

AI6101

Introduction to AI and AI Ethics

State-of-the-Art in AI

Assoc Prof Bo AN

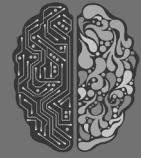
Research area: artificial intelligence, computational game theory, reinforcement learning, optimization

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AI6101 Matters

- ❑ Course Instructors: Bo An, Yu Han, Melvin Chen
- ❑ Grading: Group Project (40%), Final exam (60%)
- ❑ During class: You may ask questions at any time
 - ❑ LT3 (6:30pm-9:30pm on Monday)
- ❑ After class: visit my office, schedule a meeting, office hour
- ❑ If you can follow lectures, you can do very well in the final exam
- ❑ Deal with students with different background
- ❑ For students who want to learn more:
 - ❑ Talk to me, visit my webpage & read papers, research opportunities
 - ❑ Online competitions, projects

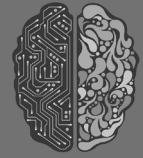




Schedule for the First Half

- The foundation of AI, history, and recent progress
- Search and intelligent agents
- Linear/integer programming
- MDP, reinforcement Learning
- Deep reinforcement Learning
- Computational game theory

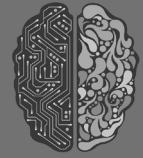




Week 1 Outline

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





What is Artificial Intelligence?

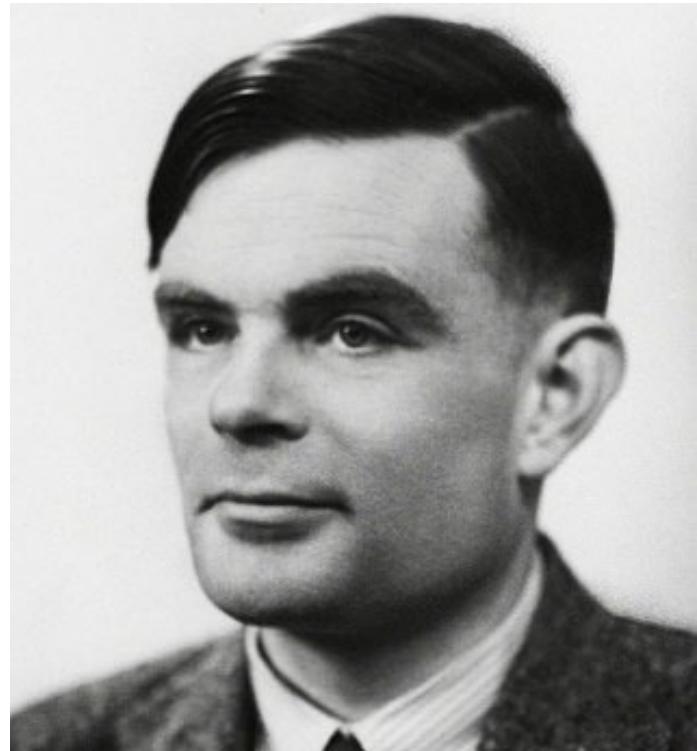
AI is intelligence demonstrated by machines, in contrast to the **natural intelligence (NI)** displayed by humans and other animals.



Birth of Artificial Intelligence

“We can only see a short distance ahead, but we can see plenty there that needs to be done.”

