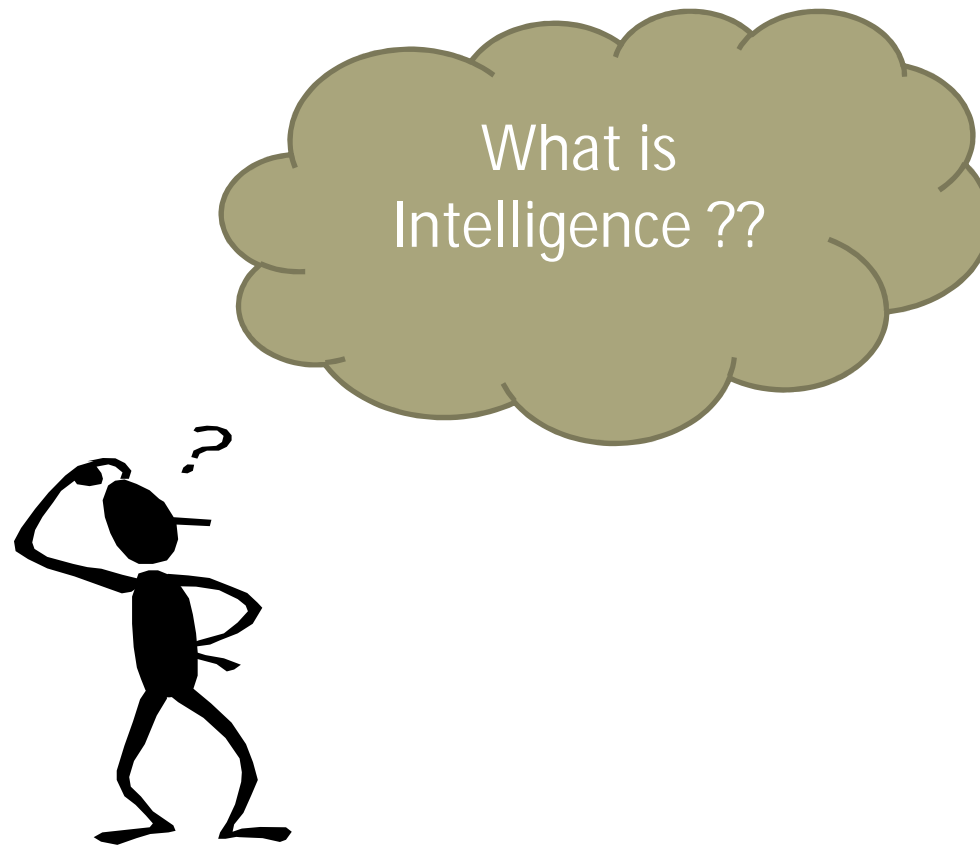


Artificial Intelligence

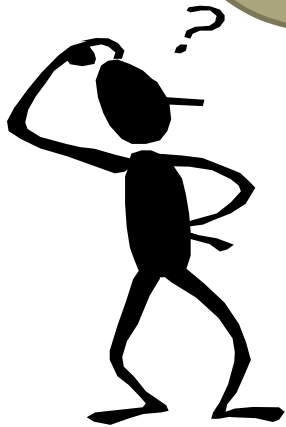
Adnan Shahzada

Artificial Intelligence



Artificial Intelligence

What is
Intelligence ??



Perceive

Understand

Remember

Think

Reason

Learn from
Experience

Adapt to the new
Situation

Problem Solving

Can Machines Think?



Humans Vs Machines

Humans	Machines
<ul style="list-style-type: none">• Symbolic calculation• Natural language understanding• Not very precise• Knowledge• Generalize from examples• Deal with noisy inputs	<ul style="list-style-type: none">• Numeric calculation• Machine Language• Precise• Data• Cannot generalize• Cannot deal with noise

Artificial Intelligence

“Study of computations that make it possible to perceive, reason and act.”

Patrick Henry Winston

- Branch of Science which deals with helping machines to find solutions to complex problems in a more human-like fashion
- In short, putting human intelligence into machines

Artificial Intelligence

- AI is concerned with the design of intelligence into an artifact.
- Design of computer systems which can exhibit intelligent behaviors
- The term was coined by John McCarthy in 1956

Why AI?

- Two main goals of AI:
 - To create useful “smart” programs able to do tasks that would normally require a human expert
 - To understand human intelligence better as we test theories of human intelligence by writing programs which emulate them

Approaches to AI

Systems that THINK
LIKE HUMANS

Cognitive modeling
approach

Systems that THINK
RATIONALLY

Laws of thought
approach

Systems that ACT
LIKE HUMANS

Turing test approach

Systems that ACT
RATIONALLY

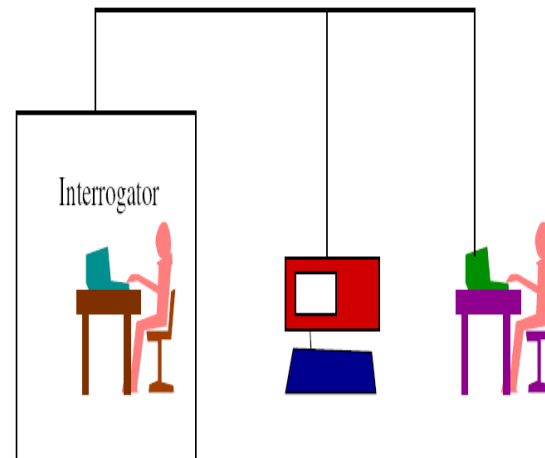
Rational agent
approach

Cognitive Modeling

- We need to understand how humans think
 - Introspection: Trying to catch our own thoughts
 - Psychological experiments
- Requires scientific theories of the internal working of the human brain
- Cognitive science brings together computer models from AI & experiments from psychology to construct theories of the working of the human mind

