NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

SC3000/CZ3005 Artificial Intelligence

Introduction

Asst/P Hanwang Zhang
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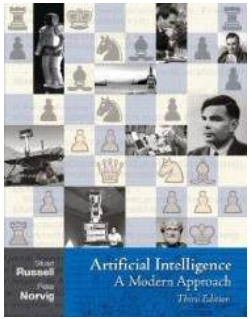
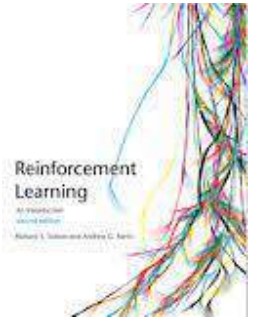
CZ3005 Info.

- Lecturers: Hanwang Zhang (me), Han Yu
- Optional Textbook:
  - S. Russell and P. Norvig Artificial Intelligence: A Modern Approach Prentice Hall, 2010, Third Edition
  - Richard S. Sutton and Andrew G. Barto Reinforcement Learning: An Introduction. 2nd Edition, MIT Press, 2018
- Grading: Programming/lab assignment (40%), Final exam (60%)
- During class: You may ask questions
  - If turned online: Leave msg in the chatbox/click raise hand
- After class: schedule a meeting, visit my office
- Tutorials start from week 3
- 2 Lab Sessions: starts from week 5/6, details to be announced on NTULearn
- If you can follow lectures, you can do very well in the final exam
- For students who want to pursue an AI career:
  - Talk to me and the other lecturer





Schedule for the First Half

Week	Date	Lecture	Lecture Topic	Tutorial	Lab
1	Jan 09 (Mon)	1	Introduction		One session in week 5/6
	Jan 11 (Wed)	2	Intelligent Agents		
2	Jan 16 (Mon)	3	Uninformed Search		
	Jan 18 (Wed)	4	Informed Search		
3	Jan 23 (Mon)	Chinese New Year No Class		1	
	Jan 25 (Wed)	5	Constraint Satisfaction		
4	Jan 30 (Mon)	6	Adversarial Search		
	Feb 01 (Wed)	7	Markov Decision Process 1		
5	Feb 06 (Mon)	8	Markov Decision Process 2	2	
	Feb 08 (Wed)	9	Reinforcement Learning 1		
6	Feb 13 (Mon)	10	Reinforcement Learning 2		
	Feb 15 (Wed)	11	Game Theory		
7	Feb 20 (Mon)	E-learning (Guest Lecture: TBD)			
	Feb 22 (Wed)	E-learning (Computer Vision & Natural Language Processing)			
RECESS					

