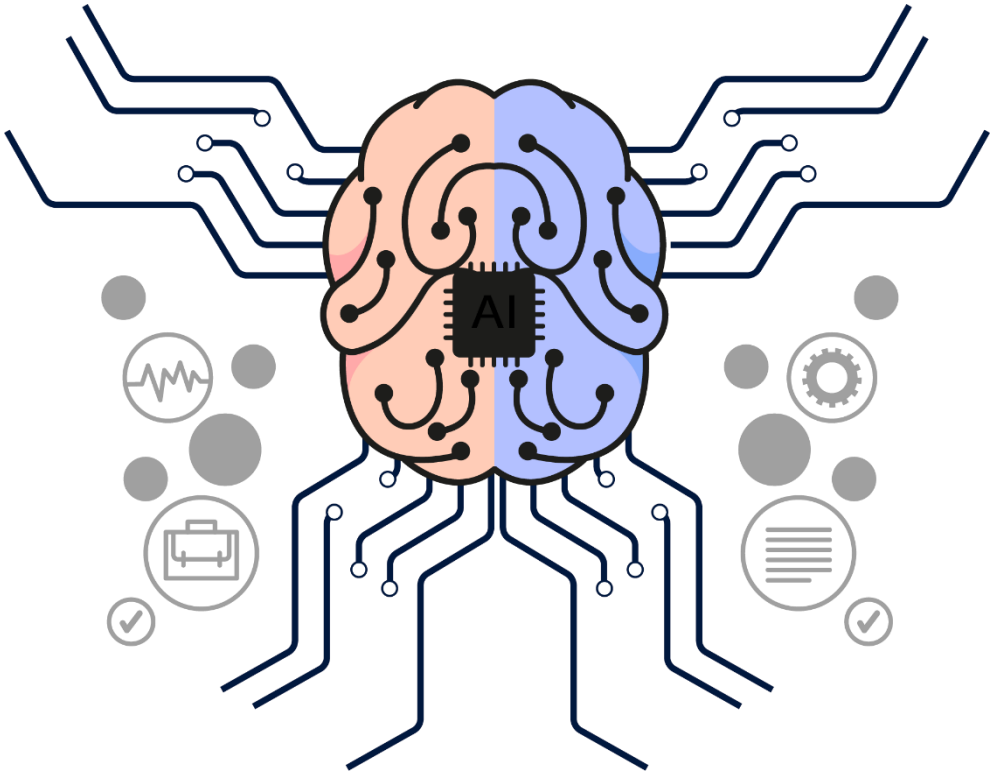
Computer Science and Artificial Intelligence

KHOA CÔNG NGHỆ THÔNG TIN
TRƯỜNG ĐẠI HỌC KHOA HỌC TỰ NHIÊN

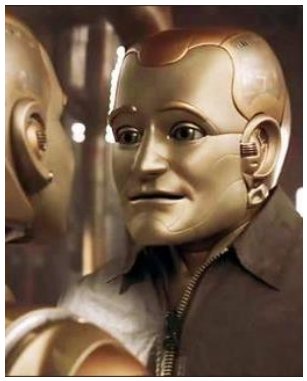
Content

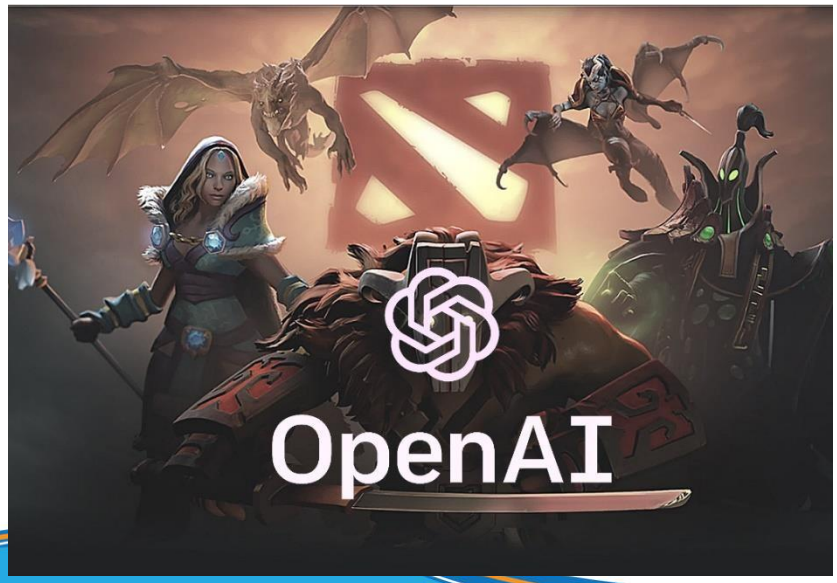
- **What is Artificial Intelligence (AI)?**
- A brief history of AI
- Artificial Neural Networks
- Additional Areas of Research
- Robotics
- Considering the Consequences

What is AI?



AI: a dream for everyone





AI Innovations: Deep Blue – AlphaGo

Deep Blue vs. Kasparov
(1997)

AlphaGo vs. Lee Sedol
(03/2016)

AI innovation: personal robots

https://www.youtube.com/watch?v=VemqlfpctM0

AI Innovations: Humanoid robots

- https://www.youtube.com/watch?v=9DaTZQxg21U

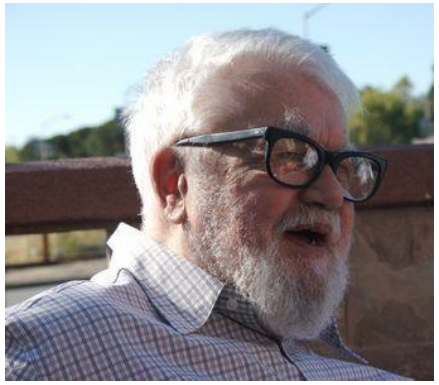
Intelligence vs. Artificial Intelligence

Intelligence includes the capacity for logic, understanding, learning, reasoning, creativity, and problem solving, etc.

Artificial intelligence (AI) attempts not just to **understand** but also to **build intelligent entities**.

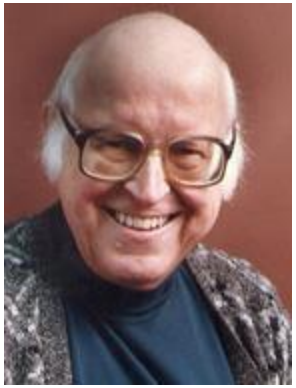
The field of Artificial Intelligence

- AI is one of the newest fields in science and engineering.
  - Work started in earnest soon after World War II
  - The name was coined at a conference at Dartmouth College in 1956.



