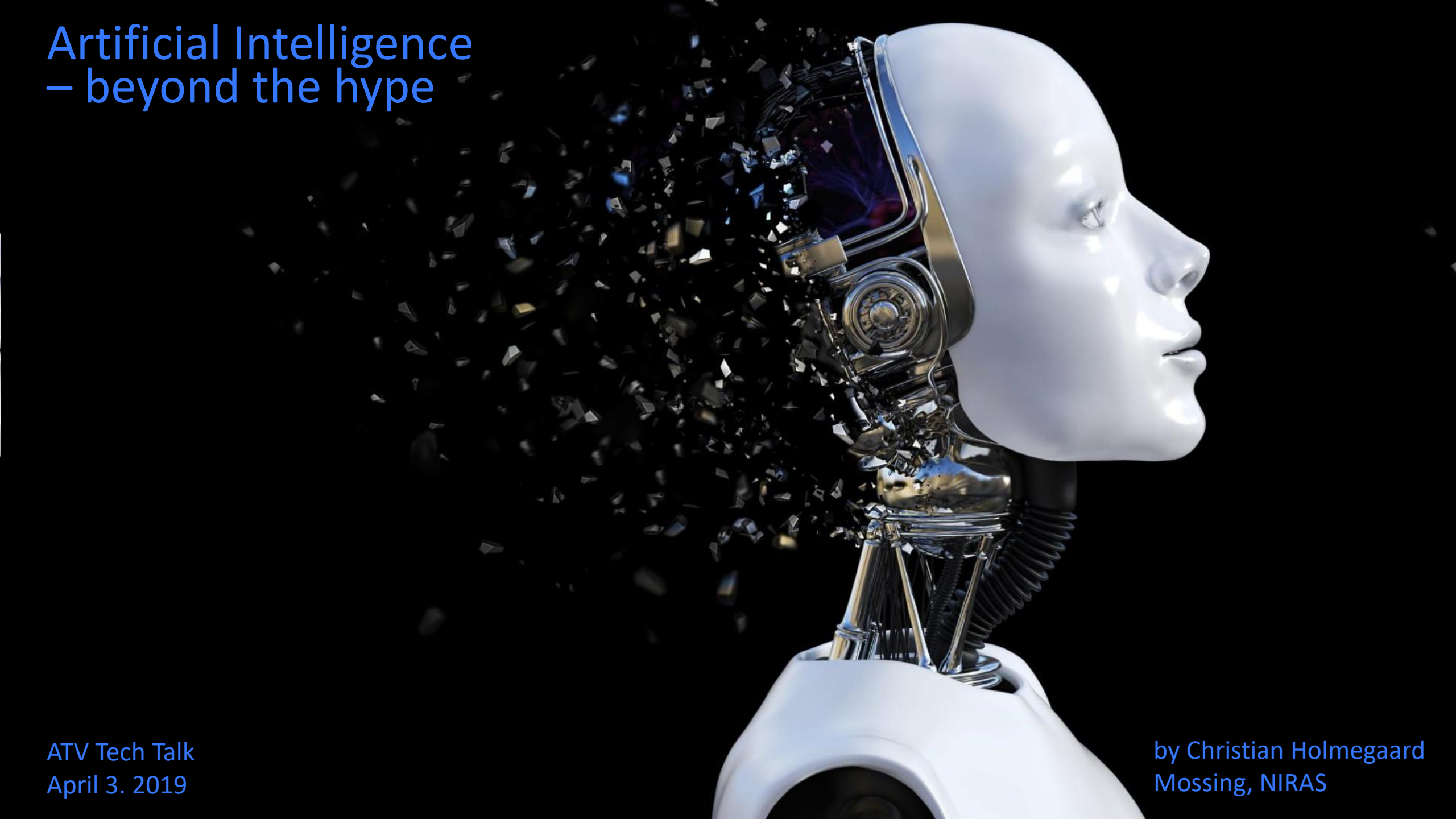
Artificial Intelligence – beyond the hype



ATV Tech Talk
April 3. 2019

by Christian Holmegaard Mossing, NIRAS

1 HOUR

Introduction: Biography + Digital offset

PART 1:

- Selected highlights from Applied AI Academy 2018
- Introduction to the AI technology and application
- Impact of AI on the Engineering Industry
- Global race for AI dominance

PART 2:

- Applied AI in Danish Engineering Consultancy
- Current trends in the Engineering Industry
- Engineering Consultancy ver. 2.0

