

**Computer Science Department
First year of Bachelor's degree**

INTRODUCTION to ARTIFICIAL INTELLIGENCE

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SUMMARY

 Definitions

 Types

 Historical

 Areas of application

INTRODUCTION


- **Intelligence** is often associated with a person's capacity for reasoning and reflection
- It is opposed to **instinct**, which would correspond more to a **reflex** than to an elaborate **thought**
- Since the emergence of **robotics & computer science**, researchers have been trying to inject elements of **human intelligence** into **machines**. Because it is designed and manufactured by humans, this form of intelligence is called **artificial intelligence**

DEFINITION

 Term coined by John McCarthy and Marvin Lee Minsky:

«Construction of computer programs that engage in tasks that are, for the moment, accomplished more satisfactorily by human beings because they require high-level mental processes such as perceptual learning, memory organization, and critical reasoning»

DEFINITION

 «Automation of activities associated with human reasoning, such as decision-making, problem-solving, learning, etc » (Bellman, 1978)

DEFINITION

- Designing systems capable of replicating human behavior in reasoning activities
- Reasoning autonomously and also adapting to changes in the environment

4 TYPES of DEFINITIONS

System that **thinks**
like **humans**

System that **thinks**
rationally

System that **acts**
like **humans**

System that **acts**
rationally

Thinking like humans :

Cognitive approach

- Requiring scientific theories of internal brain activity
- Implementing theories and comparing with humans
- The need to predict and test the behavior of human subjects (**cognitive science**)
- **Cognitive science** combines computer models of AI & experimental techniques from psychology to develop precise and verifiable theories of how the mind works

Thinking Rationally

■ Laws of thought as given by logic (Aristotle, Leibniz, Boole, Frege, etc)

□ Socrates is a man; all men are mortal; therefore Socrates is mortal

■ Formal logic allows us to write statements about objects in the world


■ Direct link between mathematics and philosophy towards modern AI

■ It is difficult to translate knowledge and real-world states into logical equations (uncertainty)

Thinking Rationally

 **Acting according to one's beliefs to achieve goals**

 **Example:** The reflex to blink, to remove one's hand from a hot object

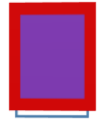
 **An approach based on the concept of an agent**
Rational agent : An agent who acts in such a way as to achieve the best solution or, in an uncertain environment, the best foreseeable solution

Thinking Rationally

Turing test



1950



Inspired by the "imitation game"






A human interrogator conversing with two entities (without seeing them) must determine which is the human and which is the machine. If they make a mistake more often than when trying to distinguish a woman from a man under the same circumstances, then the machine passes the test

Low AI	Strong AI
<ul style="list-style-type: none">■ Programs of this type are not designed to evolve	<ul style="list-style-type: none">■ The approach most similar to human behavior
<ul style="list-style-type: none">■ A program doesn't "think", it executes	<ul style="list-style-type: none">■ Capable of experiencing genuine self-awareness, feeling real emotions & understanding what motivates him to take certain actions
<ul style="list-style-type: none">■ Highly skilled in their field	<ul style="list-style-type: none">■ Requiring know how to learn and modify one's behavior

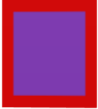
Historical

AI pioneers

(1943-1956)

-  During this period, the first work that can be considered the beginnings of artificial intelligence was carried out
-  One can cite the work of McCulloch and Pitts, who introduced a model of artificial neurons in 1943
-  Turing published his famous paper in which he introduced the Turing test

Historical Birth of AI (1956)

 It was during this year that a small group of computer scientists (Minsky, McCarthy, Shannon, Rochester) interested in the study of intelligence met for a conference on this topic

Historical

Growing hopes

(1952-1969)

- It was a very active period for the fledgling field of AI
- The Logic Theorist (by Newell and Simon) & Geometry Theorem Prover (by Gelernter) programs were able to prove certain mathematical theorems
- Newell and Simon's General Problem Solver, on the other hand, succeeded in solving simple puzzles with reasoning similar to human reasoning
- Research on neural networks was also continued
- Shakey, the first robot capable of reasoning about its own actions