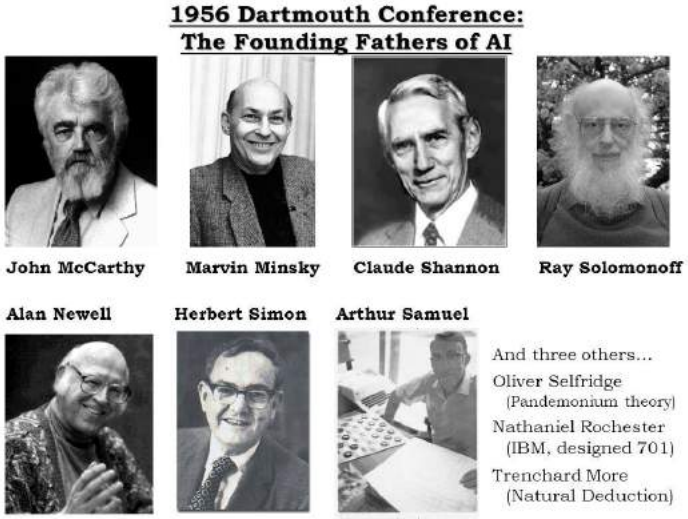
Red: no exam

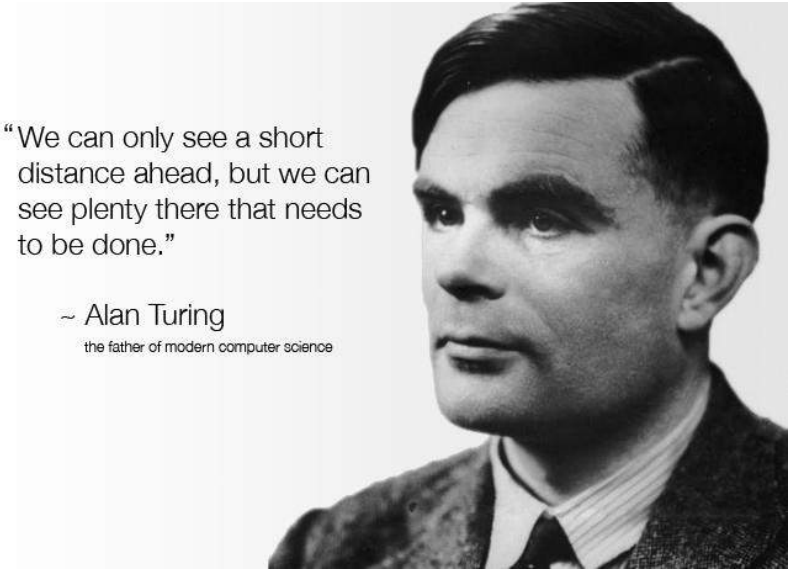
Outline

- A brief history of AI
- The state of the art
- Some recent research

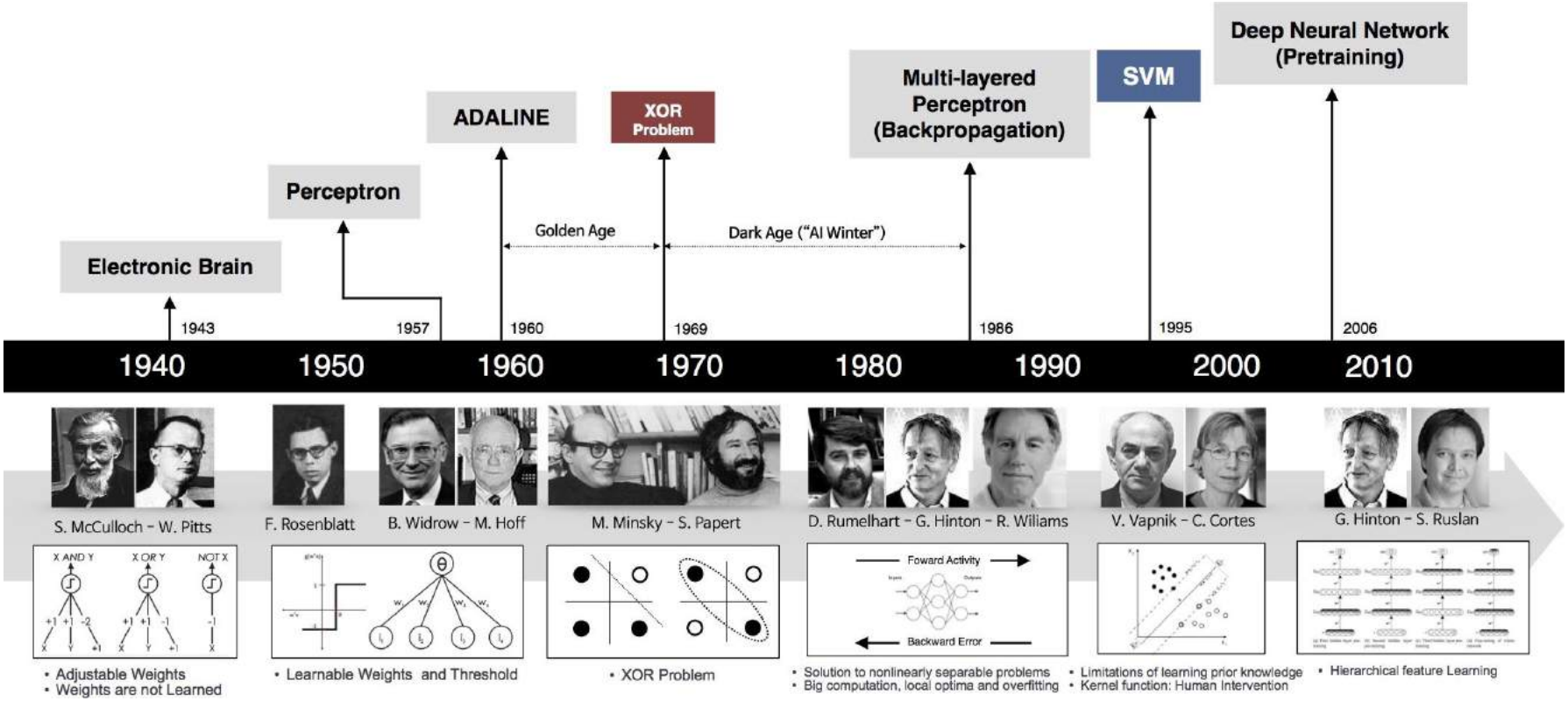
The Birth of AI

AI is intelligence demonstrated by machines, in contrast to the **natural intelligence** (**NI**) displayed by humans and other animals.



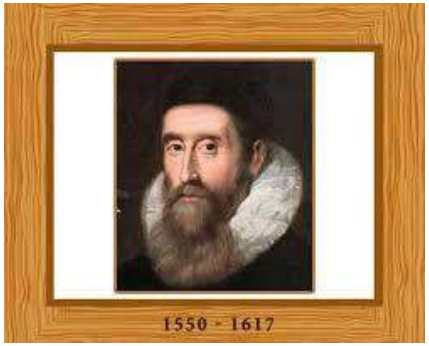


Timeline of AI Development

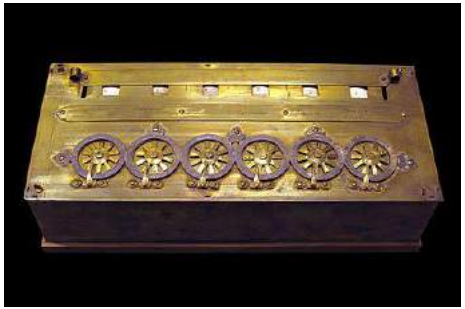


Hardware Revolution

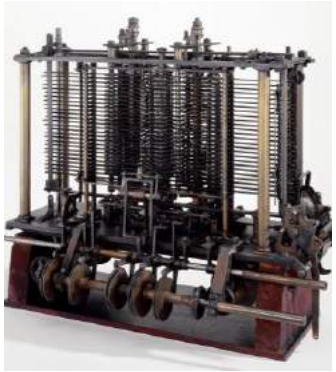
John Napier’s bones

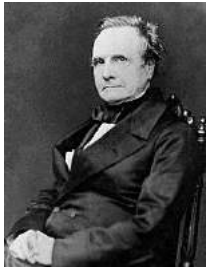


Gottfried Wilhelm Leibniz 1646--1716

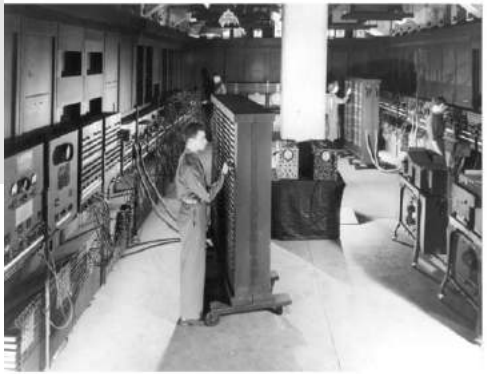


Blaise Pascal
1623--1662



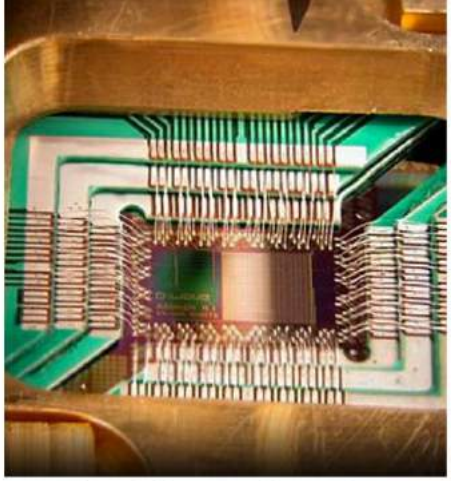


Charles Babbage
1791-1871



ENIAC 1945

Turing, Neumann



Google Quantum Computing

IBM, Apple, HP, etc

NVIDIA

Robot Soccer

TED talk by
Peter Stone
from UT Austin

http://www.youtube.com/watch?v=FXhw0_-iKwQ

Game Show

IBM's Watson Destroys Humans in Jeopardy

https://www.youtube.com/watch?v=P18EdAKuC1U

AlphaGo vs World Champions

March 9 – 15, 2016 (Lee Sedol)

- Time limit: 2 hours
- Venue: Seoul, Four Seasons Hotel
- AlphaGo Wins (4:1)

May 23 – 27, 2017 (Ke Jie)

- Venue: Wuzhen, China
- AlphaGo Wins (3:0)

