

# CZ3005 Artificial Intelligence

## Introduction

Assoc Prof Bo AN

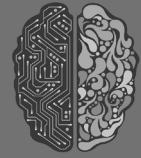
*Research area:* artificial intelligence,  
computational game theory, reinforcement  
learning, optimization

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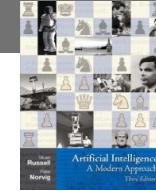
# Schedule for the First Half

- Introduction
- Intelligent agents
- Uninformed search
- Informed search
- Constraint satisfaction
- Adversarial search
- Markov decision process
- Reinforcement learning
- Computational game theory





# CZ3005 Matters



- Lecturers: Bo An, Mahardhika Pratama
- Optional Textbook: S. Russell and P. Norvig *Artificial Intelligence: A Modern Approach* Prentice Hall, 2010, [Third Edition](#)
- Grading: Programming/lab assignment (40%), Final exam (60%)
- During class: You may ask questions
  - Online (10:30-11:30 on Monday and 12:30-13:30 on Tuesday)
- After class: visit my office, schedule a meeting, office hour
- Tutorials start from week 3
- 2-3 Lab Sessions: starts from week 5/6, details to be announced in week 4
- 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
  - FYP student won the first price at 2016 Automated Negotiating Agents Competition (ANAC); top 2 at the 2017 Automated Negotiating Agents Competition (ANAC)





# Schedule for the First Half

Week	Date	Lecture	Lecture Topic	Tutorial	Lab
1	August 9		National Day – no class		
	August 10	1	Introduction		
2	August 16	2	Intelligent agents		
	August 17	3	Uninformed search		
3	August 23	4	Informed search	1	
	August 24	5	Constraint satisfaction		
4	August 30	6	Adversarial search	2	
	August 31	7	Markov decision process		
5	September 6	8	Markov decision process		One session in week 5/6
	September 7	9	Reinforcement learning		
6	September 13	10	Reinforcement learning	3	
	September 14	11	Computational game theory		
7	September 20	E-learning			
	September 21	E-learning			
		RECESS			

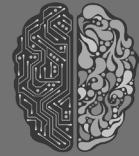




# Outline

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

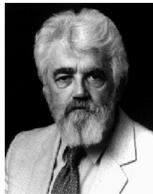




# The Birth of AI

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

## 1956 Dartmouth Conference: The Founding Fathers of AI



John McCarthy



Marvin Minsky



Claude Shannon



Ray Solomonoff

Alan Newell



Herbert Simon



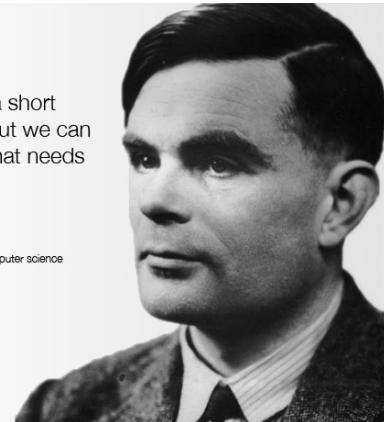
Arthur Samuel

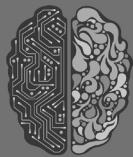


And three others...  
Oliver Selfridge  
(Pandemonium theory)  
Nathaniel Rochester  
(IBM, designed 701)  
Trenchard More  
(Natural Deduction)

