

ARTIFICIAL INTELLIGENCE



ARTIFICIAL INTELLIGENCE (A.I.)



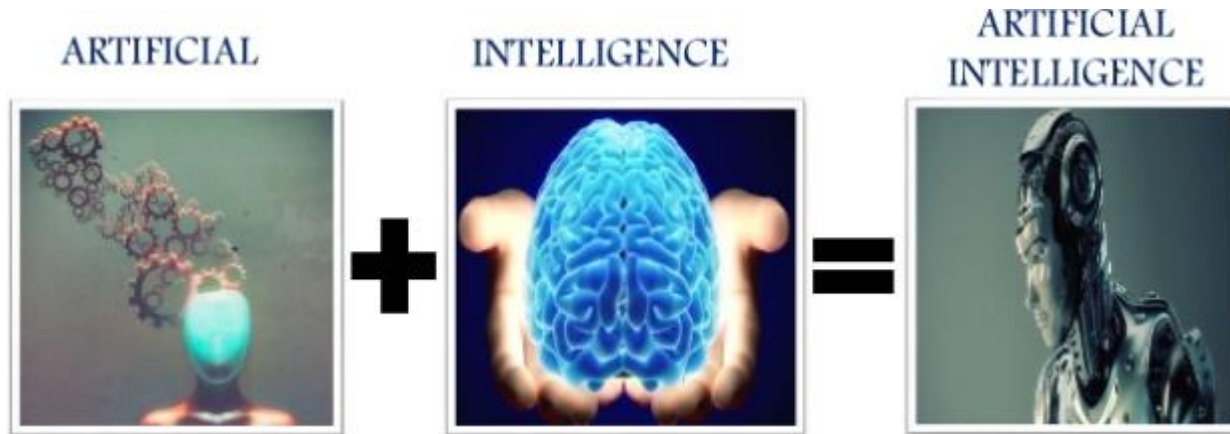
**CENTRAL
UNIVERSITY**

FAITH • INTEGRITY • EXCELLENCE

Presented by:

Dr. K. Kissi Mireku

Artificial Intelligence



 **Intelligence:** “The capacity to learn and solve problems”

Artificial Intelligence: is the simulation of human intelligence by machines.

☐ *The ability to solve problems*

☐ *The ability to act rationally*

☐ *The ability to act like humans*

What is AI?

Scientific Approach

1. Build systems that think like humans
2. Build systems that act like humans



Engineering Approach

1. Build systems that think rationally
2. Build systems that act rationally

Artificial Intelligence

According to the father of AI,
John McCarthy,

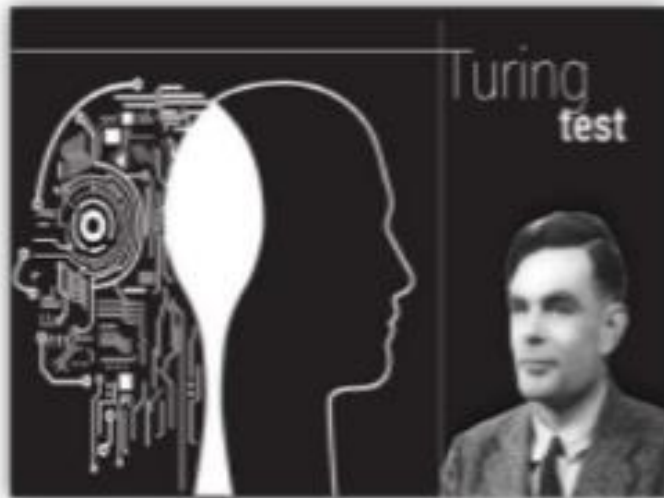


- it is *“The science and engineering of making intelligent machines, especially intelligent computer programs”*.
- Artificial Intelligence is a way of **making a computer, a computer-controlled robot, or a software think intelligently,**
 - *in the similar manner the intelligent humans think.*
- AI is accomplished by studying how human brain thinks, and how humans learn, decide, and work while trying to solve a problem, and then using the outcomes of this study as a basis of developing intelligent software and systems.