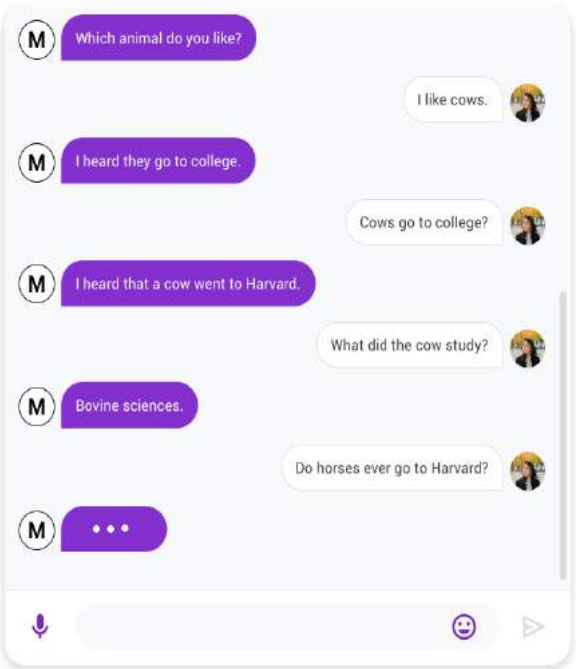
Libratus vs World Champions

The first AI to defeat top human poker players

January 11 to 31, 2017

- Venue: Pittsburgh
- 120,000 hands
- Has nothing to do with deep learning
- Algorithms for solving large scale games

AI Companion



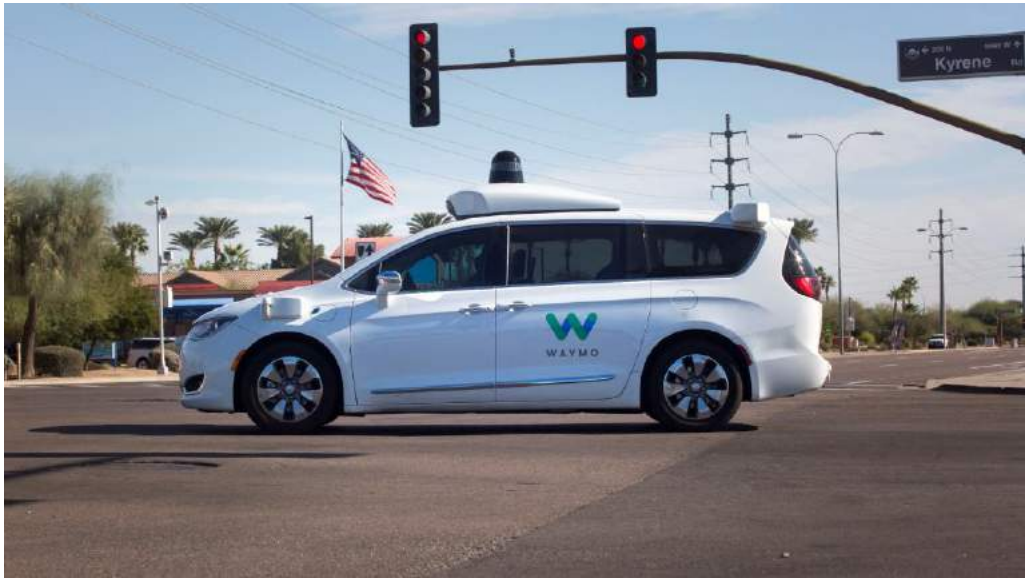
Manufacturing

Tesla
https://www.youtube.com/watch?v=-Ds1xV7M2gI

Google Driverless Car

TED talk by Sebastian Thrun from Stanford

https://www.youtube.com/watch?v=bp9KBrH8H04

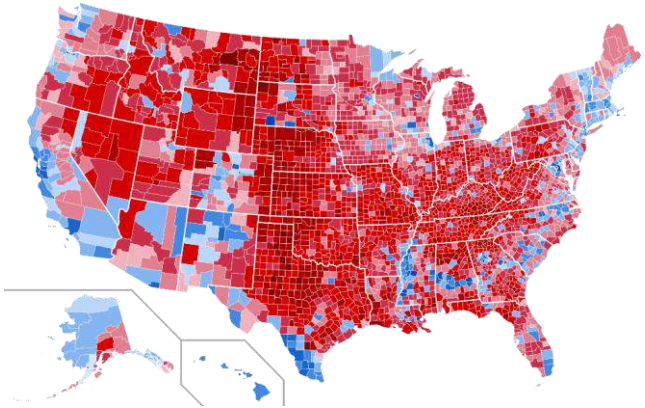


AI Predicts Elections

An artificial intelligence system that correctly predicted the last 3 elections says Trump will win

Pamela Engel, Business Insider US

October 29, 2016

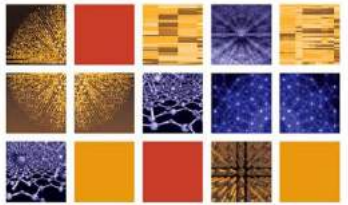


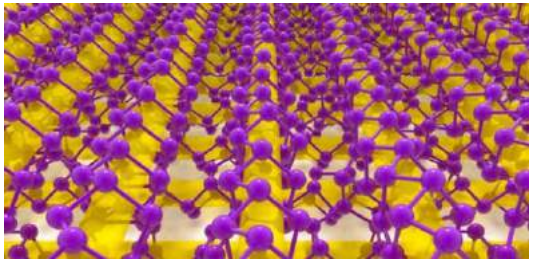
- MogIA, uses 20 million data points from online platforms like Google, YouTube, and Twitter to come up with its predictions.
- MogIA correctly predicted the past three presidential elections as well as the Democratic and Republican primaries.

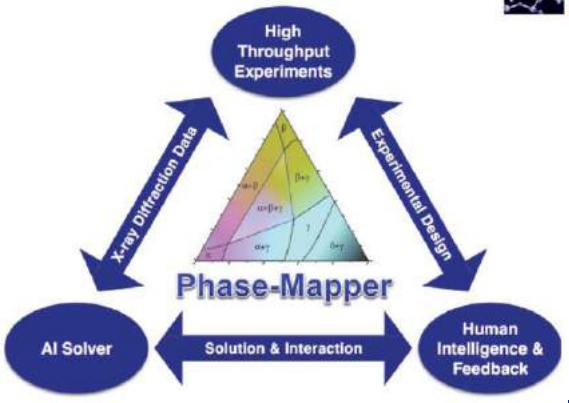
Accelerating Materials Discovery

- Phase map identification
- crystal structure of materials
- Phase-Mapper
- convolutive non-negative matrix factorization
- human feedback