My background

Experimentarium 1993 - 1997

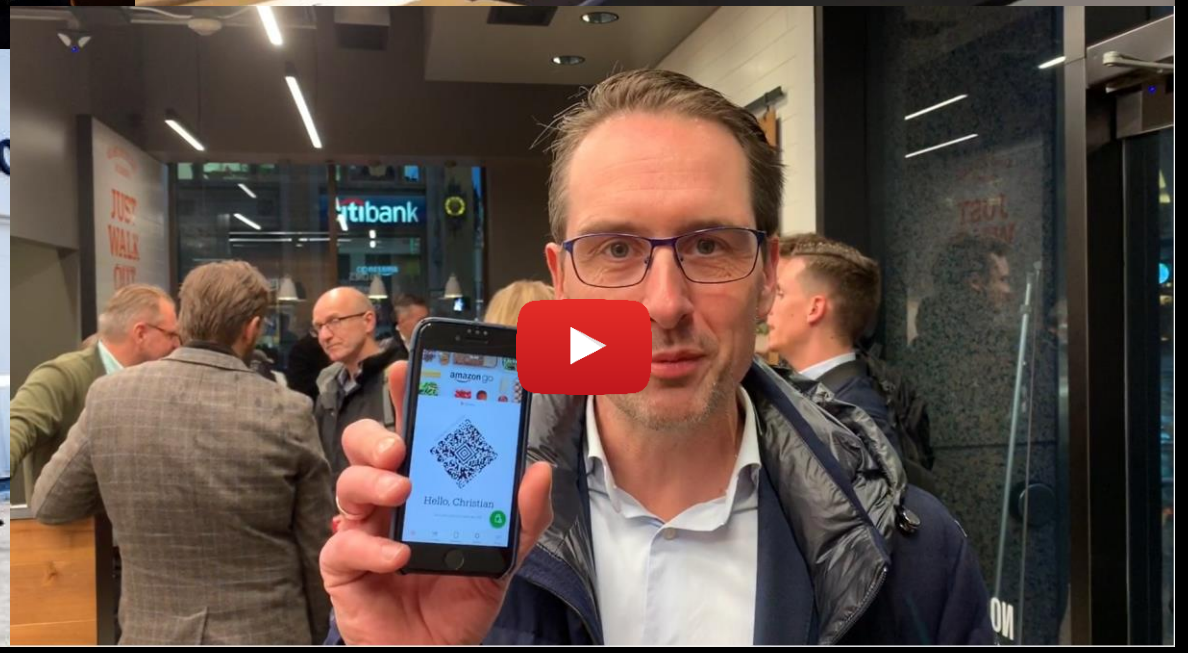
M.Sc. Microbiology 1997 (University of Copenhagen/DTU)

Orbicon (1998-2006)

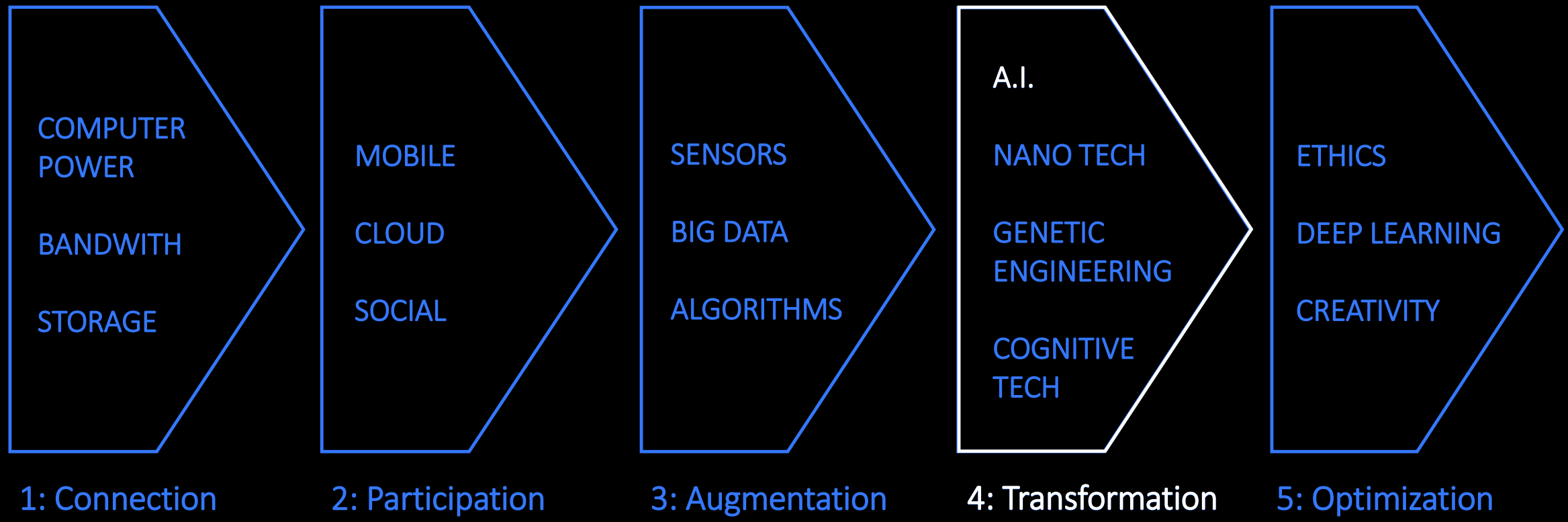
COWI A/S (2006 – 2019)

NIRAS (2019 – d.d.)