Philosophy and History of AI

- ❑ While exploiting the power of the computer systems, the curiosity of human, lead him to wonder, “*Can a machine think and behave like humans do?*”
- ❑ Thus, the development of AI started with the intention of creating similar intelligence in machines that we find and regard high in humans



1950 : “CAN MACHINES
THINK??????”

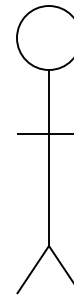
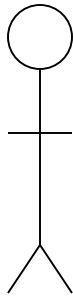
- ❑ In 1950 English mathematician *Alan Turing* wrote a landmark paper titled “Computing Machinery and Intelligence” that asked the question: “*Can machines think?*”

Acting Like a Human



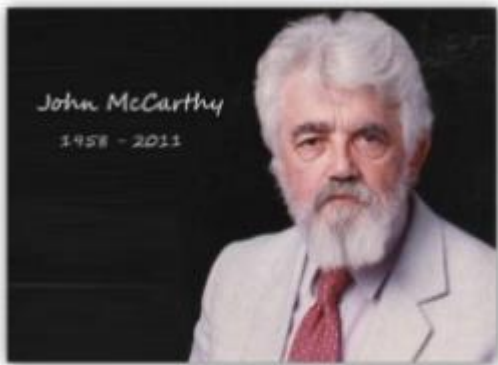
Alan Turing

- Turing Test (1950)
- Human beings are intelligent
- To be called intelligent, a machine must produce responses that are indistinguishable from those of a human



Philosophy and History of AI

THE RISE OF ARTIFICIAL INTELLIGENCE



1956 : THE TERM
“ARTIFICIAL INTELLIGENCE”
WAS FIRST INTRODUCED.

- Further work came out of a 1956 workshop at Dartmouth sponsored by John McCarthy. In the proposal for that workshop, he coined the phrase a “study of Artificial Intelligence”

Philosophy and History of AI

□ history of AI during 20th century

Year	Milestone / Innovation
1923	Karel Čapek play named “Rossum's Universal Robots” (RUR) opens in London, first use of the word "robot" in English.
1943	Foundations for neural networks laid.
1945	Isaac Asimov, a Columbia University alumni, coined the term <i>Robotics</i> .
1950	Alan Turing introduced Turing Test for evaluation of intelligence and published <i>Computing Machinery and Intelligence</i> . Claude Shannon published <i>Detailed Analysis of Chess Playing</i> as a search.
1956	John McCarthy coined the term <i>Artificial Intelligence</i> . Demonstration of the first running AI program at Carnegie Mellon University.
1958	John McCarthy invents LISP programming language for AI.
1964	Danny Bobrow's dissertation at MIT showed that computers can understand natural language well enough to solve algebra word problems correctly.
1965	Joseph Weizenbaum at MIT built ELIZA, an interactive problem that carries on a dialogue in English
1969	Scientists at Stanford Research Institute Developed Shakey, a robot, equipped with locomotion, perception, and problem solving.



Philosophy and History of AI

□ history of AI during 20th century cont...

Year	Milestone / Innovation
1973	The Assembly Robotics group at Edinburgh University built Freddy, the Famous Scottish Robot, capable of using vision to locate and assemble models.
1979	The first computer-controlled autonomous vehicle, Stanford Cart, was built.
1985	Harold Cohen created and demonstrated the drawing program, Aaron.
1990	Major advances in all areas of AI – <ul style="list-style-type: none">•Significant demonstrations in machine learning•Case-based reasoning•Multi-agent planning•Scheduling•Data mining, Web Crawler•natural language understanding and translation•Vision, Virtual Reality•Games
1997	The Deep Blue Chess Program beats the then world chess champion, Garry Kasparov.
2000	Interactive robot pets become commercially available. MIT displays <i>Kismet</i> , a robot with a face that expresses emotions. The robot <i>Nomad</i> explores remote regions of Antarctica and locates meteorites.

