

# 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

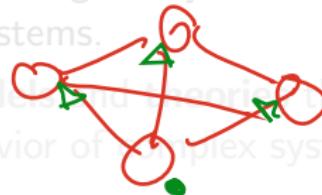
4 Cybernetics

5 Application Fields

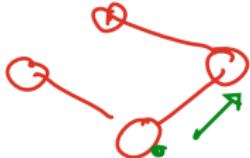


# Systems Sciences

- 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*



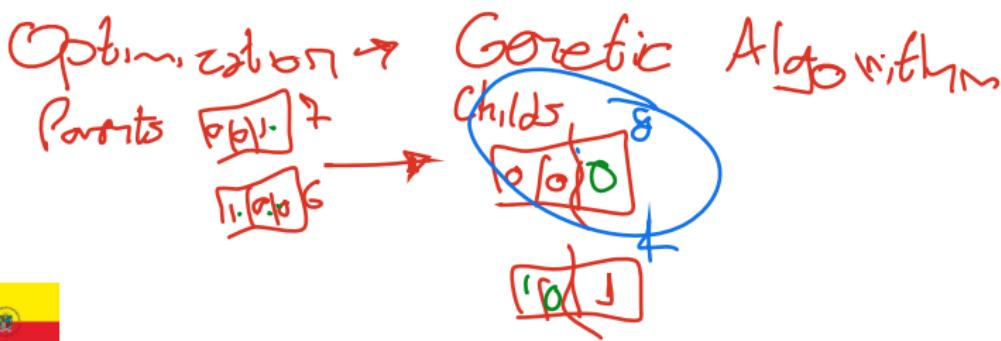
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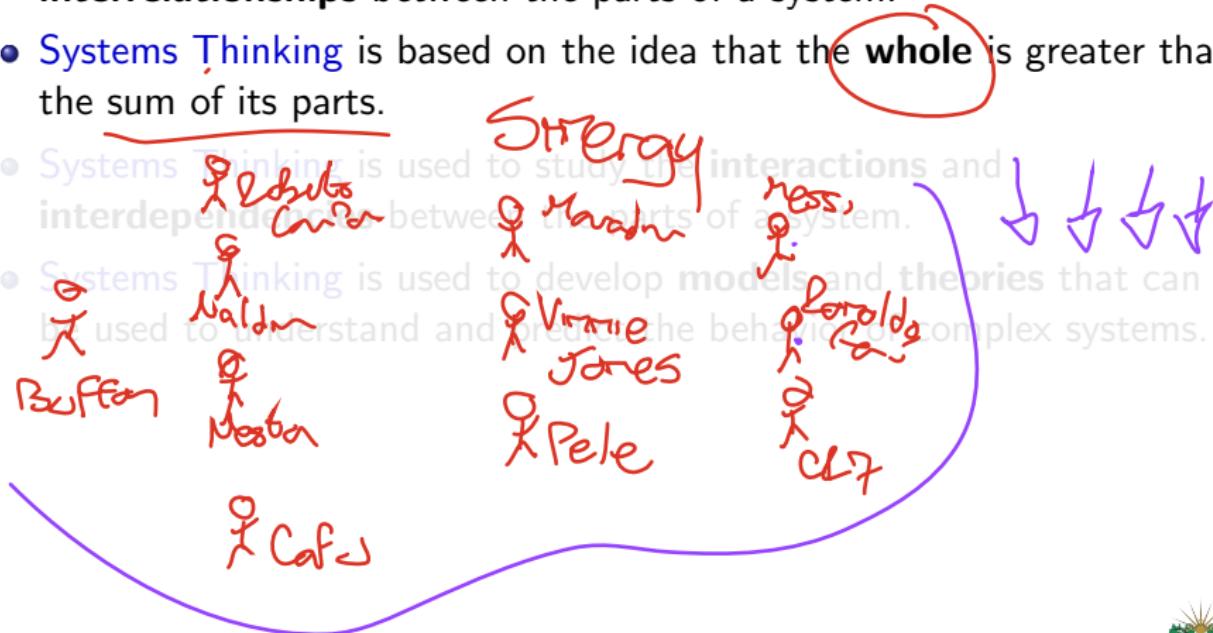
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# Dr. House



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Systems  
Thinking → Systems  
Sciences