The road to become a Digital Ambassador



Five phases of digitalization

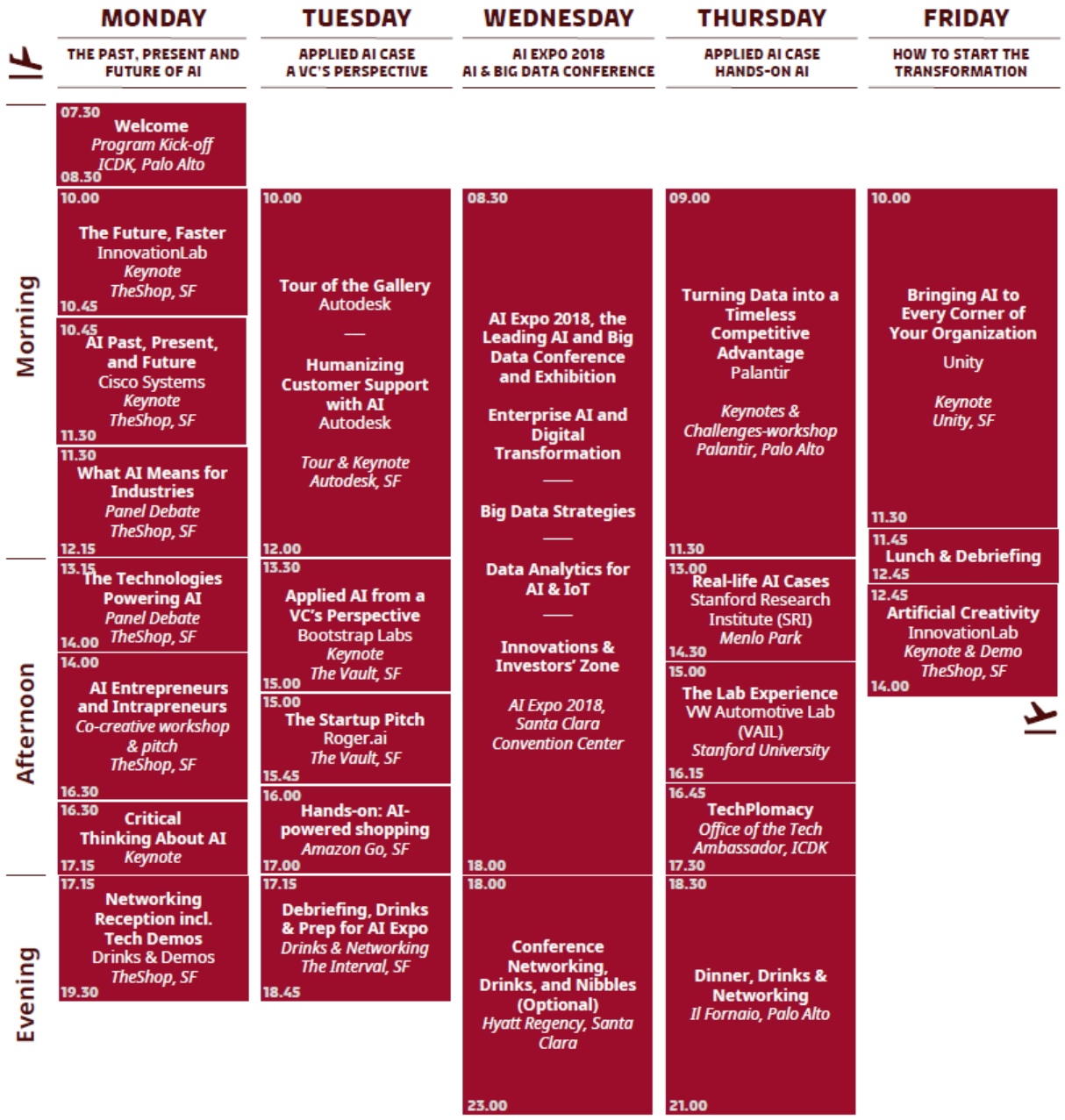


Applied AI Academy
November 2018
PART 1

The Participants

Robinson

A dense programme…



A dense programme…

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
	THE PAST, PRESENT AND FUTURE OF AI	APPLIED AI CASE A VC'S PERSPECTIVE	AI EXPO 2018 AI & BIG DATA CONFERENCE	APPLIED AI CASE HANDS-ON AI	HOW TO START THE TRANSFORMATION
Morning				09.00 **Turning Data into a Timeless Competitive Advantage** Palantir *Keynotes & Challenges-workshop Palantir, Palo Alto* 11.30	10.00 **Bringing AI to Every Corner of Your Organization** Unity *Keynote Unity, SF* 11.30
Afternoon		13.30 **Applied AI from a VC's Perspective** Bootstrap Labs *Keynote The Vault, SF* 15.00			
Evening					

