

INTRODUCTION TO SYSTEMS SCIENCES

Systems Sciences Foundations

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2025-I



Outline

1 Definitions

2 The History

3 Artificial Intelligence

4 Cybernetics

5 Application Fields



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1 Definitions

2 The History

3 Artificial Intelligence

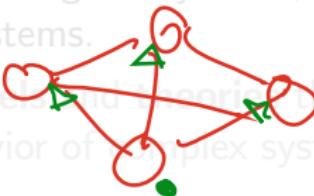
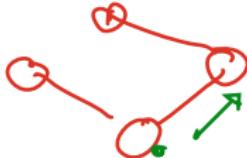
4 Cybernetics

5 Application Fields



Systems Sciences

- Systems Sciences is an interdisciplinary field that studies the nature of **complex systems** in nature, society, and science.
 - Systems Sciences uses a holistic approach to study the interactions and interdependencies between the parts of a system.
 - Systems Sciences is used to study a wide range of systems, including biological, social, and technological systems.
 - Systems Sciences is used to develop models and theories that can be used to understand and predict the behavior of complex systems.
- * Interactions*
- * Flows*



Traffic



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holistic
→ *synergy*
↓
interdependencies
→ *emergent*



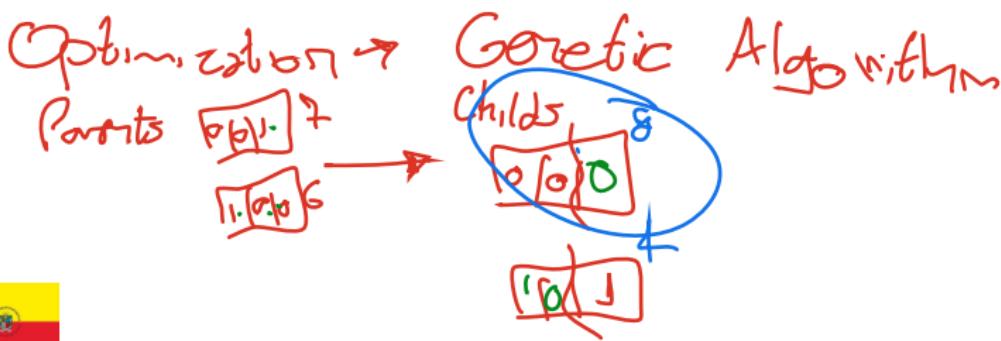
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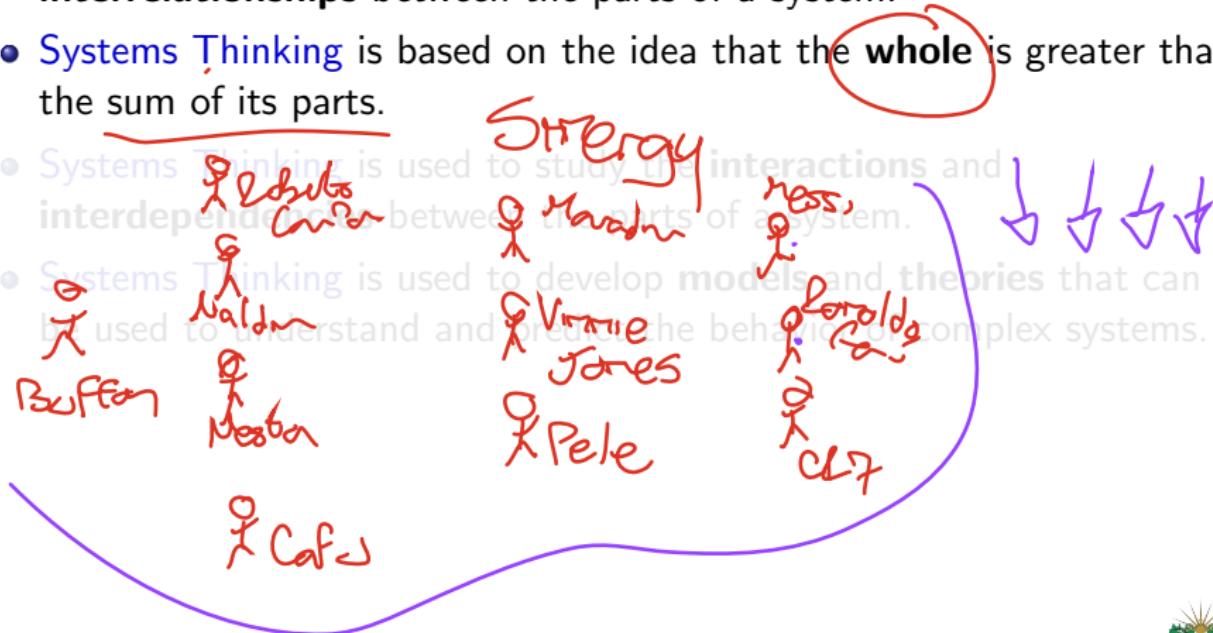
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Dr. House



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Systems
Thinking → Systems
Sciences