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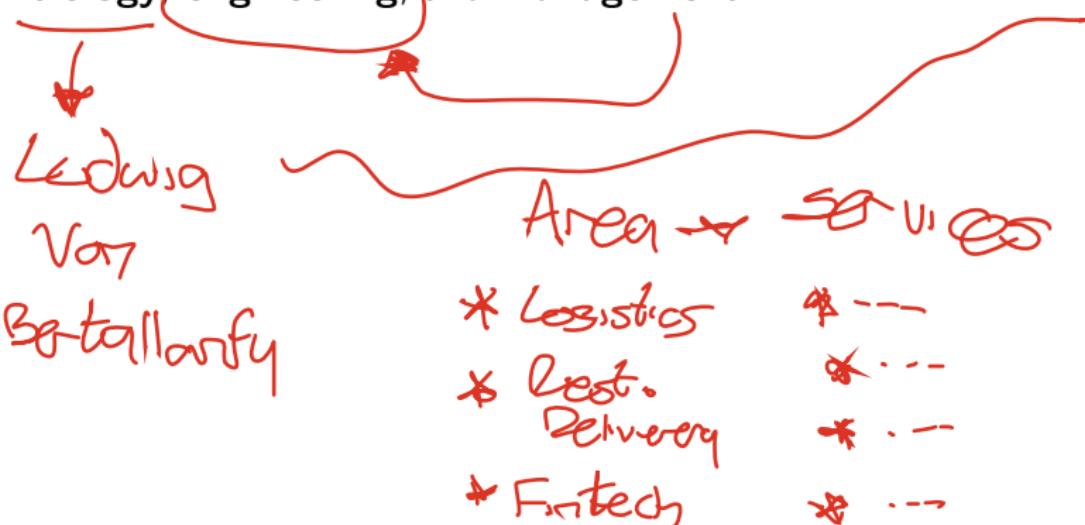
10 careers

resources  
information  
changes



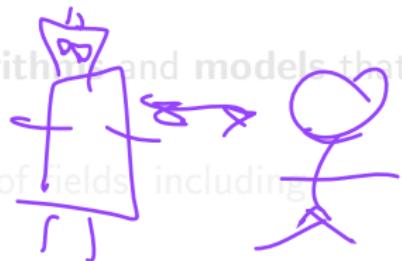
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- Artificial Intelligence is based on the idea that machines can be taught to think like humans.
- Artificial Intelligence is used to develop algorithms and models that can be used to solve complex problems.
- Artificial Intelligence is used in a wide 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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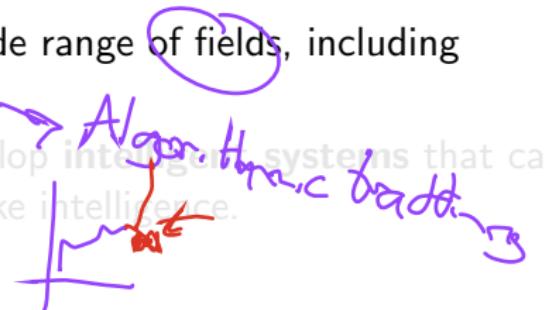
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Computer vs.  
Organistic  
machines