CURRENT STATUS OF A.I

A.I. FOR GOOD



- ☐ *Analyze Satellite Images to identify which areas have the highest poverty level*

AVIATION



- ☐ *Gate allocation for plane while landing*
- ☐ *Ticket price determination*

EDUCATION



- ☐ *Companies are creating robots to teach subjects*



CURRENT STATUS OF A.I

HEALTHCARE



- ☐ Solving a variety of problems of patients, hospitals & healthcare industry overall
- ☐ Using Avatars in place of patients

HEAVY INDUSTRY



- ☐ Robots have become very common in many industries
- ☐ Can do repetitive laborious tasks

FINANCE



- ☐ Algorithmic Trading
- ☐ Market analysis & data mining
- ☐ Personal Finance
- ☐ Portfolio management



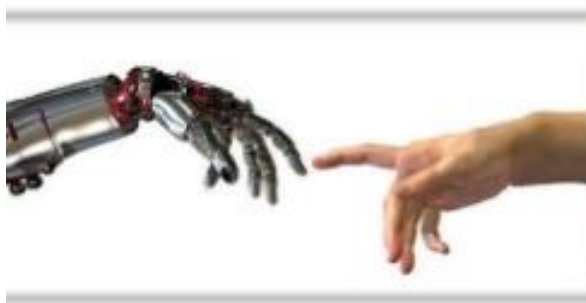
Goals of Artificial Intelligence

❑ To Create Expert Systems –

- *The systems which exhibit intelligent behavior, learn, demonstrate, explain, and advice its users.*

❑ To Implement Human Intelligence in Machines

- *Creating systems that understand, think, learn, and behave like humans.*

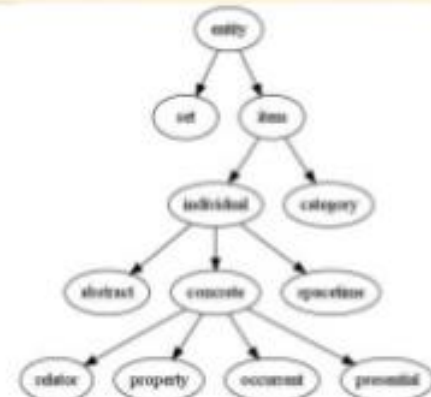


• Deduction, Reasoning, Problem solving :

- To develop algorithms that human use.
- Algorithms can require enormous computational resources and problem goes beyond a certain size

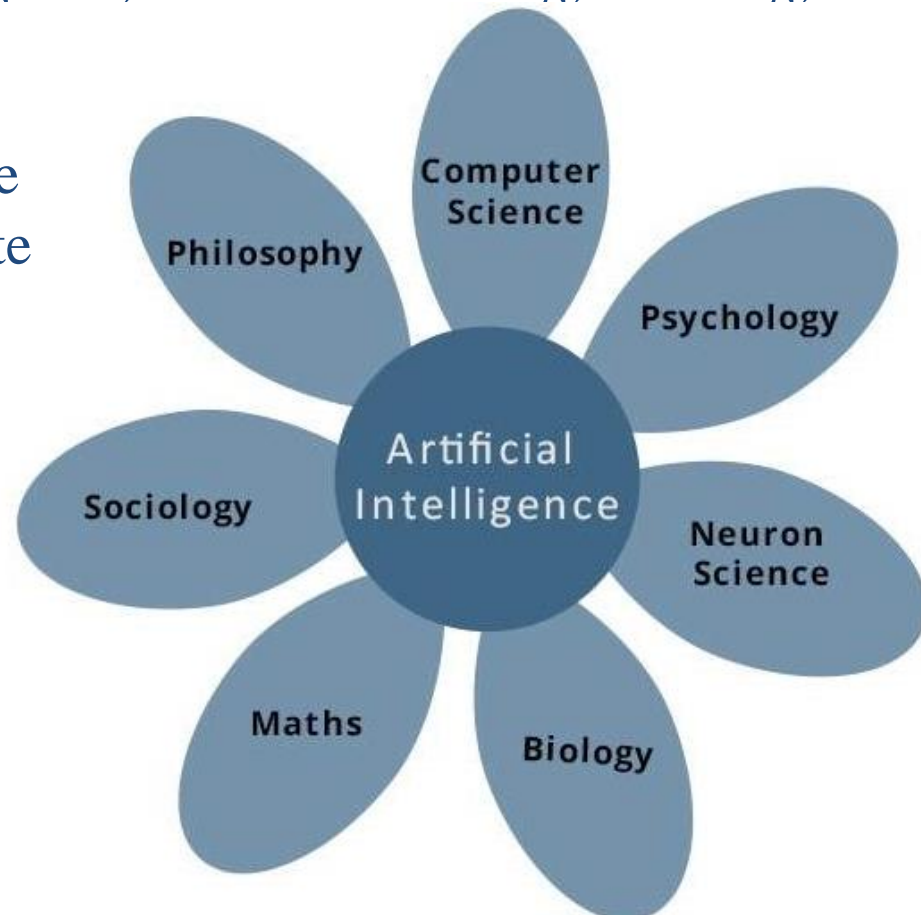
• KNOWLEDGE REPRESENTATION :

