Introduction to Artificial Intelligence (AI)

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Definition AI

- Artificial Intelligence is an attempt to make a computer, a robot, or other piece of technology ‘think’ and process data in the same way as we humans do.
- Artificial Intelligence (AI), sometimes called machine intelligence, is intelligence demonstrated by machines, in contrast to the natural intelligence displayed by humans.
- AI is a branch of science which deals with helping machines finds solutions to complex problems in a more human-like fashion.
- Often used to describe machines (or computers) that mimic "cognitive" functions that humans associate with the human mind, such as "learning" and "problem solving”.
- Artificial Intelligence, the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings.
- AI therefore has to study how the human brain ‘thinks’, learns, and makes decisions when it tries to solve problems or execute a task.
- The aim of AI is to improve technology by adding functionality related to the human acts of reasoning, learning, and problem-solving.
- Example : Home Automation Systems, Cortana is example of a voice controlled intelligent system

Need of AI

- The need for AI is fueled by the fact that it is a technology that can enhance machines by equipping them with intelligence.
- The technology is used to have machines help humans by teaching themselves to adjust, adapt, refer to more data and process that quickly in order to provide a for a better or alternative answer where possible.
- AI is to create technology that allows machines to function in an intelligent manner with or without human supervision

History of AI

- 1941: First electronic Computer
- 1951 : Term Artificial Intelligence introduced
- 1960s: Checkers-playing program that was able to play games with opponents
- 1980s: Quality Control Systems
- 2000 : First sophisticated walking robot
- 1956 - John McCarthy coined the term ‘artificial intelligence’ and had the first AI conference.
- 1969 - Shakey was the first general-purpose mobile robot built. It is now able to do things with a purpose vs. just a list of instructions.
- 1997 - Supercomputer ‘Deep Blue’ was designed, and it defeated the world champion chess player in a match. It was a massive milestone by IBM to create this large computer.
- 2002 - The first commercially successful robotic vacuum cleaner was created.
- 2005 - 2019 - Today, we have speech recognition, robotic process automation (RPA), a dancing robot, smart homes, and other innovations make their debut.
- 2020 - Baidu releases the LinearFold AI algorithm to medical and scientific and medical teams developing a vaccine during the early stages of the SARS-CoV-2 (COVID-19) pandemic. The algorithm can predict the RNA sequence of the virus in only 27 seconds, which is 120 times faster than other methods.

AI Understanding

- Help machines find solutions to complex problems in a similar way that humans do and apply similar logic in the form of heuristic (self-learning) algorithms to calculate and display the required output.
- Intelligence can be loosely defined as the capability to obtain knowledge and skills and to apply those to various situations without supervision.
- **Intelligence is made up of following also known as AI Programming Cognitive Skills**
  - Learning
  - Reasoning
  - Problem Solving
  - Perception
  - Linguistic Intelligence

AI Programming Cognitive Skills or Components of AI

Learning

- Learning for AI includes the trial-and-error method.
- It includes memorizing individual items like different solutions to problems,

Reasoning

- It is to allow the platform to draw inferences that fit with the provided situation

Problem-solving

- AI's problem-solving ability comprises data, where the solution needs to find the features.

Perception

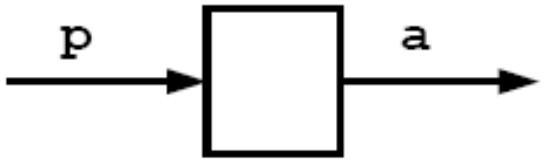
- the element scans any given environment by using different sense-organs, either artificial or real.