Systems Engineering

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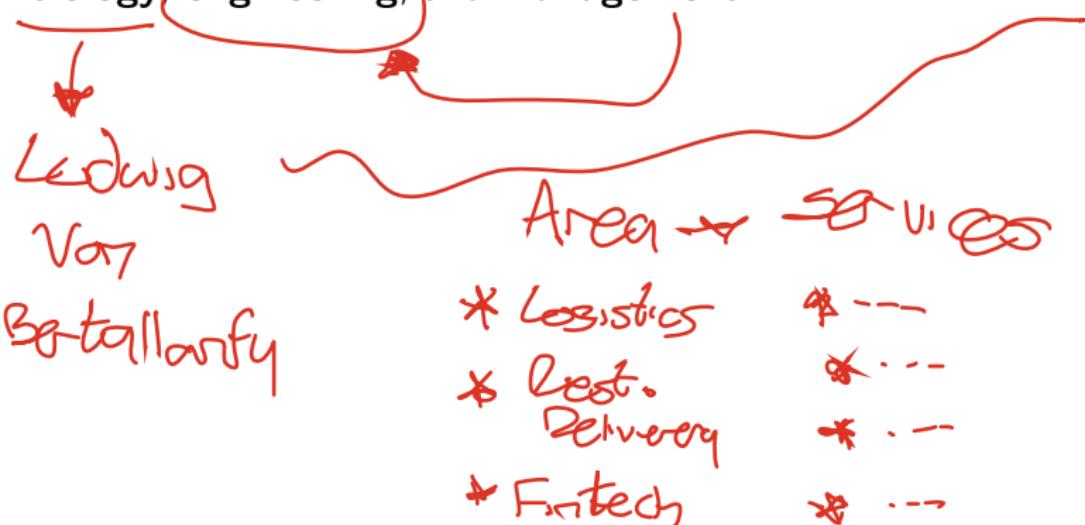
10 careers

resources
information
changes



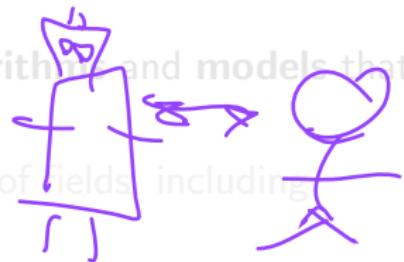
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Artificial Intelligence

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- Artificial Intelligence is based on the idea that machines can be taught to think like humans.
- Artificial Intelligence is used to develop algorithms and models that can be used to solve complex problems.
- Artificial Intelligence is used in a wide range of fields, including robotics, healthcare, and finance.
- Artificial Intelligence is used to develop intelligent systems that can perform tasks that require human-like intelligence.



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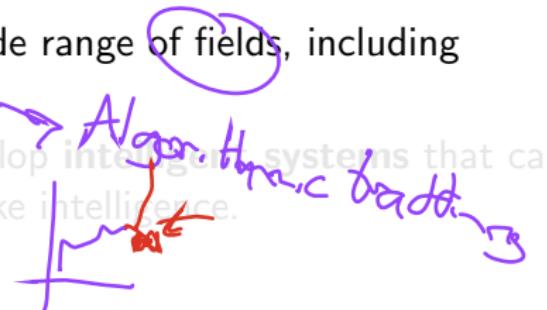
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Computer vs. organic matter



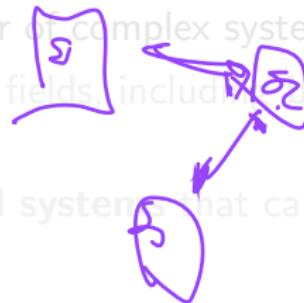
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Cybernetics

