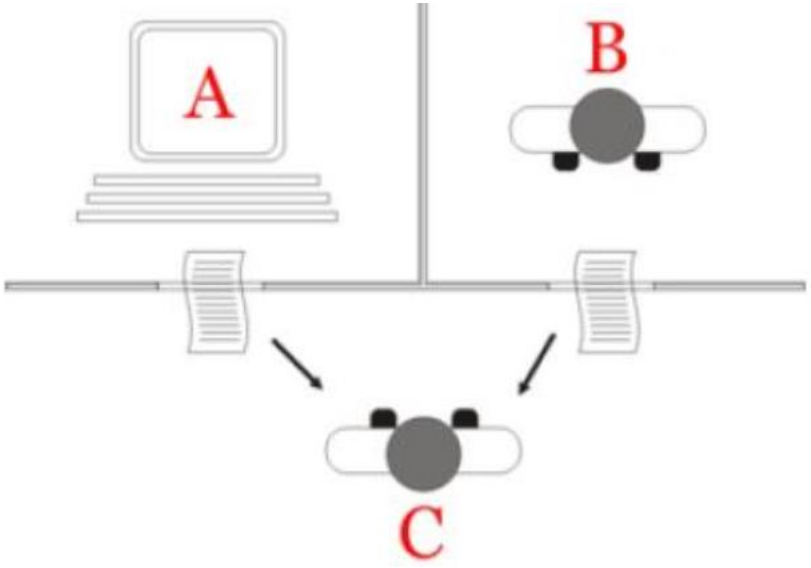
- Think like human – Cognitive modeling
  - Need to know how human brain functions - through introspection, psychological experiments, brain imaging, etc.

- Act like human – The ‘Turing test’

What is an AI?

- An attempt to replicate human intelligence

- Turing Test (1950)
  - The computer is interrogated by a human via a teletype
  - It passes if human cannot tell if there is a computer or human at the other end
    - Don’t have NLP support like today



What is an AI?

- An attempt to replicate human intelligence

- Chinese Room Problem
  - Suppose, AI has succeeded in constructing a machine that understands Chinese
  - It takes Chinese characters as input and, by following the instructions of a computer program
  - It produces other Chinese characters, which it presents as output

- Does the machine literally “understand" Chinese? – Strong AI

- Is it merely simulating the ability to understand Chinese? – Weak AI

AI based Problem Solving

- What is AI?
  - An attempt to *replicate* human intelligence
  - AI is that activity devoted to making machines intelligent, and intelligence is that quality that enables an entity to ***function*** appropriately and with *foresight* in its environment. **(Nilsson)**

- In general,
  - AI is an attempt to *automate* intelligent behaviour
  - The branch of Computer Science dealing with *intelligent behaviour automation*

AI based Problem Solving

- What is AI?
  - An attempt to *automate intelligent behaviour*

  - The capability of reasoning, planning, learning, understanding etc. by
    - perceiving the world,
    - acquiring knowledge through this experience and
    - subsequently acting in the world with this additional knowledge

AI based Problem Solving

- Reasoning
  - Logically Inferring conclusions from available knowledge
    - Diagnosing an ailment from symptoms
    - Proving theorems in mathematics

- Automated ways to use what is known to reason about something which is not explicitly known.
- Automated Reasoning:
  - Deduction