Selected sessions…

… with engineering implications

"Applied AI from a VC´s perspective"

APPLIED AI IS LEADING THE 4TH INDUSTRIAL REVOLUTION

AI IS TRANSFORMING OUR WORLD
FROM **AUTOMATED** TO **AUTONOMOUS**

THE STEPS TO AUTONOMOUS

Analytics

What happened

Predictions

What might happen

Prescription

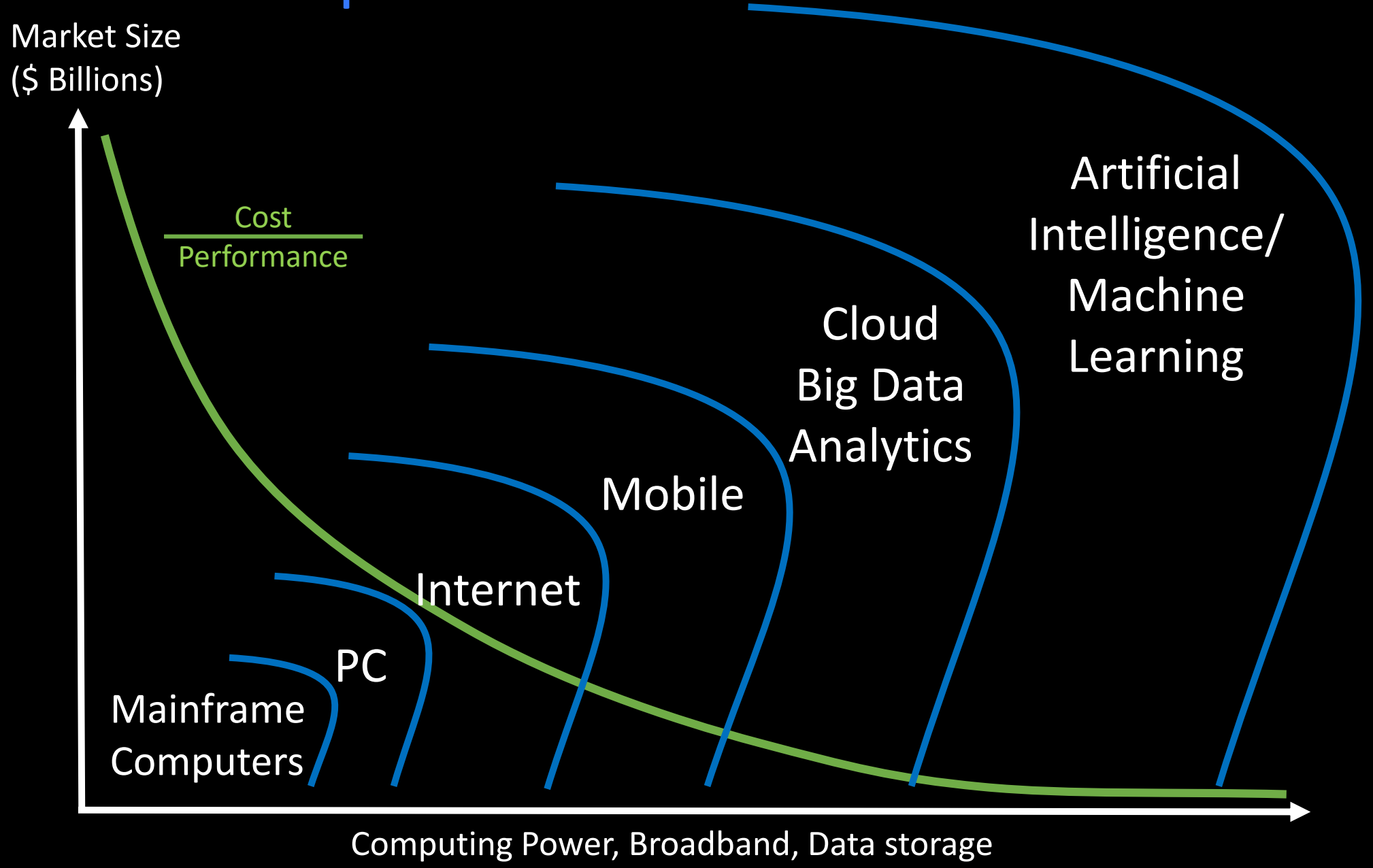
What might be a good idea to do

Autonomous

The systems make decisions themselves based on current and past acquired learning