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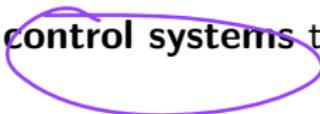
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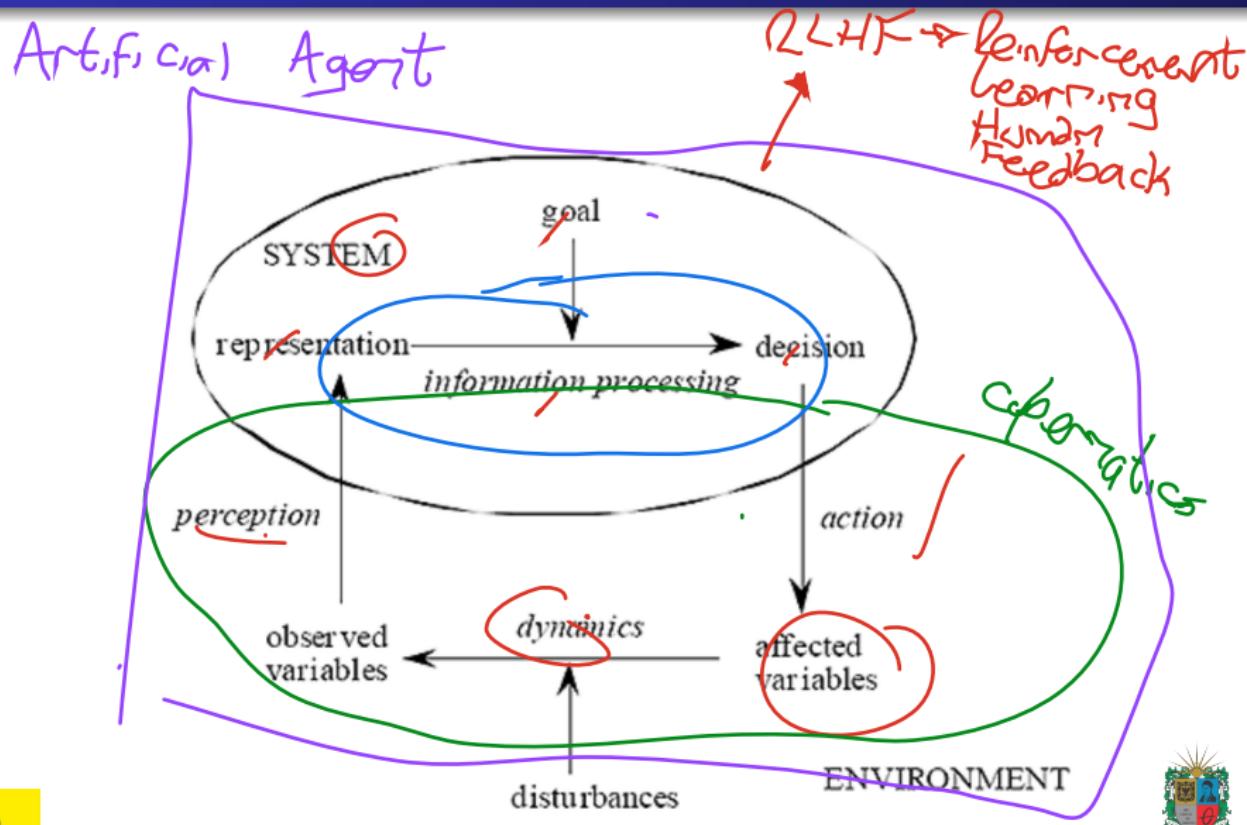