    Rule: *All the marbles in this bag are blue*

    Case: *These marbles are from this bag*

    Inference: *These marbles are blue*

  - Abduction

    Rule: *All the marbles in this bag are blue*

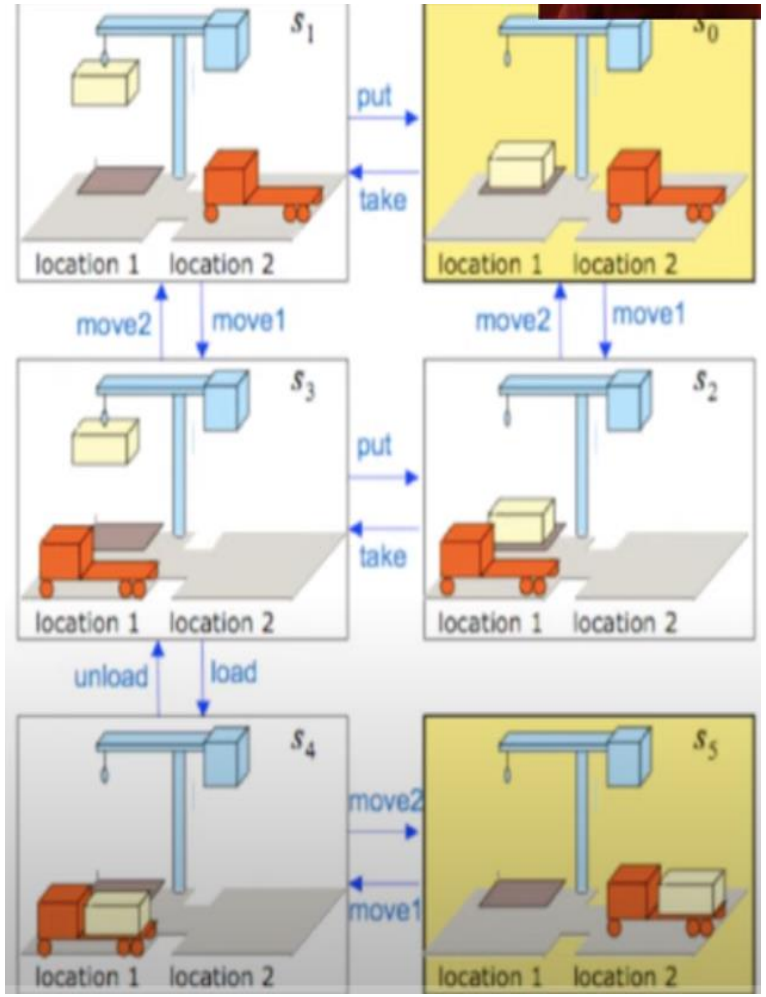
    Observation: *These marbles are blue*

    Case: *These marbles are from this bag*

- Induction
  - Case: These marbles are from this bag
  - Observation: these marbles are blue
  - Rule: All the marbles in this bag are blue

AI based Problem Solving

- Planning
  - Deciding on a sequence of actions that may help achieve a specific goal with high probability
    - Actions have preconditions to be satisfied and positive/negative after effects
    - Planning the best path for a robot