- To build machine with the capability of making working assumption and common sense.



What Contributes to AI?

- ❑ AI is a science and technology based on disciplines such as Computer Science, Biology, Psychology, Linguistics, Mathematics, and Engineering.
 - *A major thrust of AI is in the development of computer functions associated with human intelligence, such as reasoning, learning, and problem solving.*
- ❑ Out of the following areas, one or multiple areas can contribute to build an intelligent system



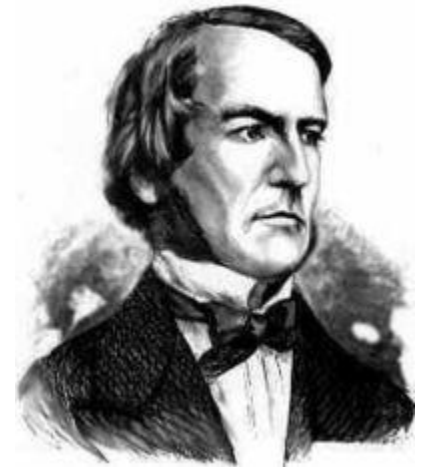
Philosophy

- Dealt with questions like:
 - *Can formal rules be used to draw valid conclusions?*
 - *Where does knowledge come from? How does it lead to action?*
- David Hume proposed the principle of induction (later)
- Aristotle-
 - *Given the end to achieve*
 - *Consider by what means to achieve it*
 - *Consider how the above will be achieved ...till you reach the first cause*
 - *Last in the order of analysis = First in the order of action*
 - *If you reach an impossibility, abandon search*



Mathematics

- Boolean Logic(mid 1800's)
- Intractability (1960's)
 - *Polynomial Vs Exponential growth*
 - *Intelligent behaviour = tractable subproblems, not large intractable problems.*
- Probability
 - *Gerolamo Cardano(1500's) - probability in terms of outcomes of gambling events*



George Boole



Cardano



Economics

- How do we make decisions so as to maximize payoff?
- How do we do this when the payoff may be far in the future?
- Concept of utility (early 1900's)
- Game Theory (mid 1900's)



Leon Walras

Neuroscience

- Study of the nervous system, esp. brain
- A collection of simple cells can lead to thought and action
- Cycle time: Human brain- microseconds

Computers- nanoseconds

❑ The brain is still 100,000 times faster



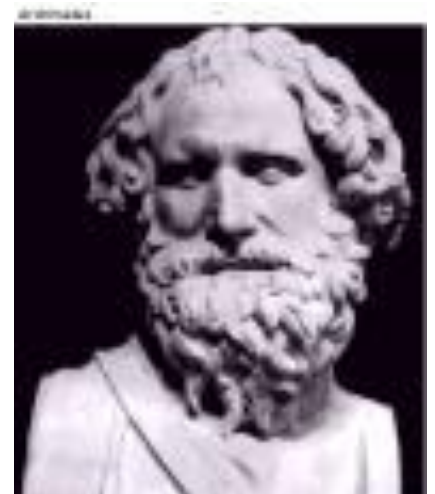
Psychology

- Behaviourism- stimulus leads to response
- Cognitive science
 - *Computer models can be used to understand the psychology of memory, language and thinking*
 - *The brain is now thought of in terms of computer science constructs like I/O units, and processing center*



Control Theory

- Ctesibius of Alexandria- water clock with a regulator
- Purposeful behaviour as arising from a regulatory mechanism to minimize the difference between goal state and current state (“error”)