John McCarthy (1927 – 2011)

Marvin Minsky (1927 – 2016)



Allen Newell (1927 – 1992)

Arthur Samuel (1901 – 1990)

Herbert Simon (1916 – 2001)

The field of Artificial Intelligence

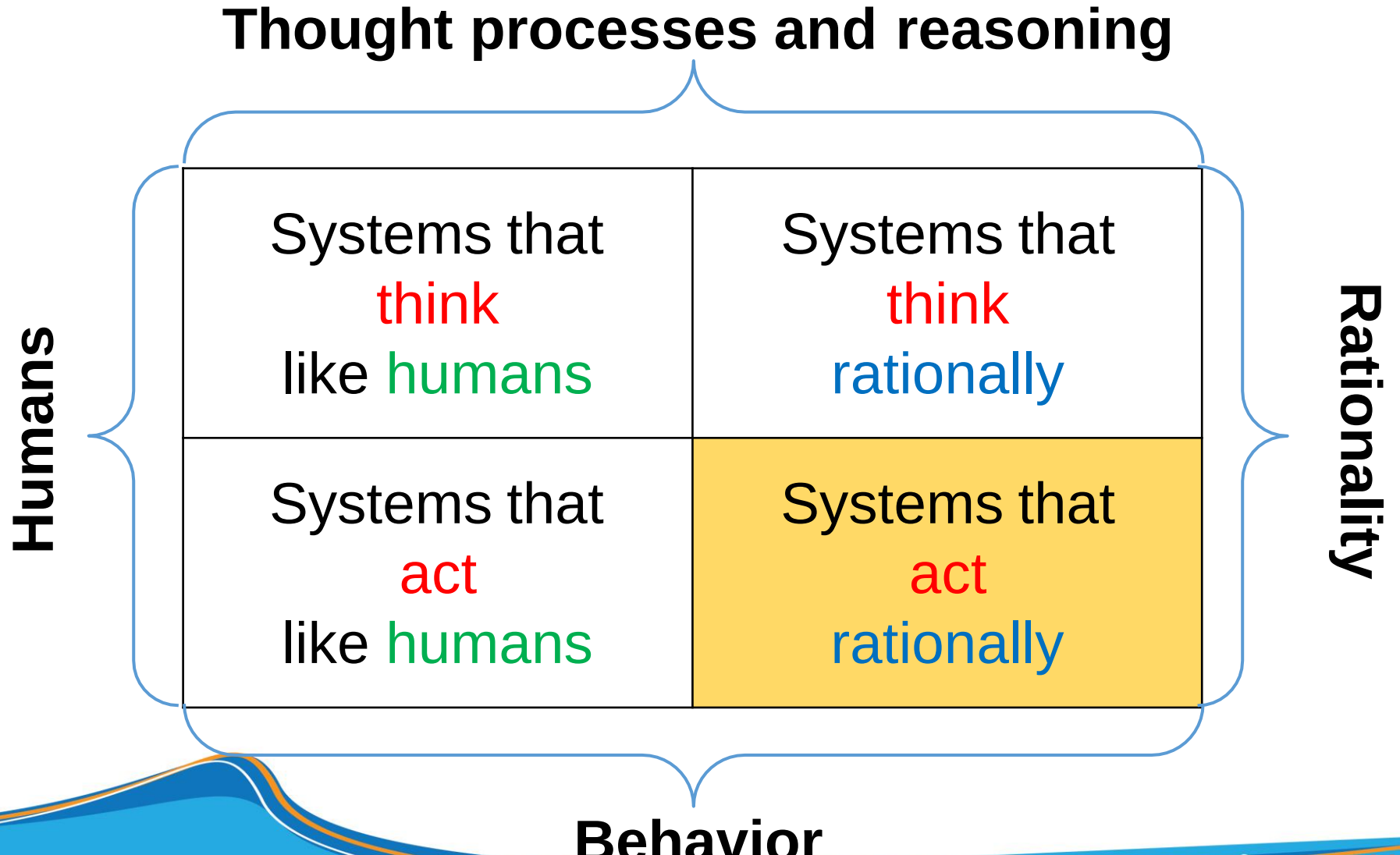
- AI research builds **intelligent entities** that **simulate humans** in different aspects.

- ✓ Thinking: learning, planning, and refining knowledge
- ✓ Perception: see, hear, feel, etc.
- ✓ Communication in natural languages
- ✓ Manipulation and moving objects

What is Artificial Intelligence?

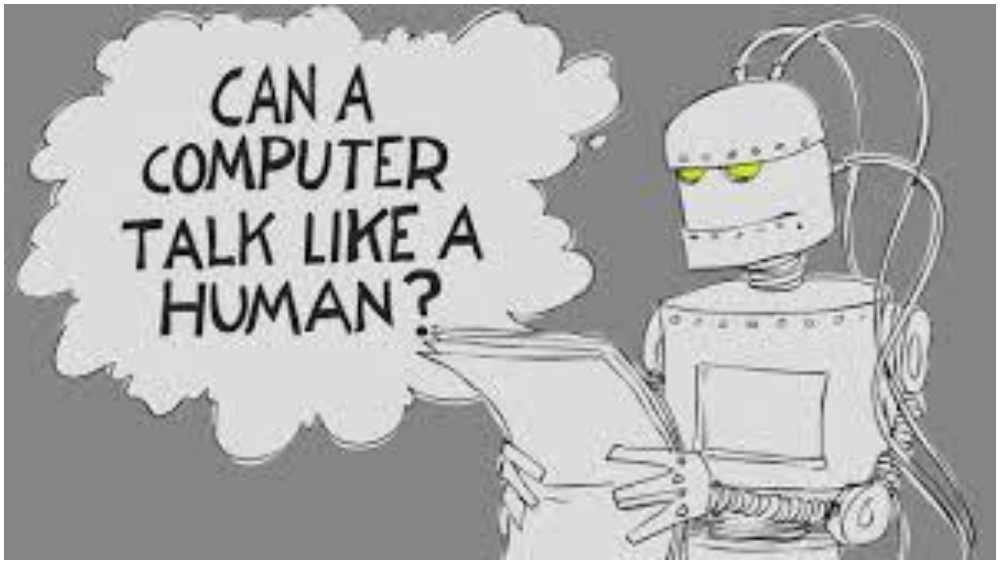
Thinking Humanly	Thinking Rationally
"The exciting new effort to make computers think . . . *machines with minds,* in the full and literal sense." (Haugeland, 1985) "[The automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning .. ." (Hellman, 1978)	"The study of mental faculties through the use of computational models." (Charniak and McDermott, 1985) "The study of the computations that make it possible to perceive, reason, and act." (Winston, 1992)
Acting Humanly	**Acting Rationally**
"The art of creating machines that perform functions that require intelligence when performed by people." (Kurzweil, 1990) "The study of how to make computers do things at which, at the moment, people are better." (Rich and Knight, 1991)	"Computational Intelligence is the study of the design of intelligent agents." (Poole *et at,* 1998) "Al . . . is concerned with intelligent behavior in artifacts." (Nilsson, 1998)

What is Artificial Intelligence?



