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Introduction to Artificial Intelligence

Highlights on AI

Concept, Logic, Methodology

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Introduction to Artificial Intelligence

Table of contents

- Prerequisites for AI ?
- Purpose of this Course.
- What is AI?
- Types of AI.
- Some trending Apps.
- Not Getting Confused? Simulations.

Prerequisites for Artificial Intelligence :

- Math (Calculus, Statistics and probability).
- Data analytics skills, discrete mathematics.
- Understanding and writing algorithms (Logic).
- Programming (Concept), language such as C, C++, C#, Java, Python)

References:

- A modern Approach
- Planning and Acting
- Logic Programming and Prolog

Purpose of this Course:

- To teach you the basics of AI. (Concept)
- To prepare you for later AI Courses (More Advanced) as:

a) Intermediate level (More Logic, programming, techniques, Mechanisms).

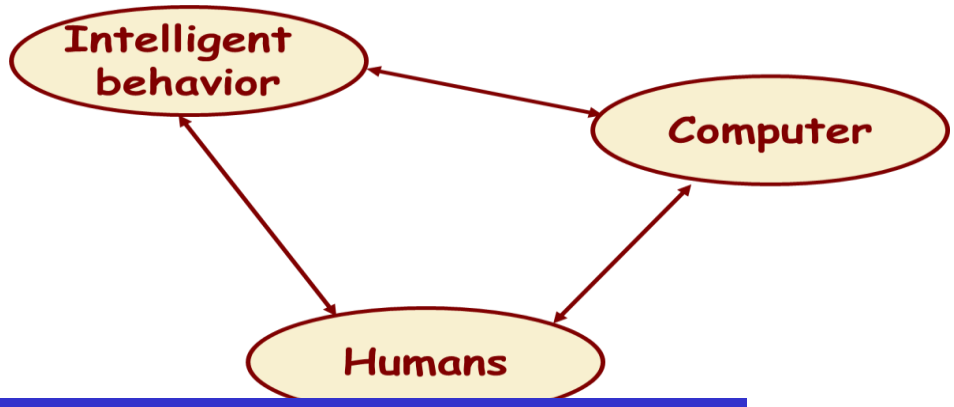
b) Advanced Level (Planning, Machine language, Expert systems)

- To excite you by introducing:

a) Simulations.

b) Source code and programs

c) AI Applications



Artificial intelligence or AI is a field that has long history

This field is constantly and actively growing and changing

In movies, robots are able to talk, think, have emotions, and make decisions just like humans.

According to the father of Artificial Intelligence John McCarthy, it is "The science and engineering of making intelligent machines, especially intelligent computer programs".

Definition:

- AI definition differ based on researchers, engineers or developers
- Support, implement and demonstrate intelligence to devices-machines.
- To perform sets of tasks intelligently - No relying on explicitly instruction.
- AI continue to be very popular, either autonomous car or Humanoid.
- Devices are capable of thinking and acting rationally and humanely.
- Views of AI fall into four categories:

Thinking humanly	Thinking rationally
Acting humanly	Acting rationally

Definition:

Every aspect-features of AI (Learning, Planning, Reasoning, Acting) can in principle be so precisely described to simulate it in a machine”

- Thinking humanly :

learning, reasoning, memory, emulate human processes, influence on models.

- Thinking rationally :

Logic as basis for programming .

- Acting humanly :

Intelligence/thinking plus the ‘hard’ peripherals: perception, language, motion.

- Acting rationally

set goals, perceive environment, communicate with other agents, plan, act.

AI prehistory:

Philosophy	Logic, methods of reasoning, mind as physical system foundations of learning, language, rationality
Mathematics	Formal representation and proof algorithms, computation, (un)decidability, (in)tractability, probability
Economics	Utility, decision theory
Neuroscience	Physical substrate for mental activity
Psychology	Phenomena of perception and motor control, experimental techniques
Computer engineering	Building fast computers
Control theory	Design systems maximize an objective function over time
Linguistics	knowledge representation, grammar

History of AI:

60's	The name "Artificial Intelligence" is coined (John McCarthy).
70's	Search and games, formal logic and theorem proving.
80's	Robotics, perception, knowledge representation, expert systems.
90's	More expert systems, AI becomes an industry.
20's	Rational agents, probabilistic reasoning, machine learning.
00's	Systems integrating many AI methods.

