

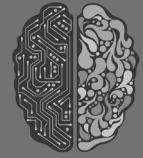
Introduction to Data Science and Artificial Intelligence

State-of-the-Art in DS&AI

Assoc Prof Bo AN

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computational game theory, optimization
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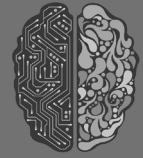




Lesson Outline

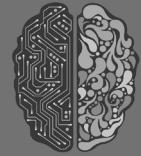
- A brief history of AI
- The state of the art





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*

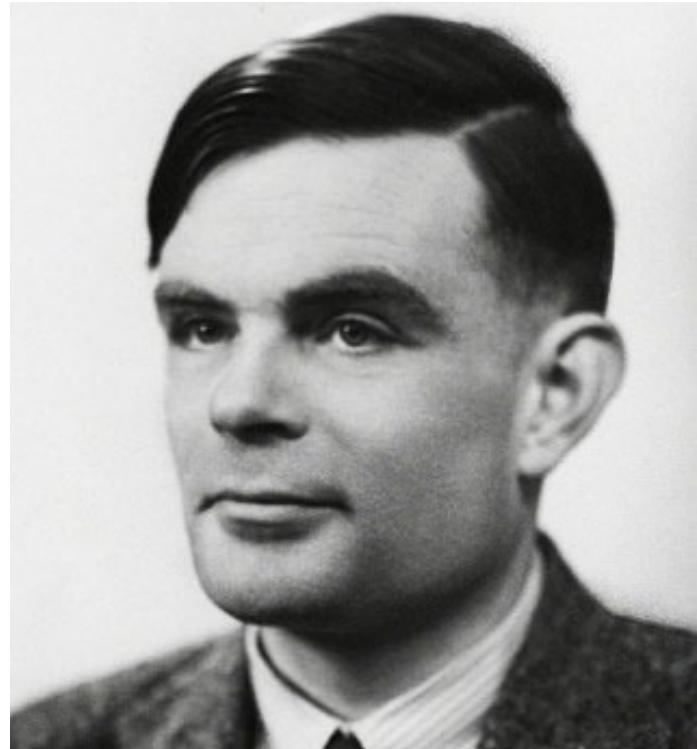


Image source: <https://www.flickr.com/photos/23925401@N06/23022750663>





Founding Fathers of AI

