

Applied “Applied Artificial Intelligence”

– a (short) Silicon Valley “appetizer”

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Carlsberg turns to AI to help develop beers

Nyt forskningsprojekt skal skabe sensorer, der kan bedømme smagsnuancer, når der skal udvikles nye typer øl

"The Beer Fingerprinting Project" hedder et nyt forskningsprojekt, som skal skabe en sensor-platform baseret på kunstig intelligens, der hurtigt og billigt kan teste smagsaromaer til ølproduktion, oplyser Innovationsfonden.

Projektet opstod hos Jochen Förster fra Carlsberg Laboratorium, og iNano ved Aarhus Universitet blev hurtigt inddraget.

Jochen Förster oplevede et behov for at kunne måle smagsaromaer ved hjælp af sensorer til at understøtte hans arbejde med at udvikle nye bryggeorganismer og i sidste ende nye øl.

Ølsmager kan lyde som et ideelle job, men det er umuligt at smage forskel på de omkring 1.000 forskellige smagsnuancer, der dagligt udvikles i Carlsberg Laboratoriet.



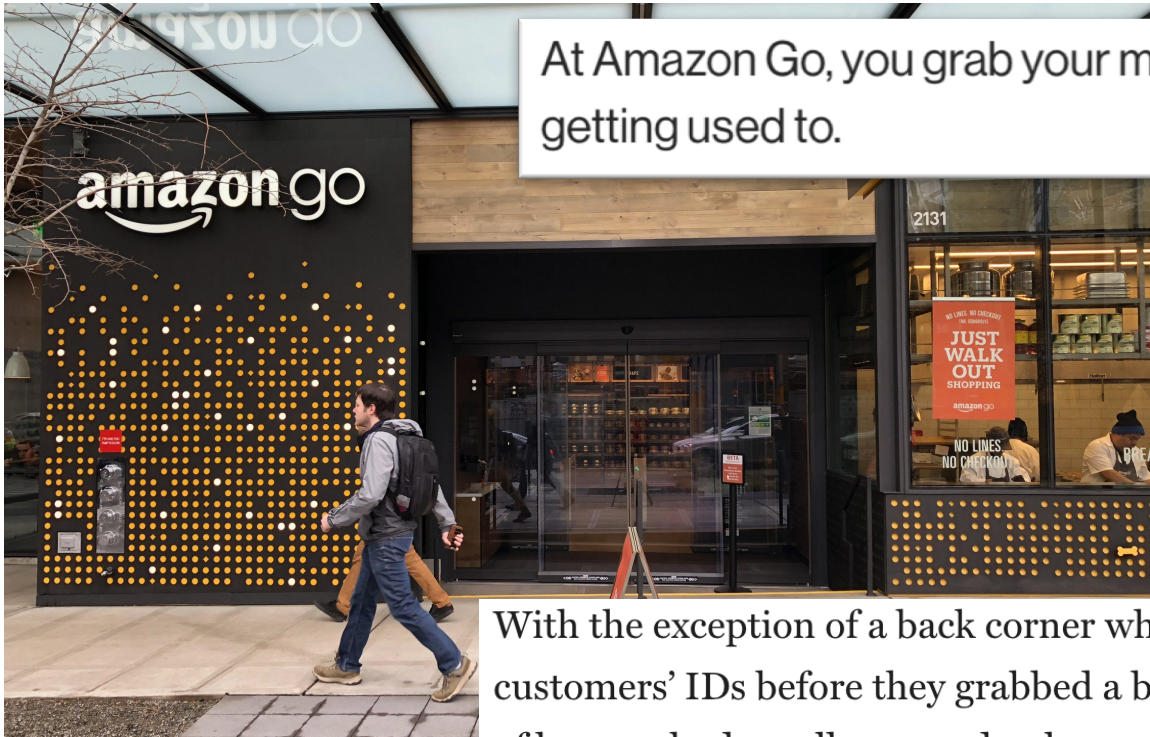
Prototypen af sensoren kan allerede skelne smagsnuancer i de fire øl Carlsberg Pilsner, Tuborg Pilsner, Wibroe og Nordic.

Foto: Colourbox

Dec 2017, bl.a. Financial Times



Clerkless stores in Seattle



At Amazon Go, you grab your milk and leave. It might take some getting used to.

With the exception of a back corner where a guy was stationed to check customers' IDs before they grabbed a bottle of pinot grigio or a six-pack of beer, nobody really seemed to be paying any attention to us. There's no need, in theory: when you take an item off the shelf, Amazon's cameras and AI should work to determine what it is and charge you for it immediately, and if you put it back on the shelf, the charge will be removed.

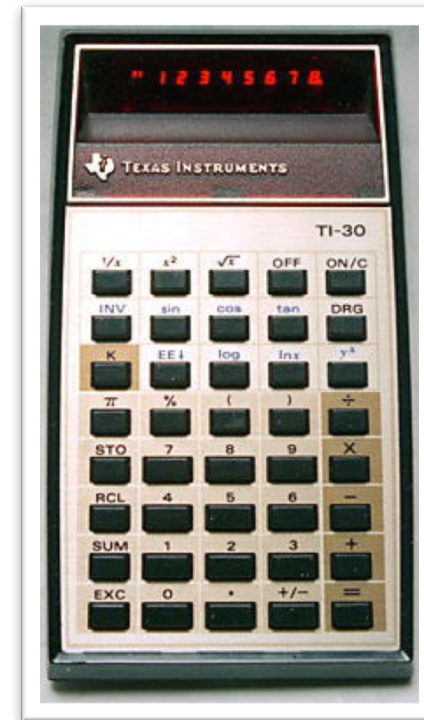
Jan 2018, bl.a. MIT technology review



Technological evolution – or revolution or something else?