Achievements of AI:

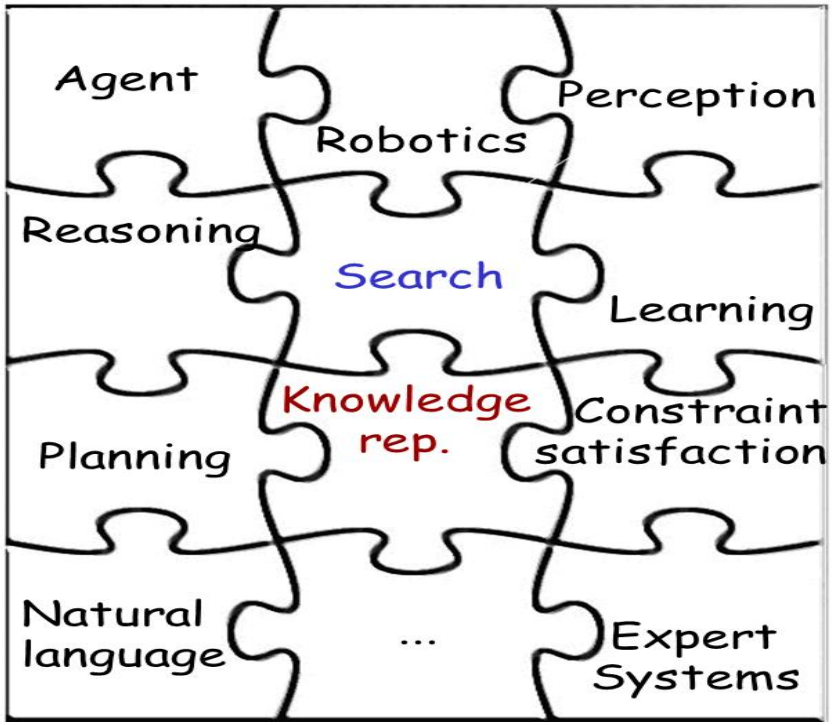
- AI techniques are used in many systems and applications: video games, route & logistics planning, medical diagnosis, hardware & software, speech recognition, road traffic monitoring, facial recognition, medical image analysis, etc...
- Computers have won over world champions in several games, including Checkers, Othello, and Chess.
- Some industries (automobile, electronics) are highly robotized, while other robots perform brain and heart surgery, are rolling on Mars, fly autonomously.

AI in Computer Science:

- AI-specific representations and algorithms: search algorithms, formal logic, machine learning, planning, etc...
- AI ways of analyzing these representations and algorithms
- Relations with other areas: automatic control, operational research, game theory

Main Areas of AI :

- Search, especially heuristic search (puzzles, games).
- Knowledge representation (including formal logic).
- Planning & Learning.
- Reasoning with uncertainty, including probabilistic reasoning.
- Agent architectures.
- Robotics and perception
- Natural language processing.



Types of Artificial intelligence?

- Artificial Narrow Intelligence (ANI): Solving a single problem, accomplishing a single task.
- Artificial General Intelligence (AGI): These proposed systems are still theoretical, such a way have more cognitive than the human being.
- Artificial Super Intelligence (ASI): Some concept of the AGI have been implemented and tested to achieve some level of human cognitivism. These systems are inheriting a decision making processes, and taking rational decisions.

Other Classification of Artificial intelligence?

- Weak AI: limited range, achieve specific task, can used supervised and unsupervised learning mechanism to process and analyze data.
- Strong AI: A vaster range, some human-level intelligence, Reinforcement learning.

Some trending Apps using AI

- AI used by several companies to design several efficient system, automate complex tasks, make business prediction.

- Historical data has been analyzed and used by Google's search, Netflix, Facebook.

- Three trending's applications relied on AI are competed to give assistant and fun to their clients. Google, Amazon, and Apple companies (Alexa vs. Google Assistant vs. Siri).

- Google Assistant developed by C++, Alexa developed by Node.js, and Python, Siri developed somehow by java through a framework (CALO) designed especially for Siri app.

- Online shopping (Giving recommendation to users), Digital personal assistants - Smartphones (Answering questions, organizing daily routine tasks), Machine translations, Cybersecurity, Business (optimizing data processing), Industries, Healthcare, E-commerce, Human Resources, Robotics.

Not Getting Confused?

- AI is relying on algorithms to process data, solve problems, and generate outputs.
- Solving problems – Using several search algorithms.
- KB – Prolog – expert system.
- Planning – sequential, temporal, contingent, probabilistic plans.
- Deep learning is a subset of Machine learning that is also a subset of AI.
- Machine learning is the ability to learn from experience, rather than just instructions. Thus, algorithms automatically learn and improve from their output as a case of reverse-engineer.
- Neural network simulates the functionality of the human brain, relies on several algorithms, specify the relationships and the patterns in the available information.
- Deep Learning used several machine language algorithm but it also relies on artificial neural networks hoping to make learning algorithms efficient and simpler to use. With Deep learning mechanism the input cab be image, text, or sound.

Not Getting Confused?

- Natural Language Processing is the ability of a machine to understand languages. NLP uses several machine language techniques and algorithms.

- Computer vision is the ability of machine to see and understand the digital images and videos. Computer vision uses several machine language techniques, and the most effective mechanism is to use the Deep Learning.