1956 Dartmouth Conference



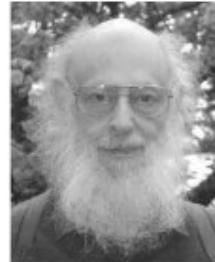
John McCarthy



Marvin Minsky



Claude Shannon



Ray Solomonoff



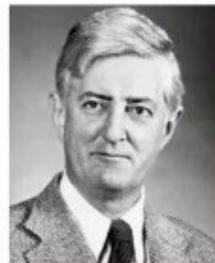
Alan Newell



Herbert Simon



Arthur Samuel



Oliver Selfridge



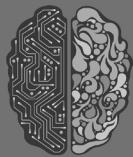
Nathaniel Rochester



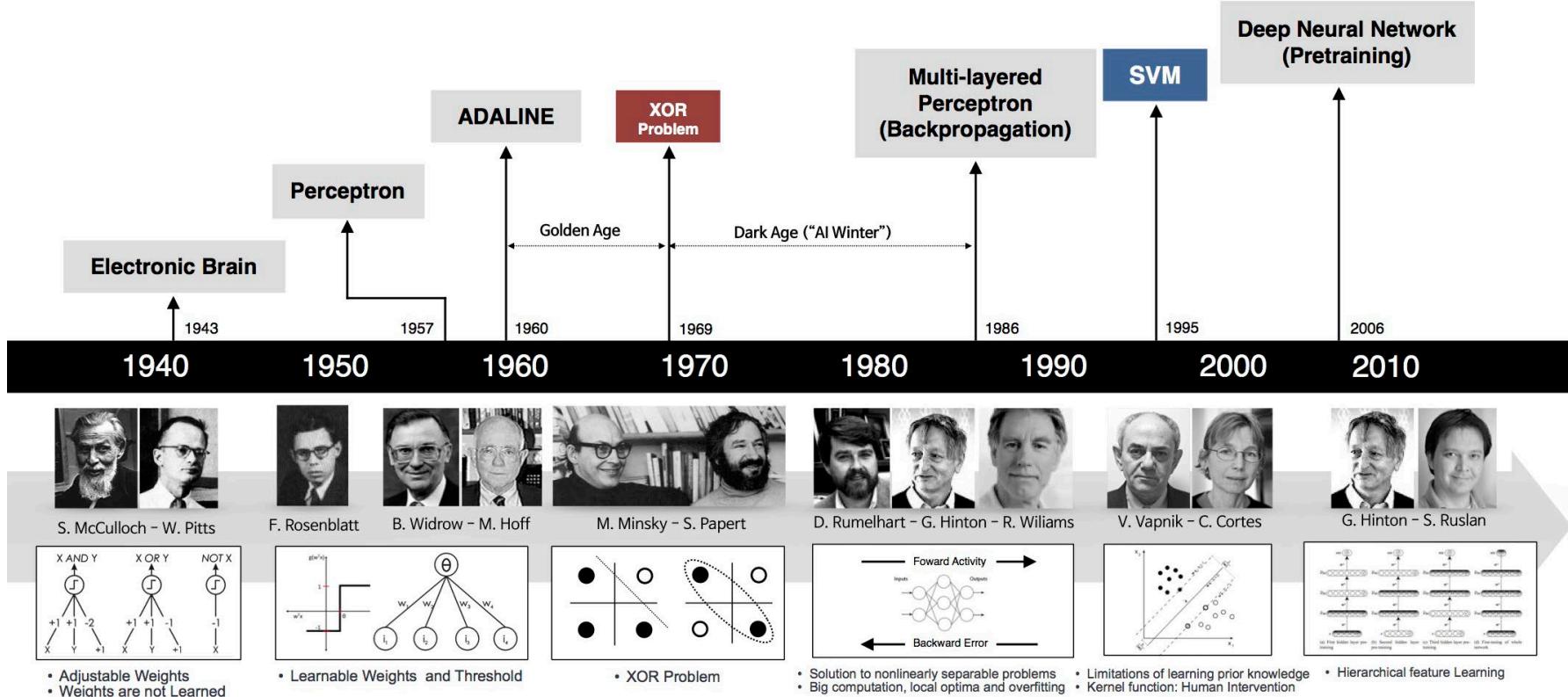
Trenchard More

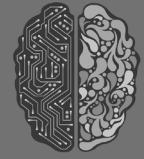
Image source: <https://www.scienceabc.com/innovation/what-is-artificial-intelligence.html>





Timeline of AI Development





Views of AI

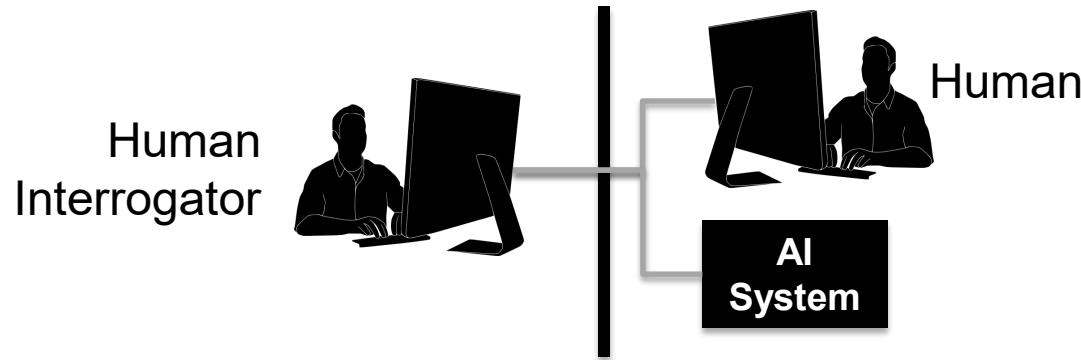
Views of AI fall into four categories:

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

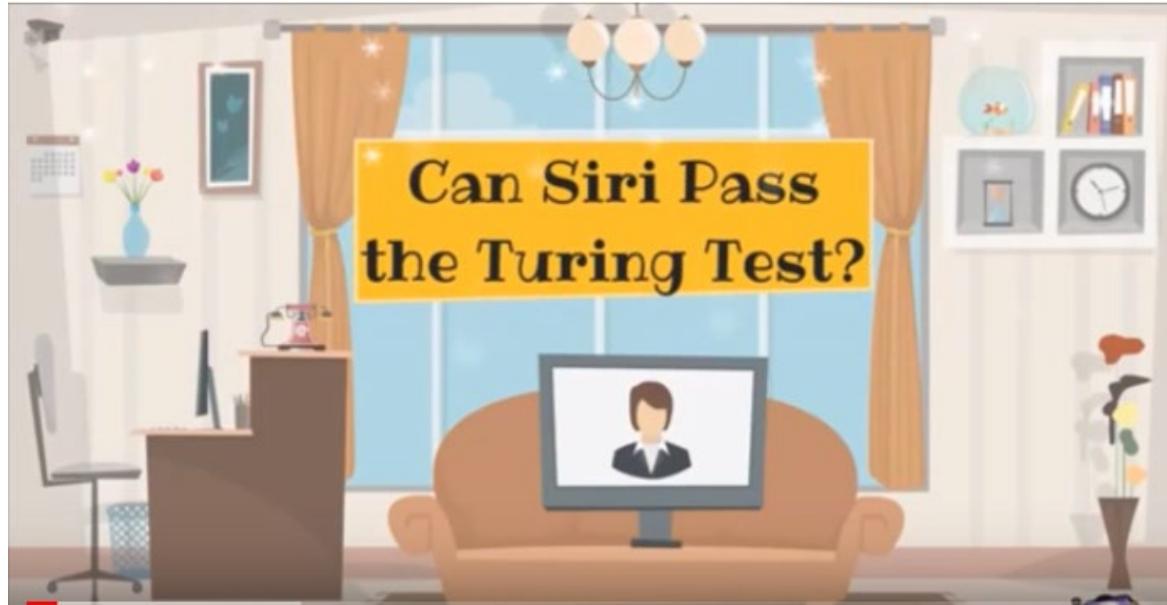
Image source: <https://svgsilh.com/image/2763393.html>





Can Siri Pass The Turing Test?

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



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students to watch>





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?



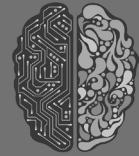


Acting Rationally: Rational Agents

- **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

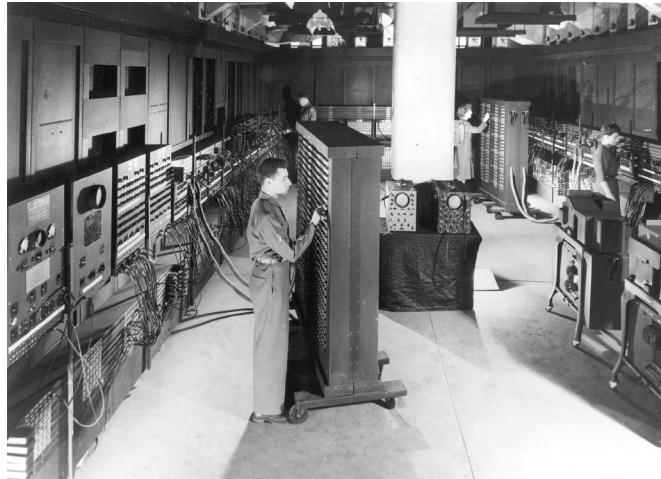






Computer Chess

Garry Kasparov VS Deep Blue



ENIAC 1946

VS



Deep Blue 1997

Image Sources:

<https://www.flickr.com/photos/gageskidmore/37137186253>

[https://en.wikipedia.org/wiki/Deep_Blue_\(chess_computer\)#/media/File:Deep_Blue.jpg](https://en.wikipedia.org/wiki/Deep_Blue_(chess_computer)#/media/File:Deep_Blue.jpg)