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Typical Cybernetics System



Robotics

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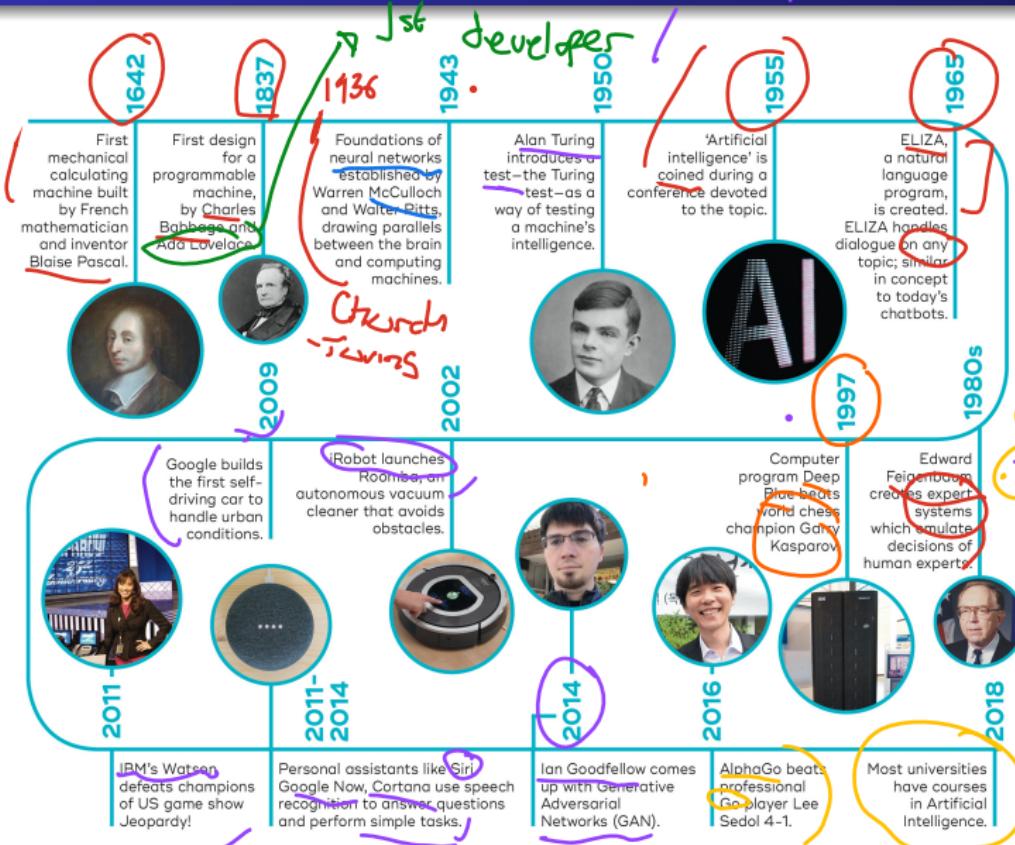