Turing Test

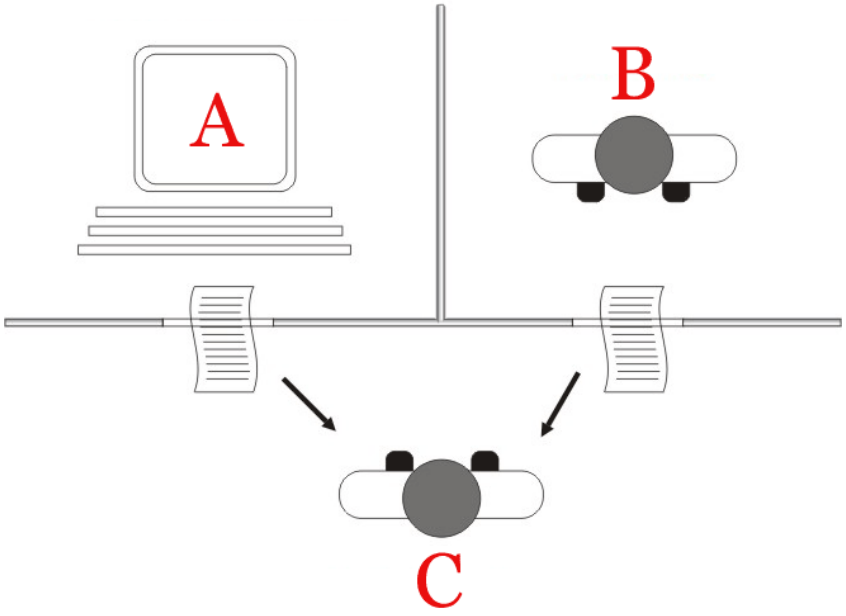
- **Turing test** (proposed by Alan Turing in 1950) has served as a benchmark in measuring progress in the field of artificial intelligence.



https://www.youtube.com/watch?v=3wLqsRLvV-c

Turing Test

- Test setup: Human interrogator communicates with test subject by typewriter.
- Test: Can the human interrogator distinguish whether the test subject is human or machine?



A better Turing Test?

- AI researchers have devoted little effort to pass the test.
- It is more important to study the underlying principles of intelligence than to duplicate an exemplar.

Sheep dog or mop?

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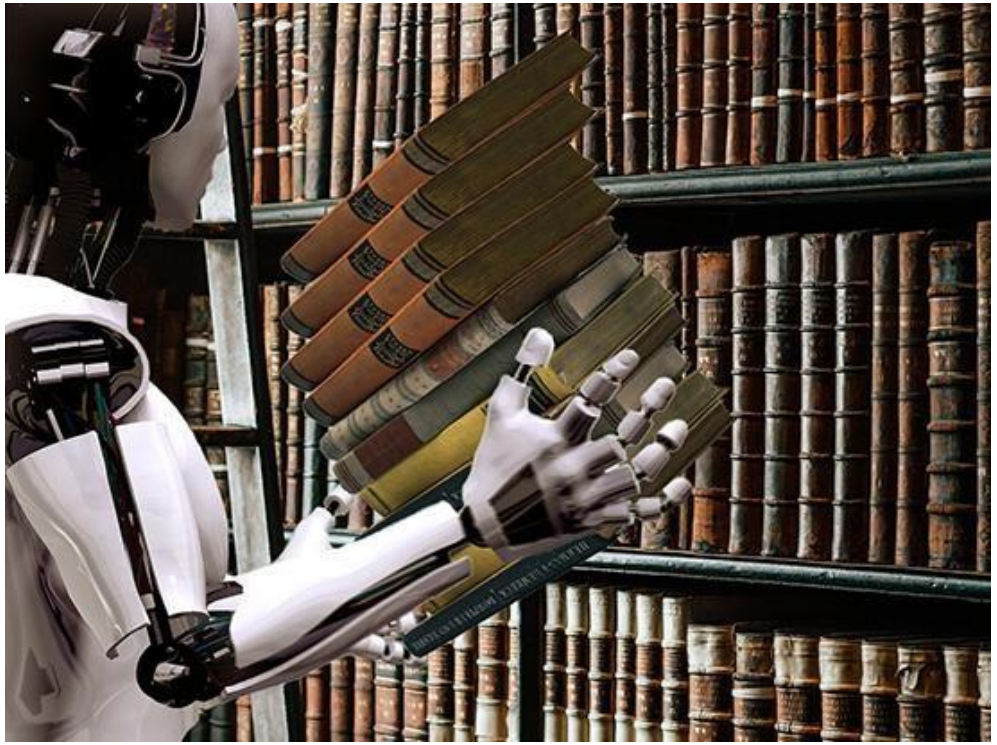
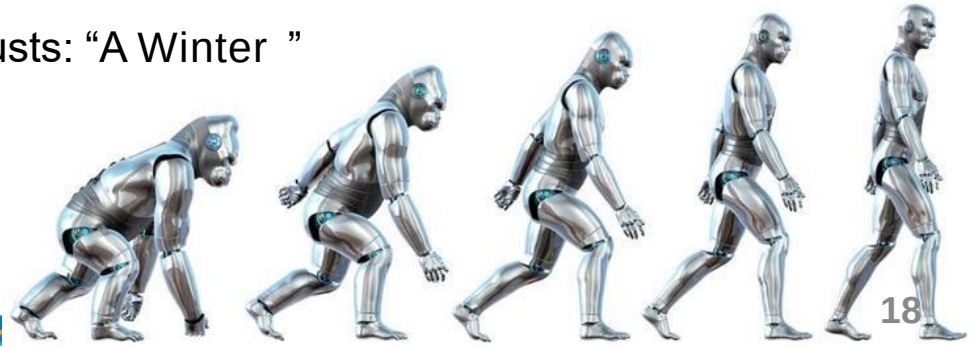
A brief history of AI