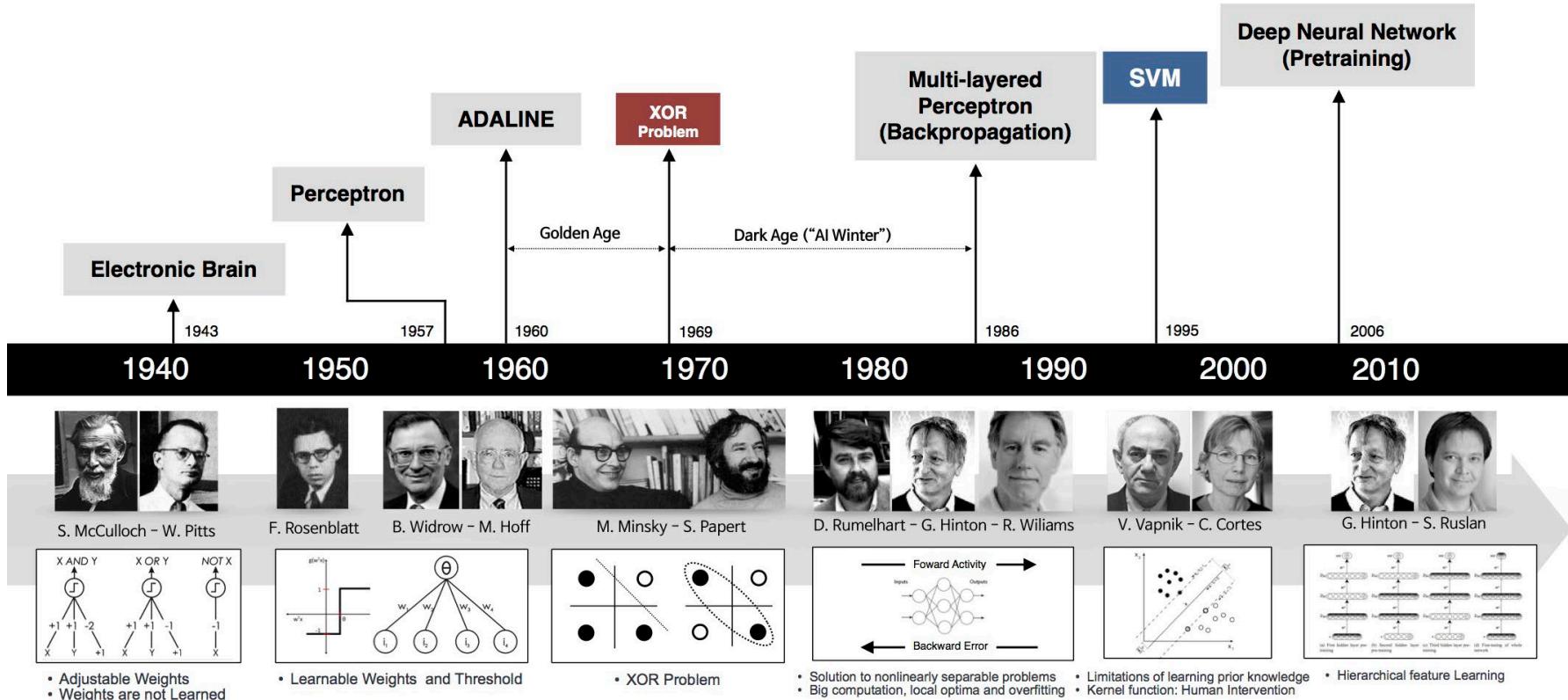
“We can only see a short distance ahead, but we can see plenty there that needs to be done.”

~ Alan Turing  
the father of modern computer science





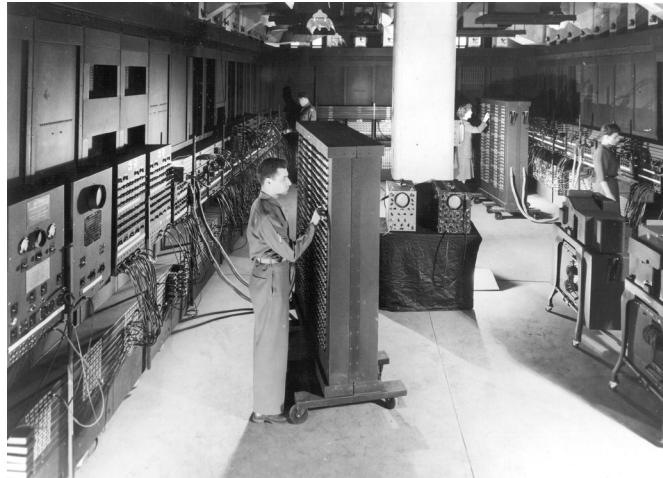
# Timeline of AI Development





# Computer Chess

Garry Kasparov VS Deep Blue



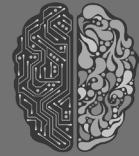
ENIAC 1946

VS



Deep Blue 1997



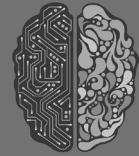


# Robot Soccer

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)