*Alan Turing
Father of Modern Computer Science*





Founding Fathers of AI

1956 Dartmouth Conference



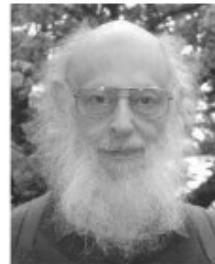
John McCarthy



Marvin Minsky



Claude Shannon



Ray Solomonoff



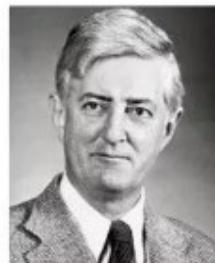
Alan Newell



Herbert Simon



Arthur Samuel



Oliver Selfridge

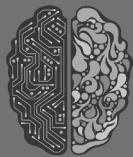


Nathaniel Rochester

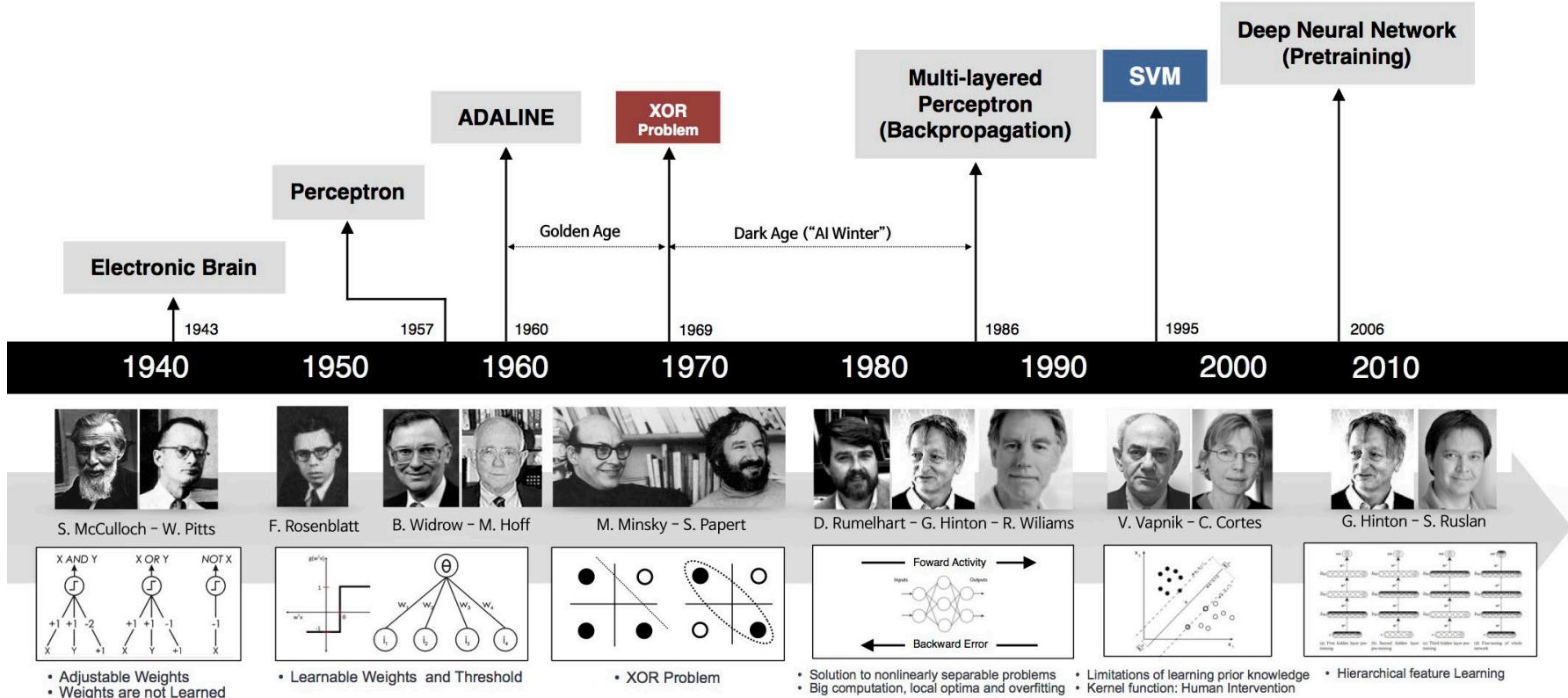


Trenchard More





Timeline of AI Development

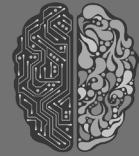




Views of AI

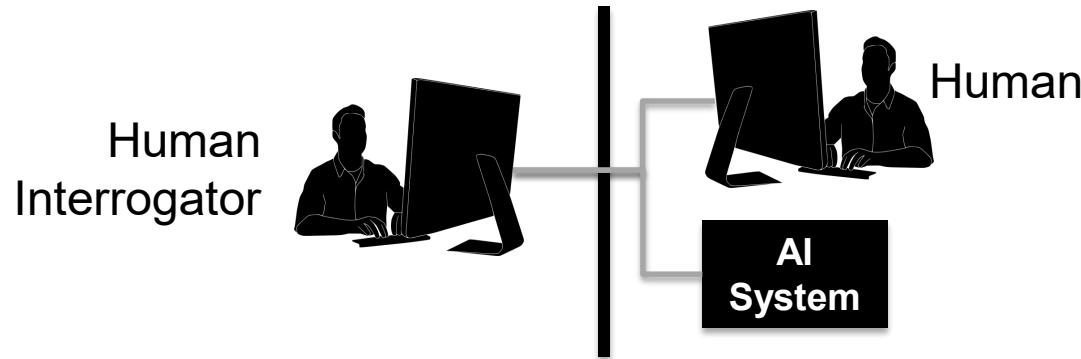
Views of AI fall into four categories:

1. Thinking Humanly
2. Acting Humanly
3. Thinking Rationally
4. Acting Rationally



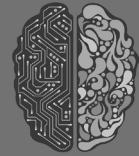
Acting Humanly: Turing Test

- Turing (1950) "Computing machinery and intelligence"
- Operational test for intelligent behavior: the Imitation Game



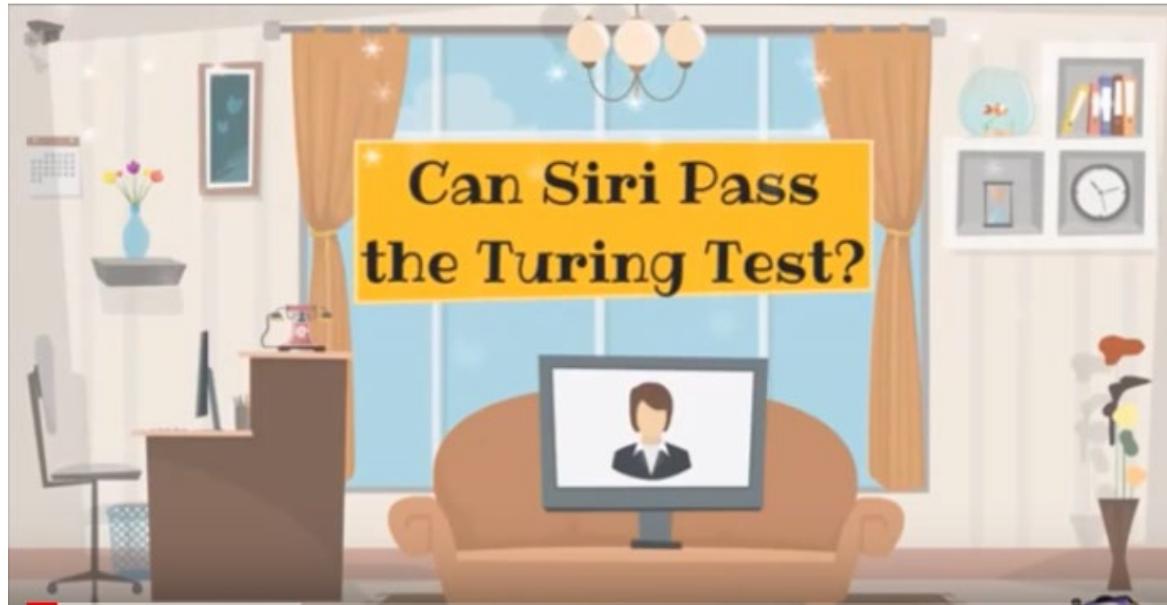
- Suggested major components of AI: knowledge, reasoning, language understanding, learning





Can Siri Pass The Turing Test?

<https://www.youtube.com/watch?v=0qcHhBSbyVw>





Thinking Humanly: Cognitive Modeling

- 1960s "cognitive revolution": information-processing psychology
- Requires scientific theories of internal activities of the brain
- Both approaches (Cognitive Science and Cognitive Neuroscience) are now distinct from AI

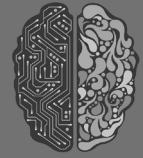




Thinking Rationally: "Laws of Thought"

- Aristotle: what are correct arguments/thought processes?
 - Several Greek schools developed various forms of logic: notation and rules of derivation for thoughts; may or may not have proceeded to the idea of mechanization
- Direct line through mathematics and philosophy to modern AI
- Problems:
 - Not all intelligent behavior is mediated by logical deliberation
 - What is the purpose of thinking? What thoughts should I have?