Shakey, first robot

- Established in 1967
- 1 hour of calculation before making a move
- Too much noise



Historical

First Disappointments

(1966-1973)

- Computing power limit
- They do not respect the ladder crossing
- Limit of knowledge
- End of investment
- Lots of criticism

Historical

First Disappointments


(1966-1973)

- The researchers had estimated it would take only 5 years to develop an automatic translator, but quickly realized that their purely syntactic approach was insufficient (to translate a text well, you must first understand it)
- This failure led to the cancellation in 1966 of all US government funding for machine translation projects

Historical

First Disappointments

(1966-1973)

 Minsky and Papert proved in their 1969 book "Perceptrons" that neural networks of the time could not calculate certain very simple functions, which called into question all research in machine learning, leading to a crisis in this branch of AI

Historical Expert Systems (1969-1979)

- The first expert system, called DENDRAL, was created in 1969 for the specialized task of determining the molecular structure of a molecule given its formula and the results of its mass spectrometry
- The MYCIN system, created in 1972, was able to diagnose at a level close to that of human experts and considerably better than that of young doctors

Historical

Feedback Neural Networks

(1986-Now)

- In the mid-1980s, four groups of researchers independently discovered the "back-propagation" learning rule, which enabled the development of neural networks capable of learning very complex functions (curiously, this rule had already been proposed in 1969, but had received no attention in the scientific community)
- Since then, machine learning has become one of the most active areas of AI, and has been successfully applied to many practical problems

Historique

Modern AI

(1987-Now)

- Artificial intelligence has, over time, become an increasingly rigorous and formal scientific discipline
- Since then, machine learning has become one of the most active areas of AI, and has been successfully applied to many practical problems

Application Domains

Knowledge

- Acquisition
- Modeling
- Representation
- Capitalization
- Discovery
- Engineering

Reasoning

- Probabilistic and Uncertain
- Temporal and Spatial
- Model-Based
- By Analogy
- Qualitative
- Inductive

Processing

- Natural Language Processing
- Speech Processing
- Image Processing
- Signal Processing
- Semantic Web Processing
- Oneologies
- Text Mining
- Terminologies

Learning, Processing, and Data Extraction

- Artificial Evolution
- Data Processing
- Computer-Assisted Learning (CAL)