Is (or was) this artificial intelligence?



“The future is already here — it's just **not very evenly distributed**”

- William Gibson, 1993 or 1999, American-Canadian science fiction writer

“We tend to **overestimate** the effect of a technology in the short run and **underestimate** the effect in the long run”

- “Amaras law” – after Roy Amara, cofounder of the Institute for the Future, Palo Alto

“It is not the technology itself driving us crazy, but our inability to keep up to speed. **The technology is the easy part.** The hard part is figuring out the social and institutional structures around the technology”

- John Seely Brown in “Cultivating the entrepreneurial learner in the 21st century”, 2015



Three AI definitions



It all started more than 50 years ago...

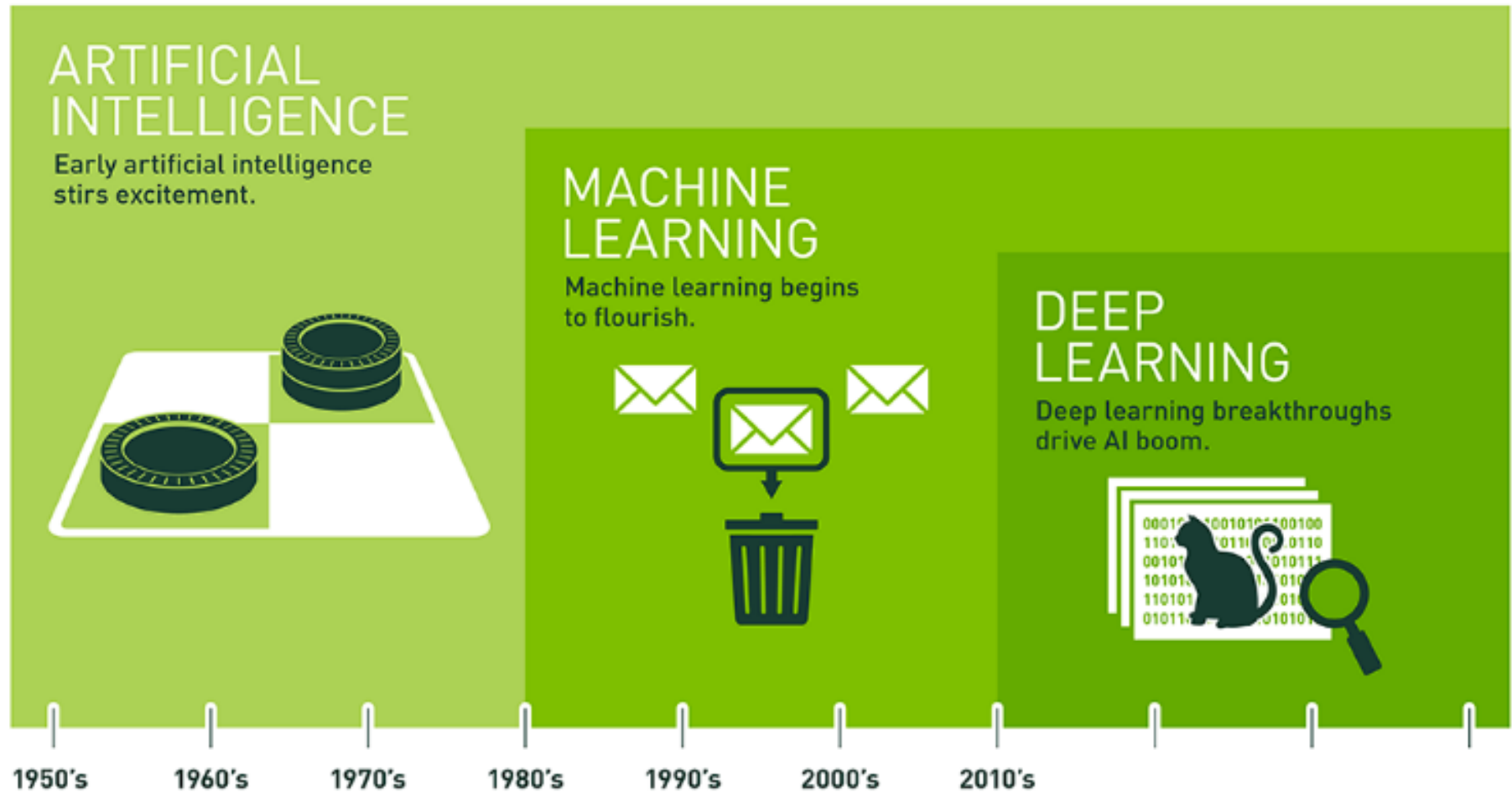


“An attempt will be made to find how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves. We think that a significant advance can be made in one or more of these problems if a carefully selected group of scientists work on it together for a summer.”