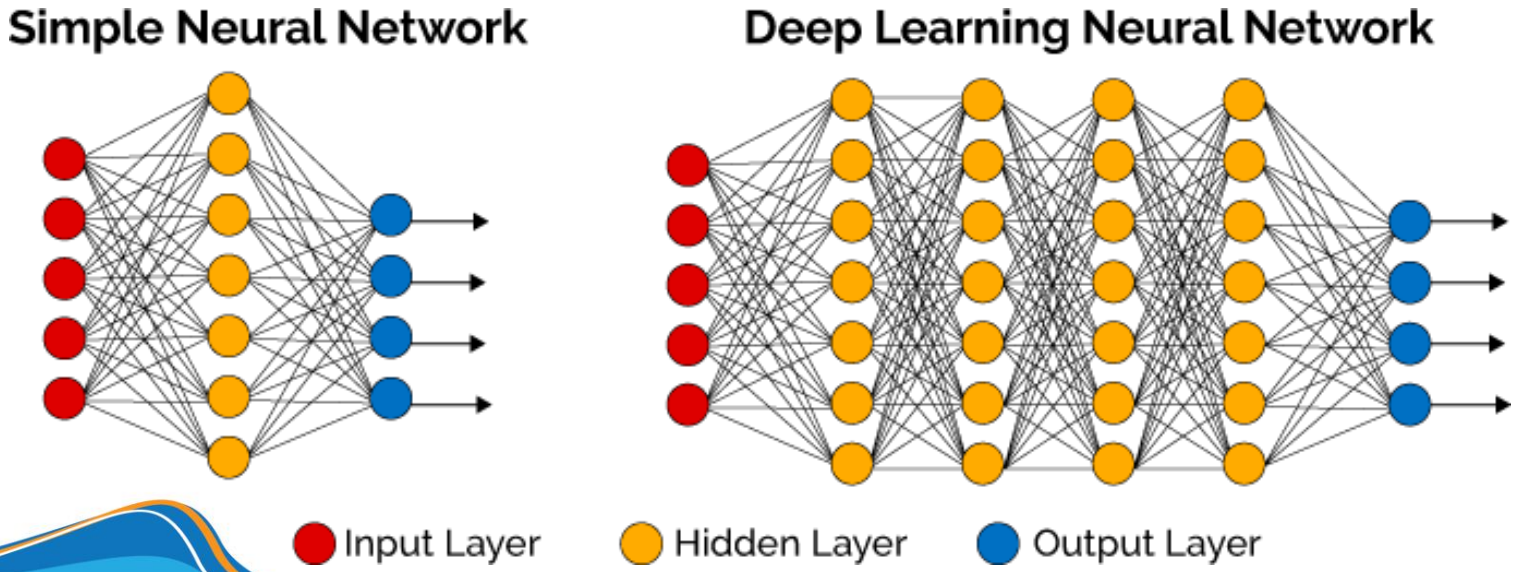
A brief history of AI

- 1940-1950: Early days
  - 1943: McCulloch & Pitts: Boolean circuit model of brain
  - 1950: Turing's "Computing Machinery and Intelligence"
- 1950—70: Excitement: Look, Ma, no hands!
  - 1950s: Early AI programs, including Samuel's checkers program, Newell & Simon's Logic Theorist, Gelernter's Geometry Engine
  - 1956: Dartmouth meeting: "Artificial Intelligence" adopted
  - 1965: Robinson's complete algorithm for logical reasoning
- 1970—90: Knowledge-based approaches
  - 1969—79: Early development of knowledge-based systems
  - 1980—88: Expert systems industry booms
  - 1988—93: Expert systems industry busts: "A Winter "



A brief history of AI

- 1990—: Statistical approaches
  - Resurgence of probability, focus on uncertainty
  - General increase in technical depth
  - Agents and learning systems… “A Spring”?
- 2000—: Where are we now?



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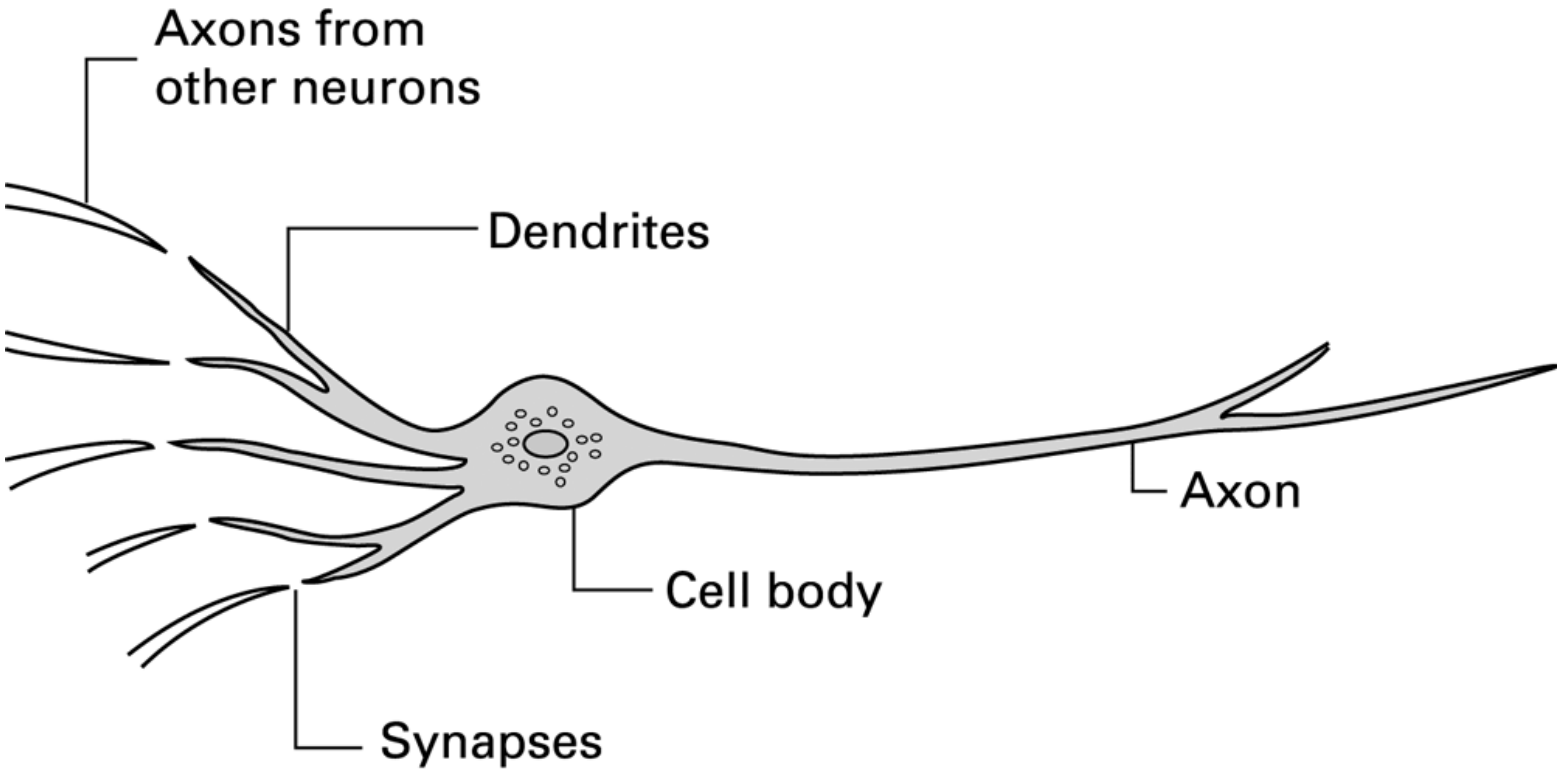
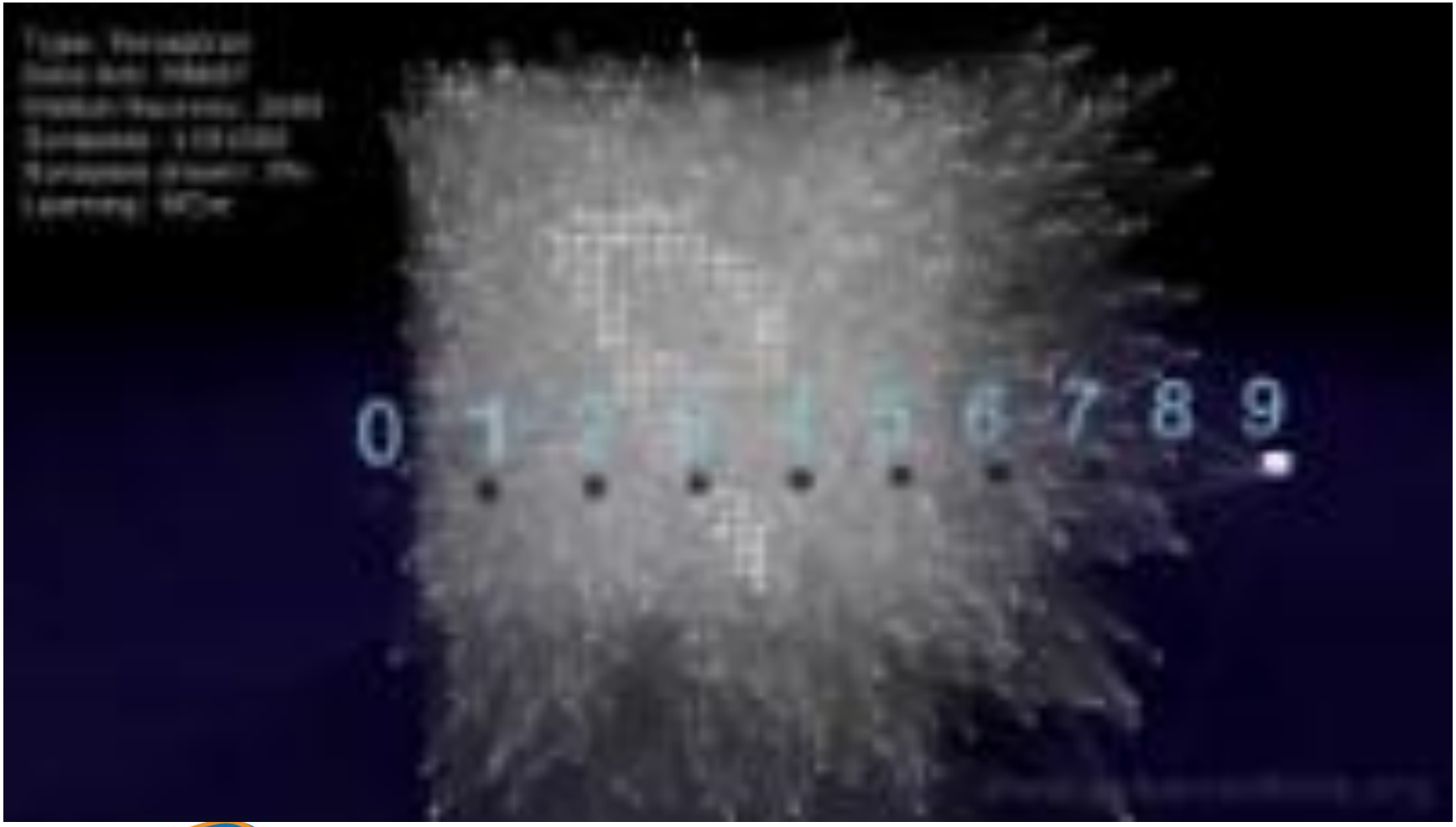
A neuron in a living biological system