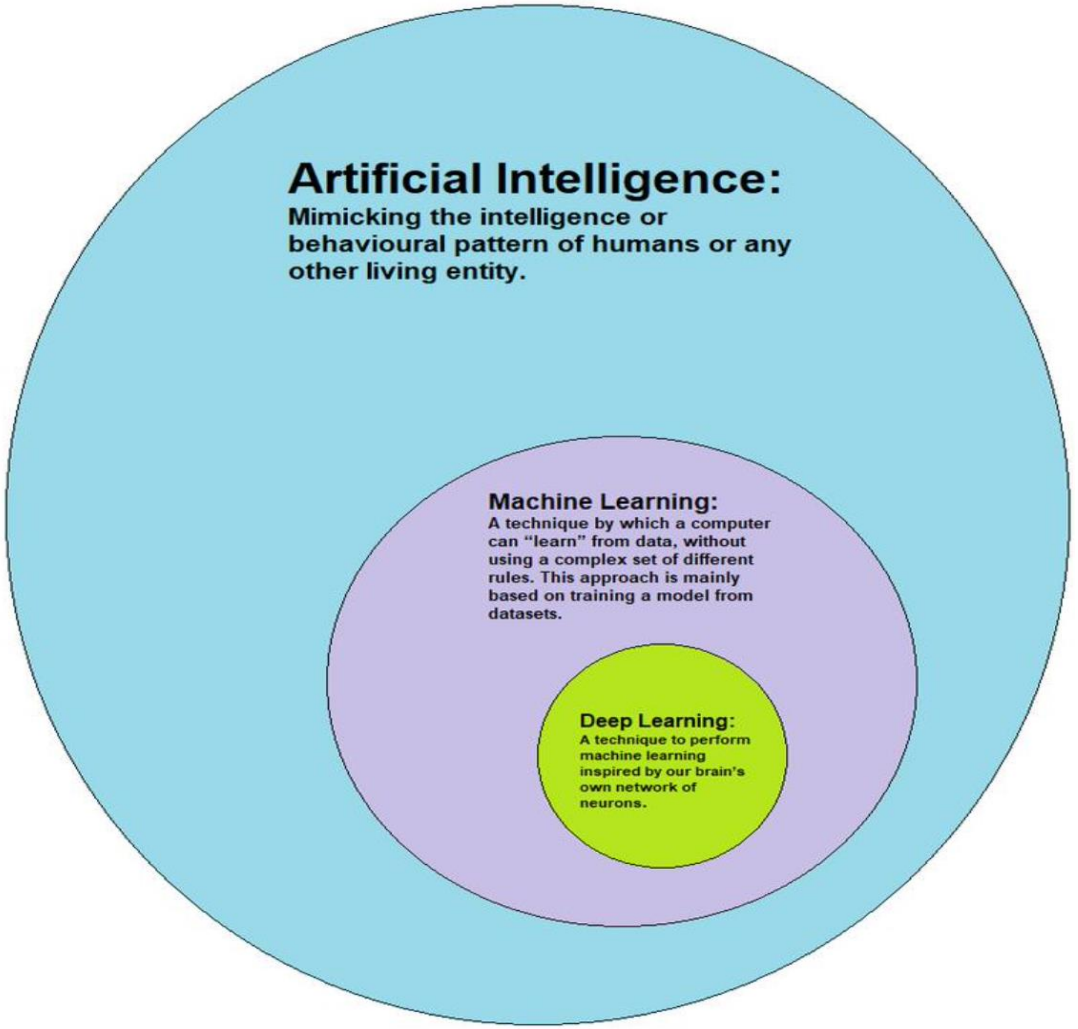
AI based Problem Solving

- Learning:
  - Building mathematical models and making predictions using past information (data)
    - Supervised, unsupervised, reinforcement
    - Learning traffic patterns, recommending movies

AI based Problem Solving

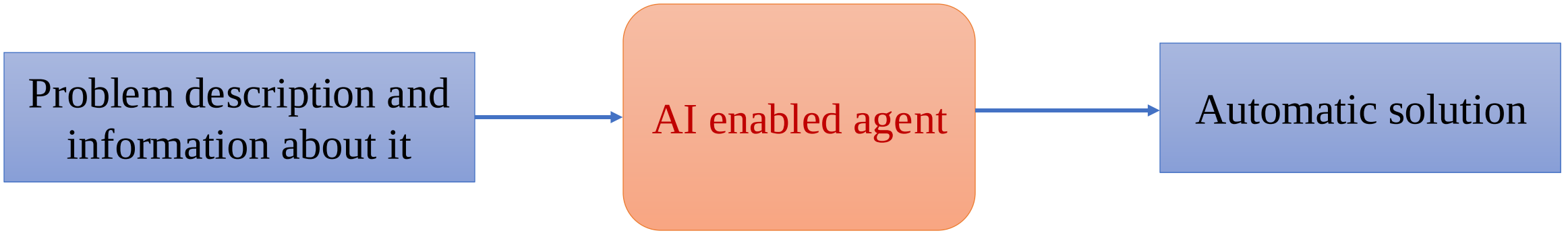
- Broad Techniques
  - Search
  - Logic
  - Constraint satisfaction
  - Planning
  - Probabilistic reasoning