(from the 1955 project proposal on “Thinking machines” and “Artificial Intelligence” – picture from 50 years reunion in 2005)



The (current) “computer science” definition



The “intelligence” definition



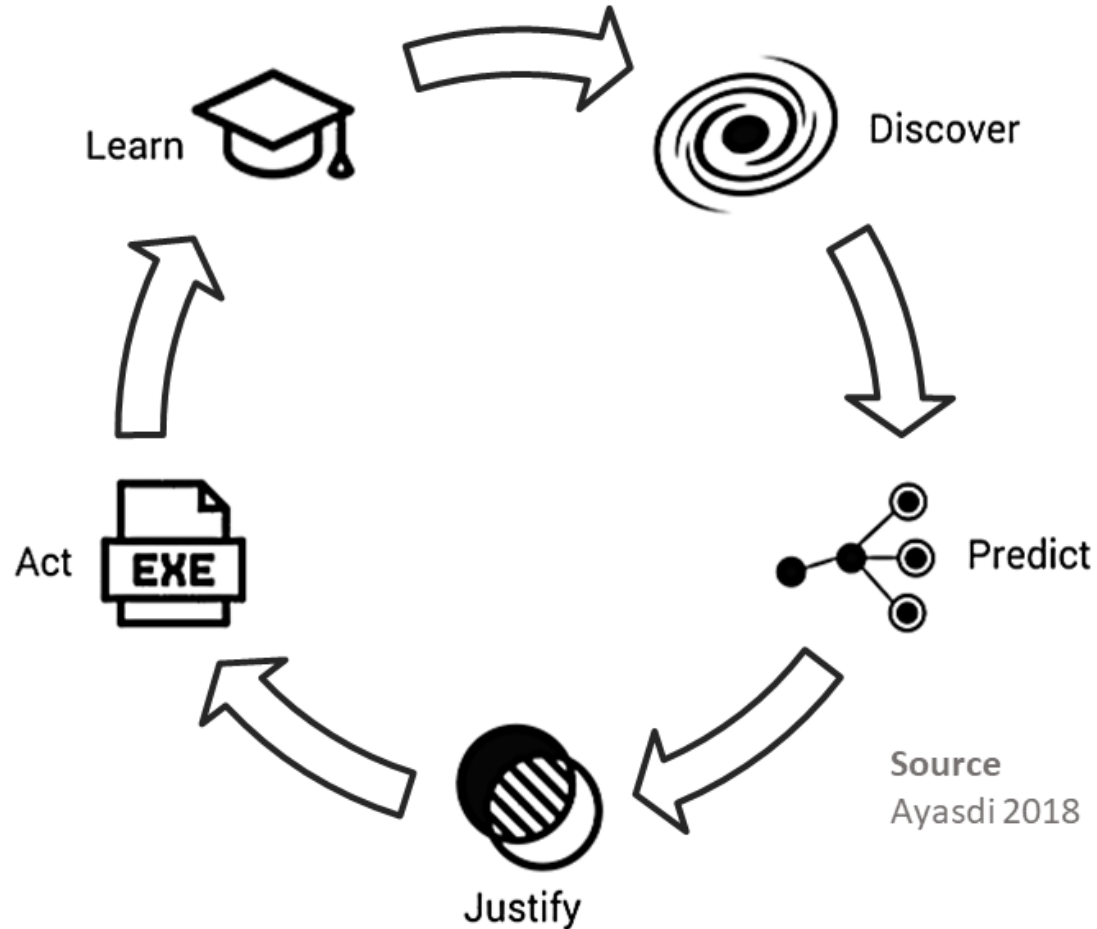
Artificial Intelligence

Machine ability to understand, learn, and act on information and events, designed to augment, provide assistance to or perform tasks independently from humans

AI Stages	Artificial Narrow Intelligence (ANI)	Artificial General Intelligence (AGI)	Artificial Super Intelligence (ASI)
Timing	Today	About 2040?	Soon after AGI
Implications	Outperform humans in specific repetitive functions, such as driving, medical diagnosis and financial advice	Compete with humans across all endeavors, such as earning university degrees and convincing humans that it is human	Outperform humans, helping to achieve societal objectives or threatening human race



The “system” definition – 5 elements



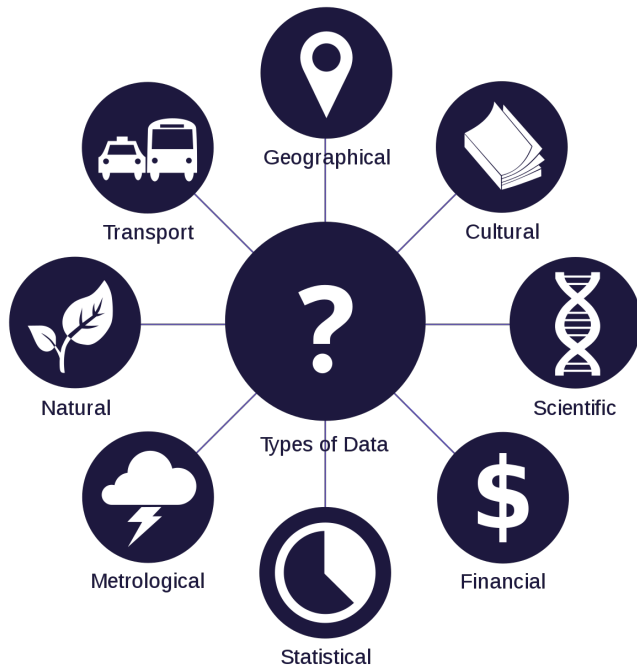
Drivers for the AI “hype”



3 key drives for the current change...