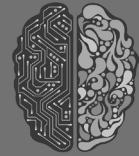




Acting Rationally: Rational Agents

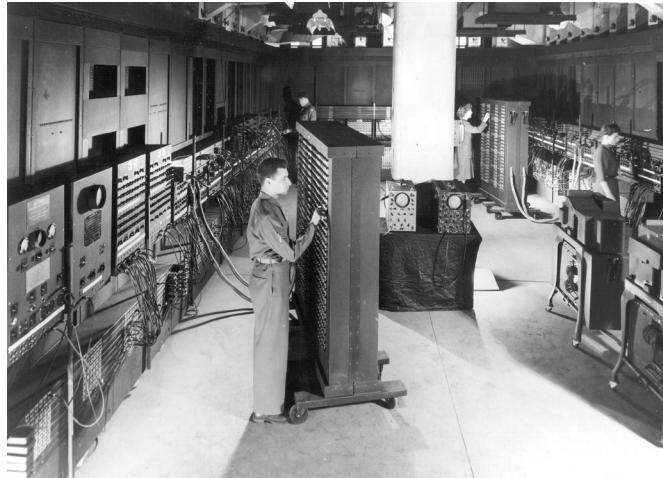
- **Rational** behavior: doing the right thing
- The right thing: that which is expected to maximise goal achievement, given the available information
- This course is about designing rational agents
- For any given class of environments and tasks, we seek the agent(s) with the best performance





Computer Chess

Garry Kasparov VS Deep Blue



ENIAC 1946

VS



Deep Blue 1997



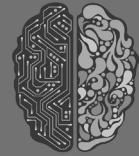


Robot Soccer

TED talk by
Peter Stone
from UT Austin

[http://www.youtube.com/
watch?v=FXhw0_iKwQ](http://www.youtube.com/watch?v=FXhw0_iKwQ)





Game Show



IBM's Watson
Destroys Humans in
Jeopardy

[https://www.youtube.com/watch?
v=P18EdAKuC1U](https://www.youtube.com/watch?v=P18EdAKuC1U)





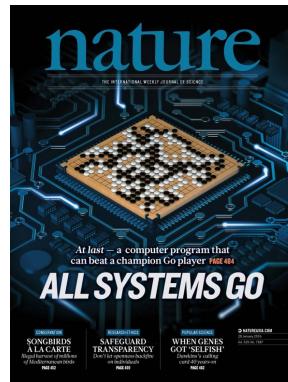
AlphaGo vs World Champions

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)



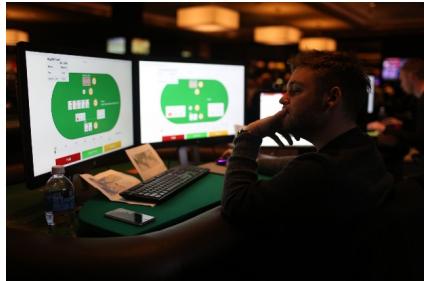


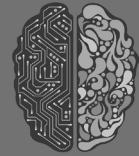
Libratus vs World Champions

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





Libratus vs World Champions



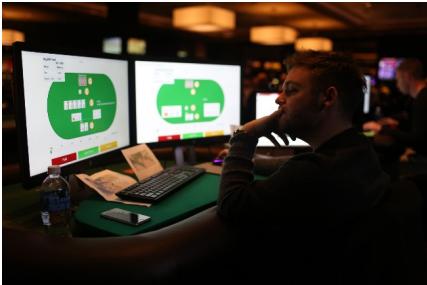
The first AI to defeat top human poker players

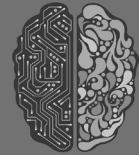
January 11 to 31, 2017

- ❑ Venue: Pittsburgh
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Has nothing to do with deep learning