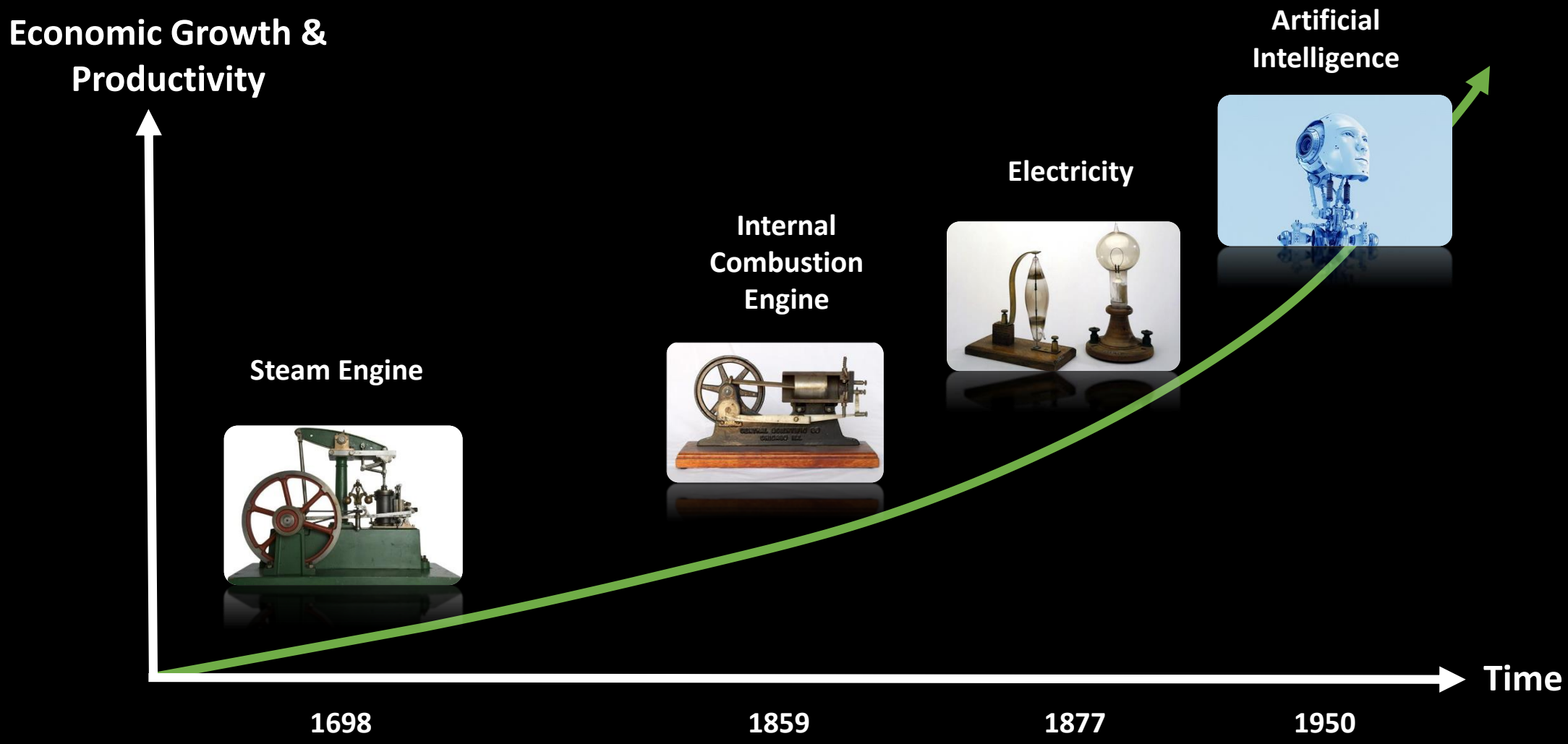
"AI is the alpha trend, because it's fundamentally changing all other trends we [Accenture] are tracking."
Paul Daugherty , Chief Technology & Innovation Officer, Accenture