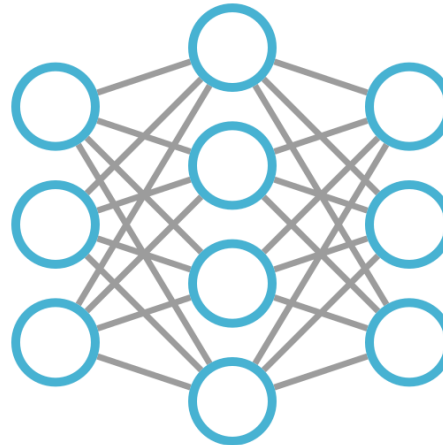
Data

Lot's of data – everywhere
about everything



Algorithms

Better, smarter, faster -
neural nets and deep
learning



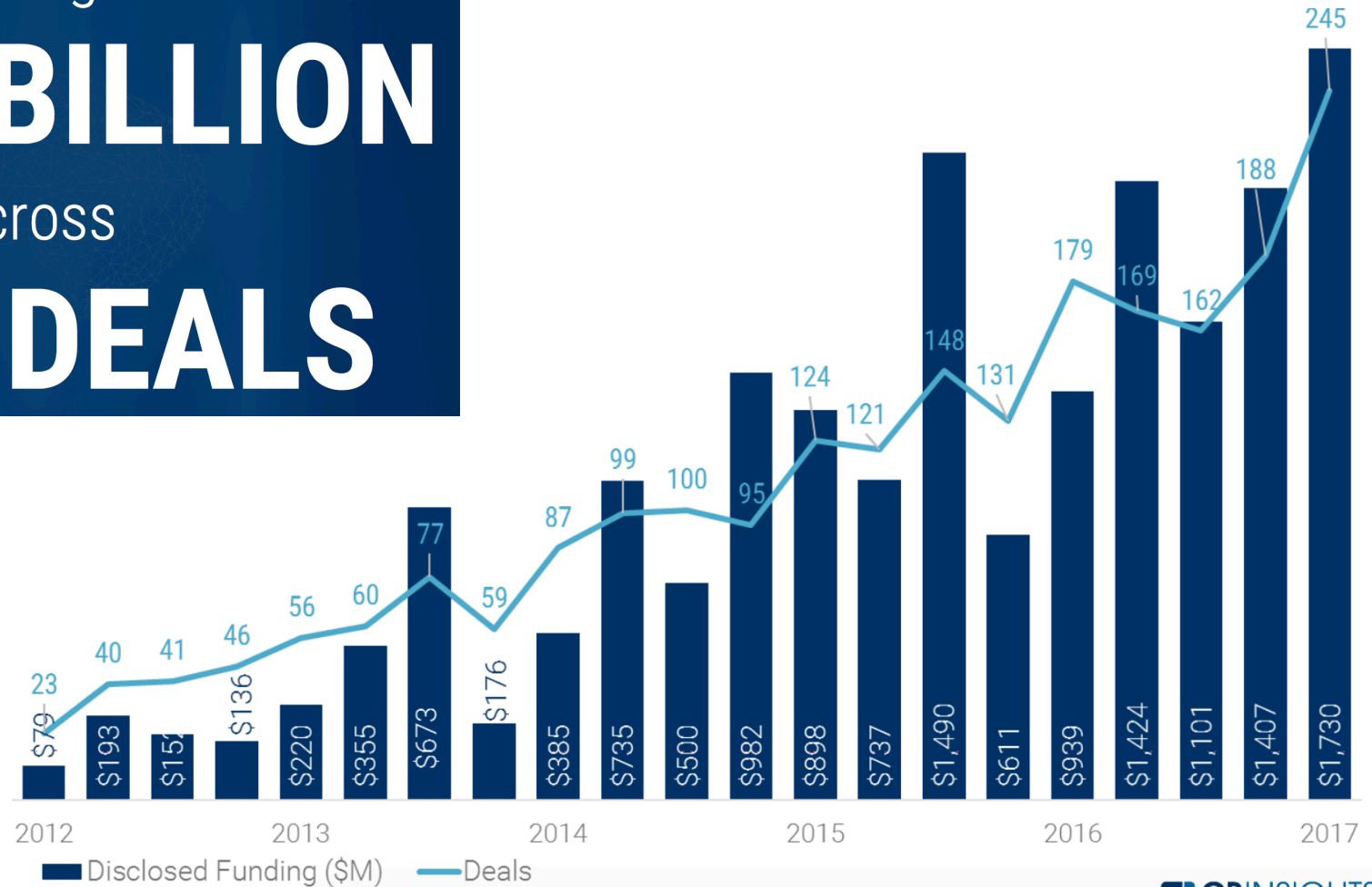
Computing power

Cheap, small, fast –
and networked

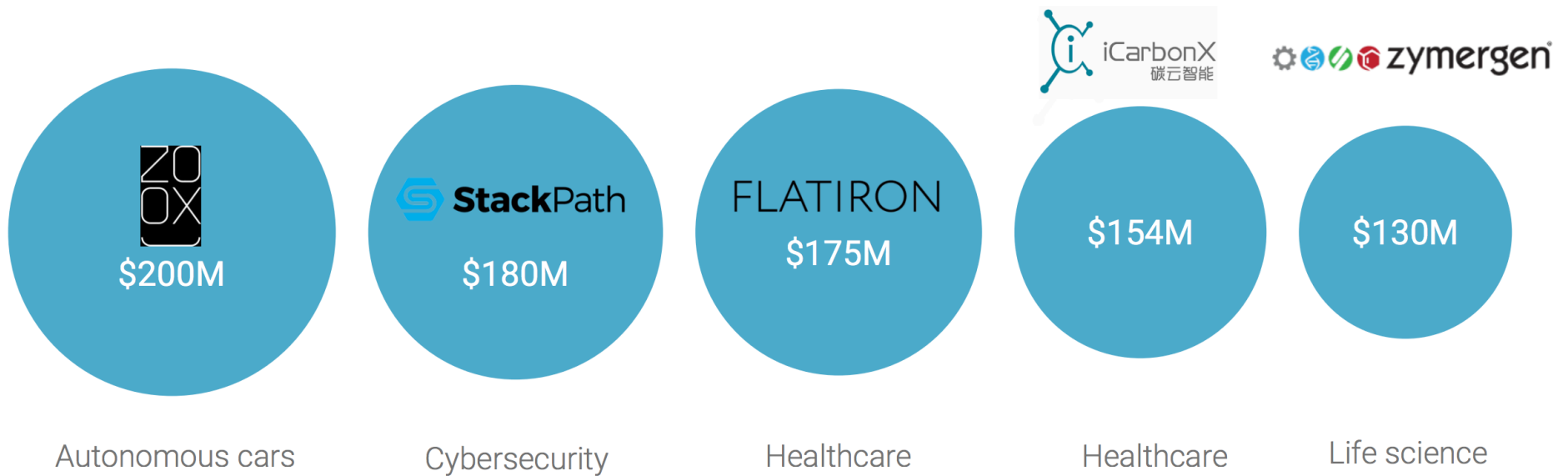


... and a lot of Investments in AI...

AI Equity Funding Since 2012:
\$14.9 BILLION
across
2250 DEALS



Some of the hot AI companies – 2016 "mega rounds"



100 of the hot AI startups

CONVERSATIONAL AI/ BOTS



VISION



AUTO



ROBOTICS



CYBERSECURITY



BUSINESS INTELLIGENCE & ANALYTICS



AD, SALES, CRM



CORE AI



HEALTHCARE



TEXT ANALYSIS/ GENERATION



IOT/IIOT



COMMERCE



FINTECH & INSURANCE



OTHER



Applied AI

Looking at 5 segments



5 sectors – Danish organizations (working on) applying AI

Finance



- Credit Scoring & Direct Lending
- Regulatory, Compliance & Fraud Detection
- Market Research & Sentiment Analysis

Healthcare



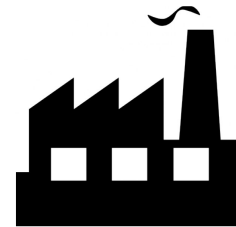
- Breast cancer diagnostics
- Clinical trials matching
- Diabetes management

Energy



- Bot based customer service
- Smarter energy consumption
- Predictive maintenance of utilities

Manufacturing



- Predictive maintenance
- Augmented reality
- Collaborative robots
- Additive manufacturing

Government



- Quality control
- Complex legal cases
- “Triage” of critical citizen inquiries
- Customer service center

See more at: www.icdk.us/aai

Healthcare example – (see www.icdk.us/aai/healthcare)



Medical imaging & diagnostics – Companies using deep learning and computer vision to identify anomalies in medical images and scans. AI promises early identification of hard-to-detect illnesses by comparing thousands of images at a speed and scale impossible for humans. Interesting companies include [Enlitic](#), [Lunit](#), [Zebra Medical Vision](#) and [Google Research](#)



Mental health – Here the focus is on early detection of mental illnesses, as well as consumer-focused products for lifestyle management and cognitive training. Interesting companies include [Ginger.io](#), [Cognoa](#) and [Koko](#).



Clinical trials & drug discovery – Companies that leverage AI to find the most effective combinations of drug compounds reducing the time and capital required in drug discovery. It also includes companies focused on clinical trial management. Interesting companies include [Mendel.ai](#), [Notable Labs](#), [Recursion Pharma](#), [Deep 6 AI](#), [IBM Watson](#), [twoxar](#) and [Atomwise](#).