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Multi-Agent Systems

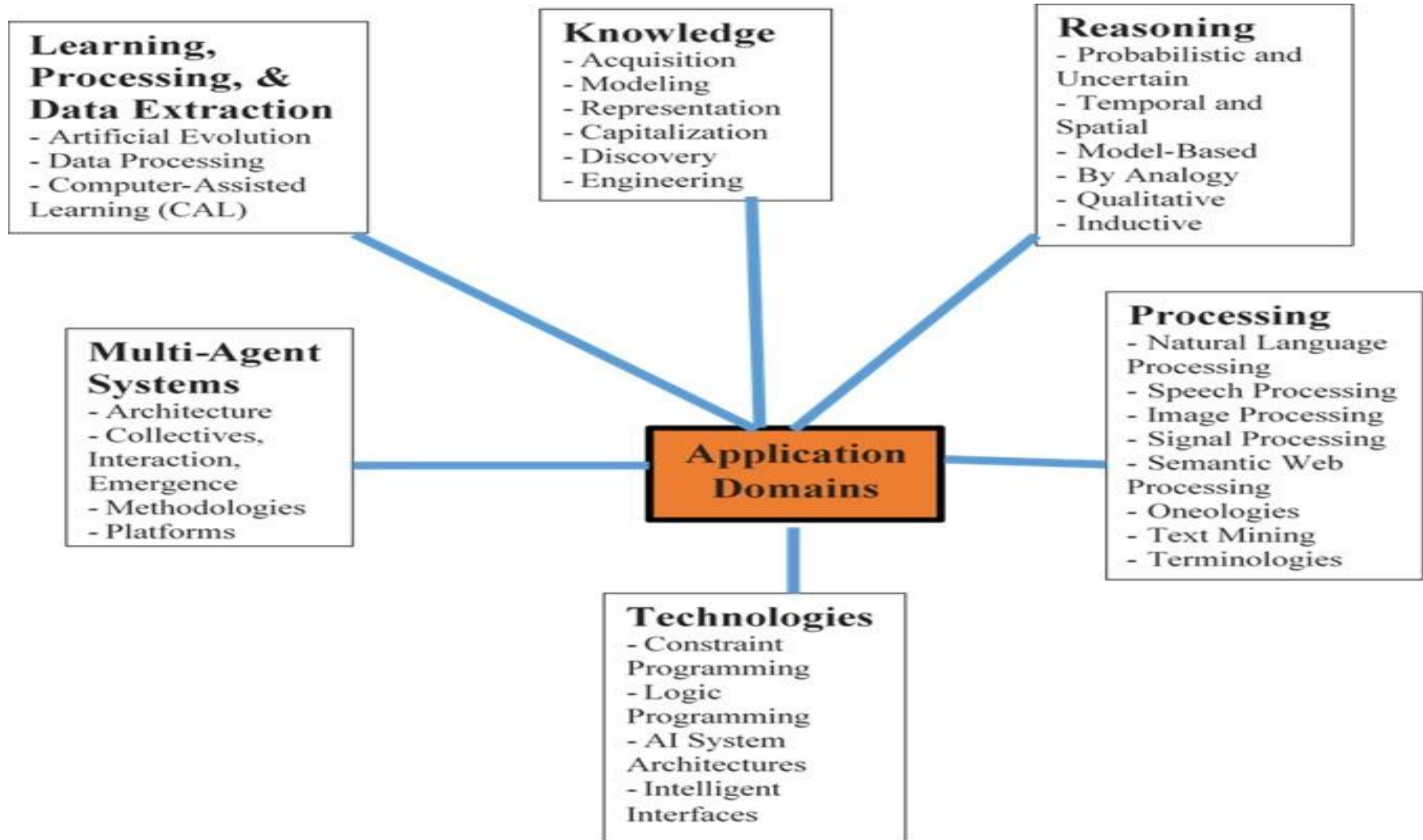
- Architecture
- Collectives, Interaction, Emergence
- Methodologies
- Platforms