Artificial Neural Networks

- Many researchers are turning to approaches that leverage phenomena observed in nature.
  - One such approach is genetic algorithms presented in the previous section.
  - Another approach is the artificial neural network (human mind)

A demo of artificial neural network

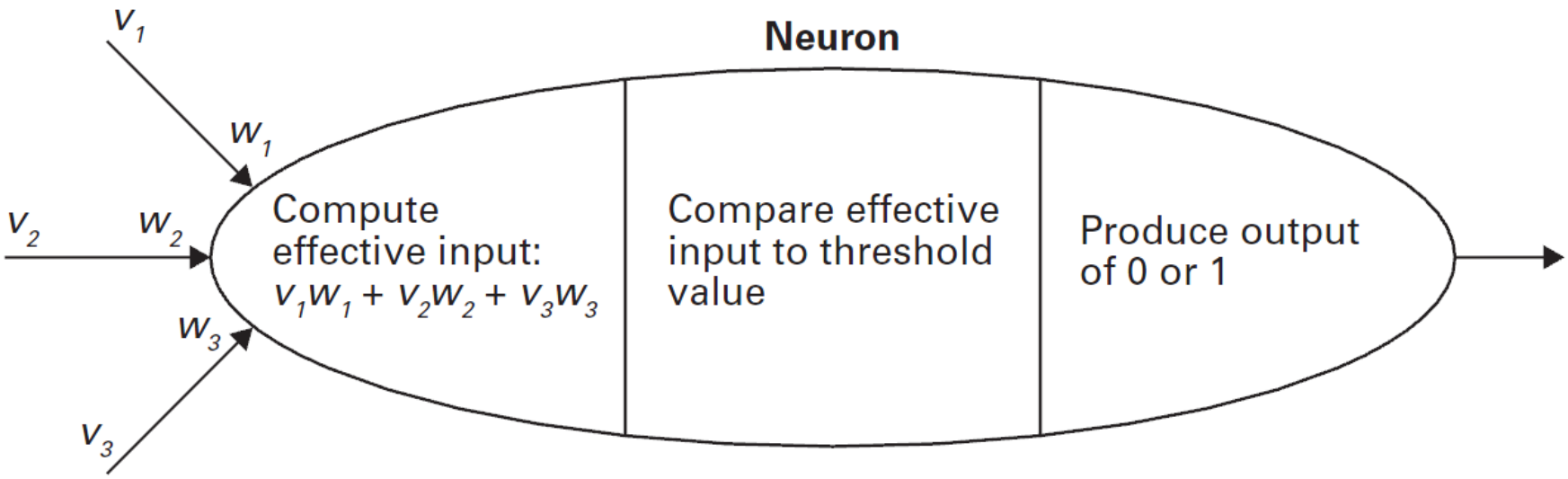


Source: https://www.youtube.com/watch?v=3JQ3hYko51Y

Artificial Neural Networks

- Artificial Neuron
  - Each input is multiplied by a weighting factor.
  - Output is 1 if sum of weighted inputs exceeds the threshold value; 0 otherwise.
- Network is programmed by adjusting weights using feedback from examples.