Healthcare example – (www.icdk.us/aai/healthcare)



Matching Clinical Trials



Company: Mendel.ai

Insights from the company

- The world's best cancer treatments are currently in trials, but that doesn't assure that the patients that fit those trials are aware of their existence even after identifying an actionable biomarker.
- Finding the right clinical trials can determine life or death for many cancer patients, but physicians just



Share

You share a list of your doctors, and we



Match

We match your records with the world's



Contact

You contact and enroll in clinical trials with the click of a button

Background

San Francisco-based matching patients, founded in 2016, has raised \$2 million in funding to develop an AI based approach to with clinical trials

Business idea

Mendel.ai uses an artificial intelligence platform to match people with clinical trials. They use technology that analyzes unstructured, natural language text from medical documents pulled from electronic health records and then compares it to a database record. The search process results in a personalized match and evaluation of eligibility for each suggested trial

Breast cancer screening

Where: Region Hovedstaden

Process: Breast cancer screening or early detection of breast cancer via mammography

What: Worldwide, breast cancer make up close to 30 percent of all diagnosed cancers in women, making it the second leading cause of women death. Mammography screening serves to detect breast cancer at an early stage. The procedure is offered to women between 50 and 69 years every second year as part of the Danish screening program for breast cancer. Region Hovedstaden annually scans around 80.000 women at four locations. For each woman 4-6 x-ray pictures – mammograms - are taken. Two radiologists goes through the pictures, to validate the diagnosis. 3,6 percent of the women are scheduled for follow-up examinations.

Key roles/competences/people: Radiologist, Patient, GP (single point of contact for the patient)

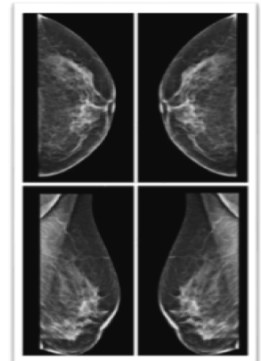
Challenge today: Radiologists are a limited resource in Region Hovedstaden. At the same time more images are generated for each examination. New solutions are therefore required to handle the increased workload, not just for mammography, but for image diagnostics in general.