Language-understanding

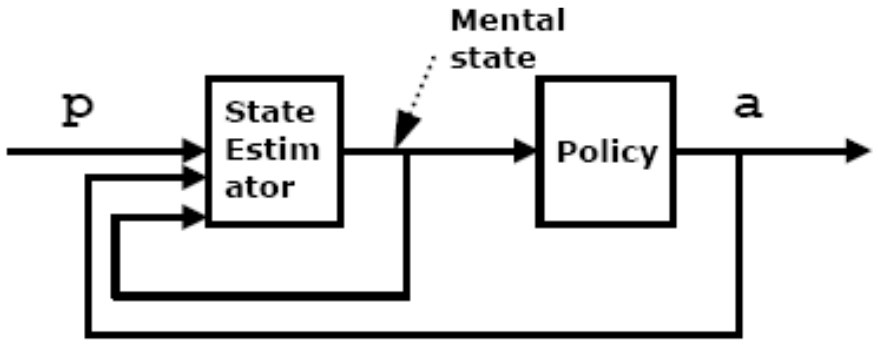
- distinctive types of language over different forms of natural meaning

AI Elements : An Agent

- AI system is composed of two main elements : Agent and Its surrounding Environment
- An agent can be either a human or a machine.
- An agent can be anything that can perceive its environment through sensors and act upon that environment through effectors.
- The intelligence of agents is calculated by their ability to create goals and achieve them.
- Anything' that can gather information about its environment and take action based on that information.



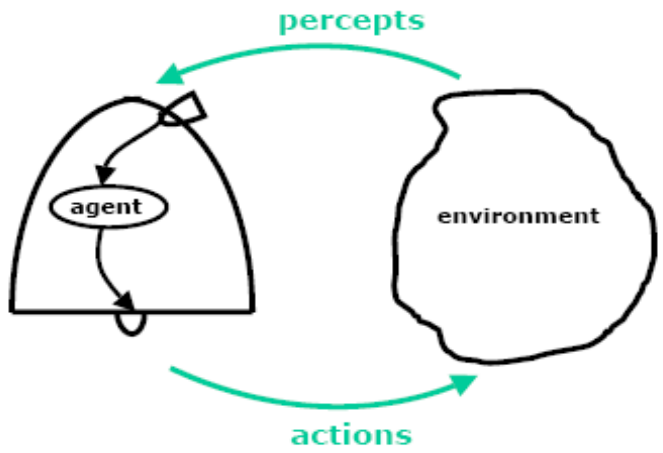
No Memory Agent



Agent with Memory

AI Elements : Environment

- An environment in artificial intelligence is the surrounding of the agent.
- The agent takes input from the environment through sensors and delivers the output to the environment through actuators.
- **There are several types of environments:**
  - Fully Observable vs Partially Observable(eg. chess and driving)
  - Deterministic vs Stochastic (random in nature)
  - Competitive (when agent competes against another agent to optimize the output) vs Collaborative (when multiple agents cooperate to produce the
  - Single-agent vs Multi-agent
  - Dynamic vs Static
  - Discrete vs Continuous



Types of AI

1. Reactive machines/ Purely Reactive
2. Limited memory
3. Theory of mind
4. Self-awareness

Types of AI : Four main types of AI

Reactive machines/ Purely Reactive

- Reactive machines are AI systems that have no memory and are task specific, meaning that an input always delivers the same output.
- These machines do not have any memory or data to work with, specializing in just one field of work. For example, in a chess game, the machine observes the moves and makes the best possible decision to win.
- Eg. Taking customer data, such as purchase or search history, and use it to deliver recommendations to the same customers.
- Eg. Netflix recommendations, beat at chess by IBM's supercomputer

Limited memory

- This algorithm imitates the way our brains' neurons work together, meaning that it gets smarter as it receives more data to train on.
- These machines collect previous data and continue adding it to their memory. They have enough memory or experience to make proper decisions, but memory is minimal. For example, this machine can suggest a restaurant based on the location data that has been gathered.
- They can look into the past and monitor specific objects or situations over time
- Eg. Self driving car