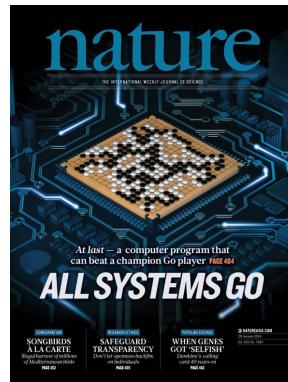
# AlphaGo vs World Champions

**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)



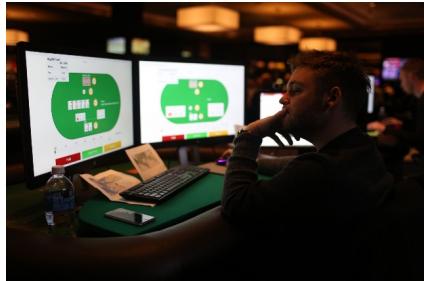


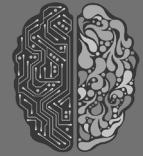
# Libratus vs World Champions

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





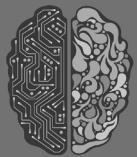
# Google Driverless Car

TED talk by Sebastian Thrun from Stanford

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

- AI is still at very early stage!





# Manufacturing

Tesla

[https://www.youtube.com/  
watch?v=-Ds1xV7M2gl](https://www.youtube.com/watch?v=-Ds1xV7M2gl)



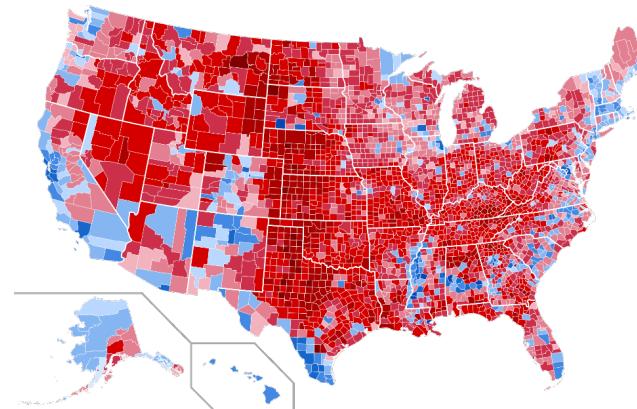


# AI Predicts Elections

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

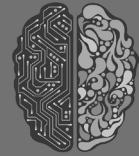
Pamela Engel, Business Insider US

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.

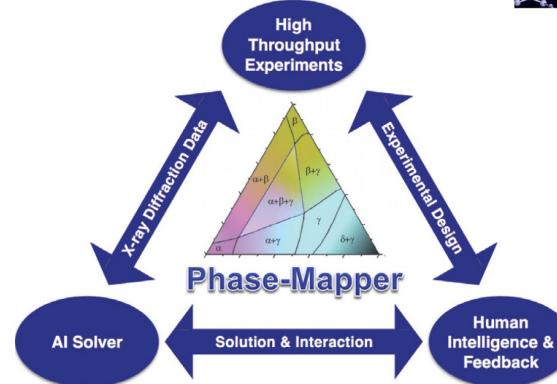
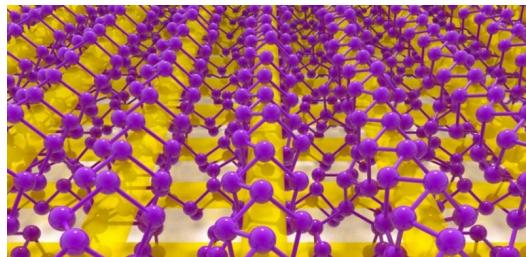
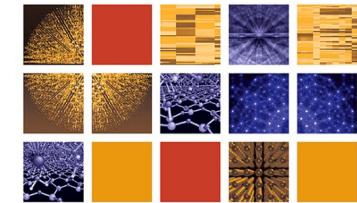