  - Machine learning
  - Deep learning



Automated Problem Solving: Requirement

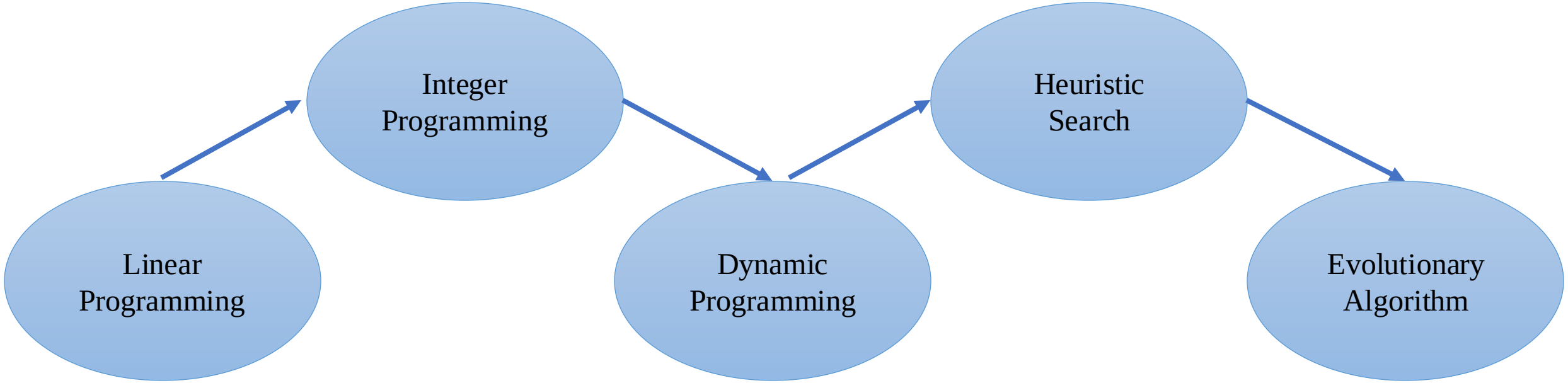
- Typically assumes an entity called '*AI enabled Agent*'
  - Being AI-enabled, this agent do not need to be individually programmed for each problem instance



How much can computer aid us in our ability to solve problems?

The Ability to Solve Problems

- Search: Efficient trial and error
  - Enormous computational complexity
  - Space-time trade-off
  - Use of domain knowledge - heuristics



During 1985-1995 computation becomes free

Knowledge and Deduction

- Storing data does not signify anything
- We have to learn how to deduct knowledge from it

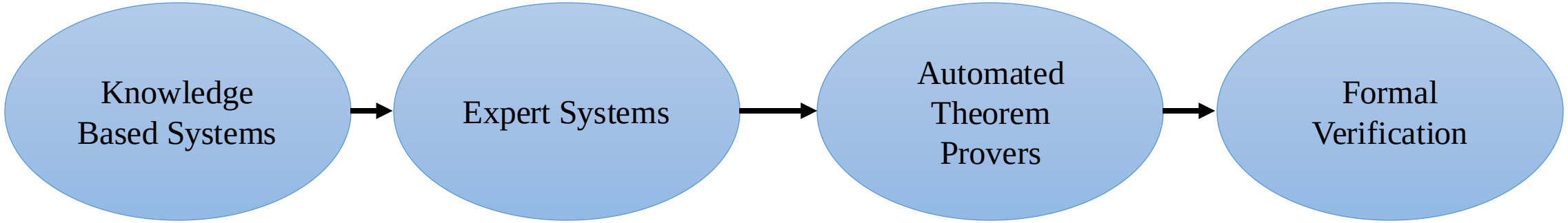
- Understanding the rules, able to interpret and use the rules to deduce new data

- What kind of logic enable us to do so?
  - Propositional Logic
  - First Order Predicate Logic

- Important
  - What do I know?
  - What do other one know?
  - What do I know about the other?

Knowledge and Deduction

- How to store and retrieve knowledge?
- How to interpret facts and rules, and be able to deduce?
- The gap between knowledge and realization
- Logics of knowledge



- The knowledgebase may be huge
- Between 1990-2000 the storage becomes free

Next Generation Issue: Smart Communication

The Ability to Learn

- Can we learn to solve a problem better?
  - Learning the answers
  - Learning the rules of the game
  - Learning to plan

What is AI?

- Automated Problem Solving
- Logic and Deduction
- Machine Learning
- Deep Learning

Human Computer Interaction

- IR
- NLP
- Computer Vision
- Robotics

AI: Application [Example]

- Respected Professor,

- I hope this email finds you well. I kindly request your consideration to enroll in the "Artificial Intelligence: Foundation and Applications" course (AI61005) as a depth elective.

- As a final-year student with seven courses this semester, this is my only opportunity to complete a micro-specialization in AI. Previously, I could not take this course due to slot clashes and core requirements.

- I am keen on pursuing research in AI applications and believe this course will provide the foundation to contribute meaningfully. I assure you of my commitment to regular attendance and excellence in the course.

Thank You