materials DISCOVERY



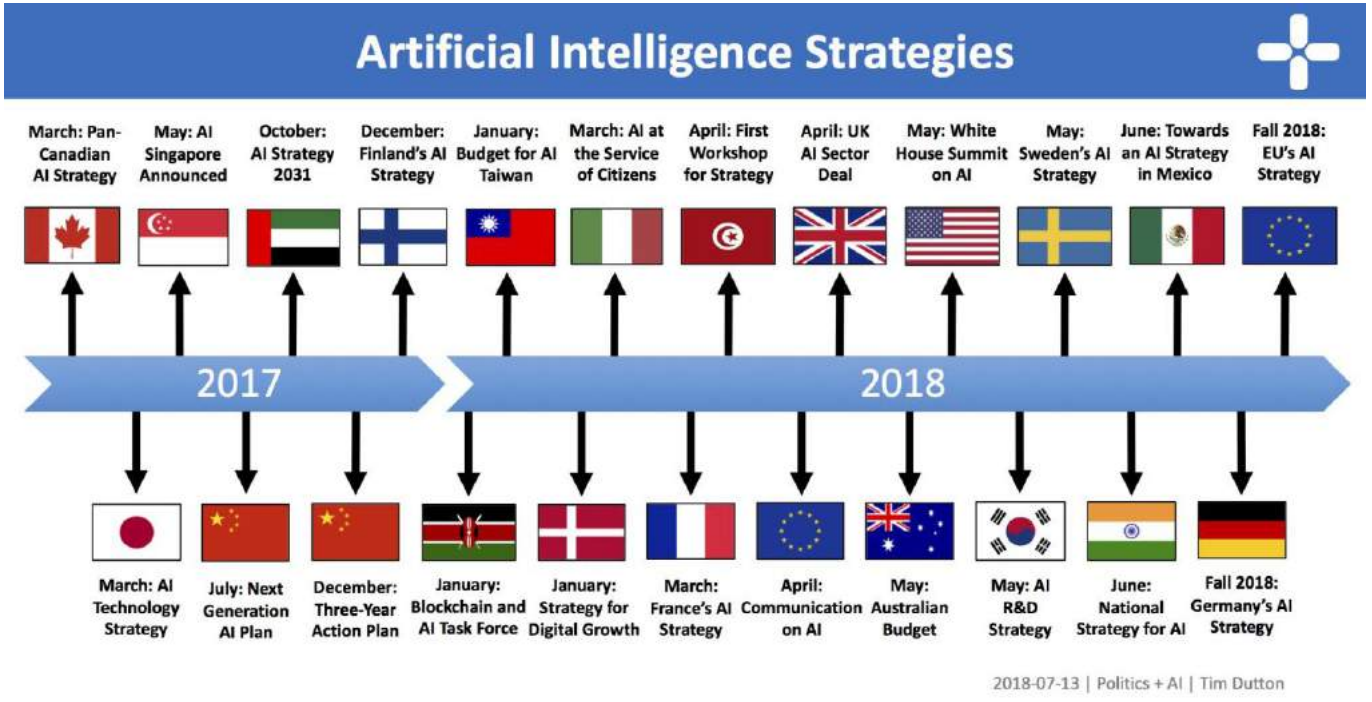




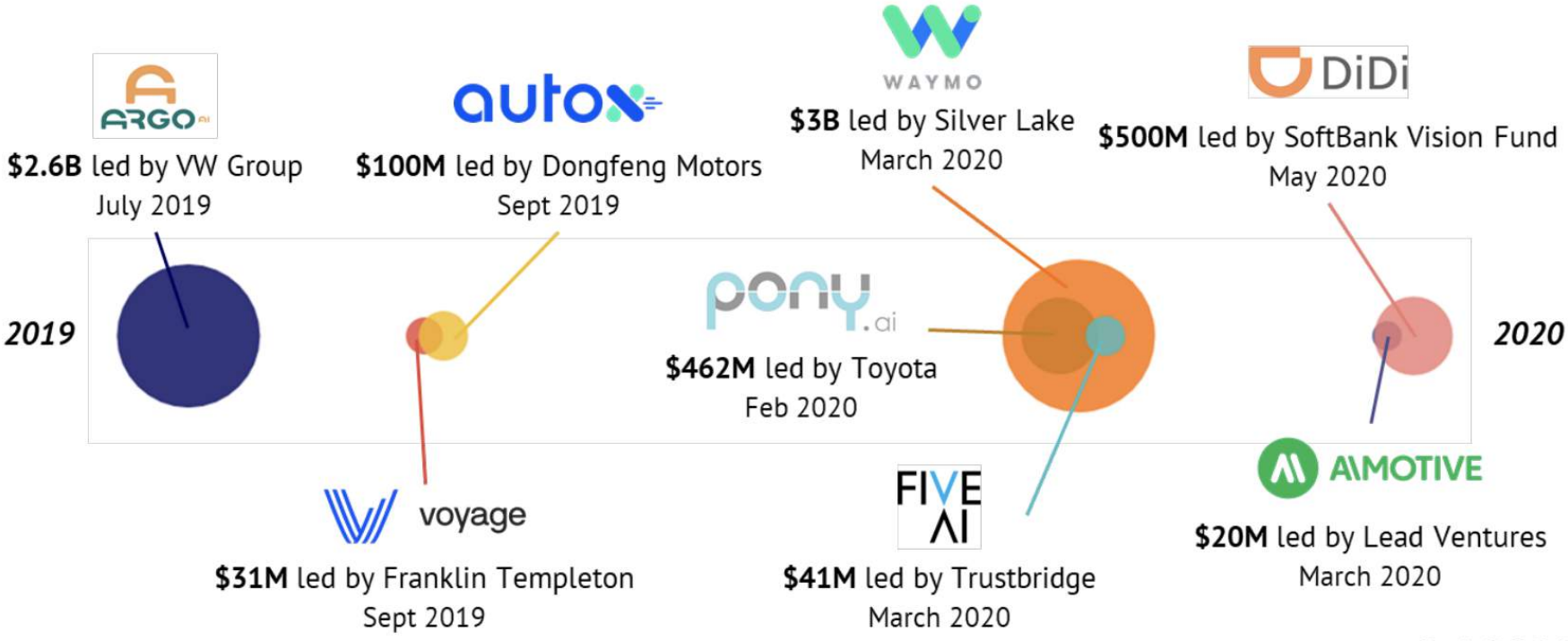
TikTok dominates your eyes

An Overview of National AI Strategies

https://www.smartnation.gov.sg/files/publications/national-ai-strategy.pdf



Self-driving Financing



stateof.ai 2020

Amazing AIGC (AI Generated Content)

Input: A tissue box with word ‘pytorch’