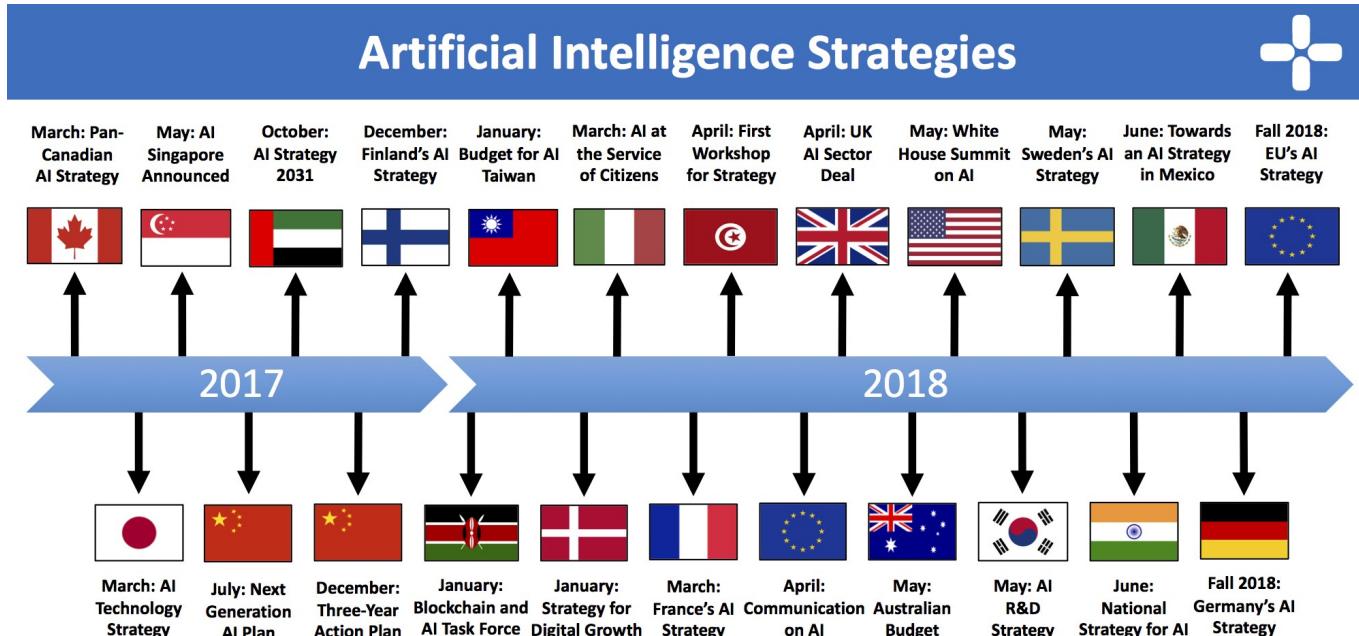
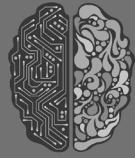
# Accelerating Materials Discovery