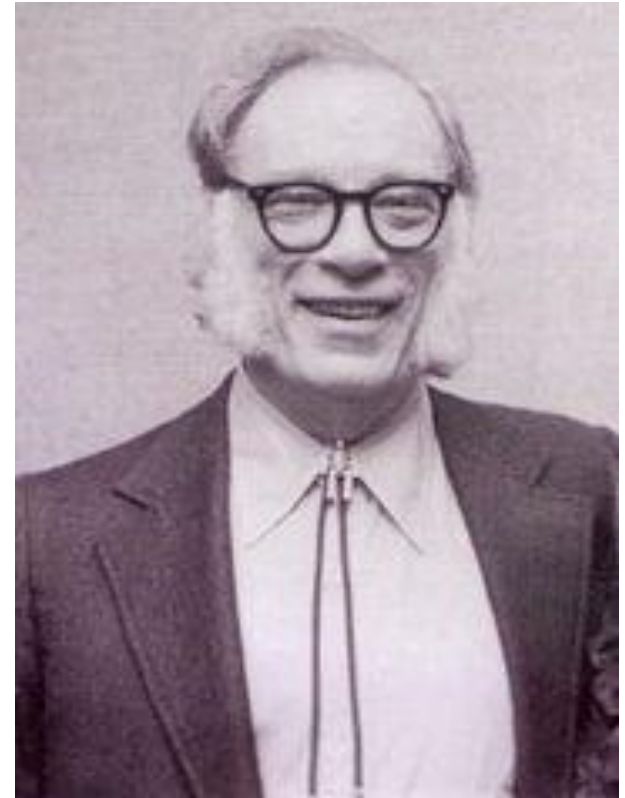


Robotics

- Robotics- the science and technology of robots, their design, manufacture, and application.



- Liar! (1941)



Isaac Asimov

- Mechatronics- mechanics, electronics and computing which, combined, make possible the generation of simpler, more economical, reliable and versatile systems.



Norbert Wiener

Cybernetics- the study of communication and control, typically involving regulatory feedback, in living organisms, in machines, and in combinations of the two.



Programming Without and With AI

Programming Without AI	Programming With AI
A computer program without AI can answer the specific questions it is meant to solve.	A computer program with AI can answer the generic questions it is meant to solve.
Modification in the program leads to change in its structure.	AI programs can absorb new modifications by putting highly independent pieces of information together. Hence you can modify even a minute piece of information of program without affecting its structure.
Modification is not quick and easy. It may lead to affecting the program adversely.	Quick and Easy program modification.

AI Technique

In the real world, the knowledge has some unwelcomed properties –

- *Its volume is huge, next to unimaginable.*
- *It is not well-organized or well-formatted.*
- *It keeps changing constantly.*

AI Technique is a manner to organize and use the knowledge efficiently in such a way that –

- *It should be perceivable by the people who provide it.*
- *It should be easily modifiable to correct errors.*
- *It should be useful in many situations though it is incomplete or inaccurate.*
- *AI techniques elevate the speed of execution of the complex program it is equipped with.*



Applications of AI

AI has been dominant in various fields such as –

- **Gaming** – AI plays crucial role in strategic games such as chess, poker, tic-tac-toe, etc., where machine can think of large number of possible positions based on heuristic knowledge.
- **Natural Language Processing** – It is possible to interact with the computer that understands natural language spoken by humans.
 - *The goal of NLP is to enable people and computers to LP communicate in a natural (humanly) language(such as, English) rather than in a computer language.*
- **Vision Systems** – These systems understand, interpret, and comprehend visual input on the computer. For example,
 - *A spying aeroplane takes photographs, which are used to figure out spatial information or map of the areas.*
 - *Doctors use clinical expert system to diagnose the patient.*
 - *Police use computer software that can recognize the face of criminal with the stored portrait made by forensic artist.*



Applications of AI

AI has been dominant in various fields such as –

- **Expert Systems** – There are some applications which integrate machine, software, and special information to impart reasoning and advising. They provide explanation and advice to the users.
 - *An Expert System is a computer program designed to act as an expert in a particular domain (area of expertise).*
 - *Expert systems currently are designed to assist experts, not to replace them, They have been used in medical diagnosis, chemical analysis, geological explorations etc.*
 - *Nasa K10 rover expert system robot.*

• **Speech Recognition** – Some intelligent systems are capable of hearing and comprehending the language in terms of sentences and their meanings while a human talks to it. It can handle different accents, slang words, noise in the background, change in human's noise due to cold, etc.