Input: A ‘pytorch’ brand mouthwater

Input: ‘OpenAI’ written on a T-shirt

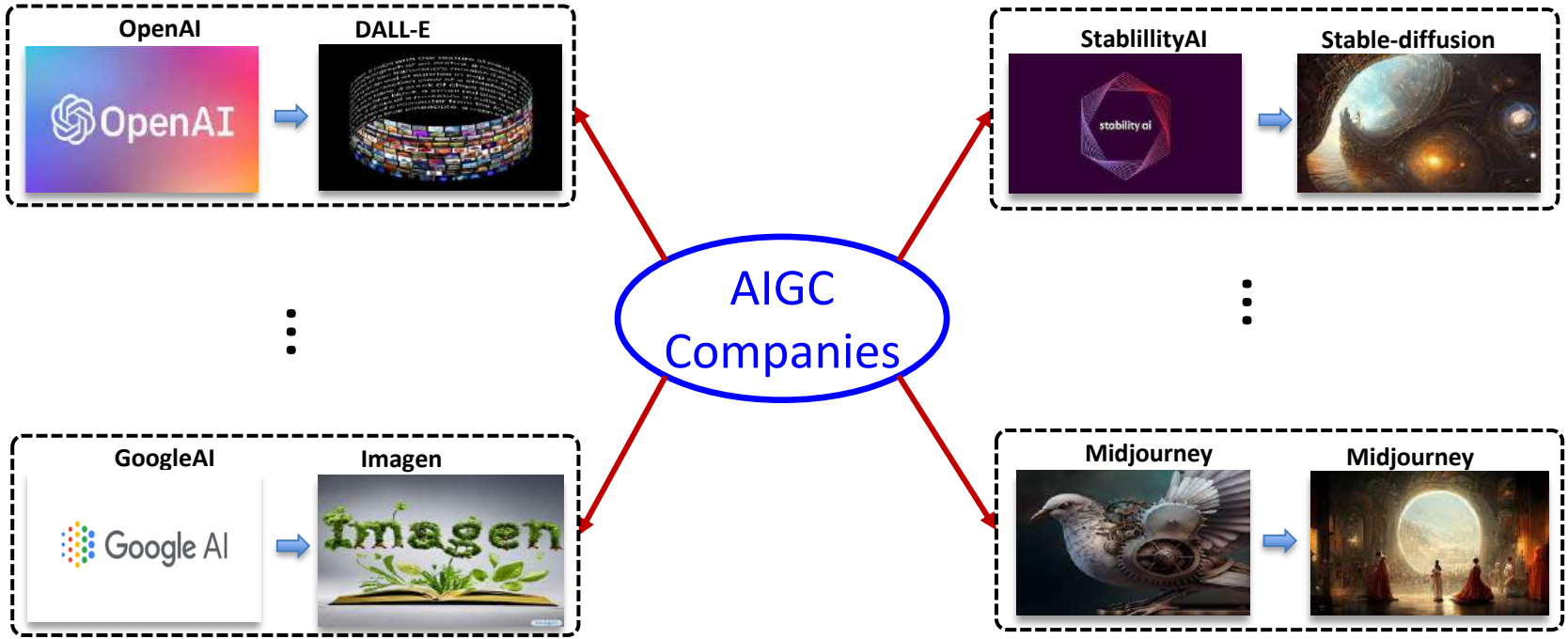
AIGC

Input: A clock in shape of an avocado

Input: A clock imitating a strawberry

Input: A teapot in style of pigs

AIGC is Growing Up



ChatGPT (Generative Pre-training Transformer)

Introducing ChatGPT research release Try ↗ Learn more ›

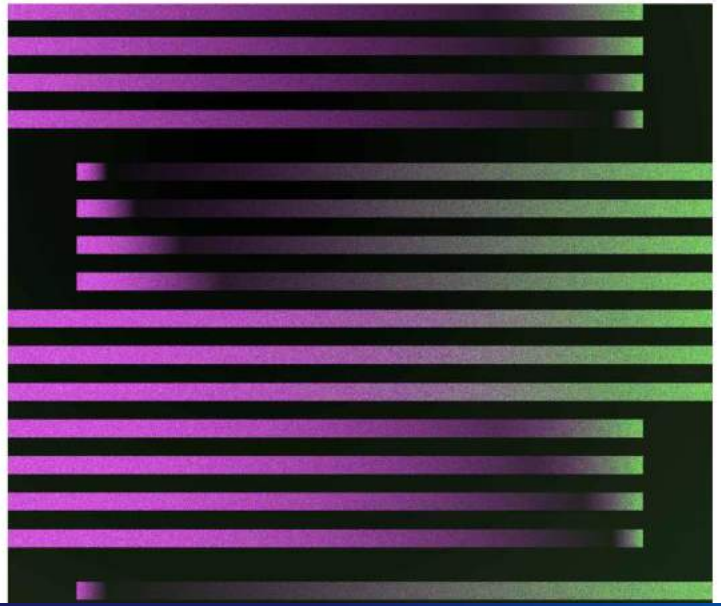
OpenAI

API RESEARCH BLOG ABOUT

ChatGPT: Optimizing Language Models for Dialogue

We've trained a model called ChatGPT which interacts in a conversational way. The dialogue format makes it possible for ChatGPT to answer followup questions, admit its mistakes, challenge incorrect premises, and reject inappropriate requests. ChatGPT is a sibling model to InstructGPT, which is trained to follow an instruction in a prompt and provide a detailed response.

TRY CHATGPT ↗



AI still at Very Early Stage

- Recent AI breakthrough

IMAGENET

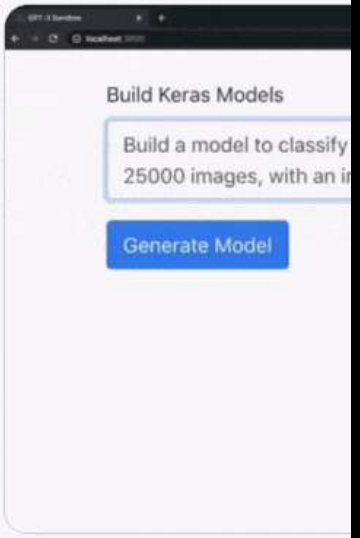
- What's next: AI for ***complex*** interaction

- Stochastic, open environment
- Multiple players
- Sequential decision, online
- Strategic (selfish) behavior
- Distributed optimization