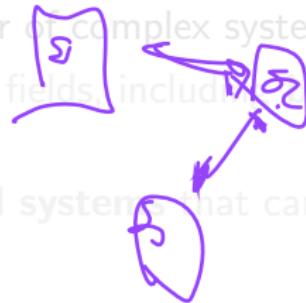
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- Cybernetics is based on the idea that systems can be controlled and regulated using feedback mechanisms.
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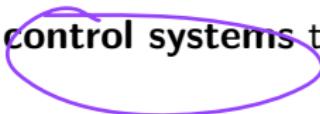
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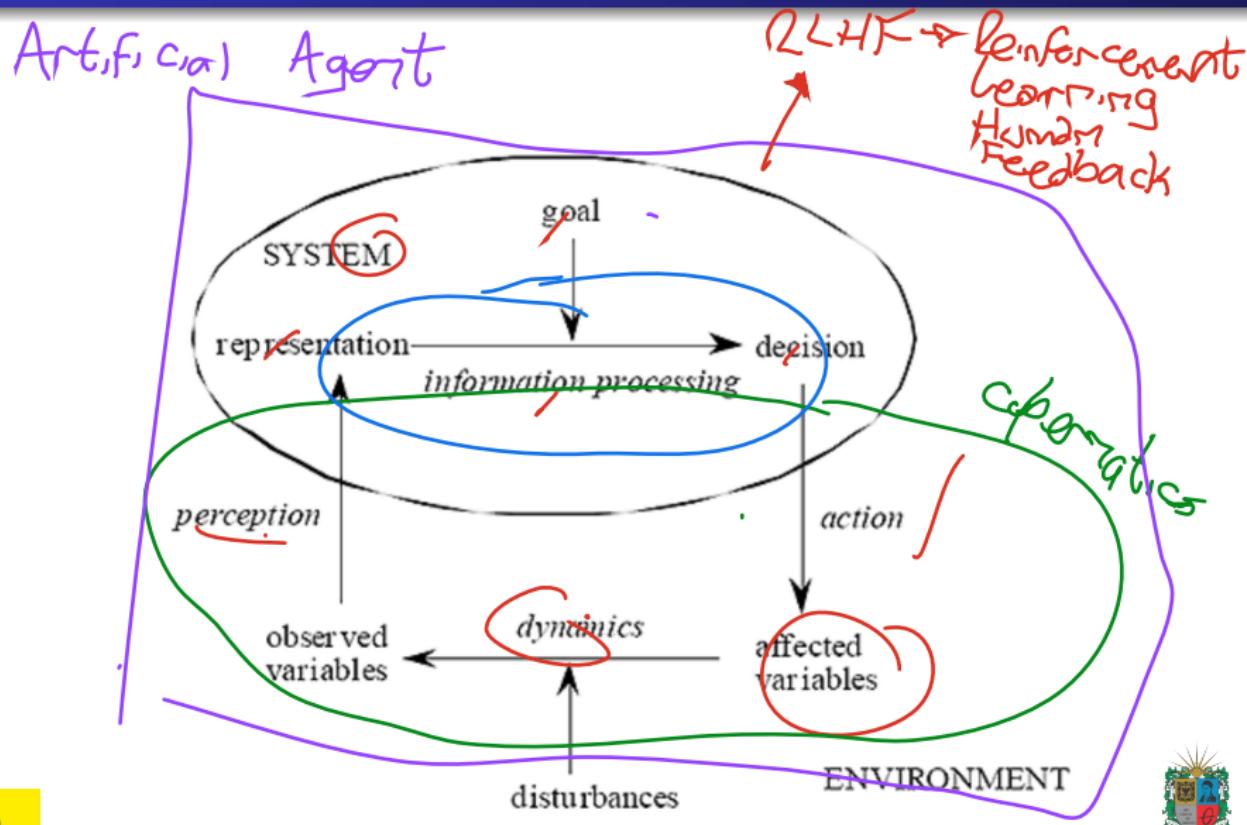


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## Typical Cybernetics System