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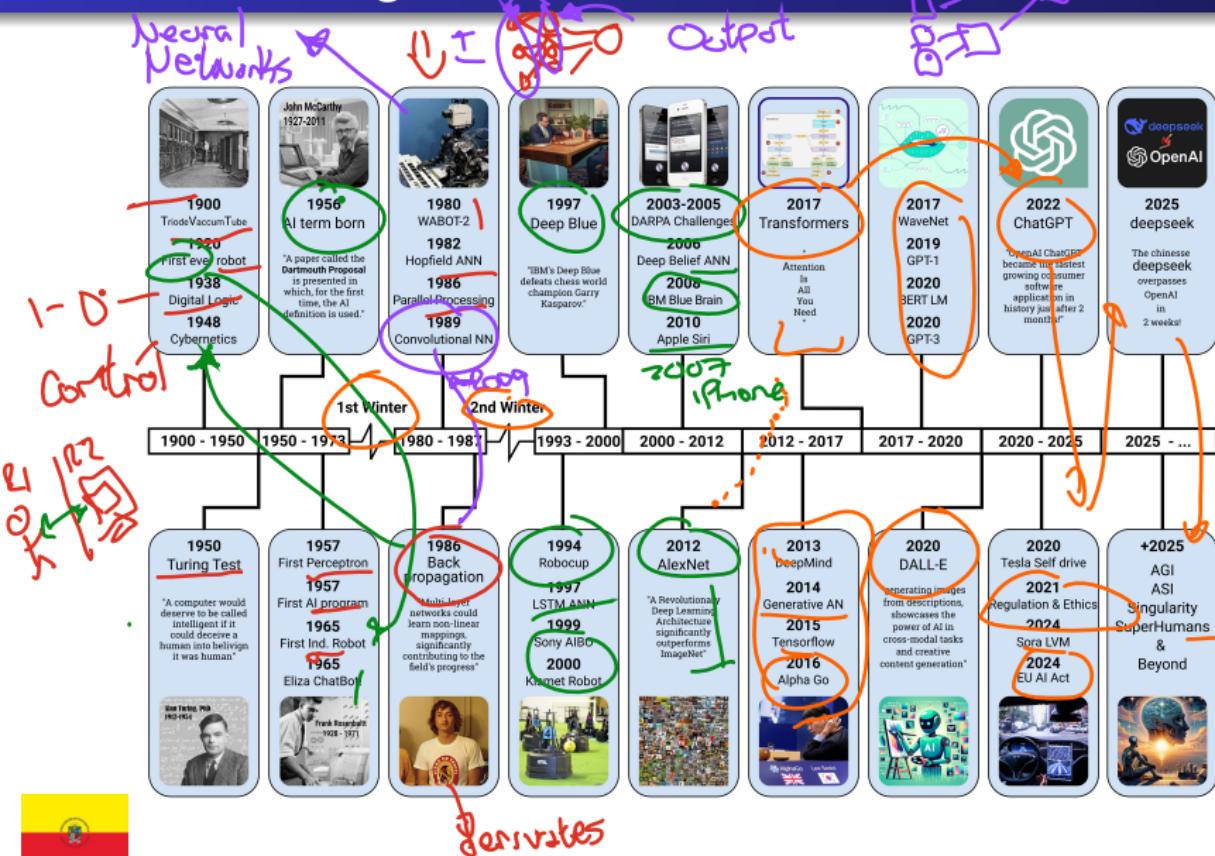
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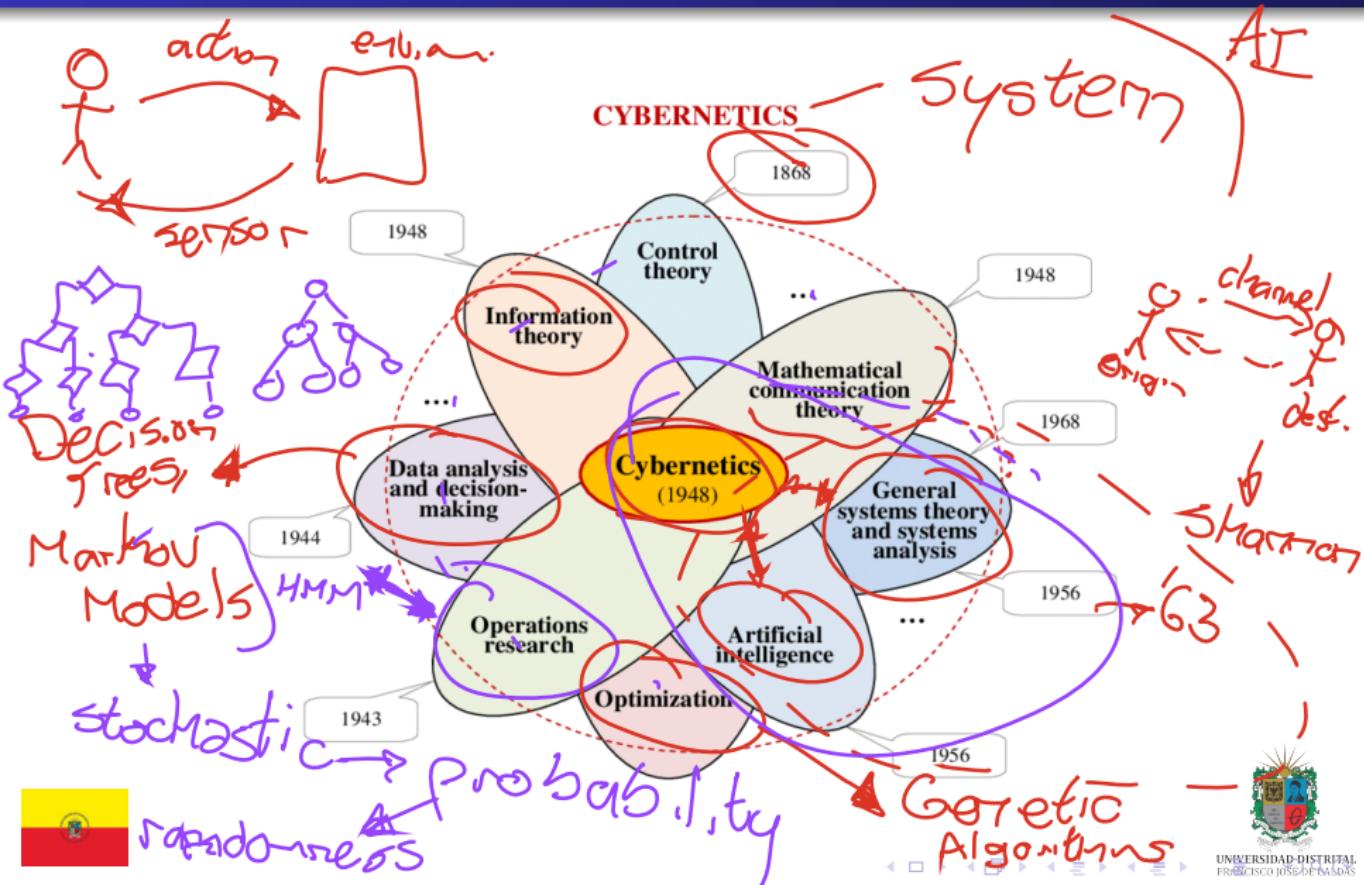
Artificial Intelligence Timeline I