AI scenario: Initially the ambition is to replace one of the two radiologist with an AI digital assistant, that looks at the pictures and does an initial assessment. The AI assistant works alongside the radiologist, who then plays the role of "second opinion" validating that the AI input – just like today, where the two radiologists validate each other's findings.

A future scenario, depending on a positive outcome of the "digital assistant" case, is to fully automate the image diagnostics process, perhaps using two different solutions.

Benefits...

- Improved patient pathway
- Improved resource allocation in units doing image diagnostics
- Reduction in number of errors in the written report from the radiologist
- Fewer false positives, so less healthy citizens will be called upon for follow-up examinations
- Fewer false negatives, leading to an increase in detecting breast cancer early



State of AI

Trying to cut through the hype



“AI Index” (aiindex.org / ai100.stanford.edu)

Stanford | One Hundred Year Study on Artificial Intelligence (AI100)



We are essentially “flying blind” in our conversations and decision-making related to Artificial Intelligence.

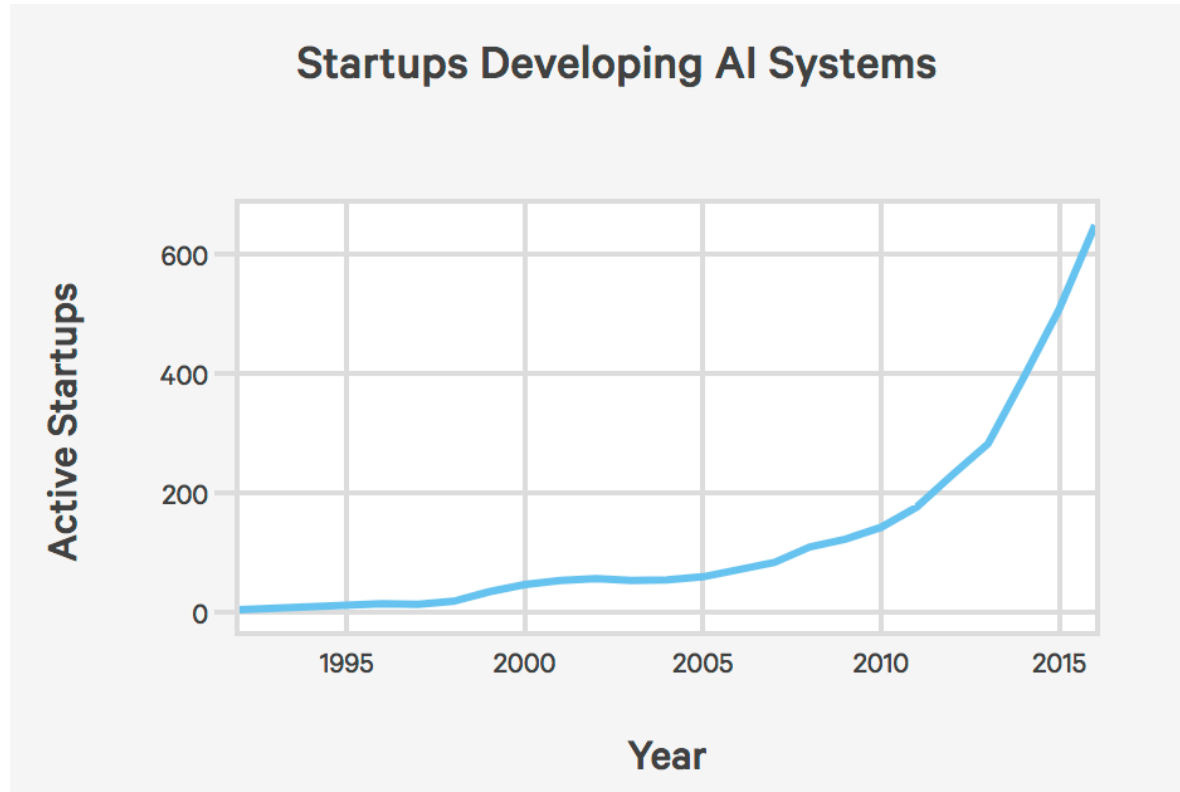
Ground the conversation about AI in data.

A project within the *Stanford 100 Year Study on AI (AI 100)*, The AI Index is an initiative to **track, collate, distill** and **visualize** data relating to artificial intelligence.

It aspires to be a comprehensive resource of data and analysis for **policymakers, researchers, executives, journalists** and others to rapidly develop intuitions about the complex field of AI