- Robotics field can use NLP (social interaction), Computer Vision (mapping, detection, grasping), Planning (either independent approach such as high-level plans or dependent approach as A* algorithm to navigate through waypoints), KB (inference and reasoning).

- Keep in mind that several AI algorithms and techniques can be implemented and used together to achieve only a single task.

- On the other hand, to illustrate the concept, you should know about several approaches and mechanisms to know well how any single AI system can be designed, developed, or even worked.

Simulations

- Checking Several Applications designed to solve path problem and 8 queens game (search in the state space vs local search). These applications designed based on BFS, DFS, A*, min-conflicts algorithms. These designed applications are written in C# and Vb.net using Visual studio 2015.
- Prolog – FOL , Expert system, how to use inference mechanism to ask for information that lead to a proper decision or reason
- Planning systems, how to use PDDL to seek for a proper plan to achieve a complex task.
- Robotics system, ROS and Turtlebot 3 simulators to check how robot relies on several multi-agent system to achieve some task.
- Linear regression and classification methods towards supervised learning mechanisms.

Advantages

- Reduction in human errors.
- Takes risk instead of humans.
- Availability 24/7.
- Routine and repetitive works.
- Faster decisions.

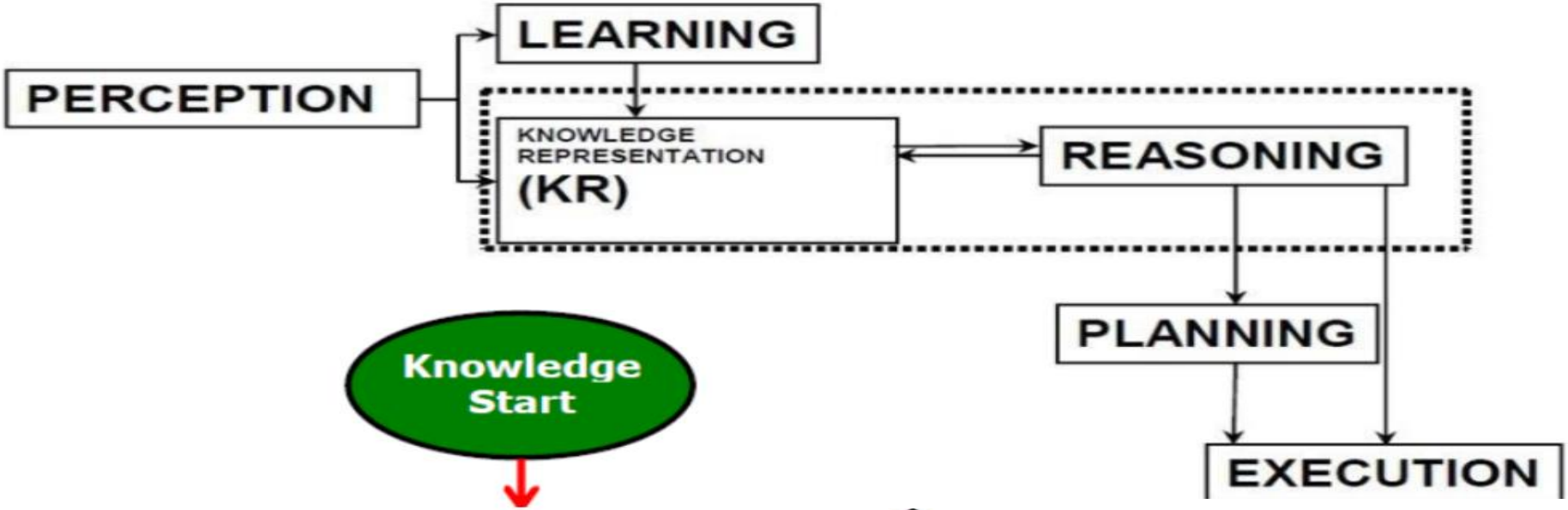
Disadvantages

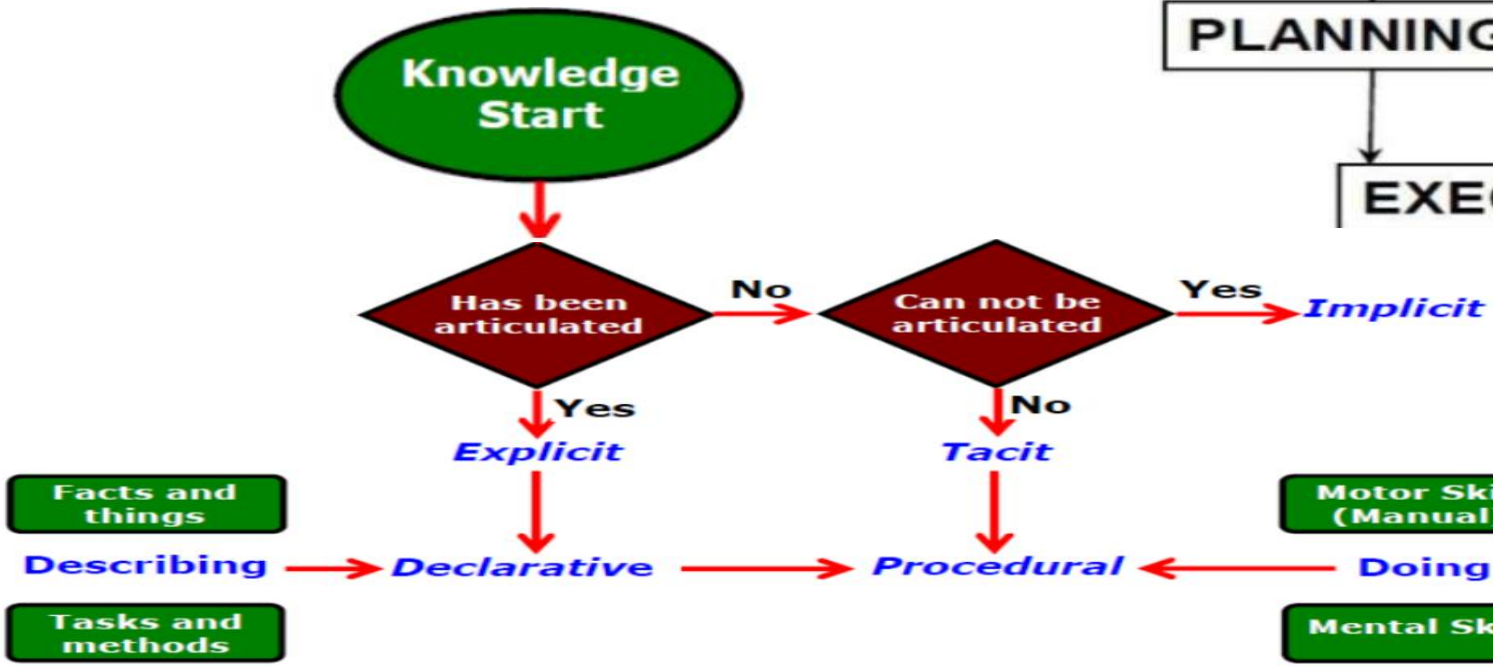
- High cost of creation.
- Making human lazy.
- Unemployment.

- How agent or machine represent knowledge?

- Objects.
- Performance.
- Facts
- Knowledge-base
- Meta-Knowledge

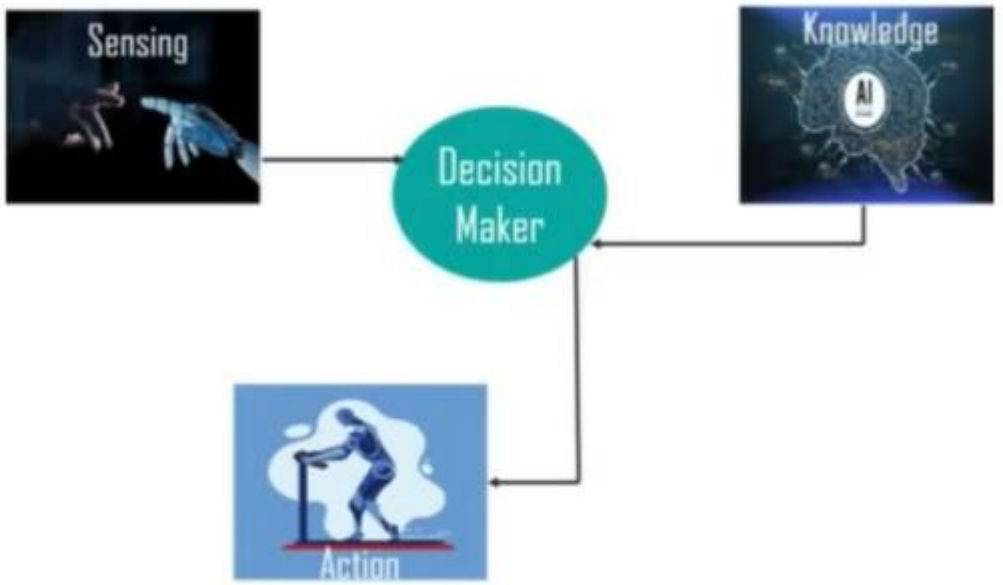
- Knowledge system Components





- Relation between Representations

- Relationship between Knowledge and intelligence?



- Sense - Action
- Sense – Plan - Action
- Sense – Learn - Action

- Techniques used to handle representations?

- Check Simulation folder.

Thank you for your attention!

Questions?