Google bing

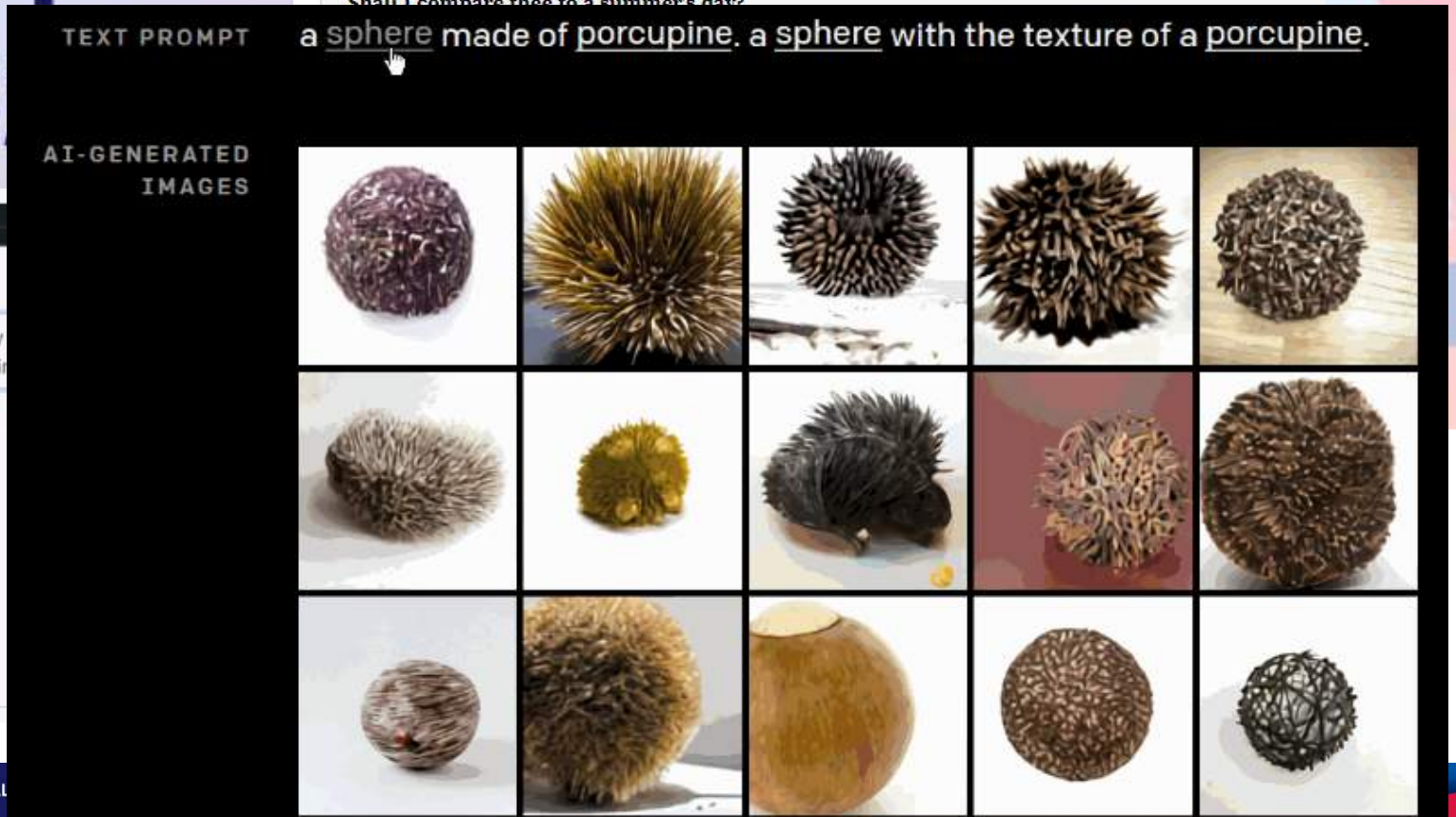
Open

GPT-



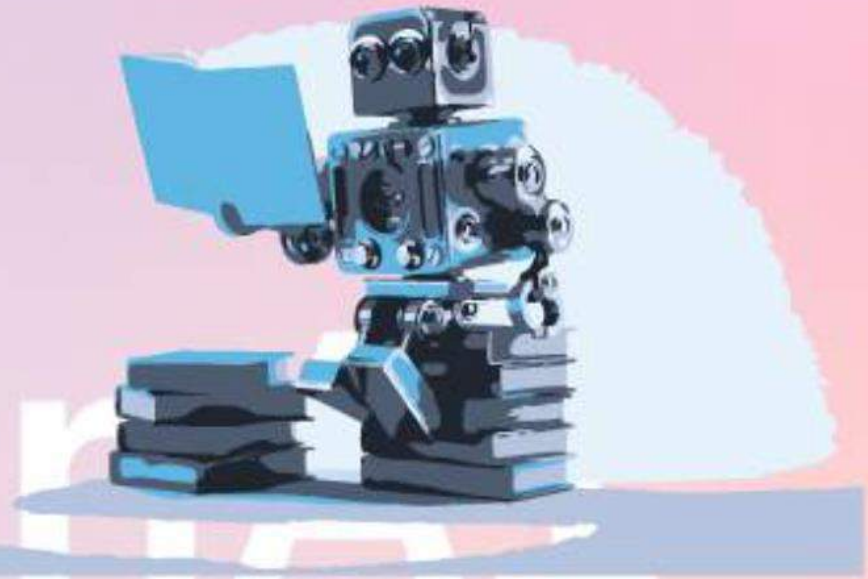
William Shakespeare ¶

Transformer AI poetry: Poetry classics as reimagined and rewritten by an artificial intelligence.
"Sonnet 18"
William Shakespeare
Shall I compare thee to a summer's day?