Types of AI : Four main types of AI Cont…

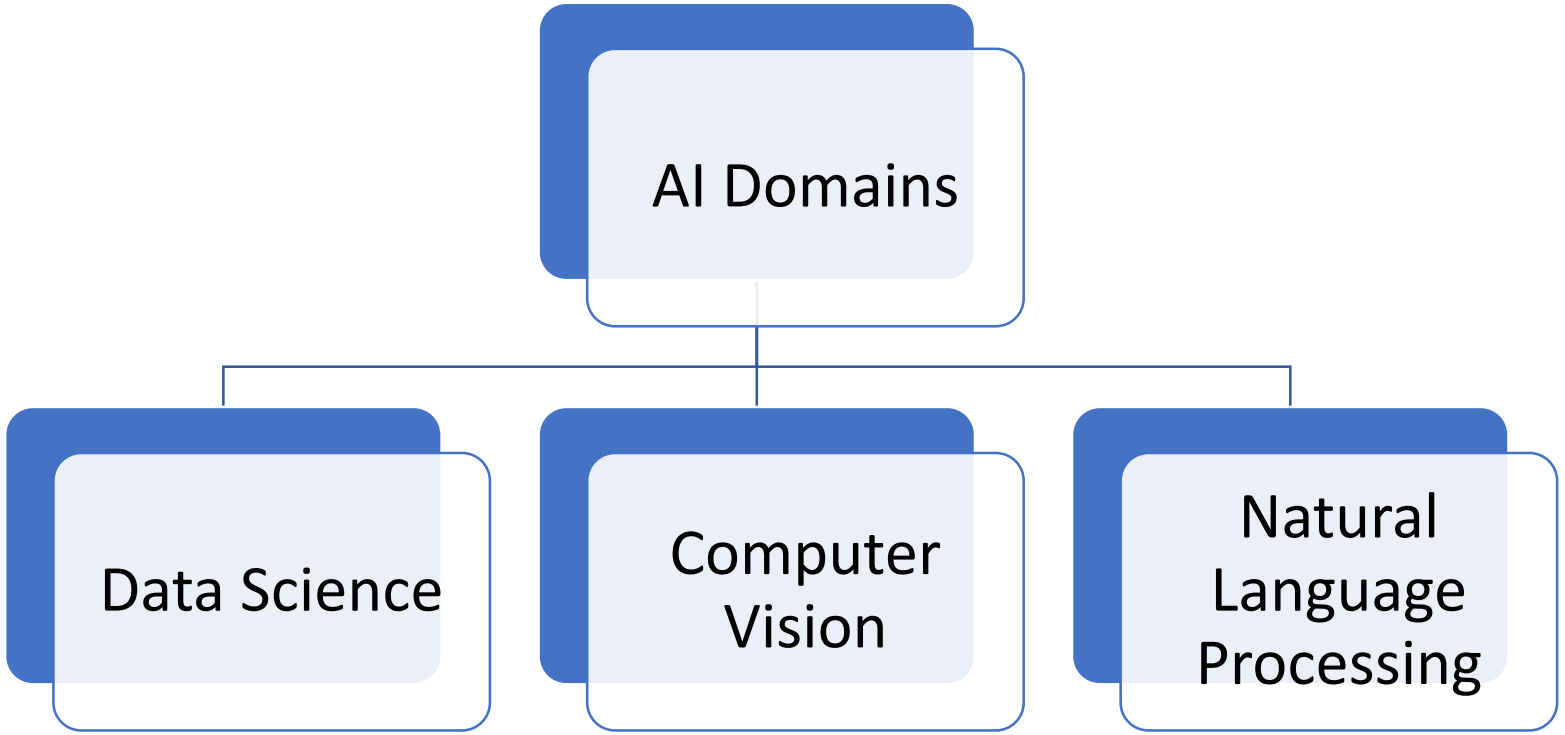
Theory of mind

- Theory of mind and self-awareness are AI types that will be built in the future. As such, there aren't any real world examples yet.
- This kind of AI can understand thoughts and emotions, as well as interact socially. However, a machine based on this type is yet to be built.
- If it is developed, theory of mind AI could have the potential to understand the world and how other entities have thoughts and emotions.
- In the future, theory of mind AI machines could be able to understand intentions and predict behavior, as if to simulate human relationships.