Financial implications…

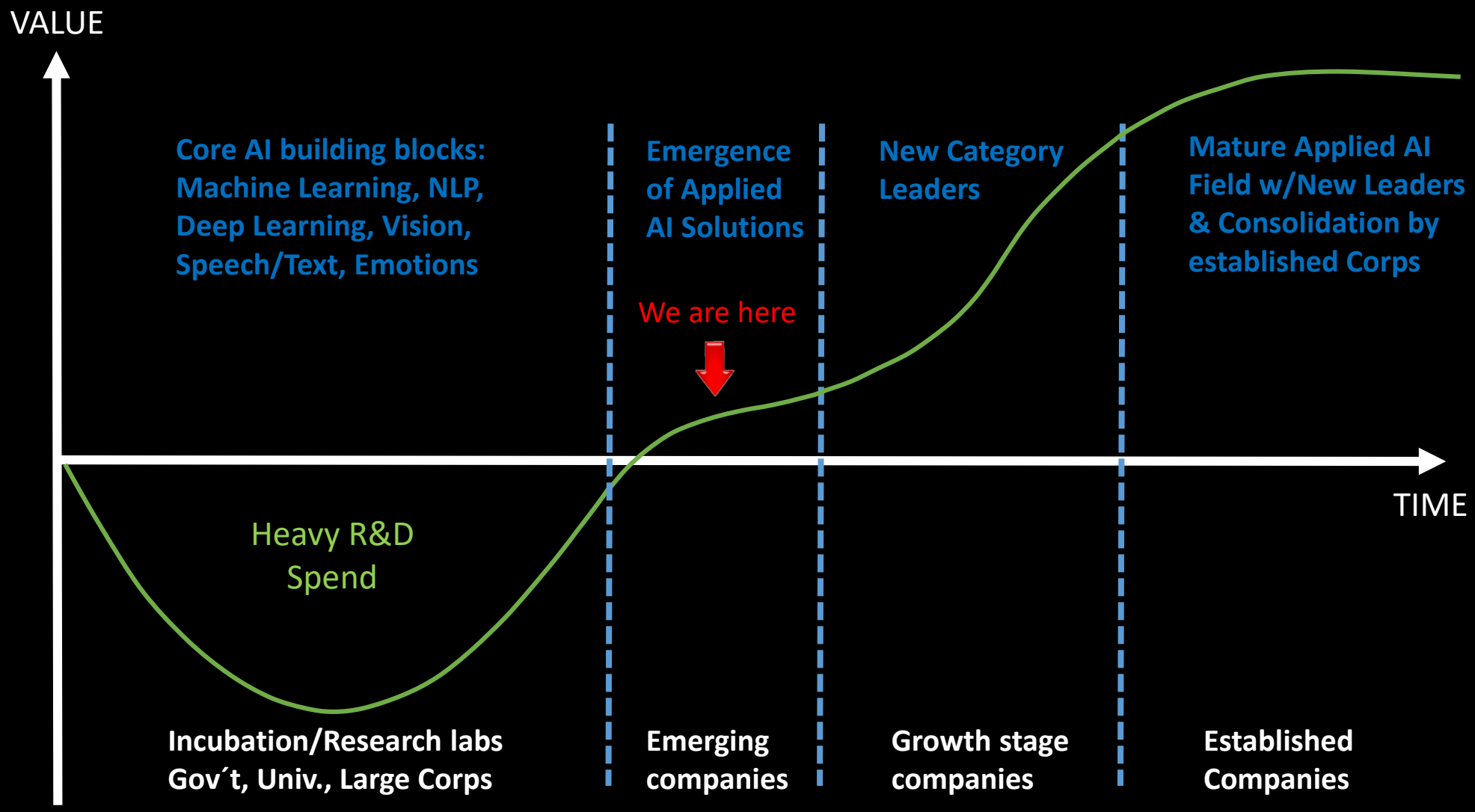


Over the last 250 years…

General purpose technology innovation have generated massive economic and productivity growth



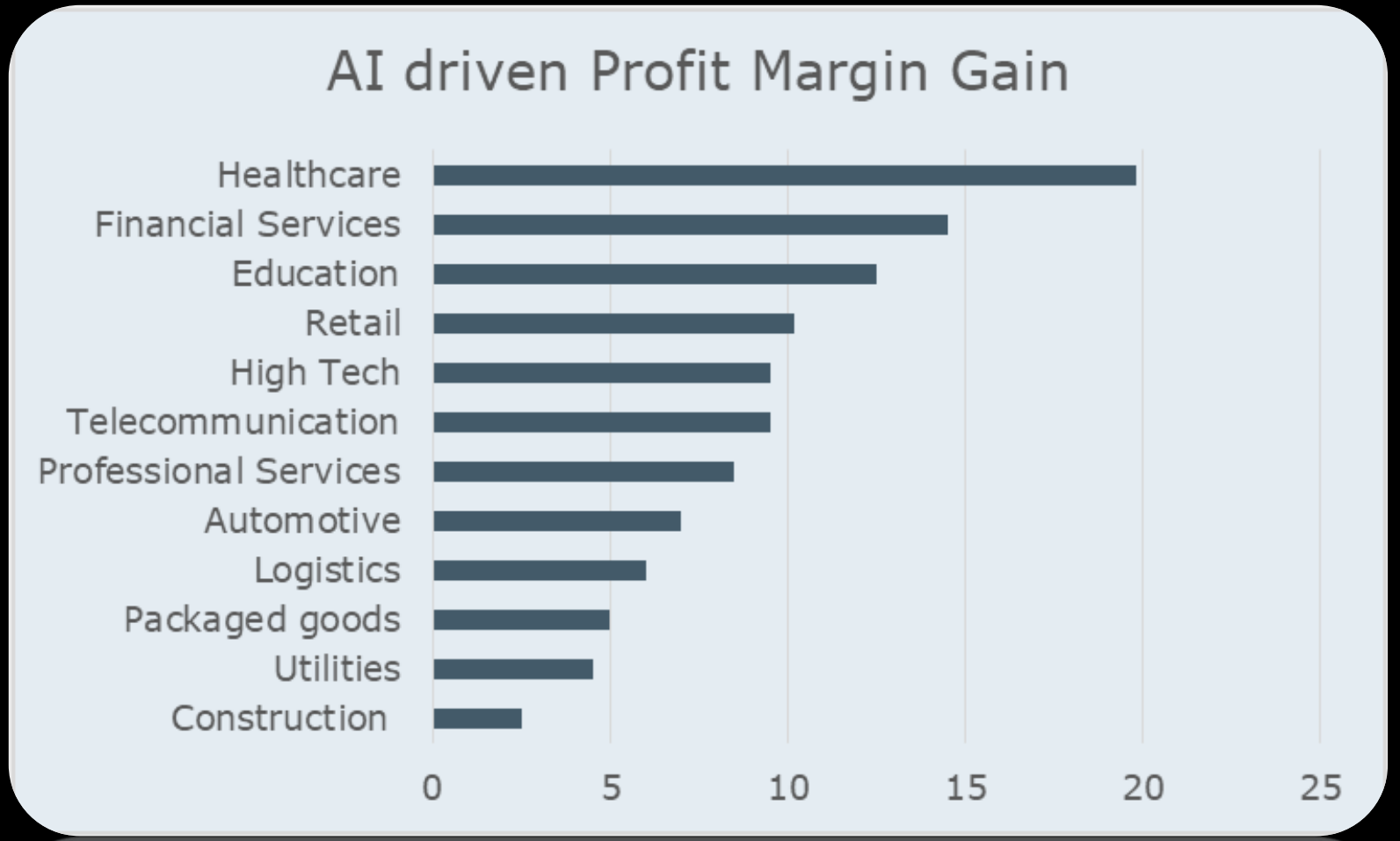
AI – where are we now?