Algorithms for solving large scale games





Google Driverless Car

TED talk by Sebastian Thrun from Stanford

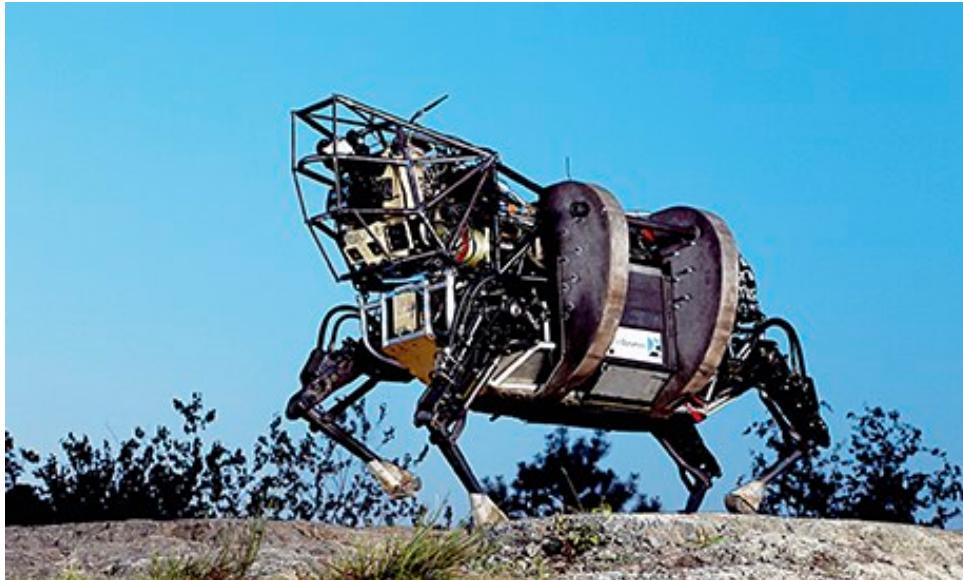
[https://www.youtube.com/
watch?v=bp9KBrH8H04](https://www.youtube.com/watch?v=bp9KBrH8H04)

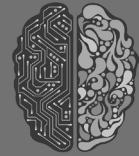




Google Robot Dog

<https://www.youtube.com/watch?v=4NzcB6TMzjw>





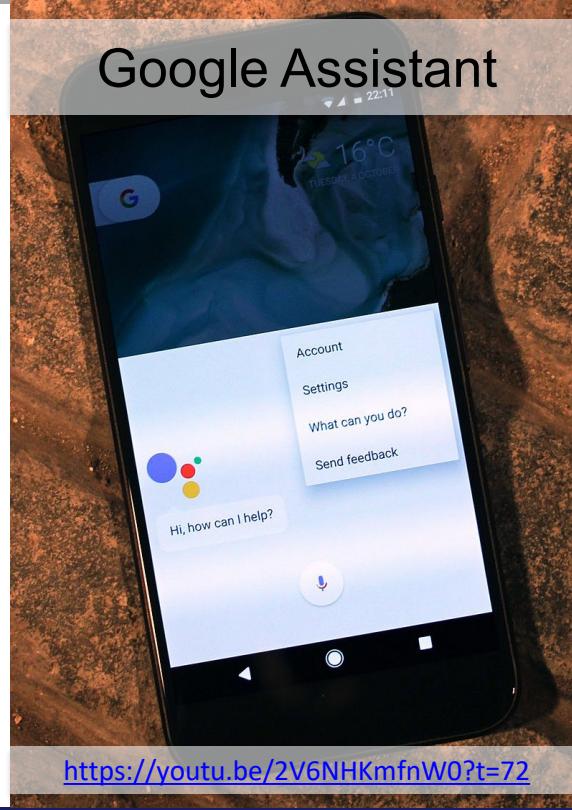
Natural Language Processing

Mi Box Voice Assistant



<https://youtu.be/S38ZJELrMmQ?t=16>

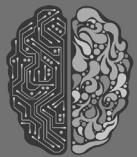
Google Assistant



<https://youtu.be/2V6NHKmfW0?t=72>

Alexa Amazon



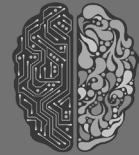


Manufacturing

Tesla

[https://www.youtube.com/
watch?v=8_lfxPI5ObM](https://www.youtube.com/watch?v=8_lfxPI5ObM)



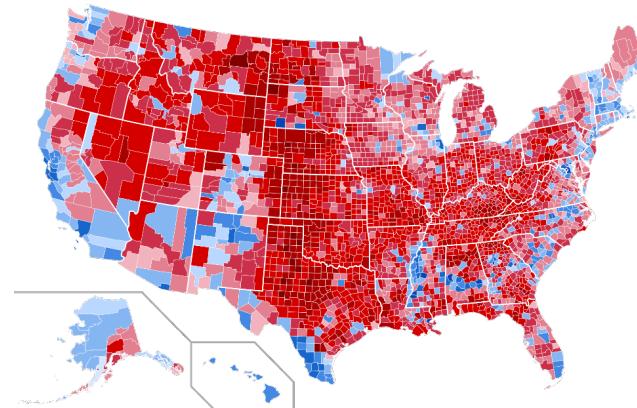


AI Predicts Elections

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.