Technologies

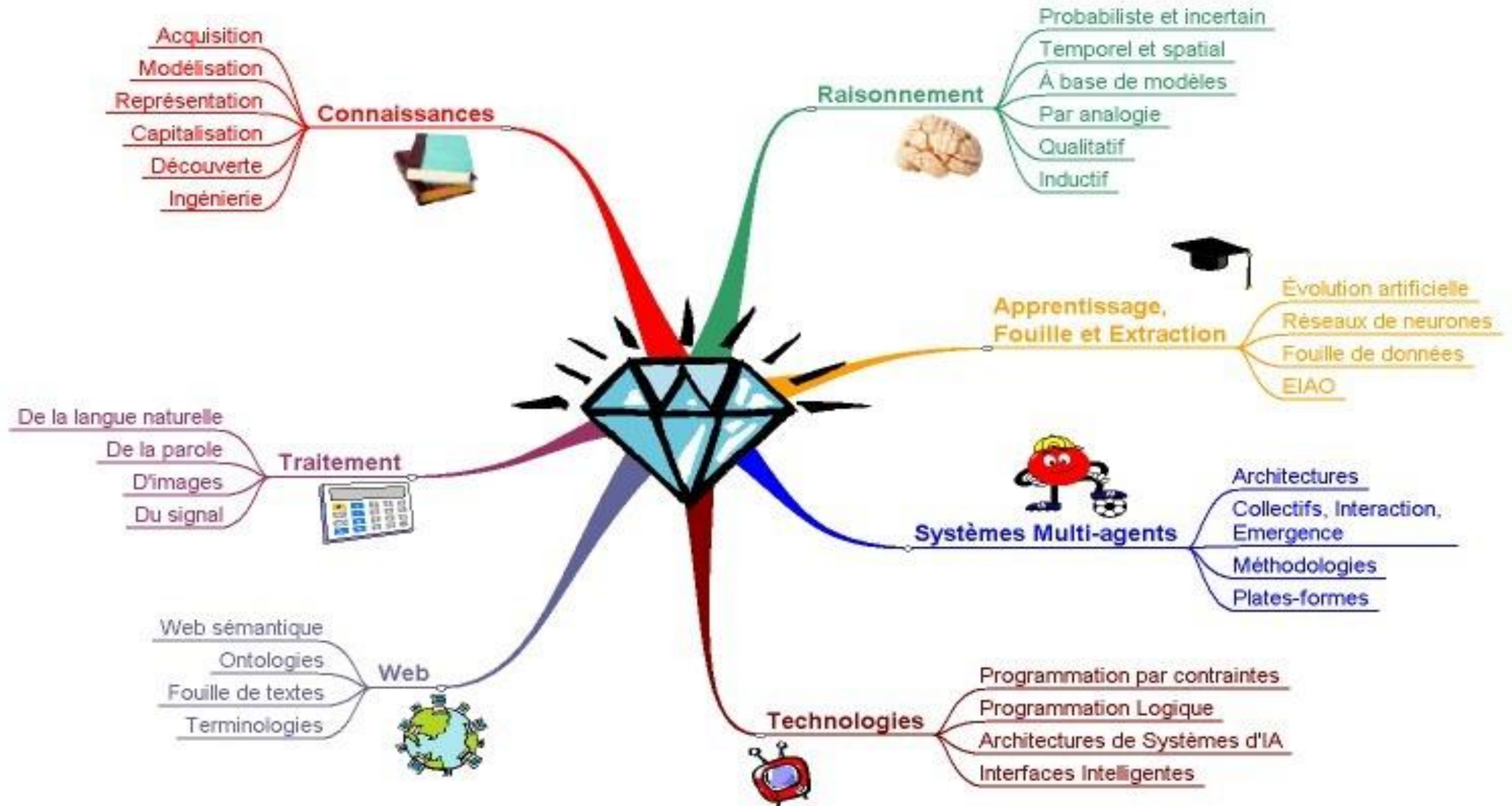
- Constraint Programming
- Logic Programming
- AI System Architectures
- Intelligent Interfaces