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

materials  
DISCOVERY

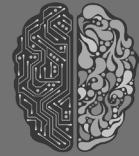


# An Overview of National AI Strategies



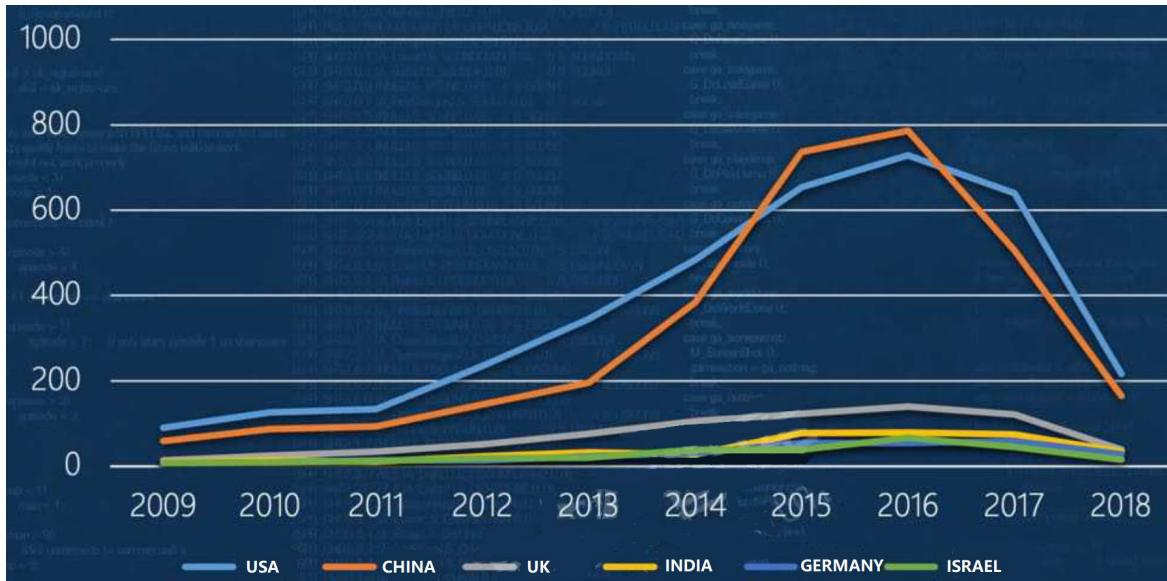
2018-07-13 | Politics + AI | Tim Dutton

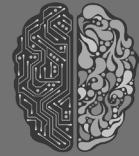




# Newly Added AI Companies in Main Countries

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





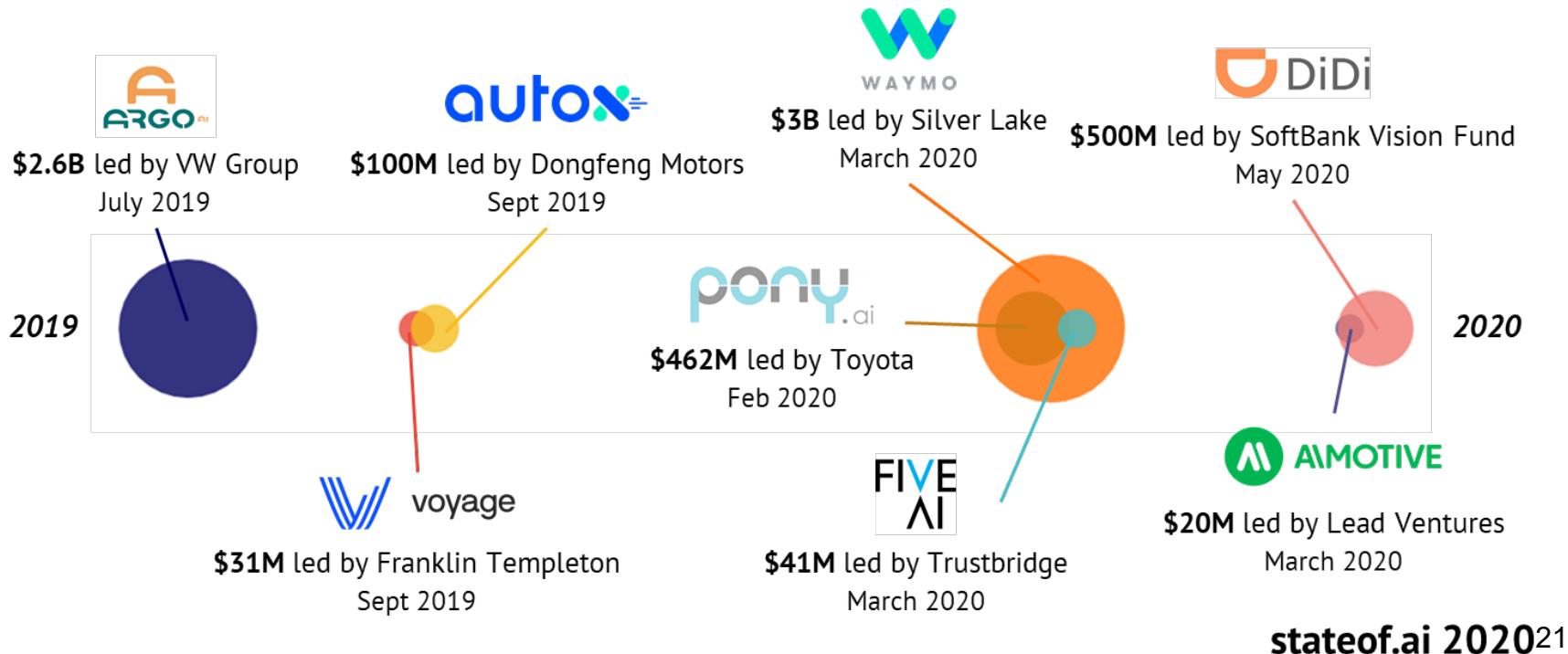
# Newly Added Financing of AI Companies

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





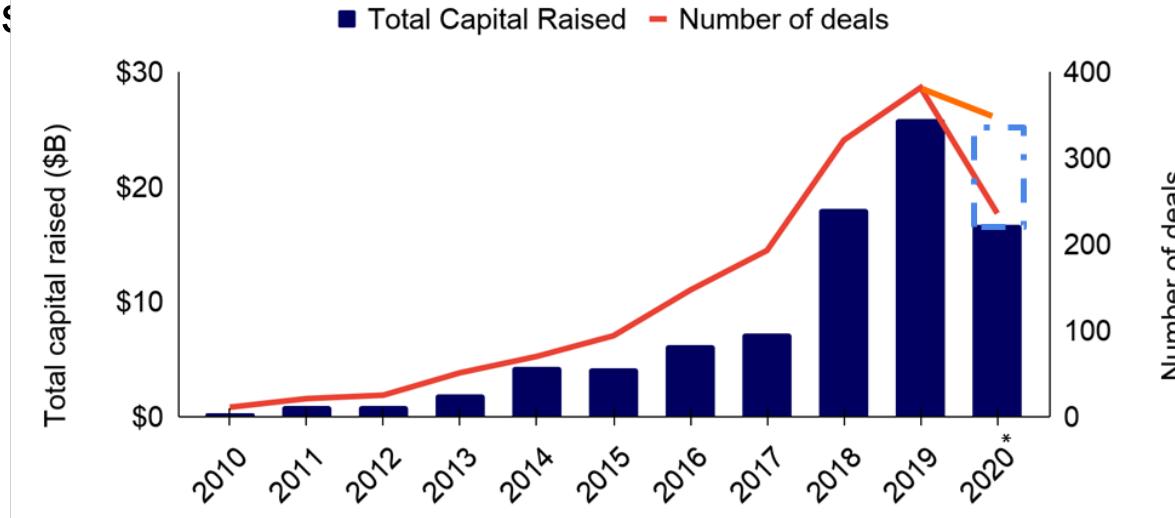
# Self-driving Contenders Raised \$7B Since July 2019





# Private >\$15M Funding Rounds for AI-first Companies Remain Strong in Spite of COVID-19

- 2020 is likely to hit \$25B+ in total volume and 350+ deals. Rounds >\$100M consistently account for ~10% of all funding rounds since 2018 onwards.



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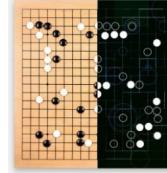




# AI still at Very Early Stage

- Recent AI breakthrough

IMAGENET



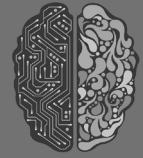
- What's next: AI for *complex* interaction

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



Google™  
bing





# Some Recent Research

- Separate slides and will not be covered in any quiz/exam