- *It simplifies the process of interactive communication between people and computers, thus it advances the goal of NLP. Siri, on iOS using speech recognition.*



Applications of AI

- **Handwriting Recognition** – The handwriting recognition software reads the text written on paper by a pen or on screen by a stylus. It can recognize the shapes of the letters and convert it into editable text.
- **Intelligent Robots** – Robots are able to perform the tasks given by a human. They have sensors to detect physical data from the real world such as light, heat, temperature, movement, sound, bump, and pressure. They have efficient processors, multiple sensors and huge memory, to exhibit intelligence. In addition, they are capable of learning from their mistakes and they can adapt to the new environment.
 - *A Robot is a electro-mechanical device that can by programmed to perform manual tasks or a reprogrammable multi functional manipulator designed to move materials, parts, tools, or specialized devices through variable programmed motions for performance of variety of tasks. An ‘intelligent’ robot includes some kind of sensory apparatus that allows it to respond to change in it’s environment. A Honda robot.*



Speech and Voice Recognition

Working of Speech and Voice Recognition Systems

The user input spoken at a microphone goes to sound card of the system. The converter turns the analog signal into equivalent digital signal for the speech processing. The database is used to compare the sound patterns to recognize the words.

Finally, a reverse feedback is given to the database.

This source-language text becomes input to the Translation Engine, which converts it to the target language text. They are supported with interactive GUI, large database of vocabulary, etc

Speech Recognition	Voice Recognition
The speech recognition aims at understanding and comprehending WHAT was spoken.	The objective of voice recognition is to recognize WHO is speaking.
It is used in hand-free computing, map, or menu navigation.	It is used to identify a person by analysing its tone, voice pitch, and accent, etc.
Machine does not need training for Speech Recognition as it is not speaker dependent.	This recognition system needs training as it is person oriented.
Speaker independent Speech Recognition systems are difficult to develop.	Speaker dependent Speech Recognition systems are comparatively easy to develop.

PROS & CONS of AI

PROS	CONS
Precision and Accuracy	Cost incurred in the maintenance and repair
Space exploration	<input type="checkbox"/> Not able to act any different
Used for mining process	<input type="checkbox"/> Lack the human touch
Can do laborious tasks	Lack a creative mind
Fraud detection, manage records	<input type="checkbox"/> Lack common sense
Lacking the emotional side	<input type="checkbox"/> Unemployment
Can do repetitive and time-consuming tasks	<input type="checkbox"/> Abilities of humans may diminish
Robotic pets, Robotic radiosurgery	<input type="checkbox"/> Robots superseding humans
Function without stopping, Risk Reducing Diagnosis and Treatment	<input type="checkbox"/> Humans may became dependent on machines <input type="checkbox"/> Wrong hands causes destruction

Future of AI

The future is really UNKNOWN.

But we can imagine two different kind of future of A.I.

1) Positive

- *Positive imagination of Future Maybe, the day is not far when we will just sit back in our cozy little beds and just command our personal Robot's to entirely do our ruts . He will be a perfect companion for us. Just enjoy the Technology. A 'gardener' theme robot.*

2) Negative

- *Negative imagination of Future It may end in other way too. Some day there will be a knock at our door. As we open it, we'll see a large number of Robots marching into our house destroying everything we own and looting you. This is because ever since there is an advantage in the Technology, it attracts anti- social elements. This is true for Robots too. Because now they will have full power to think as human, even as of anti-social elements. So we should think trice before giving them power of Cognition.*
 - *An imaginary soldier robot.*



Assignment 1

What is Artificial Intelligence in terms of the following?

1. Scientific Approach
2. Engineering Approach

How can Artificial Intelligence be used in the current state of affairs in terms of the following?

1. Education
2. Healthcare
3. Finance
4. Aviation
5. Heavy Industry