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)

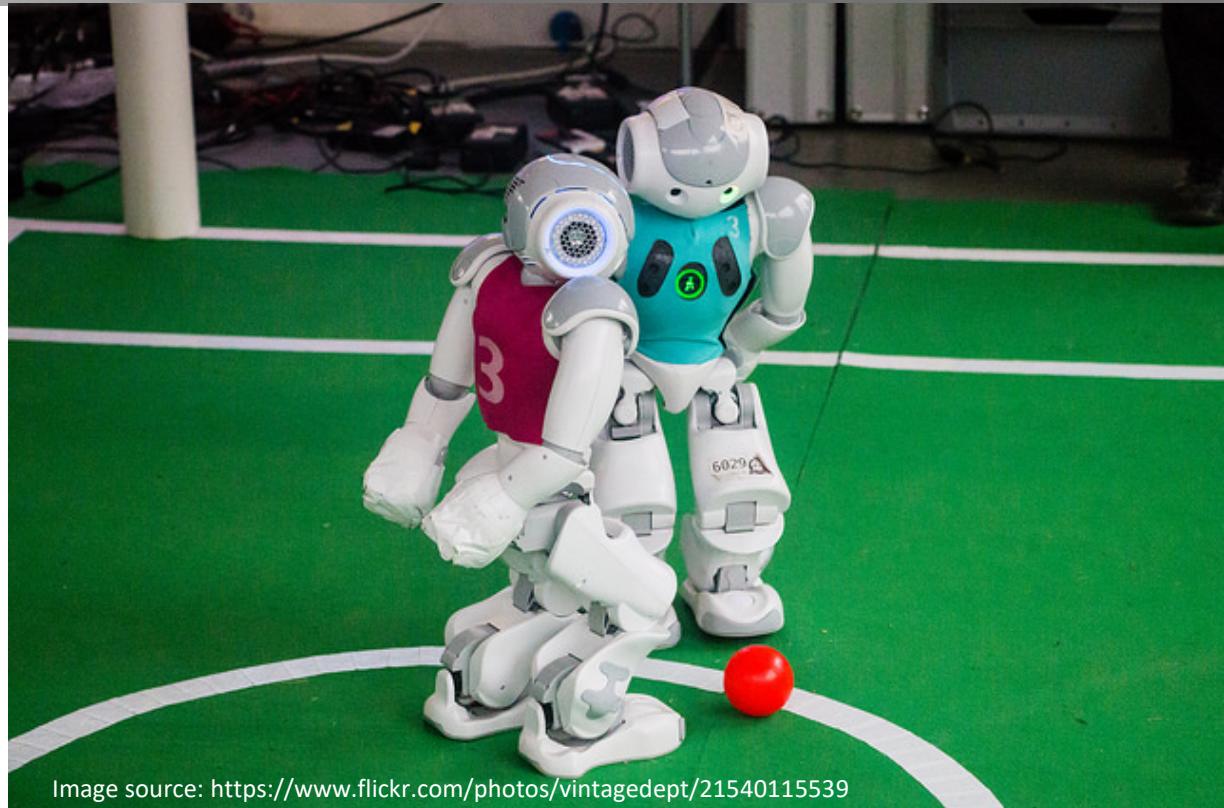


Image source: <https://www.flickr.com/photos/vintagedept/21540115539>



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Game Show



Image source: https://commons.wikimedia.org/wiki/File:IBM_Watson_w_Jeopardy.jpg

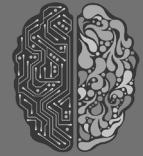
IBM's Watson
Destroys Humans in
Jeopardy

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



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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)