Startups

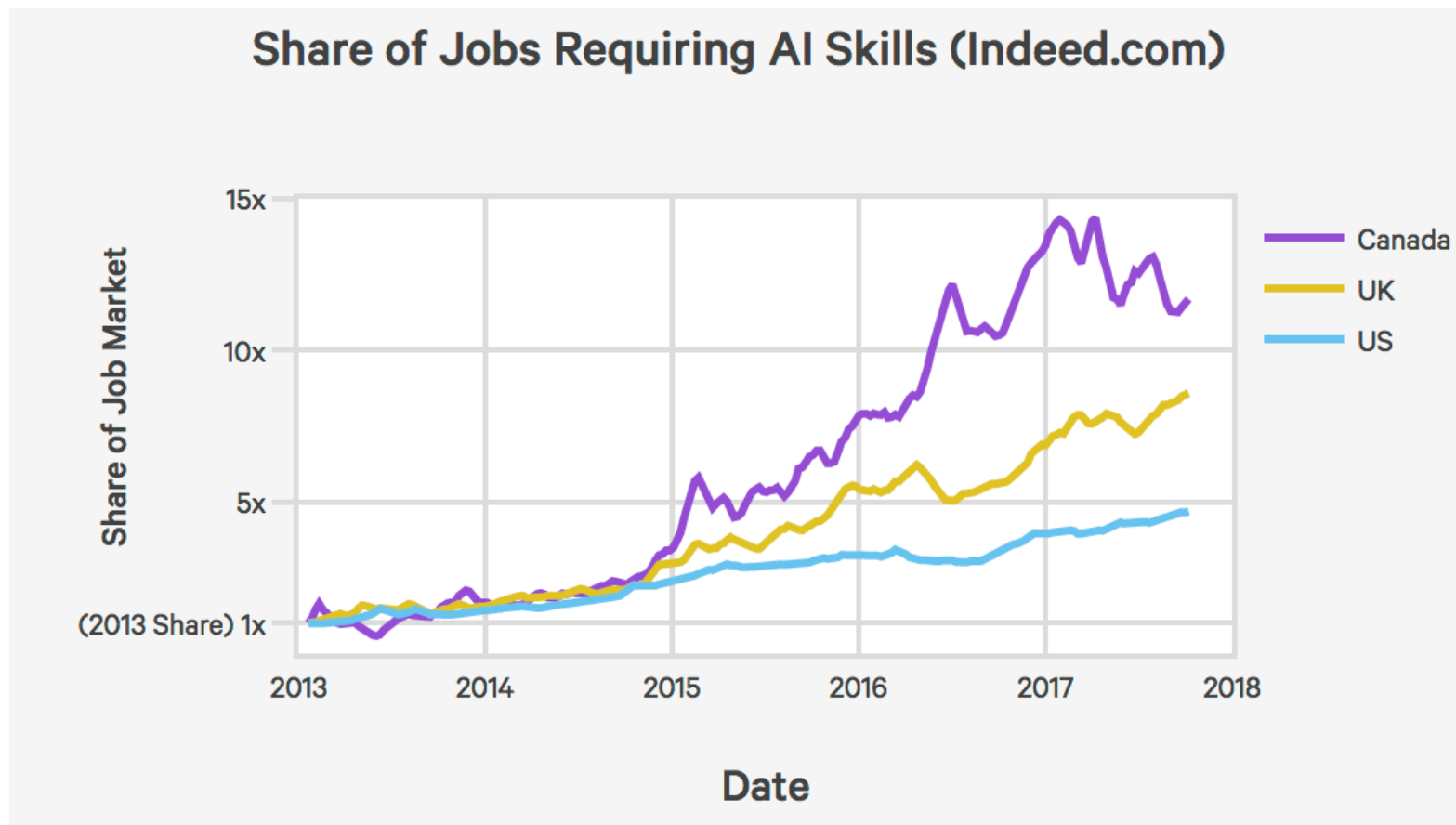


14x

The number of active US startups developing AI systems has increased 14x since 2000.