# Robotics

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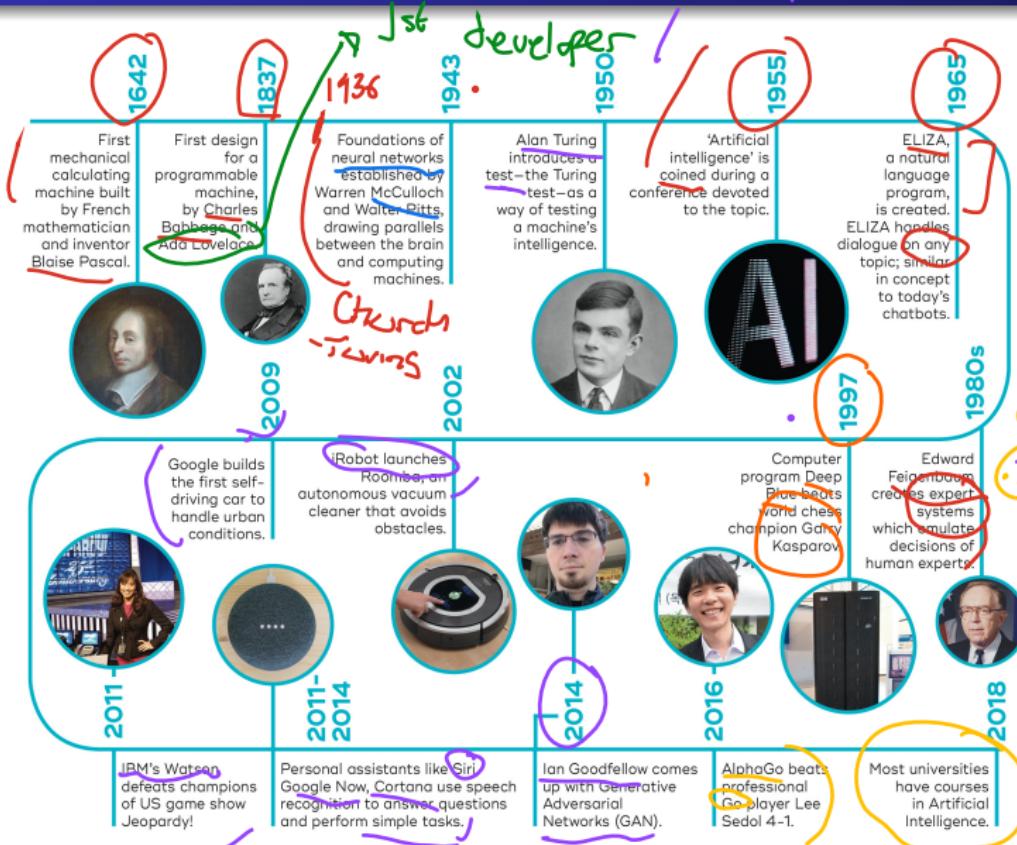
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