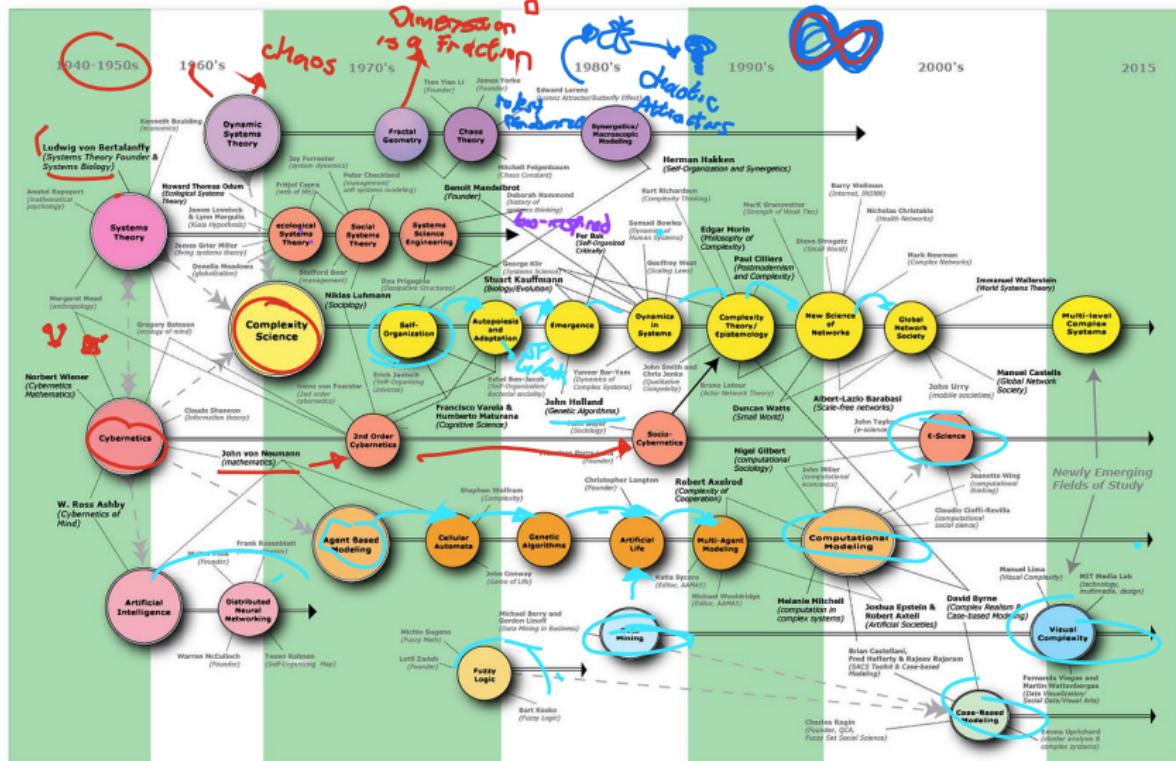
Artificial Intelligence Timeline II



Cybernetics Timeline



Systems Sciences Timeline



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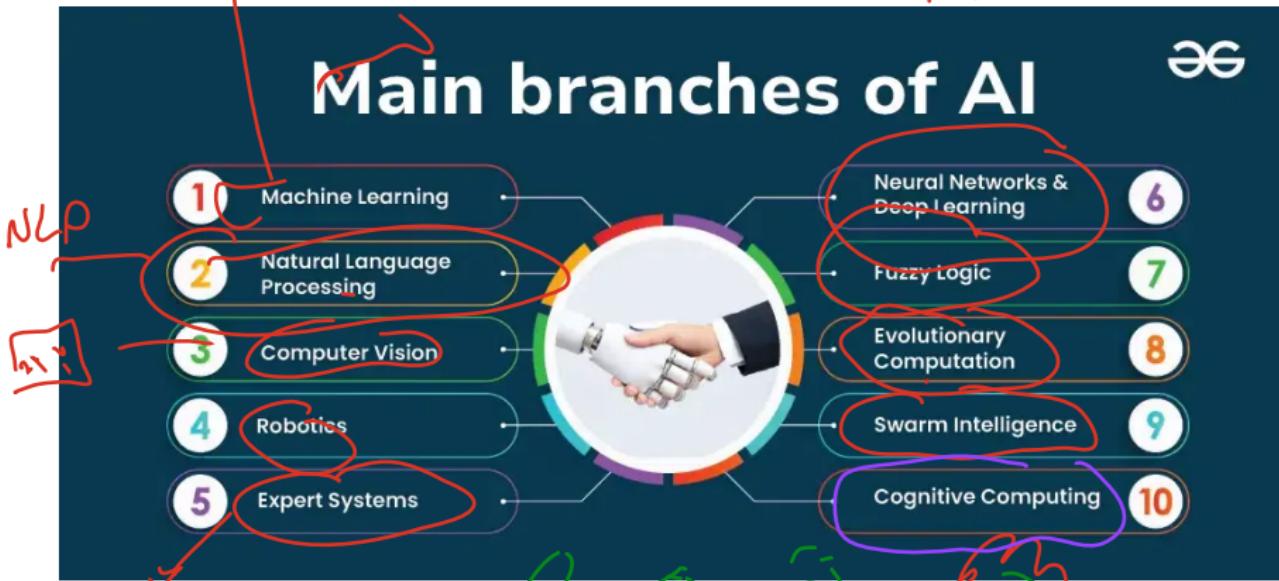
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Main Branches of AI

Learn from examples

p	i	o	out
z	z		4.
3	4		7
s	s		10



AI Types

- Artificial Intelligence can be divided into two main types:
 - Narrow AI: Also known as Weak AI, this type of AI is designed to perform a specific task, such as playing chess or driving a car.
 - General AI: Also known as Strong AI, this type of AI is designed to perform any intellectual task that a human can do.
- Also, there is a third type of AI:
 - Superintelligent AI: This type of AI is designed to perform intellectual tasks that are beyond human capabilities.

99% → applications

↓
Machine
Learning



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Open AI ~ LLM + Frequent + Reasoning
Benchmark



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Benchmark



Weak AI vs Strong AI

99, 9).

Criteria	Weak AI (Narrow AI)	Strong AI (General AI)
Definition	Designed to perform a specific task. <i>ML</i>	Designed to perform any intellectual task that a human can do.
Examples	<u>Chatbots</u> , <u>self-driving cars</u> , and <u>recommendation systems</u> .	<u>Human-like robots</u> and <u>superintelligent AI</u> .

Table: Comparison between Weak AI and Strong AI



área
problema



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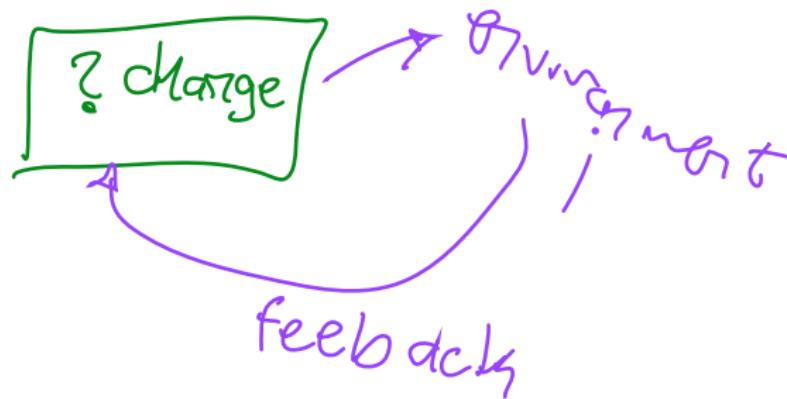
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Types of Cybernetics

- Cybernetics can be divided into two main types.
 - First-order Cybernetics: This type of cybernetics focuses on the **control** and **communication** in living organisms and machines.
 - Second-order Cybernetics: This type of cybernetics focuses on the **observer** and the **observed** in living organisms and machines.



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Open - learning

Learning



Sub-areas of Cybernetics

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 - Biological Cybernetics: This sub-area focuses on the **control** and **communication** in living organisms.
 - Engineering Cybernetics: This sub-area focuses on the **control** and **communication** in machines and systems.
 - Social Cybernetics: This sub-area focuses on the **control** and **communication** in social systems.
 - Management Cybernetics: This sub-area focuses on the **control** and **communication** in organizations and businesses.
 - Educational Cybernetics: This sub-area focuses on the **control** and **communication** in educational systems.