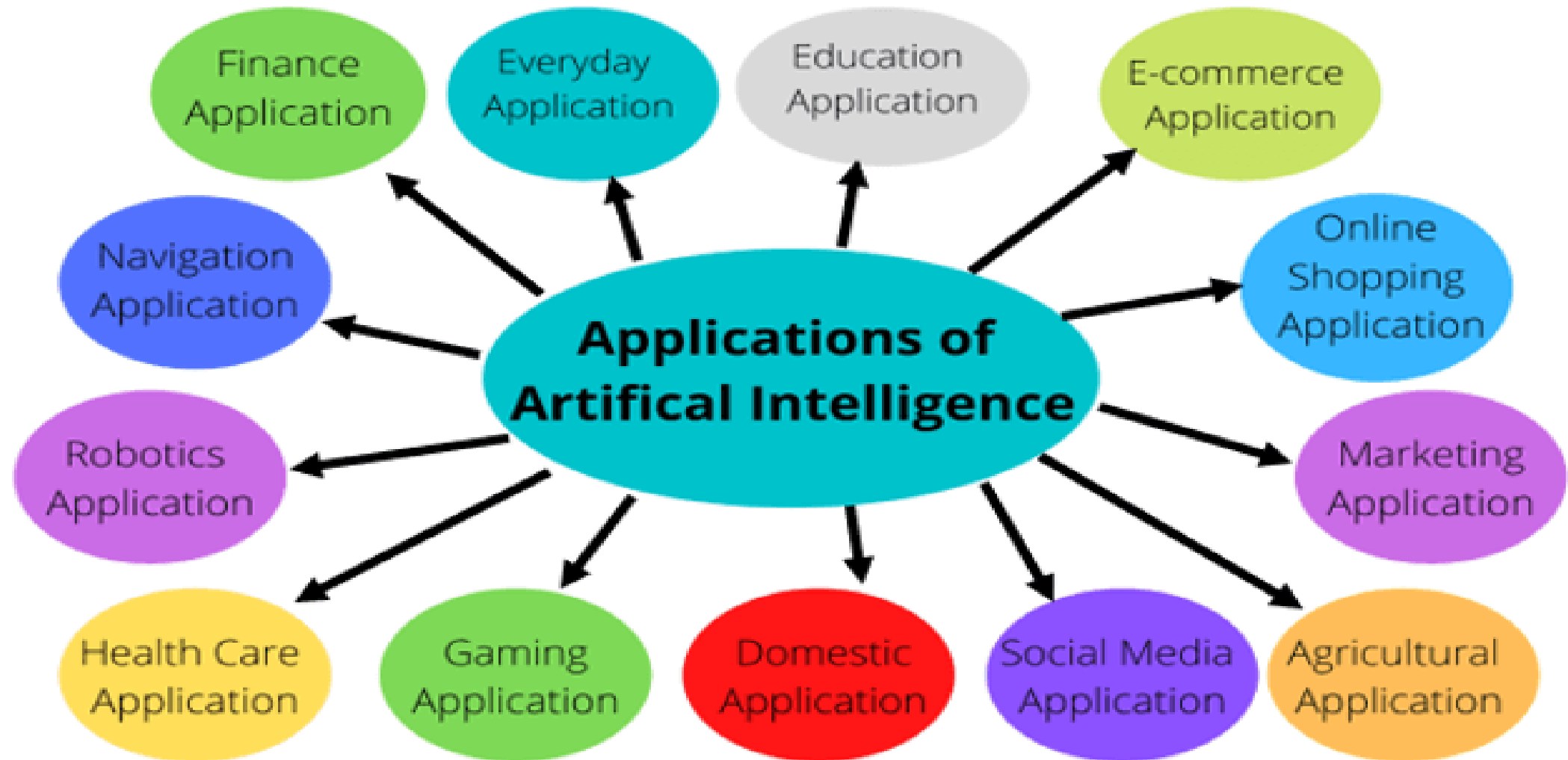
TP Prolog

<https://introai.kesug.com/>



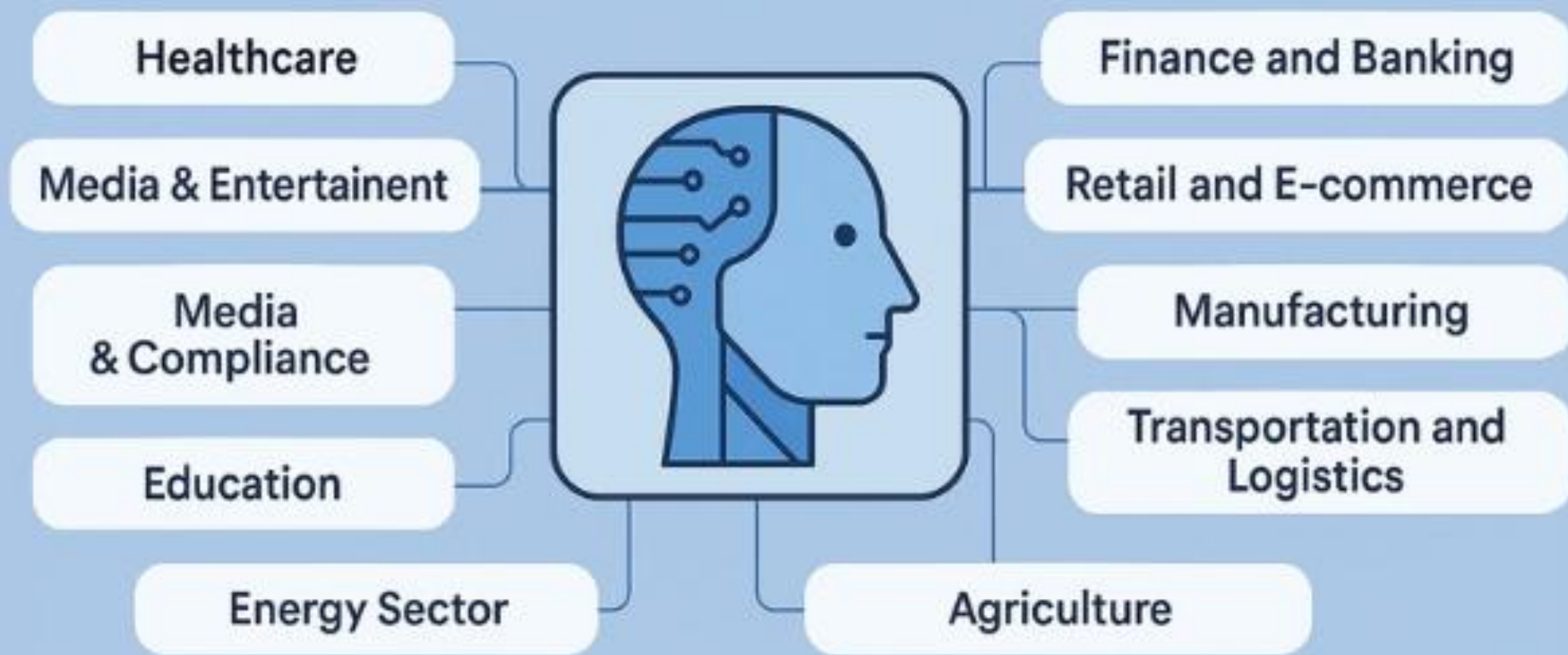
Areas of application





Top 10 AI Applications

Across Major Industries



Applications of AI



Healthcare



Automobile



Finance



Surveillance



Social Media



Entertainment



Education



Space Exploration



Gaming



Robotics



Agriculture



E-commerce

Machine Learning

Le machine learning, basé sur des données, permet des prédictions et des décisions précises grâce à des modèles ajustés automatiquement, contrairement à la programmation traditionnelle. Il existe plusieurs types d'apprentissage au sein du ML : supervisé, non supervisé et renforcé.

Intelligence Robotique

La robotique en IA implique la création de machines autonomes ou semi-autonomes capables de percevoir, décider et agir dans leur environnement. Elle fusionne l'IA, la vision par ordinateur et le contrôle pour concevoir des robots interagissant avec le monde réel.

Vision par ordinateur

La vision par ordinateur est un domaine de l'IA où les machines analysent des images pour prendre des décisions. Elle leur permet de voir et de comprendre les données visuelles en imitant le processus visuel humain. À l'aide de caméras et d'algorithmes, elle peut rapidement détecter des défauts ou des anomalies dans les images.

Deep Learning

Le deep learning utilise des réseaux de neurones pour analyser des données complexes, inspiré du cerveau humain. Il permet de trouver des informations intéressantes mais son processus n'est pas toujours très clair. Il est utilisé dans la vision par ordinateur et le traitement du langage naturel.