Self-awareness

- The finale for the evolution of AI would be to design systems that have a sense of self, a conscious understanding of their existence. This type of AI does not exist yet.
- Self-aware machines are the future generation of these new technologies. They will be intelligent, sentient, and conscious.
- because there is still so much to uncover about the human brain's intelligence and how memory, learning, and decision-making work.

Main Domains of AI Technology



What is Data Science ?

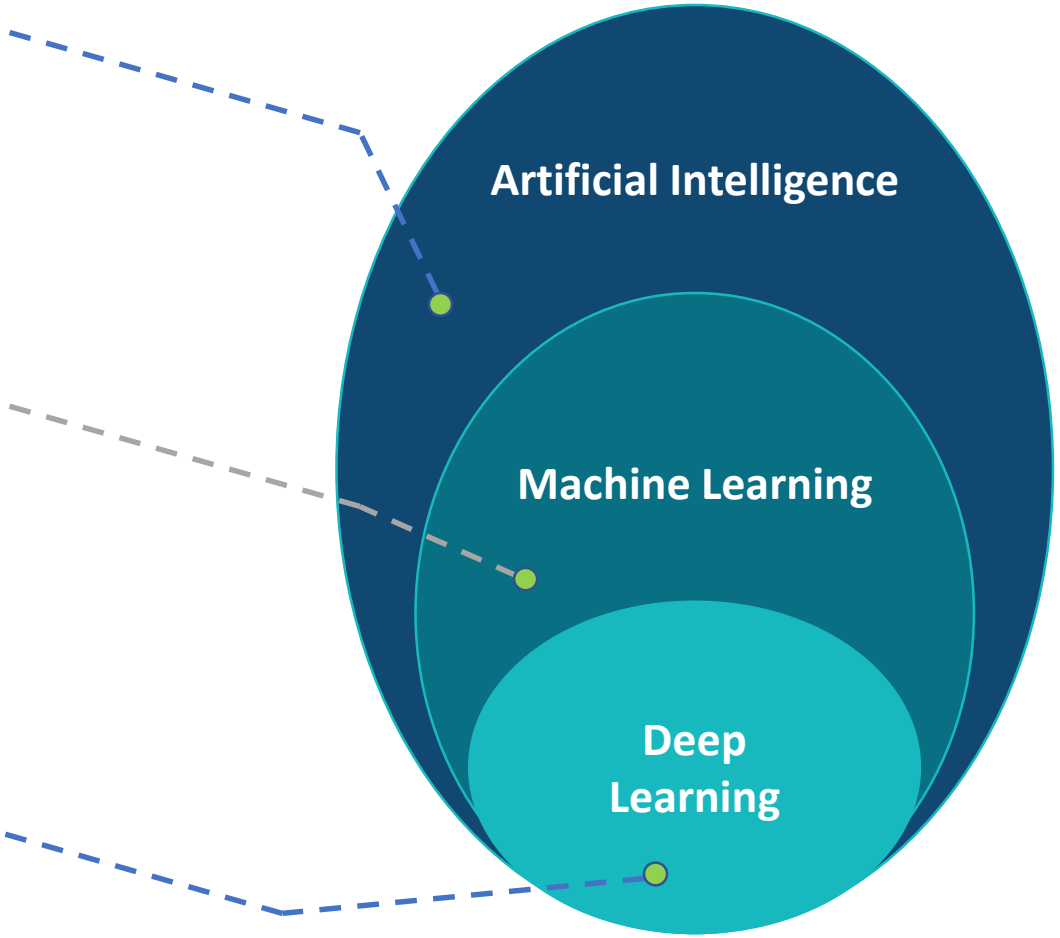
- Data science is an inter-disciplinary field that uses scientific methods, processes, algorithms and systems to extract knowledge and insights from many structural and unstructured data.
- Data science is related to data mining, machine learning and big data
- Data science is a "concept to unify statistics, data analysis and their related methods" in order to "understand and analyze actual phenomena" with data