OpenAI

GPT-3

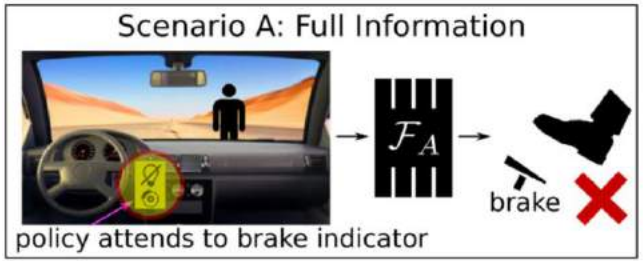


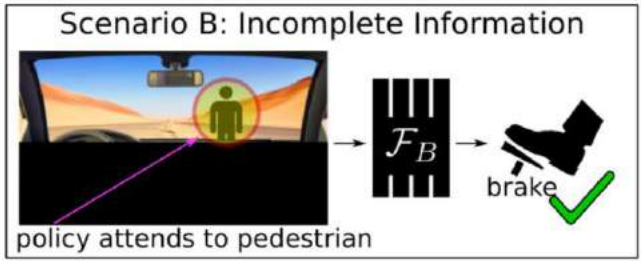
$12M/run

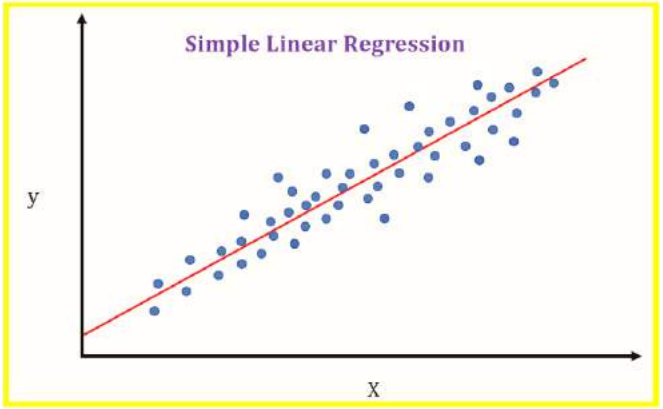
85,000kg/run

2.5L car
700,000 km

AI is far behind rocket science

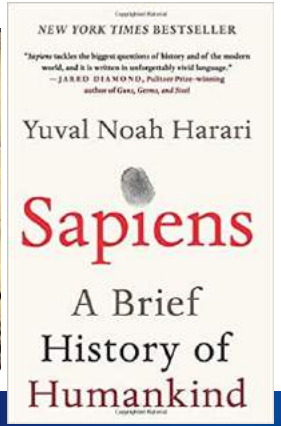






Ubiquitous Bias in AI

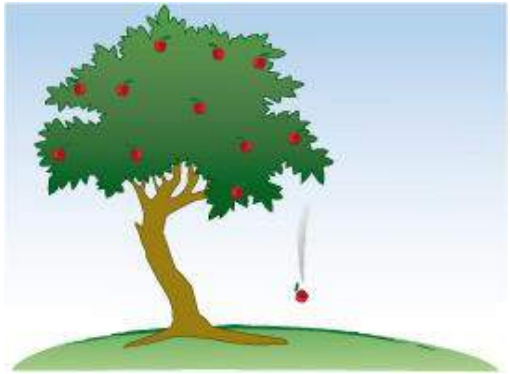
Facebook's A.I. labeled the video of Black men as content "about Primates."

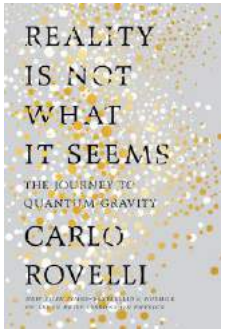


Pigeon Superstition --- by B.F. Skinner

Allegory of the Cave --- by Plato in Republic

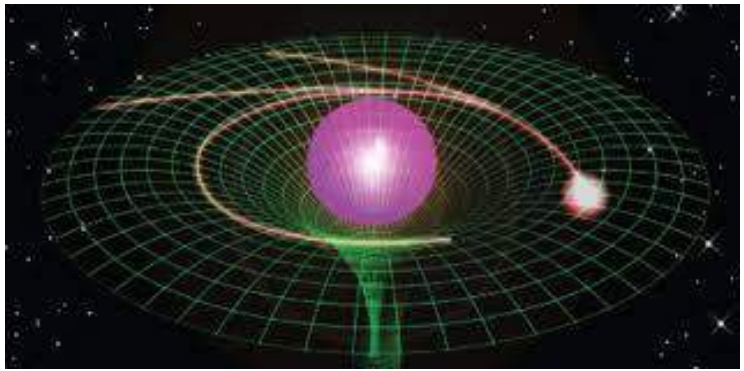
Intelligence: Know the Physics from Projection

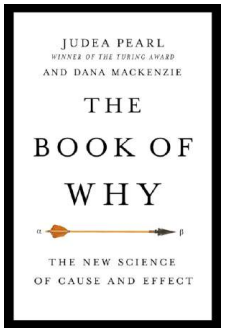




"Reality is not what it seems"

AI: Know the Physics from Data

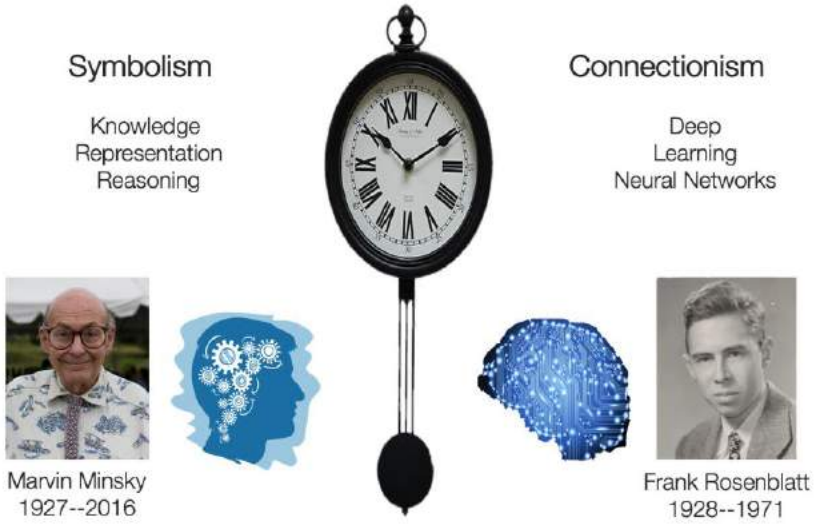




"The Book of Why: A New Science of Causality"

Some Recent Research

- Neural-Symbolic



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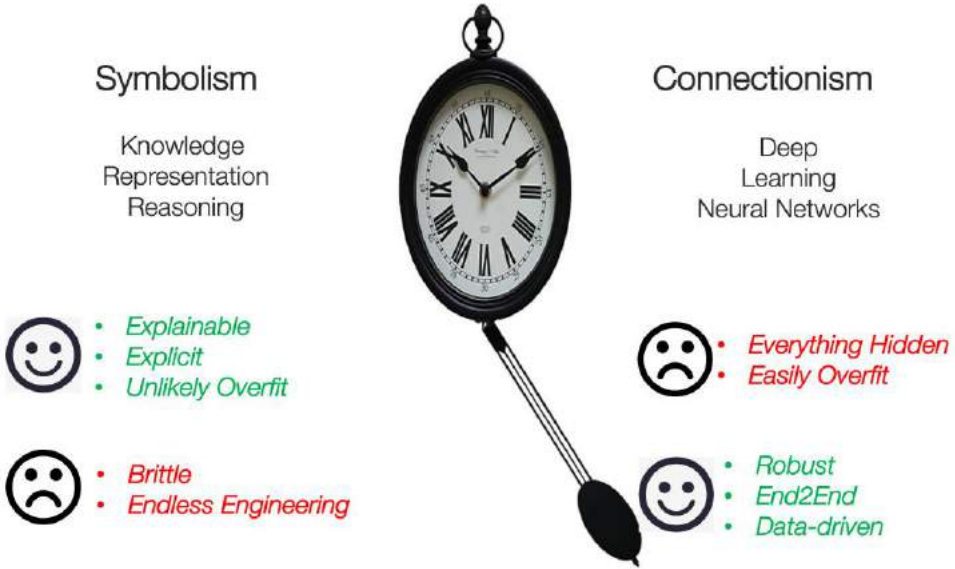