The activities within a processing unit



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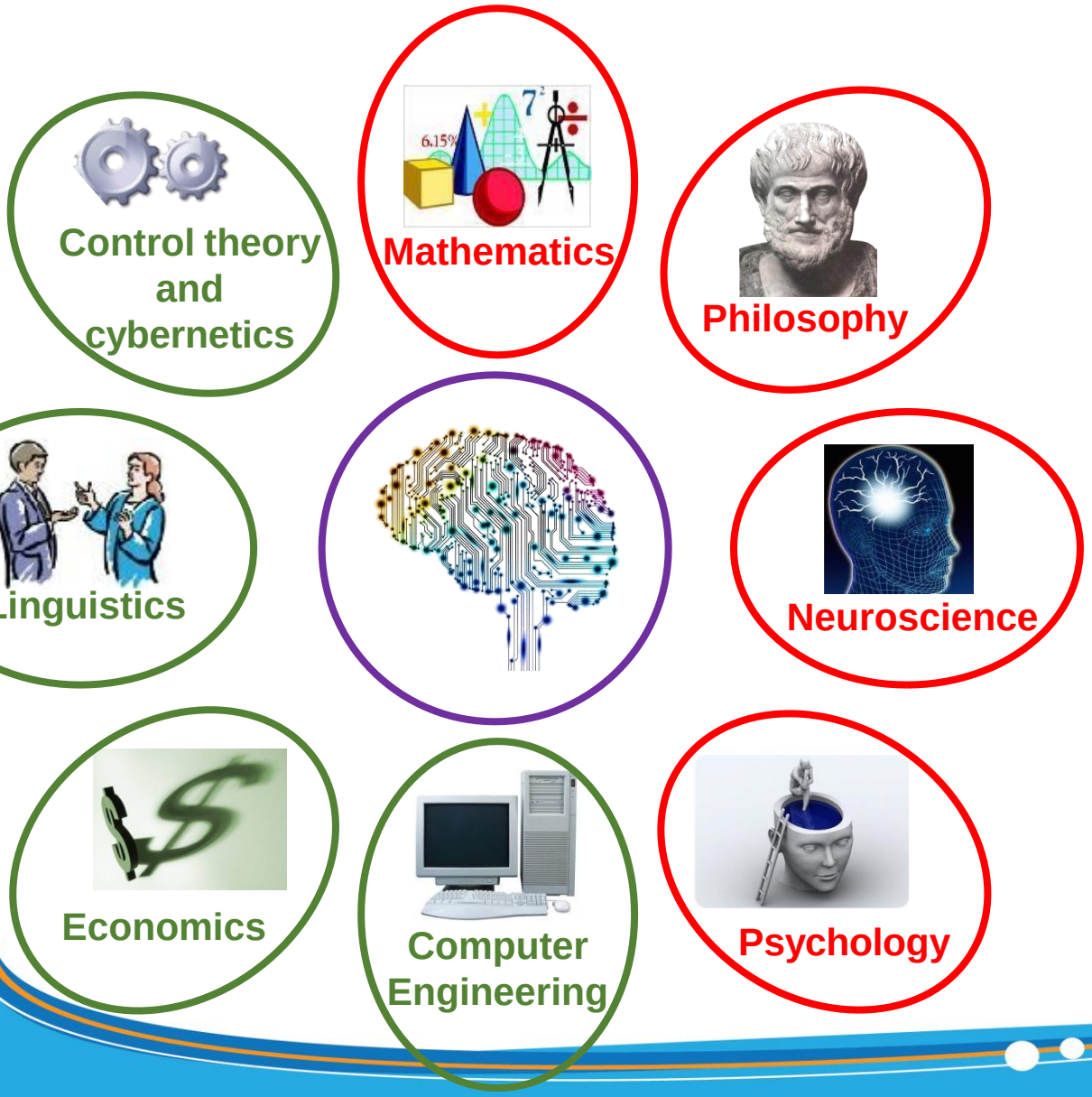
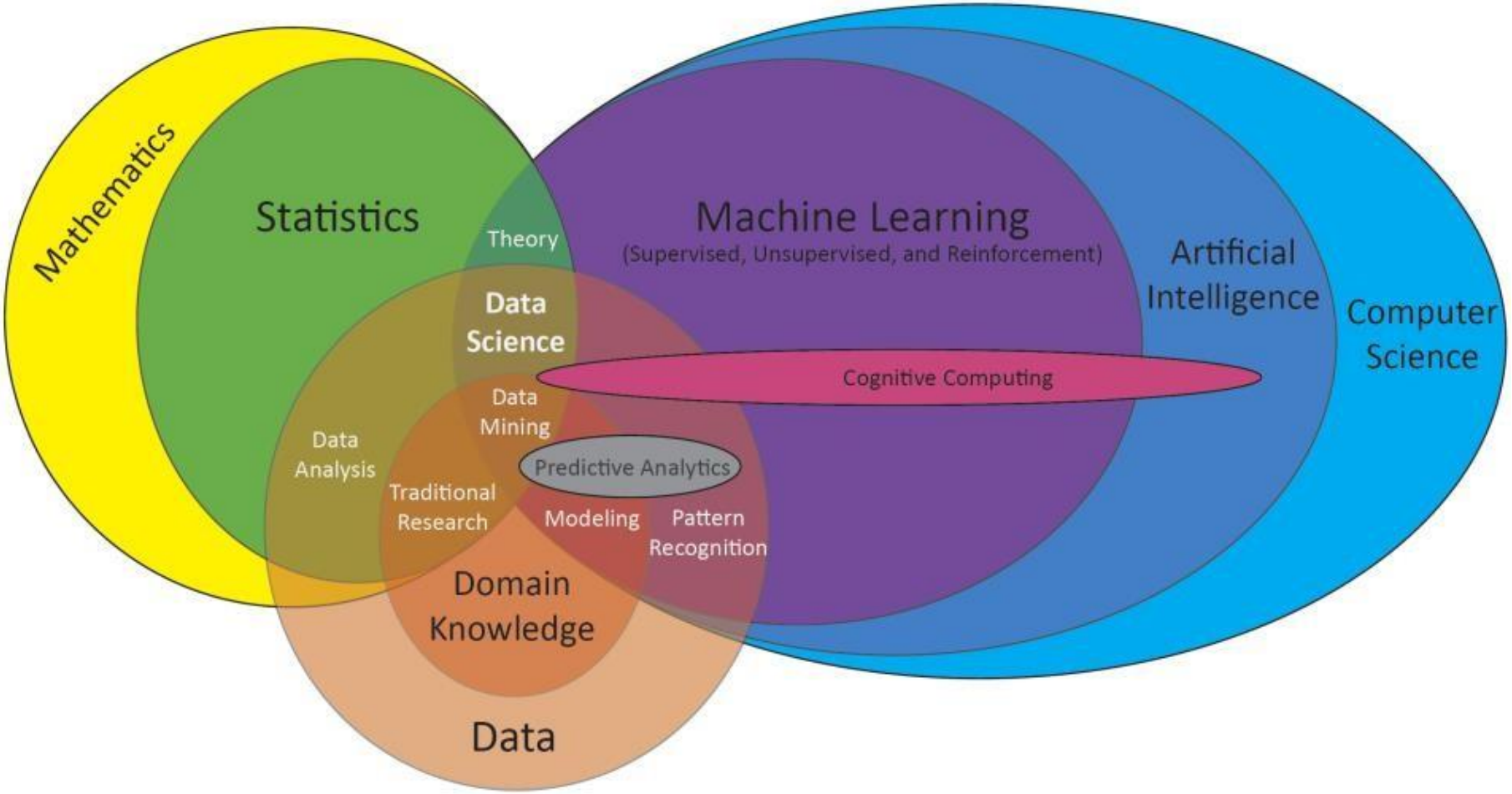
Research fields related to AI