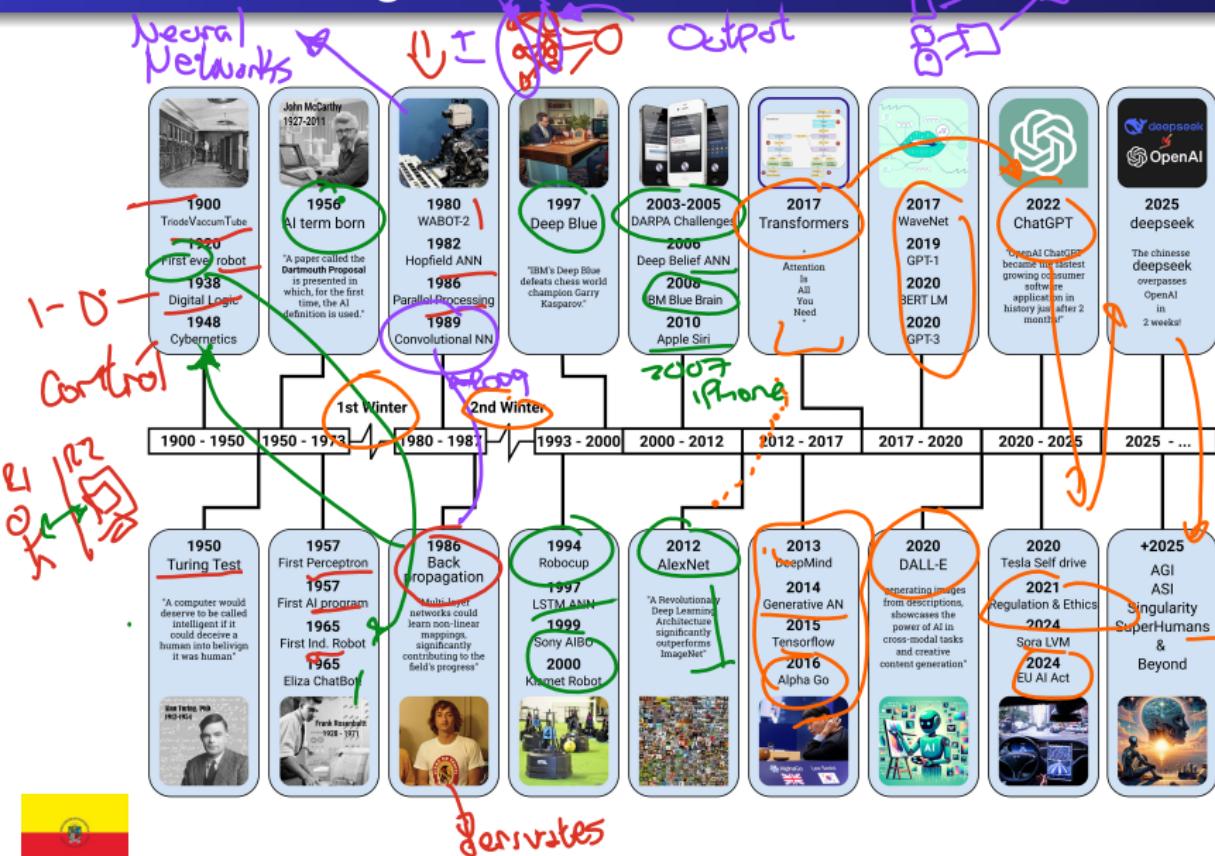
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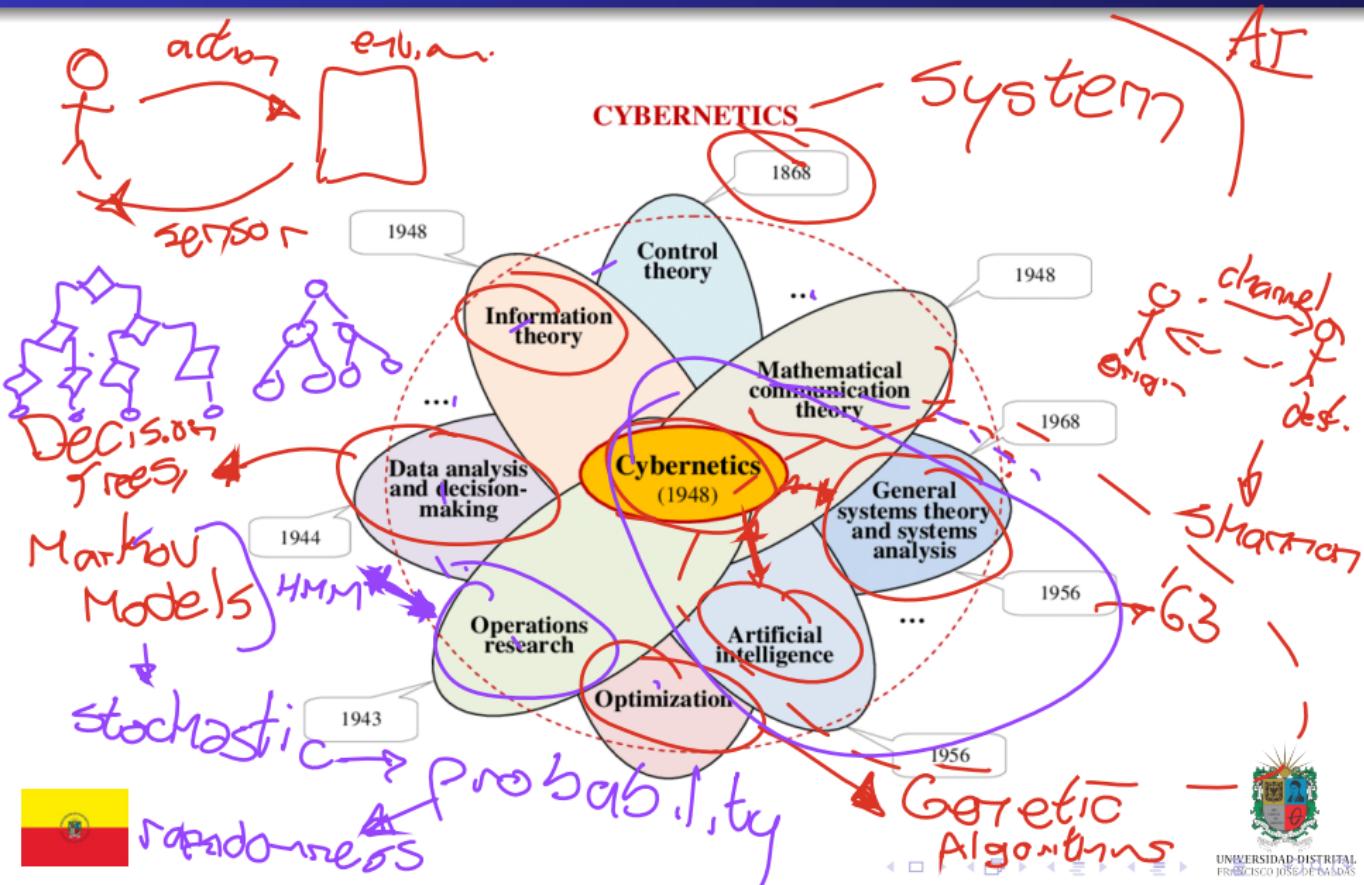
# Artificial Intelligence Timeline I