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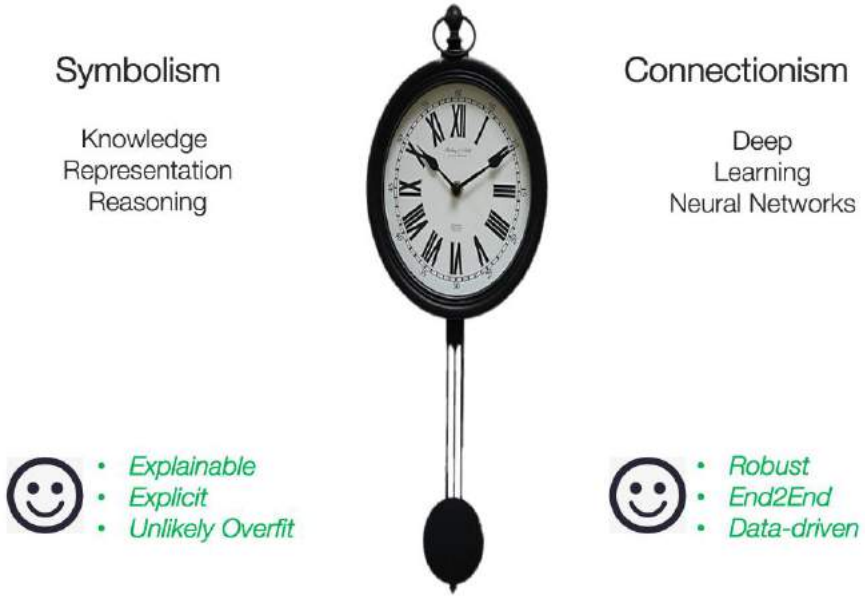
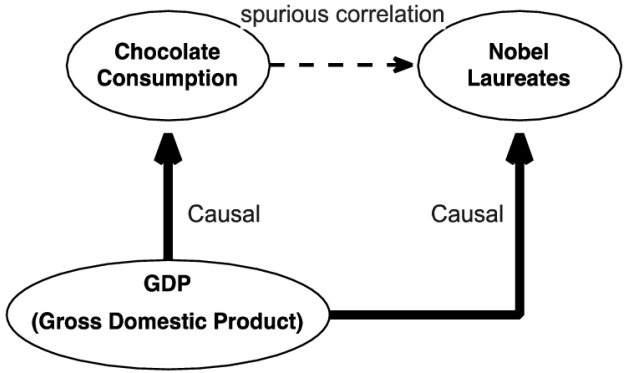
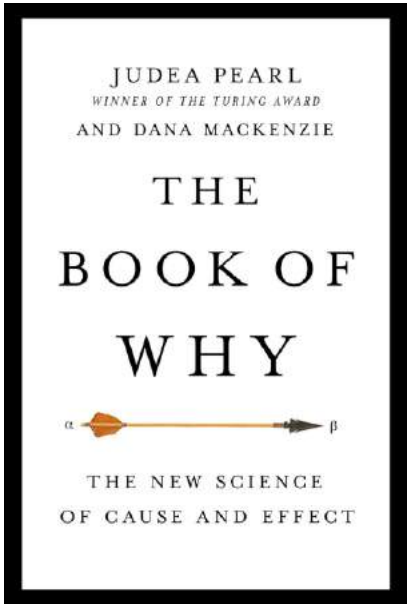
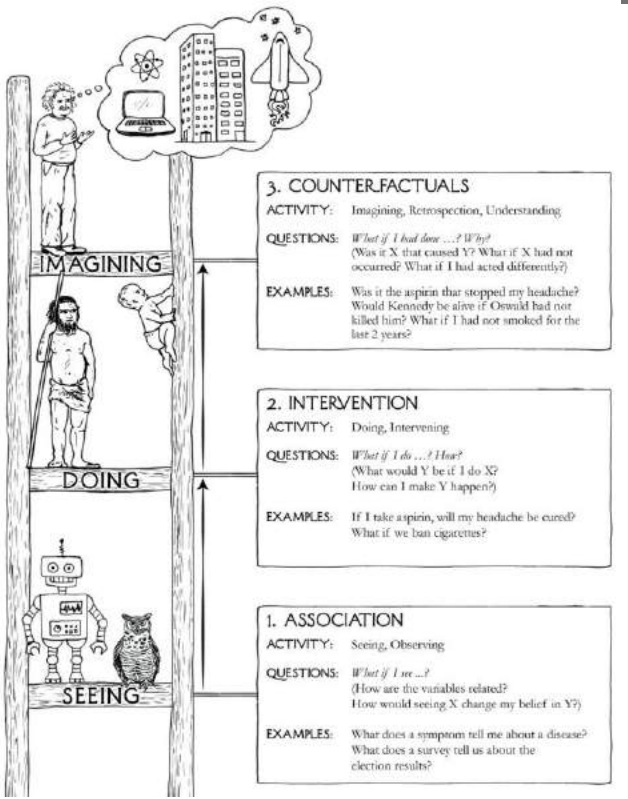


Some Recent Research

- Causal Inference







Where to follow the trend?

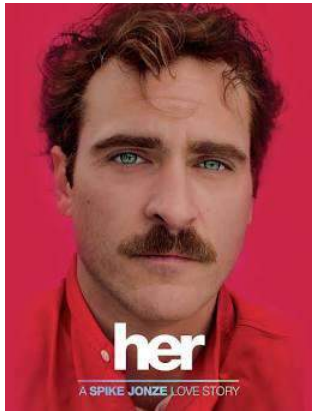
- Deep Learning: *ICLR*
- Computer Vision: *CVPR/ECCV/ICCV*
- Natural Language Processing: *ACL/EMNLP*
- Robotics: *ICRA*
- General AI: *AAAI, NeurIPS*

AI Arts


KEANU REEVES LAURENCE FISHBURNE
MATRIX


CHAPPiE


ALIEN
COVENANT


her
A SPIKE JONZE LOVE STORY


PS4
Only On PlayStation
DETROIT
BECOME HUMAN
18
quantic dream