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robotics
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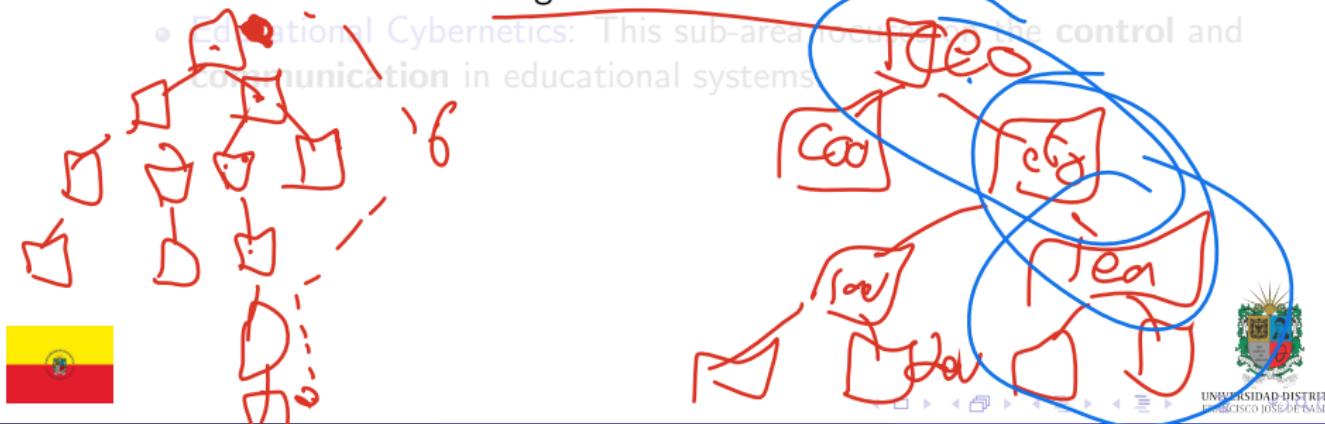
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 - Social networks → Cybersecurity.
↳ Fear ↳ Phishing.



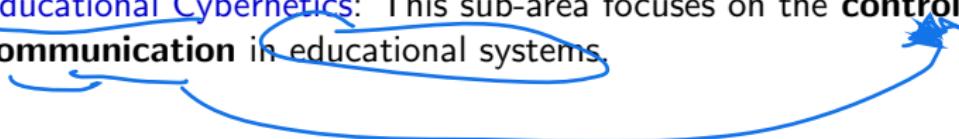
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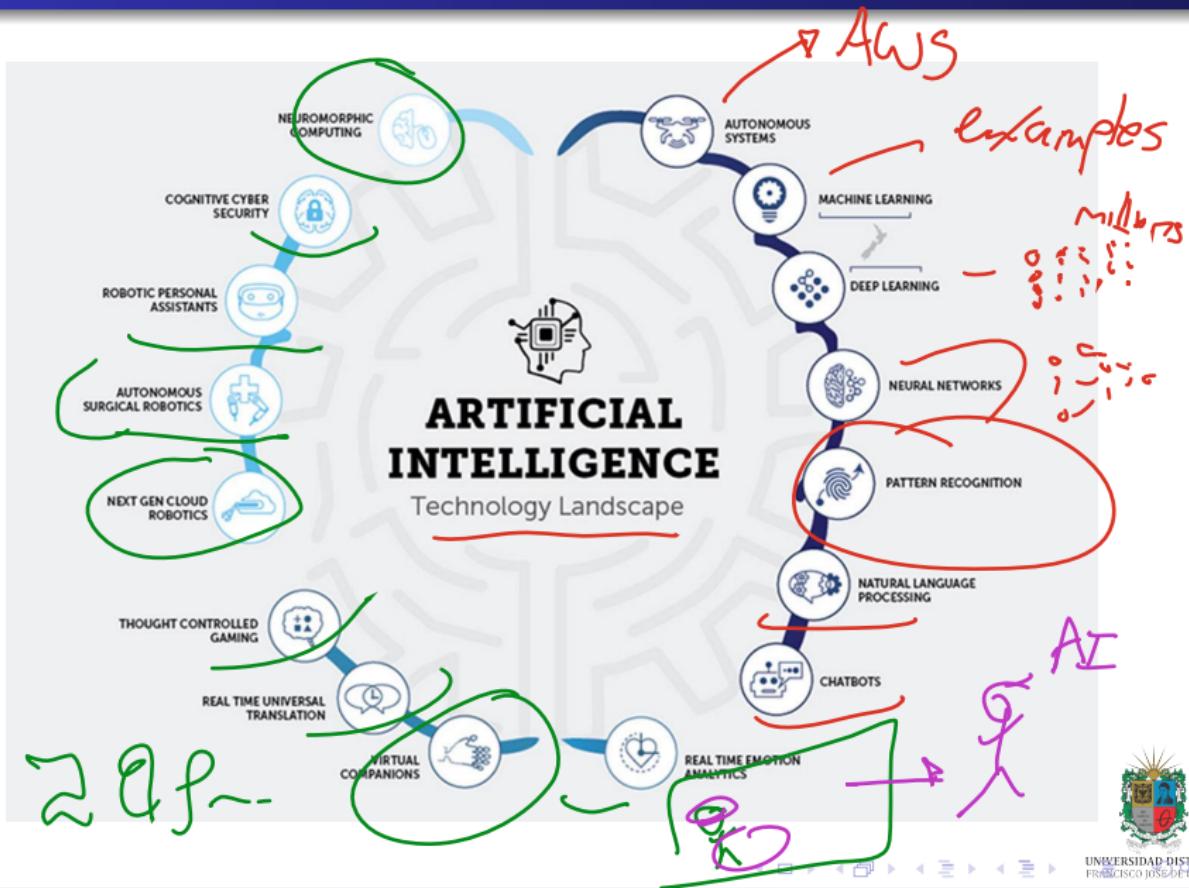
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AI Landscape