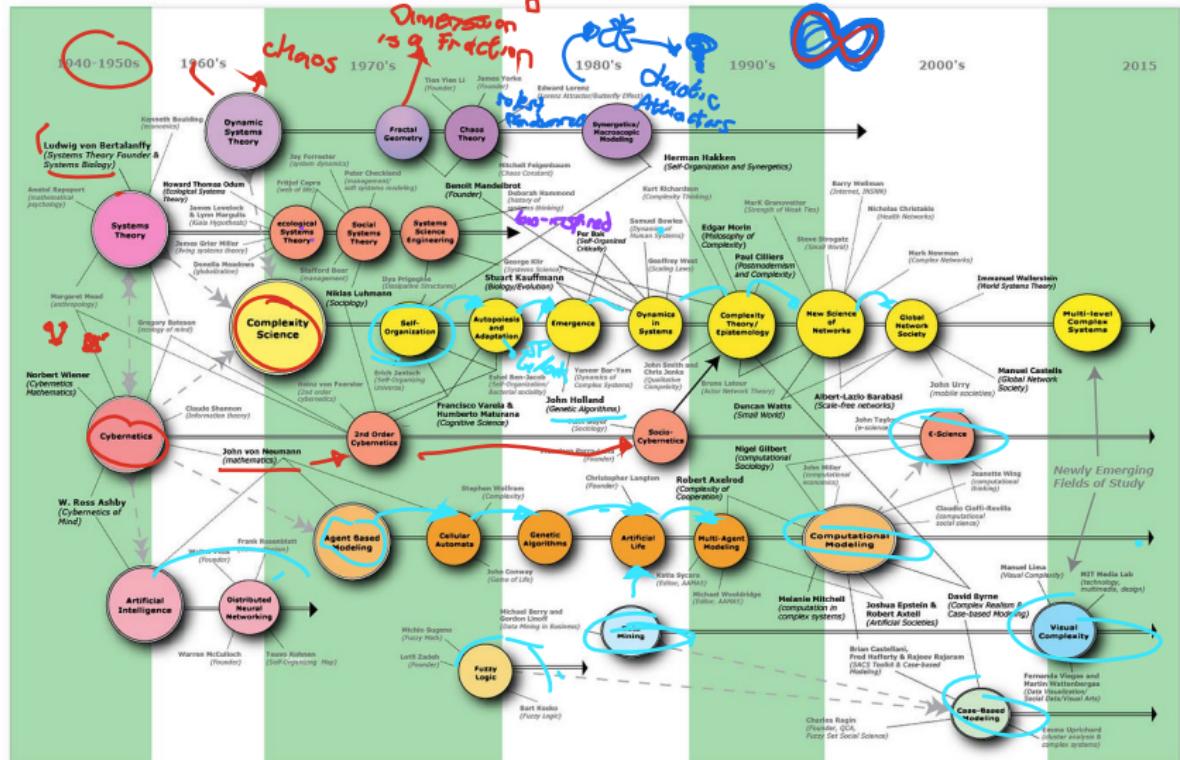
# Artificial Intelligence Timeline II



# Cybernetics Timeline



# Systems Sciences Timeline



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## Main Branches of AI

## Learn from examples

# Main branches of AI



# 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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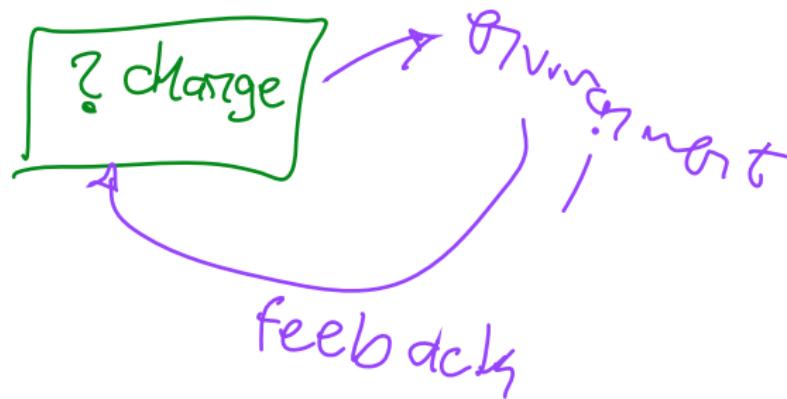
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# Types of Cybernetics