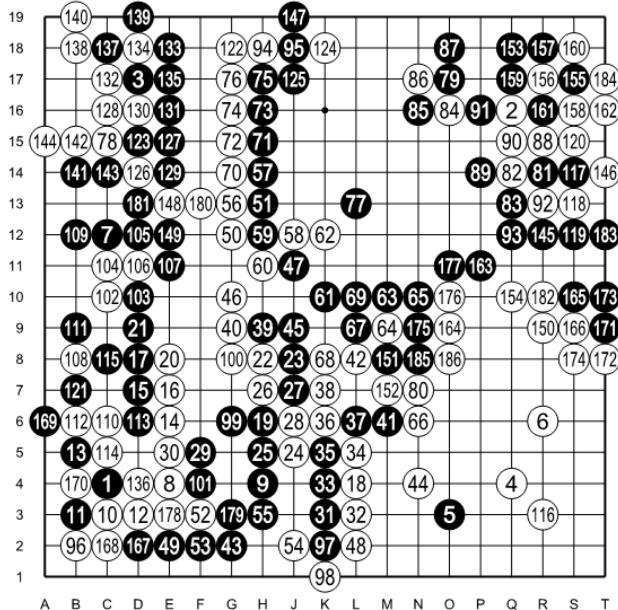


Image source: [https://commons.wikimedia.org/wiki/File:Lee_Sedol_\(B\)_vs_AlphaGo_\(W\)_-_Game_1_-_BW.jpg](https://commons.wikimedia.org/wiki/File:Lee_Sedol_(B)_vs_AlphaGo_(W)_-_Game_1_-_BW.jpg)





Libratus vs World Champions

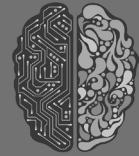
The first AI to defeat top human poker players

January 11 to 31, 2017

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







Google Driverless Car

TED talk by Sebastian Thrun from Stanford

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



Image source: https://commons.wikimedia.org/wiki/File:Google_driverless_car_at_intersection.gk.jpg



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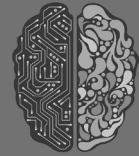
Google Robot Dog



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

Image source: https://commons.wikimedia.org/wiki/File:Bio-inspired_Big_Dog_quadruped_robot_is_being_developed_as_a_mule_that_can_traverse_difficult_terrain.tiff





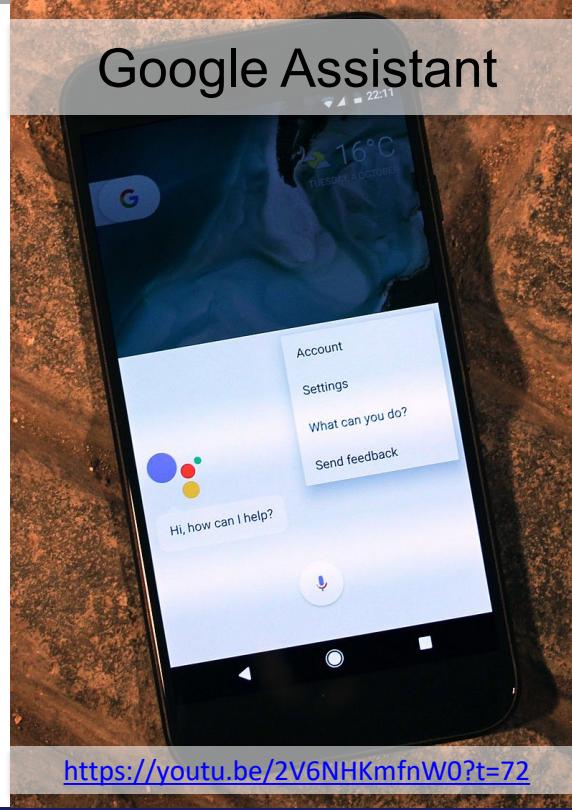
Natural Language Processing

Mi Box Voice Assistant



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

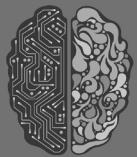
Google Assistant



<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)