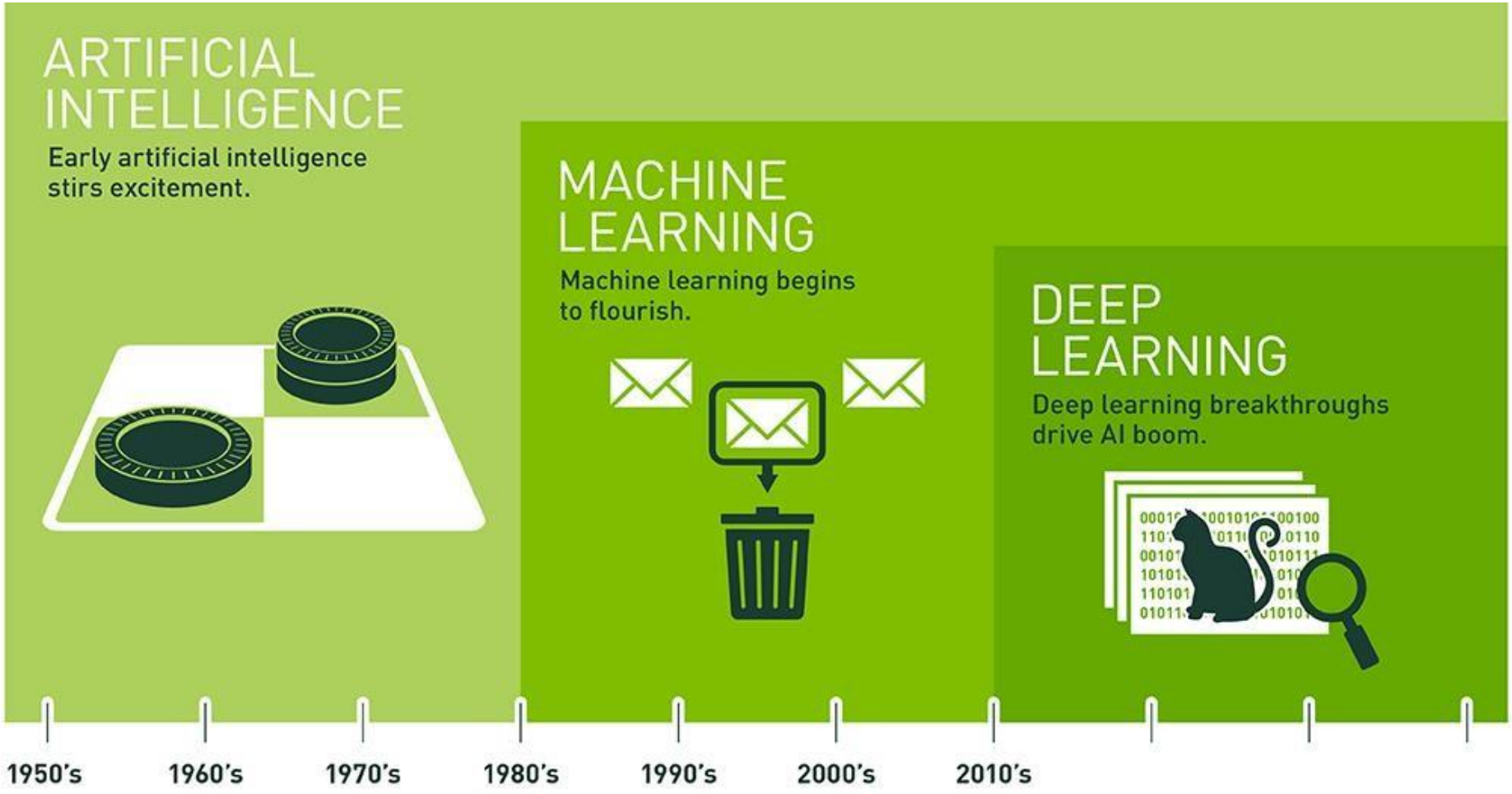
Research fields related to AI

Field	Description
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, rational economic agents
Neuroscience	Neurons as information processing units.
Psychology/ Cognitive Science	How do people behave, perceive, process information, represent knowledge.
Computer Engineering	Building fast computers
Control Theory	Design systems that maximize an objective function over time
Linguistic	Knowledge representation, grammar

Research fields related to AI



AI and related concepts



Source: https://blogs.nvidia.com/blog/2016/07/29/whats-difference-artificial-intelligence-machine-learning-deep-learning-ai/

Pros and Cons of AI

- More powerful and more useful computers
- New and improved interfaces
- Solve new problems
- Better handling of information
- Relieve information overload
- Conversion of information into knowledge

- Increased costs
- Difficulty with software development - slow and expensive
- Few experienced programmers

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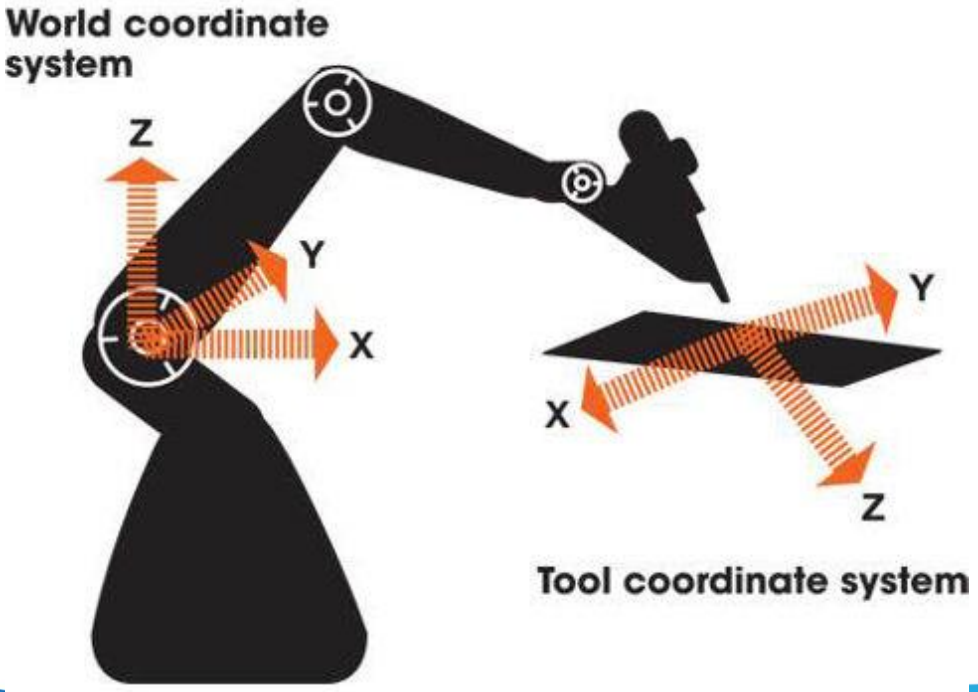
Robotics

- Truly autonomous robots require progress in perception and reasoning.
- To interact with the world, robots need mechanisms to manipulate objects and to move about.
- In the early days of robotics, the field was closely allied with the development of manipulators, most often mechanical arms with elbows, wrists, and hands or tools.

Robotics

- Research dealt not only with how such devices could be maneuvered but also with how knowledge of their location and orientation could be maintained and applied.



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Issues Raised by Artificial Intelligence

Discuss about:

- When should a computer's decision be trusted over a human's?
- If a computer can do a job better than a human, when should a human do the job anyway?
- What would be the social impact if computer "intelligence" surpasses that of many humans?