AI competences

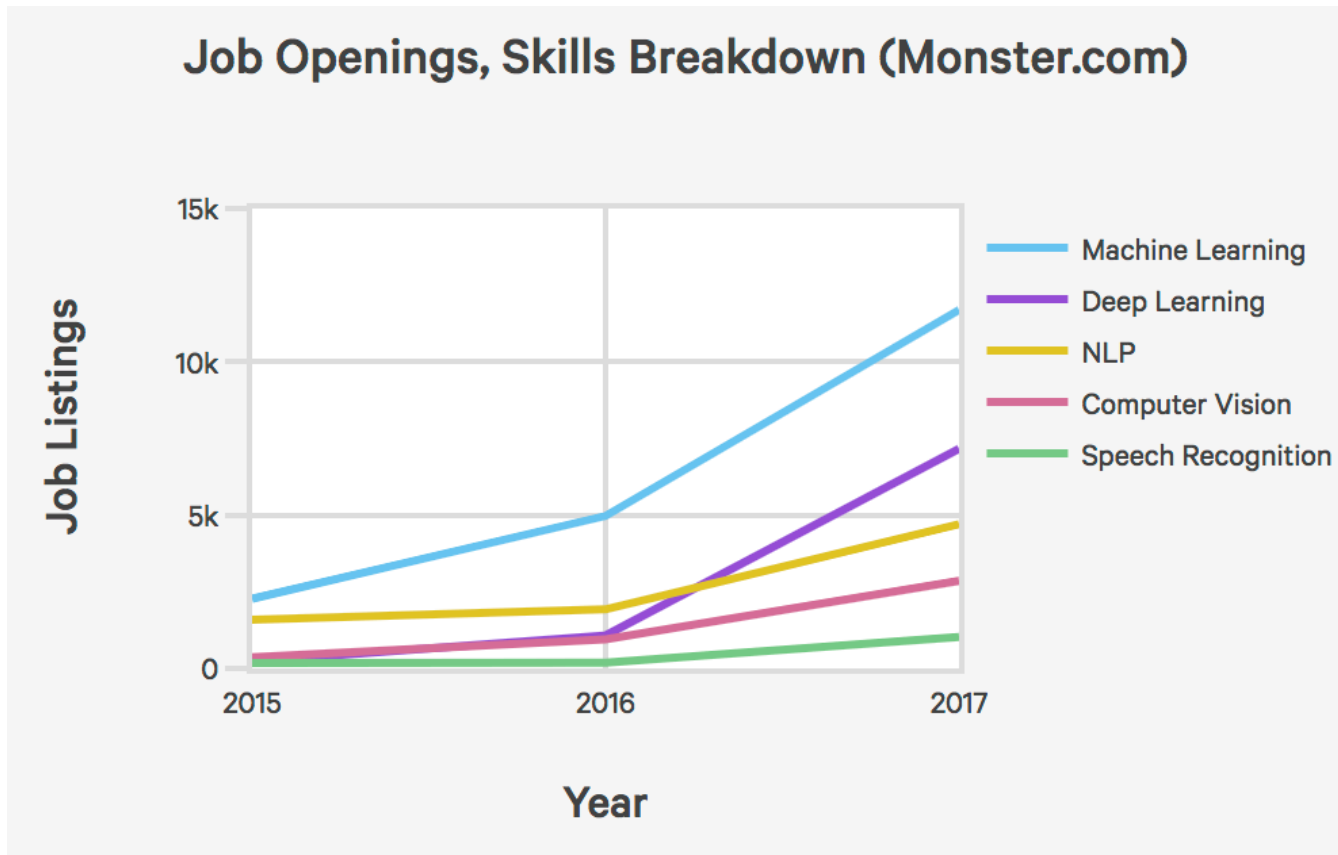


4.5x

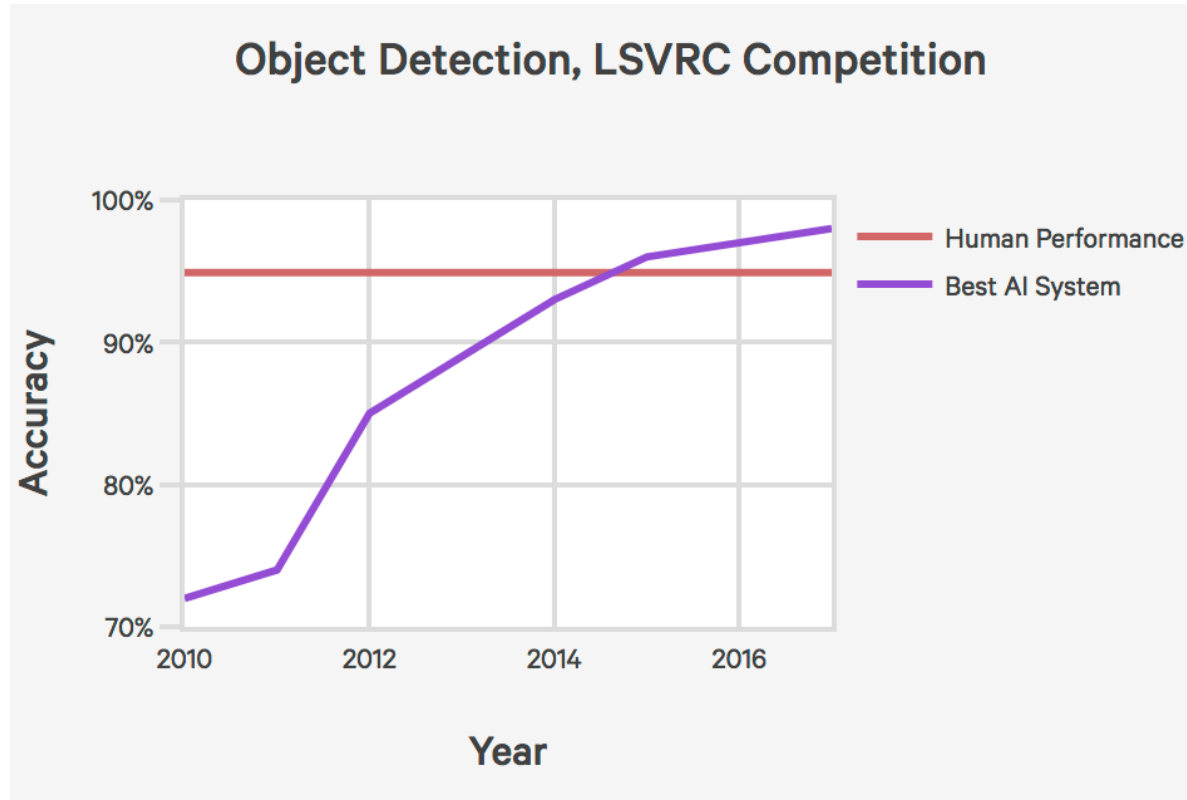
The share of jobs requiring AI skills in the US has grown 4.5x since 2013.



Job openings



AI Vision - 1



2.5%

Error rates for image labeling have fallen from 28.5% to below 2.5% since 2010.



How far have we come?



Jeopardy!

In 2011, the IBM Watson computer system competed on the popular quiz-show Jeopardy! against former winners Brad Rutter and Ken Jennings. Watson won the first place prize of \$1 million.

Object Detection in ImageNet

In 2016, the error rate of automatic labeling of ImageNet declined from 28% in 2010 to less than 3%. Human performance is about 5%.

Poker

In January 2017, a program from CMU called Libratus defeated four top human players in a tournament of 120,000 games of two-player, heads up,

Skin Cancer Classification

In a 2017 Nature article, Esteva et al. describe an AI system trained on a data set of 129,450 clinical images of 2,032 different diseases and compare its diagnostic performance against 21 board-certified dermatologists. They find the AI system capable of classifying skin cancer at a level of competence comparable to the dermatologists.

Go

In March of 2016, the AlphaGo system developed by the Google DeepMind team beat Lee Sedol, one of the world's greatest Go players, 4-1.



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