Analyse prédictive

Intelligence Artificielle

Reconnaissance d'image

Classification d'images

Détection d'objets/suivi d'objets

Systèmes experts

Les systèmes experts sont des applications d'IA qui imitent le raisonnement d'experts humains dans des domaines spécifiques, utilisant des bases de connaissances pour résoudre des problèmes.

Traitement automatique du langage naturel

Le NLP convertit les données entre le non structuré et le structuré, crucial pour la traduction, les assistants virtuels, l'analyse des sentiments et la détection de spam. Il est une boîte à outils pour résoudre les problèmes liés au langage.

Classification & clustering

Extraction de l'information

Traduction

Assistants virtuels & chatbot









Reconnaissance vocale

La reconnaissance vocale convertit la parole en texte, tandis que la reconnaissance de la parole se concentre sur la traduction de la parole verbale en texte écrit.

Planification/organisation

La planification en IA crée des plans d'action structurés pour atteindre des objectifs. Ces plans guident les agents dans la résolution de problèmes dans un environnement donné. Les défis incluent la formalisation des actions, la prise en compte de l'incertitude et la génération automatique des plans.

Recent or future achievements

-  Robot Cook
-  Go shopping (Amazon Go)
-  Google cars (Established in 2020)
-  Siri (Apple, voice control)
-  Smart Home
-  Games
-  Watson Program
-  Help with medical diagnosis

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