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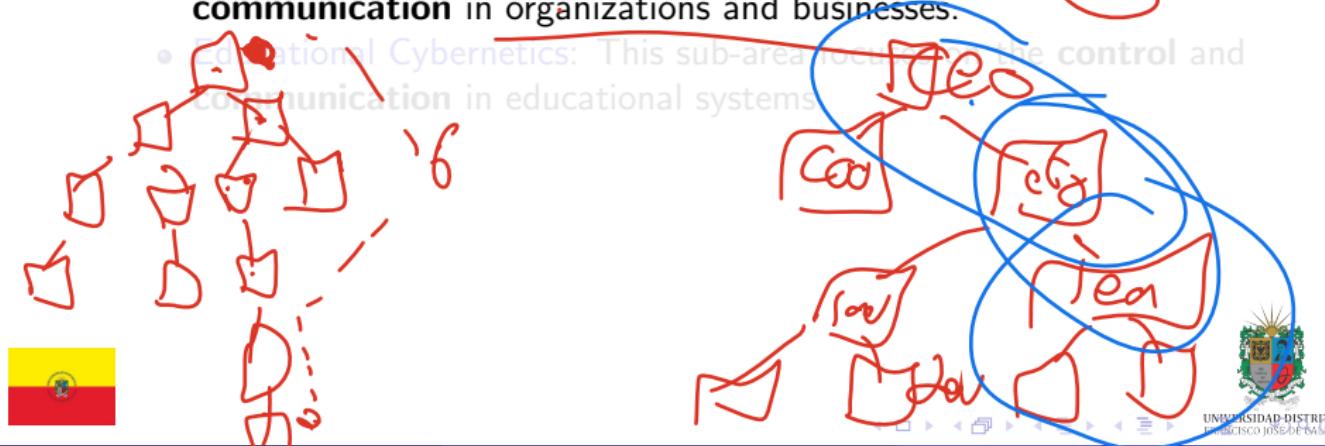
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  - Social networks → Cybersecurity.  
↳ Poll ↳ Fear ↳ Phishing.



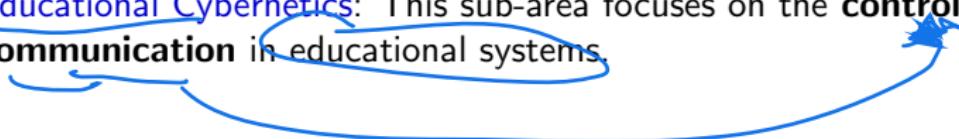
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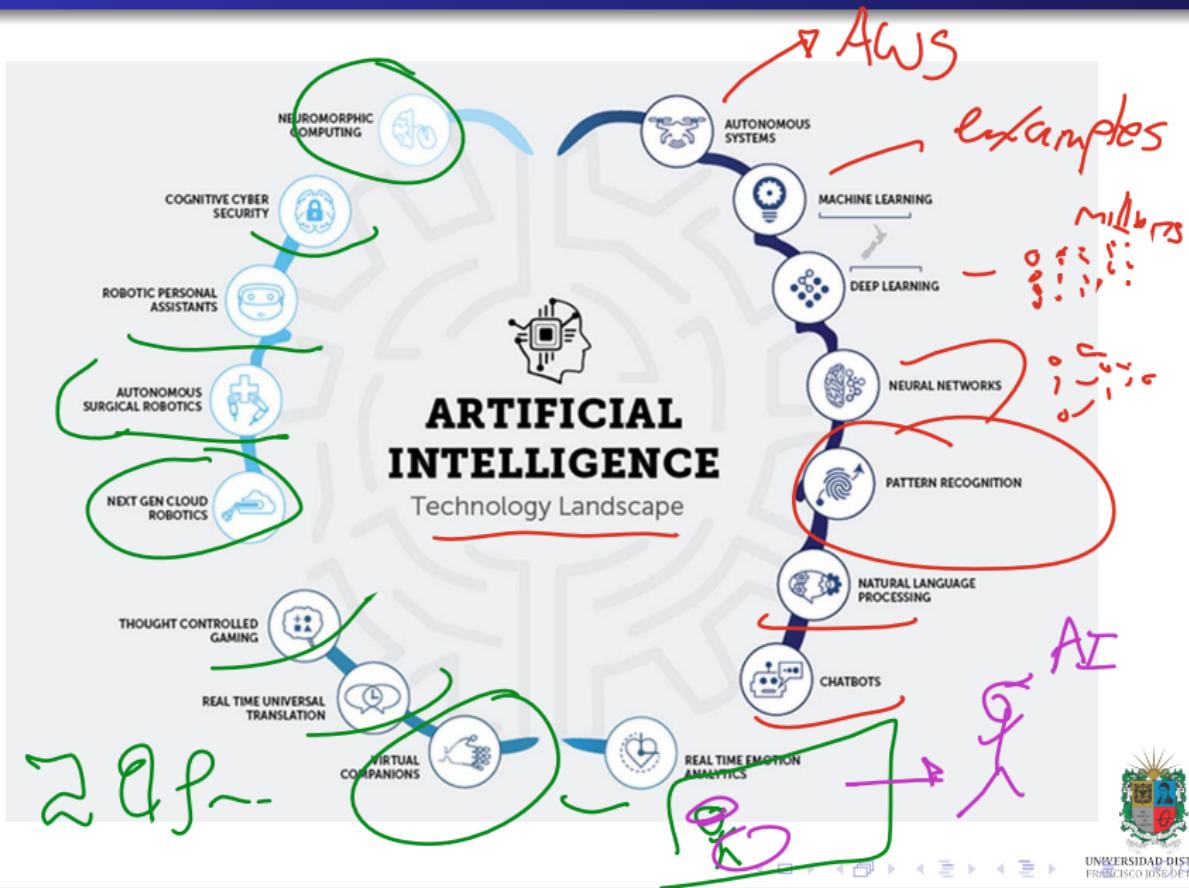
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# AI Landscape