Computer Vision Startups — 2015

In 2015
Face → Liar / Drink - Sleep
Drive



Leading Computer Vision Innovators

clarifai

Object
Recognition

Sighthound

People
Tracking

SMART EYE[®]
Eye Tracking

PointGrab
Gesture
Recognition

CRUISE

Automated Driver
Assistance

**BLUE RIVER
TECHNOLOGY**

Precision
Agriculture

Dacuda
Scanning method

Smartphone
3D Scanning

PIX4D
simply powerful

UAV 3D
Reconstruction

**MIRADA
medical**

Medical
Imaging

chui

Facial
Recognition

More: <https://www.ventureradar.com/>

Venture
Radar

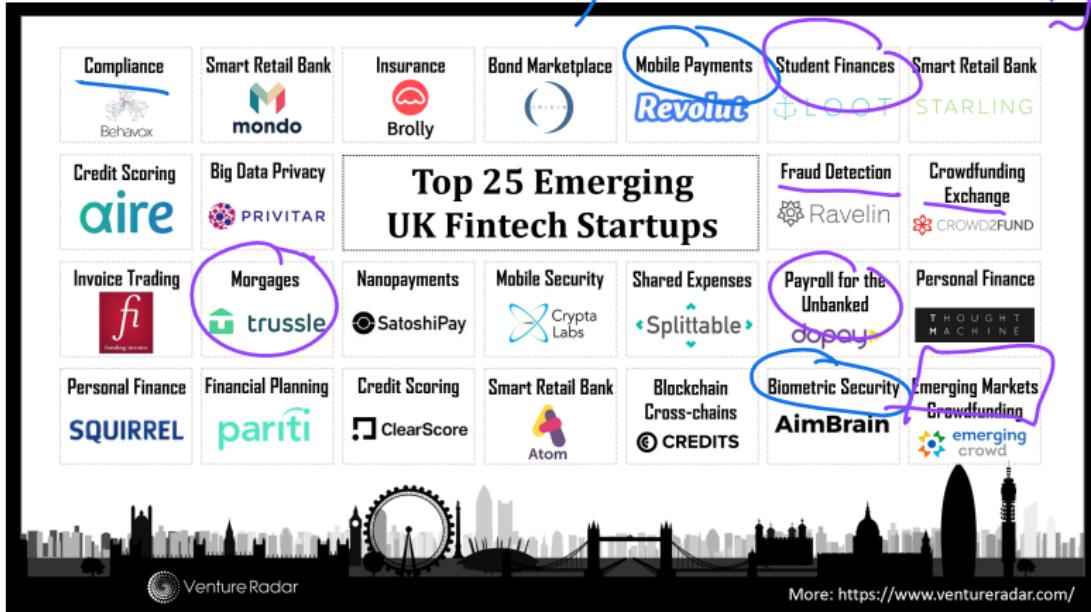
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UK Fintech Startups — 2015

Fintech
FinTech → Fintech

Crowdfunding



Artificial Intelligence Startups — 2017

chatbot → expert
call center → comments → sentiment analysis

The diagram illustrates the progression of AI startups across various sectors. It starts with 'Augmenting knowledge work using AI' and moves through 'Law & Contracts', 'Customer Service', 'Sales', 'Personal Assistants', 'Investing', 'Business Intelligence, Journalism, Research', 'Audit & Compliance', 'Medical & Other Image Analysis', and 'Other Medical'. A large black arrow points diagonally upwards from left to right, labeled 'Humans focus more on creativity, social intelligence, manual dexterity, and...'.

Artificial Intelligence Startups
Augmenting knowledge work using AI

25% of all job-based tasks will be automated by 2019 - Forrester Research	Law & Contracts	Customer Service	Sales	Personal Assistants
Many experts believe that by 2050 machines will have reached human level intelligence	ROSS Okira LEGAL ROBOT	FinGenius DigitalGenius CAPITO SYSTEMS COGNICOR	AVISO CONVERSICA re:inter	x.ai VANARD WEALTHARC INOVANCE
Hundreds of startups are already using AI to augment knowledge work	BEAGLE DOXAII	Wise.io	agolo NarrativeScience	SYNAPSIFY
	Audit & Compliance	Medical & Other Image Analysis	Tractable	Wired Informatics
	AppZen MetaMind	clarifai enlitic		

More: <https://www.ventureradar.com/>



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Thanks!

Questions?



Repo: <https://github.com/EngAndres/ud-public/tree/main/courses/systems-sciences-foundations>