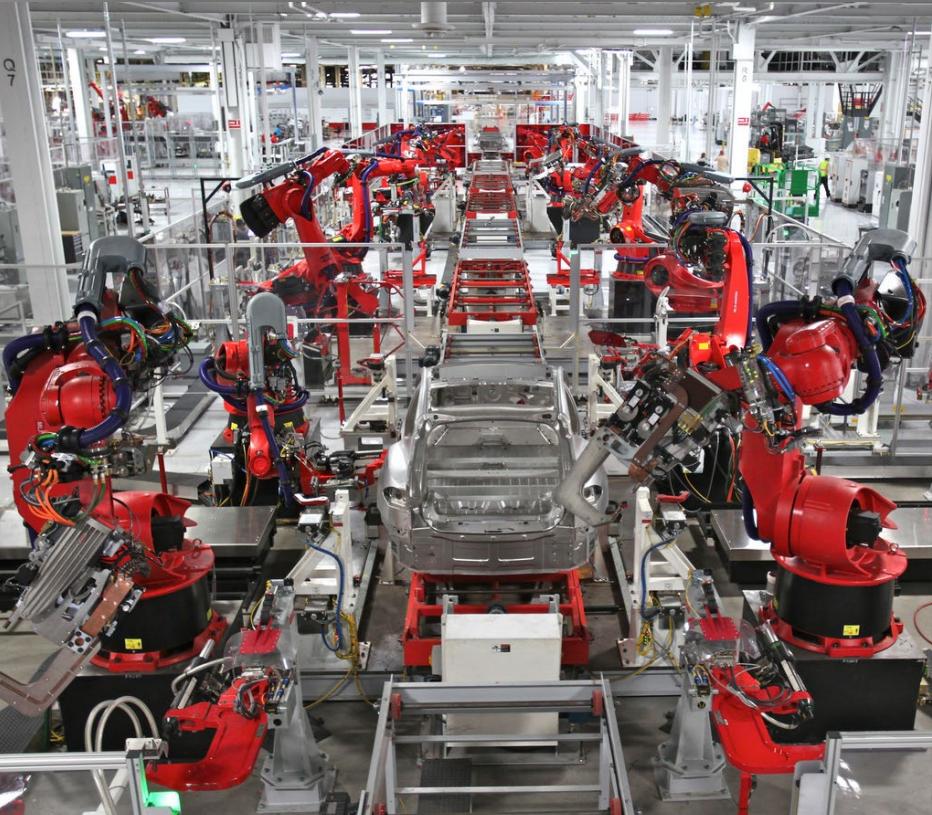
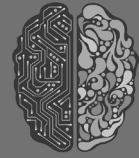


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Artificial Intelligence for Finance



Source: World Economic Forum, 2015

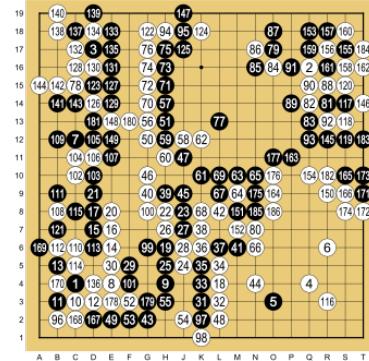


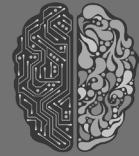


AI for Complex Interactions

Recent AI breakthrough

IMAGENET





What's Next?

For AI Complex Interactions

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

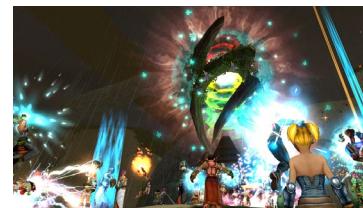


Image sources:

- https://en.wikipedia.org/wiki/RoboCup_Standard_Platform_League#/media/File:SPL_Team_B-Human,_RoboCup_2016.jpg
- https://en.wikipedia.org/wiki/Massively_multiplayer_online_role-playing_game#/media/File:Ryzom_screenshot_4.png
- <https://pixabay.com/en/network-iot-internet-of-things-782707/>
- <https://www.flickr.com/photos/thebetterday4u/37556363291>
- [https://en.wikipedia.org/wiki/Google_Assistant#/media/File:Android_Assistant_on_the_Google_Pixel_XL_smartphone_\(29526761674\).jpg](https://en.wikipedia.org/wiki/Google_Assistant#/media/File:Android_Assistant_on_the_Google_Pixel_XL_smartphone_(29526761674).jpg)
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