# Computer Vision Startups — 2015

In 2015  
Face → Liar / Drink - Sleep  
Drive



## Leading Computer Vision Innovators

**clarifai**

Object  
Recognition

**Sighthound**

People  
Tracking

**SMART EYE<sup>®</sup>**  
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

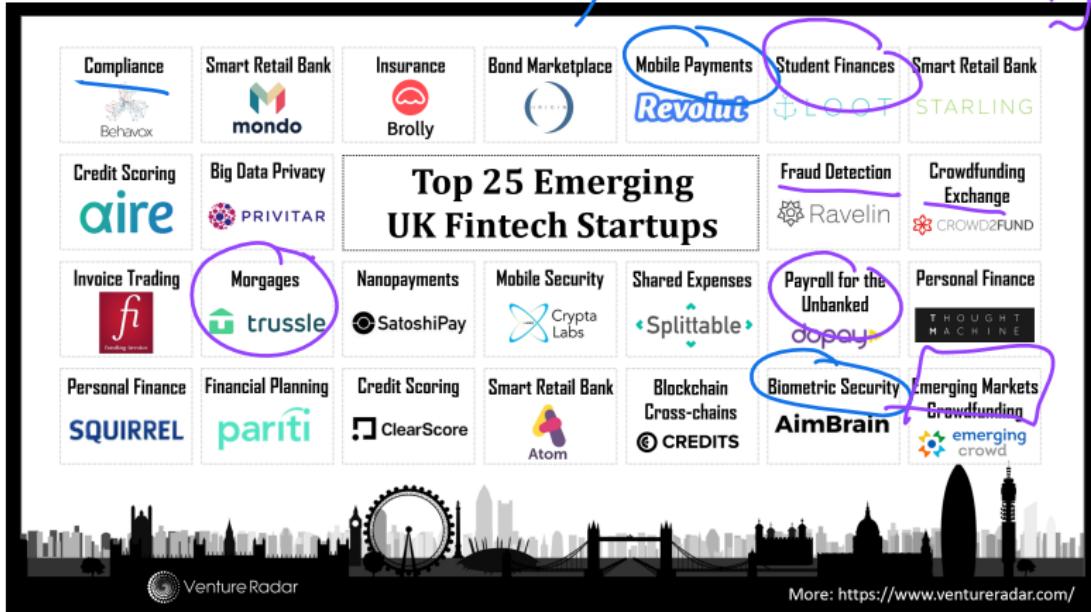
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# UK Fintech Startups — 2015

Fintech  
FinTech → Fintech

Crowdfunding



# Artificial Intelligence Startups — 2017



## Artificial Intelligence Startups

Augmenting knowledge work using AI



25% of all job-based tasks will be automated by 2019  
- Forrester Research

Many experts believe that by 2050 machines will have reached human level intelligence

Hundreds of startups are already using AI to augment knowledge work



Law & Contracts	Customer Service	Sales	Personal Assistants
ROSS  Okira Kelson  LEGAL ROBOT	FinGenius  DigitalGenius  CAPITO SYSTEMS  COGNICOR  Wise.io	AVISO  CONVERSICA  re:infer  sensai	x.ai  VANARE  WEALTHARC  INOVANCE
BEAGLE  DOXAII	agolo	NarrativeScience  SYNAPSIFY	Business Intelligence, Journalism, Research
Audit & Compliance	Medical & Other Image Analysis	clarifai	Other Medical
AppZen	MetaMind	enlitic	Tractable  Wired Informatics

Humans focus more on creativity, social intelligence, manual dexterity, and...

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



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# Thanks!

## Questions?



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