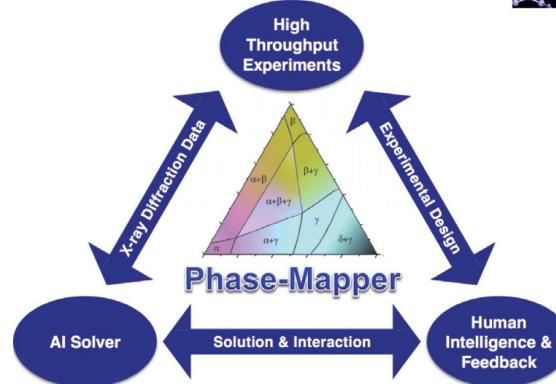
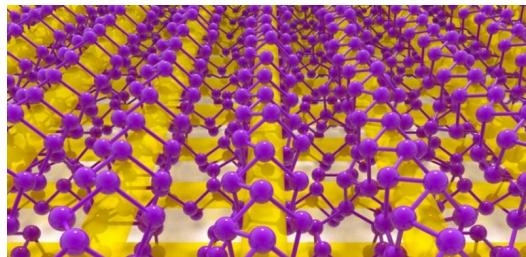
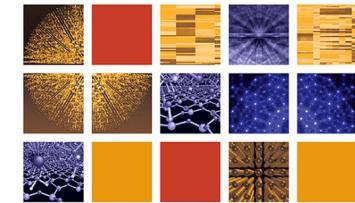




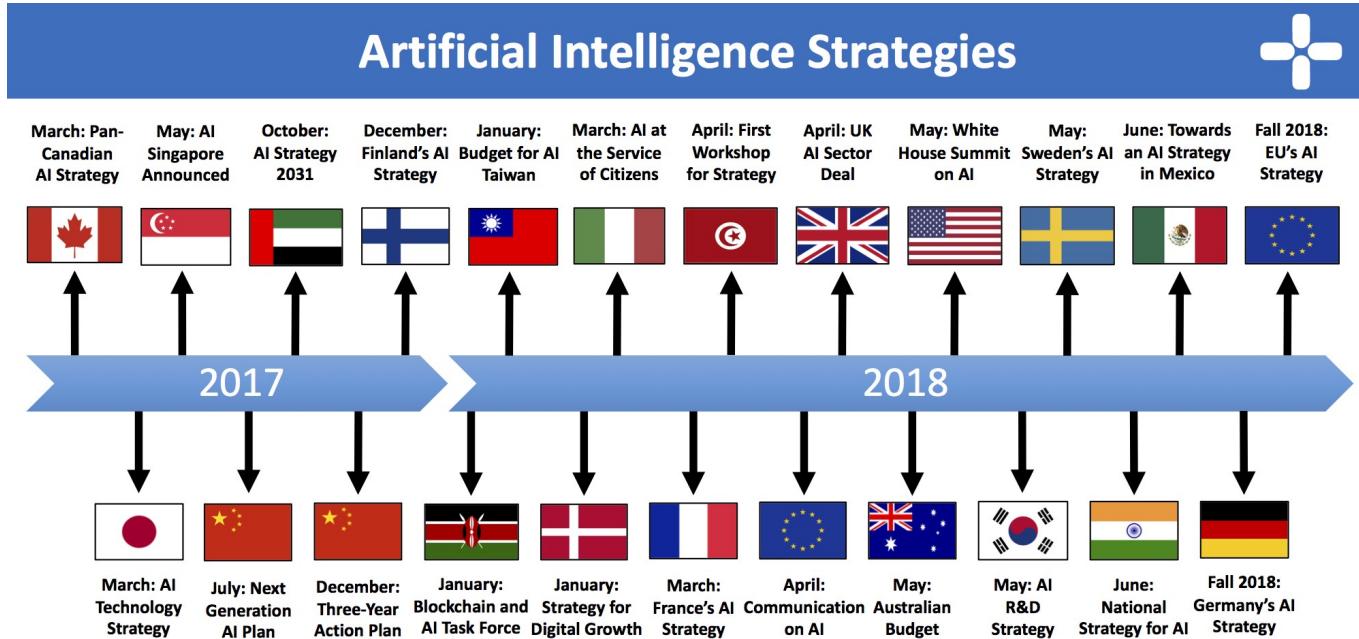
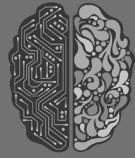
Accelerating Materials Discovery