CS Educational Objectives

- Provide students with knowledge in soft computing, data mining, biometrics, machine learning and pattern recognition, parallel programming, data hiding and some other field of computer science.
- Researching skills

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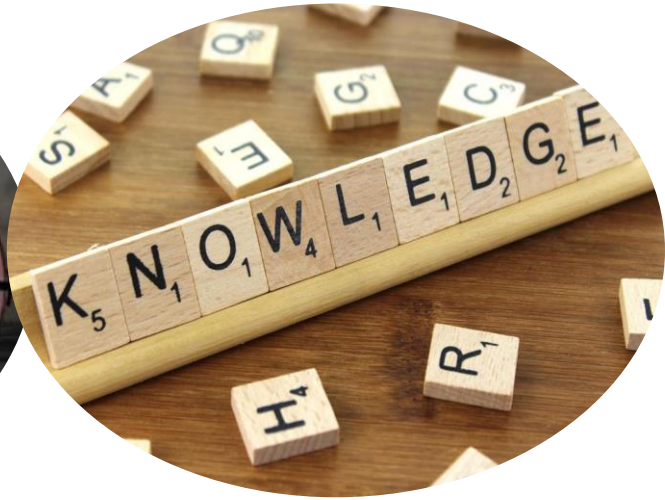
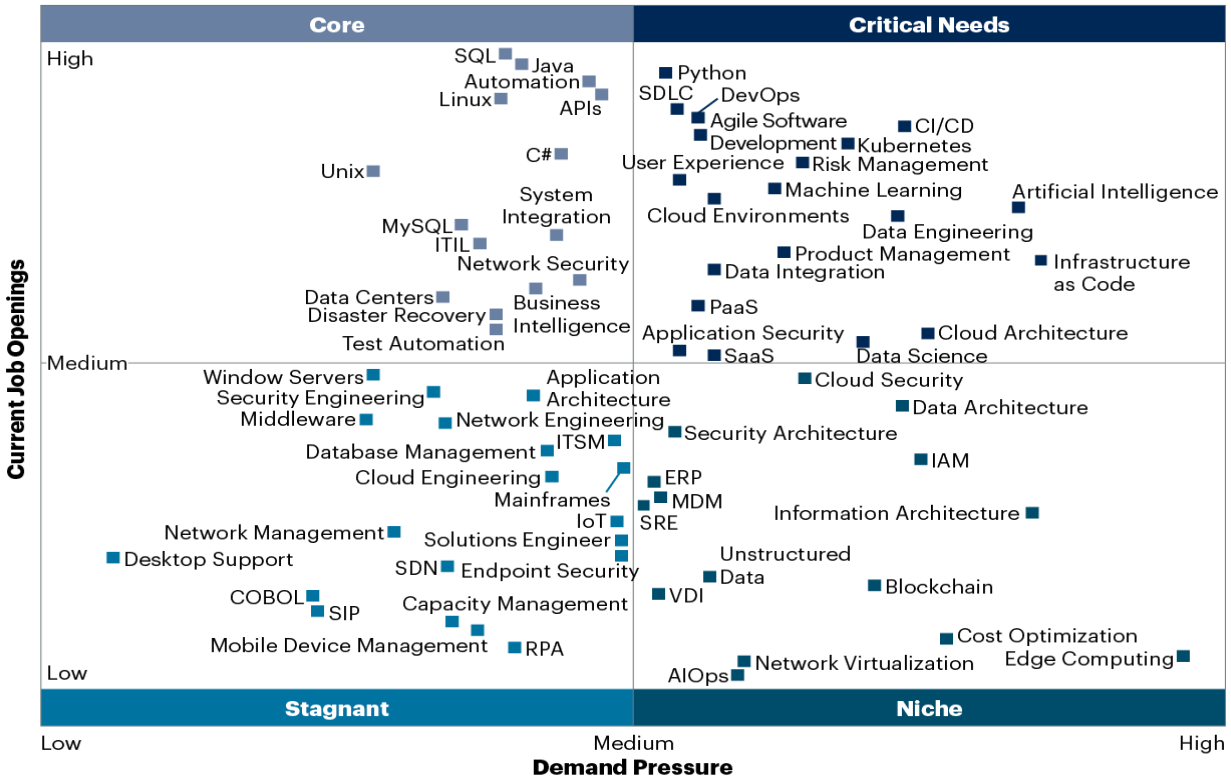
DEVELOPMENT OF PERSONAL VALUES



DEVELOPMENT OF PERSONAL VALUES

Map Market Demand and Pressure for IT Skills, 2022 IT Skills Quadrant



Source: Gartner
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Gartner

DEVELOPMENT OF PERSONAL VALUES

Solution Path to Personal Skill Development and Career Success

Development and Career Goals	• Be well-positioned to innovative • Remain valuable to the organization • Advance internal career ambitions • Improve work experience and engagement • Stay competitive in the broad job market
5 Add Value Back	• Support I&O skill transformation • Advocate for training programs and tools • Participate in training programs
4 Close the Gap	• Engage in continuous learning • Balance knowledge with experience • Take Stretch Assignments
3 Identify Learning Needs	• Identify skill and competency requirements • Perform a gap analysis • Create an individual development plan
2 Select a Career Trajectory	• Deepen and update skills in current role • Broaden skills to move to adjacent role • Build new competencies to move to a leader/manager role • Transform skills to pivot to divergent or emerging role
1 Map Your Career Landscape	• Technology • Business • Personal

Source: Gartner
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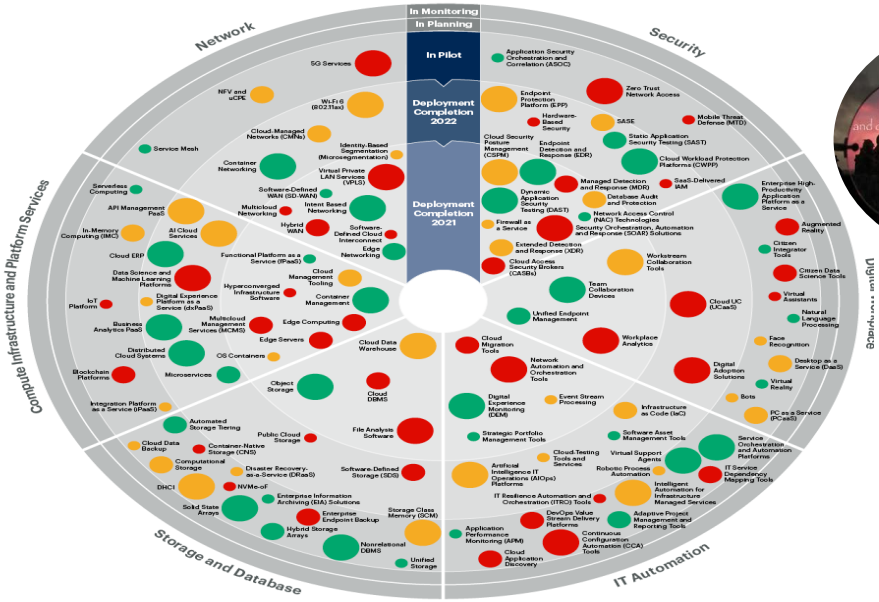
Emerging Technology Roadmap for Large Enterprises



Source: Gartner
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DEVELOPMENT OF PERSONAL VALUES

"Success is no accident. It is hard work, perseverance, learning, studying, sacrifice and most of all, love of what you are doing or learning to do."

– Pele

"I'm convinced that about half of what separates successful entrepreneurs from the non-successful ones is pure perseverance."

- Steve Job

DEVELOPMENT OF PERSONAL VALUES

"Have the courage to follow your heart and intuition. They somehow already know what you truly want to become."
- Steve Job

Great achievement is usually born of great sacrifice, and is never the result of selfishness.
- Napoleon Hill

Football is like life - it requires perseverance, self-denial, hard work, sacrifice, dedication and respect for authority.
- Vince Lombardi

DEVELOPMENT OF PERSONAL VALUES