Artificial Intelligence: A Natural Pursuit

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Overview

What is AI?

What recently happened to AI?

Topics in AI

- Machine Learning (Supervised, Unsupervised, Reinforcement)
- Neural Networks and Deep Learning
- Computer Vision and Robotics
- Speech and Natural Language Processing
- Multiagent Systems: Game Theory and Mechanism Design
- Crowdsourcing
- Planning and Scheduling
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Imagination and Reality

From the Mahabharata[1]

Imagination and Reality

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Modern-day videoconferencing[2]
The Urge to Replicate Human Behaviour and Thought

Automaton, Swiss CIMA Museum[1]

Babbage’s Difference Engine (1830s)[2]

AI: Definitions

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**AI Paradox**: Once we understand how X works, X is no longer AI!
Dartmouth Summer Research Project on Artificial Intelligence (1956)

John McCarthy (1927–2011)[1]

Marvin Minsky (1927–2016)[2]

Allen Newell (1927–1992)[3]

Herbert Simon (1916–2001)[4]

1950’s–1980’s

Theorem proving: Logic Theorist (Newell and Simon).
Mobile robotics: Shakey (Rosen).
Pattern recognition: Pandemonium (Selfridge).
Speech processing: Spoken language systems (Reddy).
Expert systems: Dendral (Feigenbaum).

[1] https://upload.wikimedia.org/wikipedia/commons/thumb/0/0c/SRI_Shakey_with_callouts.jpg/250px-SRI_Shakey_with_callouts.jpg

[2] https://upload.wikimedia.org/wikipedia/commons/7/79/More_A’s.jpg
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1980’s: AI Winter!

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AI in Life Today

[4] https://media.licdn.com/mpr/mpr/AAEAAQAAAAAARQAAAAJGZmMGZhYWMxLTE0NDQtNDQ1Ni1iNWE3LTJ1NWVkYWFhMmJjNg.jpg
Internet

Growth of Data

Amount of global digital information created & shared
- from documents to pictures to tweets -
grew 9x in five years to nearly 2 zettabytes* in 2011, per IDC.

Global Digital Information Created & Shared, 2005 – 2015E

KPCB

Note: * 1 zettabyte = 1 trillion gigabytes. Source: IDC report “Extracting Value from Chaos” 6/11.
Cheaper Hardware and Sensors

[1] https://smist08.files.wordpress.com/2012/09/clouddevices.png
Machine Learning

Learn a model

Face recognition, Credit-card fraud discovery, Sentiment analysis, ...

Deep learning can find highly non-linear patterns in visual, audio data.
Learn a model

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Machine Learning: Supervised Learning

Given labeled data, produce model to predict labels for unseen data.

Machine Learning: Unsupervised Learning (Clustering)

Given unlabeled data, produce model to assign to clusters.

[1] https://qph.ec.quoracdn.net/main-qimg-3bed74bc6559f62e6bbc2cdeea74f1dc
Machine Learning: Reinforcement Learning

**Question:** How must an agent in an unknown environment act so as to maximise its long-term reward?

**Answer:** Reinforcement Learning (RL).

[Video 1](https://www.youtube.com/watch?v=TmPfTpjtdgg)
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Learning to play breakout [Video¹]

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Neural Networks and Deep Learning

Computer Vision and Robotics

**Objective**: Integrate Sensing, Thinking, and Acting to perform task.

[Video of task 1]

1. [https://www.youtube.com/watch?v=-mOS5FknyLo](https://www.youtube.com/watch?v=-mOS5FknyLo)
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[Video of task 1]
[Video of task 2]

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[Video of task 1]
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[Video of task 3]

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3. https://www.youtube.com/watch?v=0d8qwrGHPR8
Speech and Natural Language Processing

**Topics:** Text summarisation, Sentiment analysis, Machine translation, etc.

Security and game theory: algorithms, deployed systems, lessons learned,

Crowdsourcing

Indian Pond-Heron is the 5th most commonly encountered bird in India, appearing in 35% of bird lists.

Planning and Scheduling

[1] https://ak.jogurucdn.com/media/image/p15/media_gallery-2015-12-16-7-fotor_delhi_3dd7a445519e5fc50a3459bc558a24f3.jpg