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

materials
DISCOVERY



An Overview of National AI Strategies



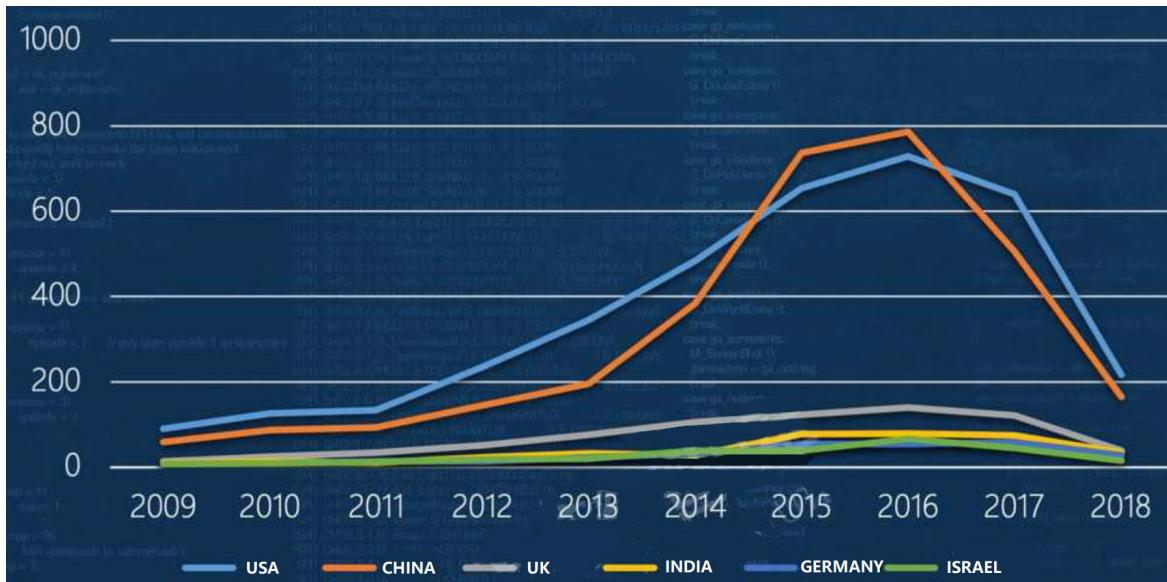
2018-07-13 | Politics + AI | Tim Dutton

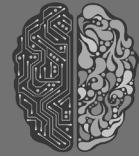




Newly Added AI Companies in Main Countries

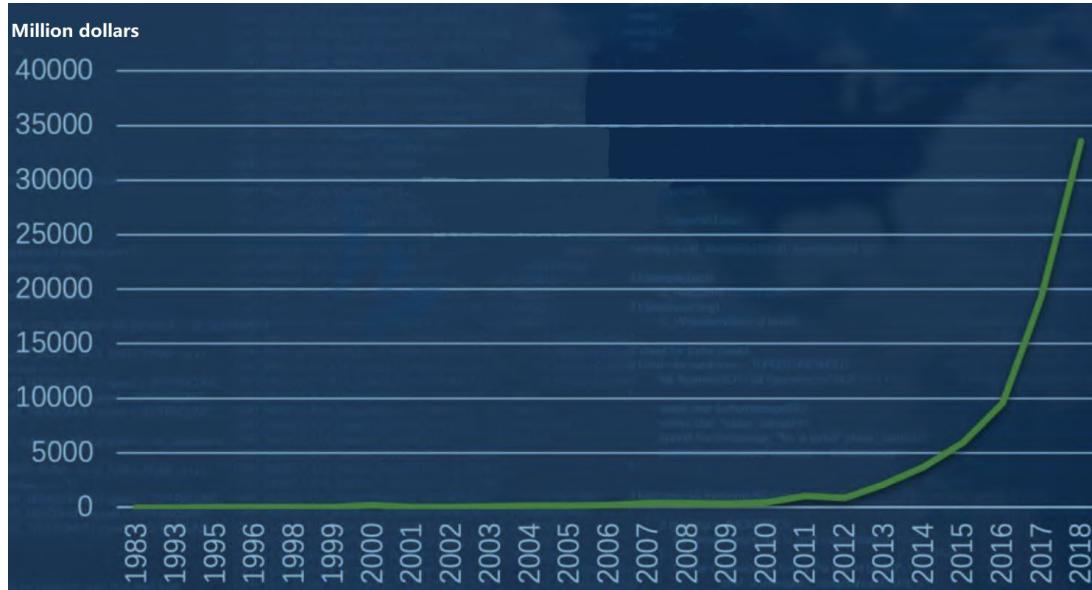
- Before 2016, it increases
- After 2017, it decreases