Turing Test

- Test by Alan Turing
- Three rooms, connected by a network
 - human interrogator
 - human response (via computer)
 - computer response
- The interrogator has to determine which is the human and which is the computer



Laws Of Thought

- Date back to Aristotle who attempted to describe irrefutable thought process
- Syllogism provides patterns for arguments structures that give correct conclusions from correct premises, e.g.,
 - Socrates is a man; all men are mortal; so conclude:
 - Socrates is mortal
- Initiated the field of logic
- Emphasis is on correct inference
- Drawbacks
 - Informal knowledge has to be expressed in formal terms by logical notations
 - Problems with just a few dozen facts can require a lot of computations
 - Not all intelligent behavior can be mediated by logical deliberations

Rational Agents

- Rational behavior: Doing the right thing
- What is the right thing???
 - Maximize the achievement towards a goal given some information
- An agent is something that acts
- Computer agents
 - Operate under autonomous control
 - Perceive their environment
 - Adapt to change
 - Make correct inferences
- Rational agent attempts to achieve the best outcome/best expected outcome
- Doesn't necessarily involve thinking, e.g., reflex actions

Types to AI

- Weak AI
 - Only simulates human thoughts and actions
- Strong AI
 - Intelligent on their own
- Applied AI
 - Commercially valuable
- Cognitive AI
 - Test Theories about how human mind works

Disciplines involved in AI

- Many disciplines contribute to goal of modelling intelligent entities:
 - Computer Science
 - Psychology (human reasoning)
 - Philosophy (nature of belief, rationality, etc)
 - Linguistics (structure and meaning of language)
 - Human Biology (how brain works)
- Subject draws on ideas from each discipline

History of AI

Event	Year
First electronic computer	1941
McCulloch & Pitts artificial neuron	1943
First neural network (Minsky & Edmonds)	1951
Birth of AI. Coined by McCarthy Dartmouth conference	1956
Eliza	1965
Dendral (chemical analysis system)	1967
SHRDLU (robot arm carried out instructions in English)	1971
Prolog	1972
MYCIN (Formally termed first expert system)	1974
Blackboard model for speech understanding	1980
Backprop for neural nets	Mid 80
Data mining and virtual reality	90s
Deep Blue AI system beats human chess master	1997

Some AI paradigms

- Expert systems
- Neural networks
- Genetic algorithms
- Fuzzy logic
- Data Mining

Typical AI Problems

- Intelligent entities need to perform both mundane and expert tasks
- Mundane Tasks:
 - Planning routes
 - Object Recognition
 - Natural Language Communication
 - Navigating around obstacles
- Expert Tasks:
 - Diagnosis
 - Mathematical Problem Solving

Applications of AI

- Game playing
- Computer vision
- Natural language processing
- Diagnosis systems
- Control
- Optimisation
- Robotics

Eliza- A computer Therapist

Eliza : Hello, I am Eliza.

You : Hi, I am Adnan

Eliza : How long have you been Adnan?

You : all my life

Eliza : Tell me more...

You : What more should I tell you about my name?

Eliza : I'm not sure I understand you fully.

You : My parents gave me this name.

Eliza : Names don't interest me.

You : Ok, Then what interests you?

Eliza : We were discussing you, not me.

You : But i want to discuss you

Eliza : You're not really talking about me, are you?

You : yes

Eliza : Are you Sure?

You : yes

Eliza : Please don't repeat yourself!

You : ok you are boring me now

Eliza : What makes you think I am boring you now?

You : because you are talking non-sense.

Eliza : Say, do you have any psychological problems?

Historical Success Stories

- ALVINN (1989)
 - Autonomous Land Vehicle In a Neural Network
 - Camera enabled vision
 - NN is used to decide which way the car should turn or go
- Deep Blue (1997)
 - Chess playing computer by IBM
 - World Champion Kasparov was beaten by DB
- Mars Exploration Rover (2004)
 - Still Operating after 5 years
 - search for and characterize a wide range of rocks and soils
- Language Translator used by US Military

AI in your everyday life

- Cars
 - Self-parking
 - Speech recognition
- Intelligent Games
 - Chess
 - Combat and sports video games (Half life, Cricket)
- Medicine
 - Clinical Decision Support systems
 - Pattern Recognition for Cancer diagnosis
- Internet
 - Search Engines

What AI still unable to do?

- Understand natural language robustly
- Surf the web
- Interpret an arbitrary visual scene
- Construct dynamic plans on run time
- Exhibit truly autonomous intelligence