AI, ML, DL

Artificial Intelligence:
- A technique which enables machine to mimic human behavior

Machine Learning:
- Subset of AI which uses statistical methods to enable machines to improve the experience

Deep Learning:
- Subset of ML which makes the computation of multi-layer neural network feasible



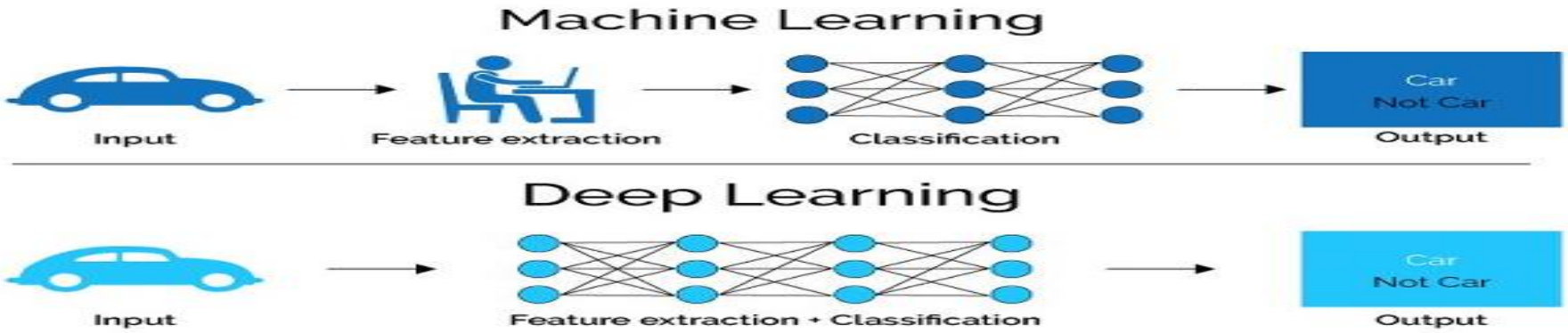
Ways to implement AI

Machine Learning

- It is machine learning that gives AI the ability to learn.
- This is done by using algorithms to discover patterns and generate insights from the data they are exposed to

Deep Learning

- Deep learning, which is a subcategory of machine learning, provides AI with the ability to mimic a human brain's neural network.
- It can make sense of patterns, noise, and sources of confusion in the data.



What is machine learning ?

- A computer program is said to learn from experience E with respect to some task T and some performance measure P, if its performance on T, as measured by P, improves with experience E
  - Tom Mitchell, 1997

- Machine Learning is the field of study that gives computers the ability to learn without being explicitly programmed
  - Arthur Samuel, 1959

- Machine Learning is the science (and art) of programming computers so they can learn from data

Examples of ML Applications

- Analyzing images of products on a production line to automatically classify them
  - This is image classification, typically performed using convolutional neural networks
- Detecting tumors in brain scans
  - This is semantic segmentation, where each pixel in the image is classified (typically use CNNs)
- Automatically classifying news articles
  - This is natural language processing (NLP), and more specifically text classification
- Automatically flagging offensive comments on discussion forums
  - This is also text classification, using the same NLP tools
- Forecasting your company's revenue next year, based on many performance metrics
  - This is a regression task (i.e., predicting values) that may be tackled using any regression model
- Making your app react to voice commands
  - This is speech recognition, which requires processing audio samples: since they are long and complex sequences, they are typically processed using RNNs, CNNs, or Transformers

Examples of ML Applications

- Detecting credit card fraud
  - This is anomaly detection example
- Segmenting clients based on their purchases so that you can design a different marketing strategy for each segment
  - This is clustering example
- Representing a complex, high-dimensional dataset in a clear and insightful diagram
  - This is data visualization, often involving dimensionality reduction techniques
- Recommending a product that a client may be interested in, based on past purchases
  - This is a recommender system
- Building an intelligent bot for a game
  - This is often tackled using Reinforcement Learning

Thank You

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