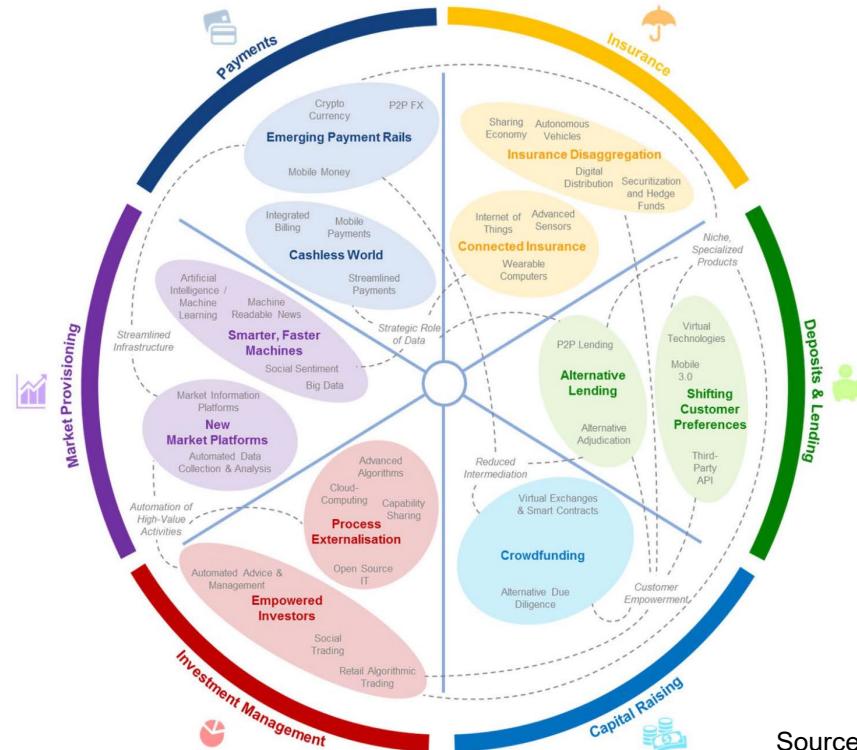
Newly Added Financing of AI Companies

- Different from the newly added AI companies, the financing increases





Artificial Intelligence for Finance



Source: World Economic Forum, 2015

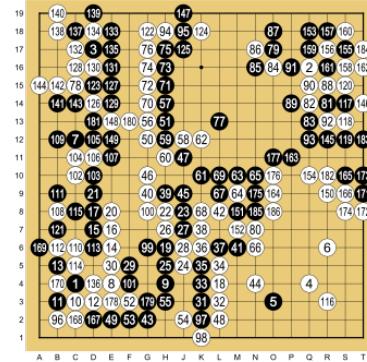


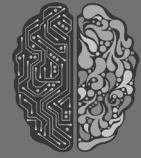


AI for Complex Interactions

Recent AI breakthrough

IMAGENET





What's Next?

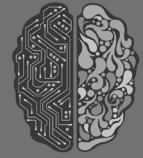
For AI Complex Interactions

- Stochastic, open environment
- Multiple players
- Sequential decision, online
- Strategic (selfish) behaviour
- Distributed optimisation



Google™
bing





Some Recent Research

- Separate slides and will not be covered in the exam