"AI has the potential to boost rates of profitability by an average of 38% and could lead to an economic boost of US$14 trillion in additional gross value added (GVA) by 2035"

Accenture

Applied AI potential in different Industries

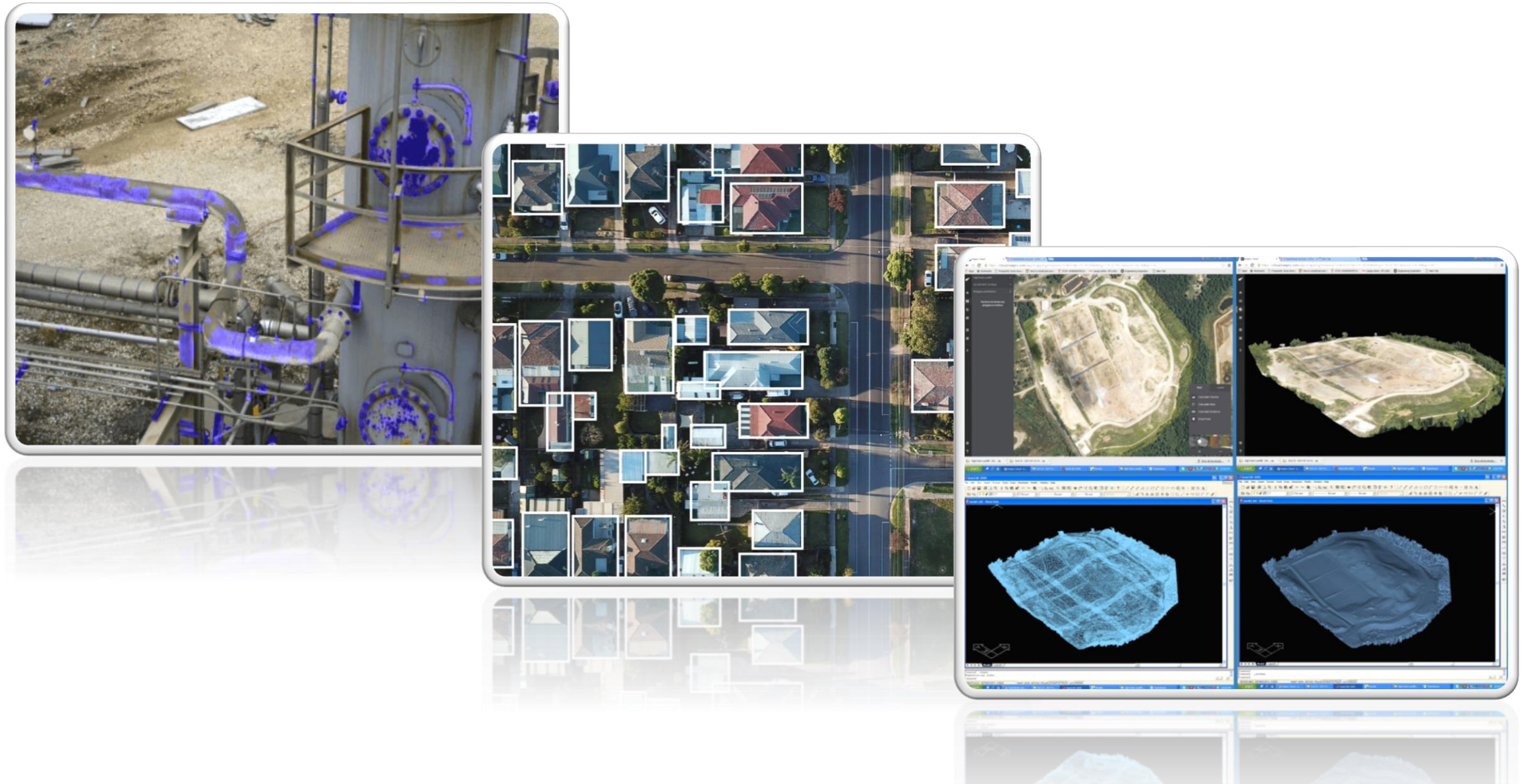


Source: MOVE TO AI 2018

Applied AI disrupting the Construction Industry…

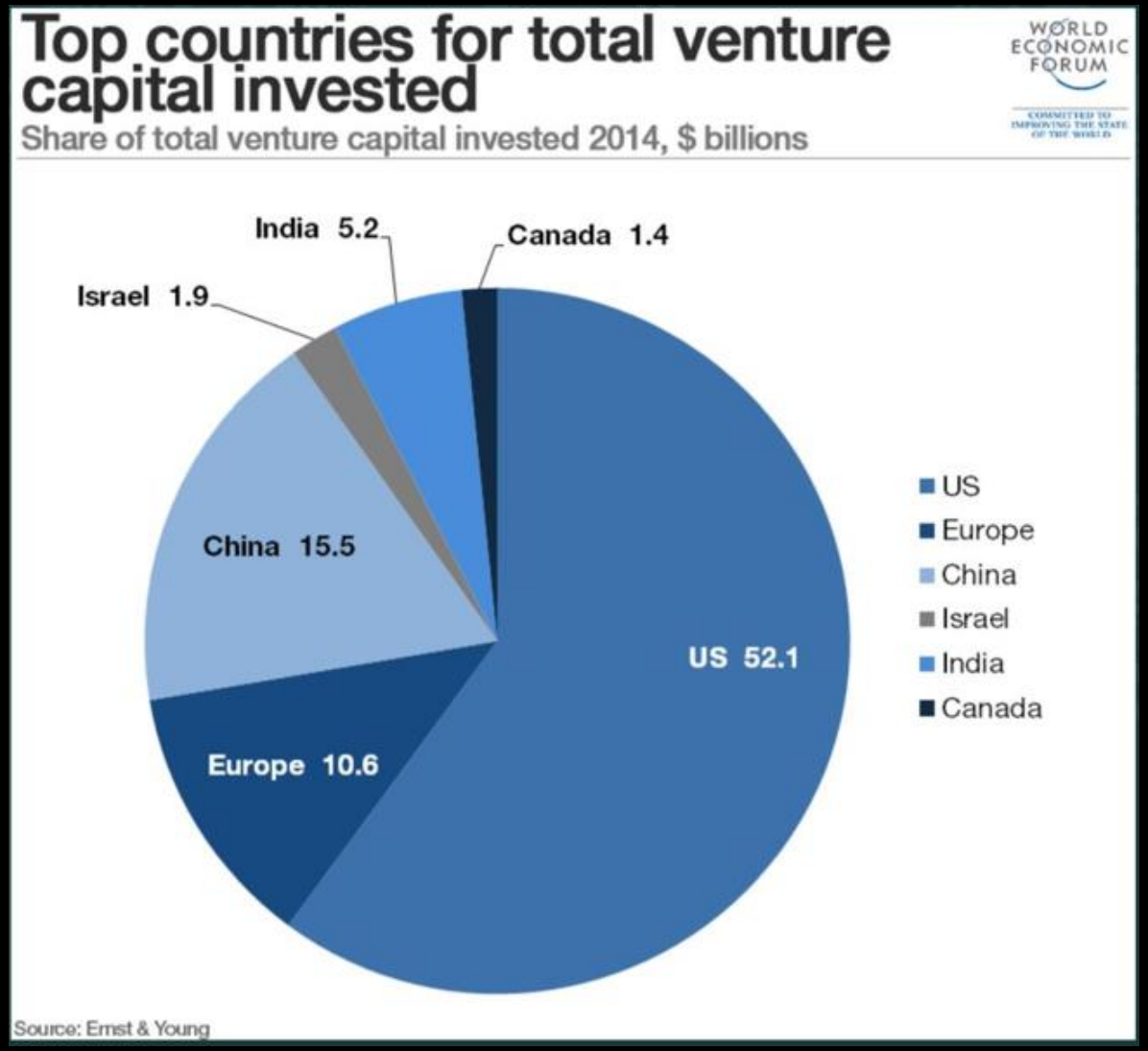
indus.ai
CONSTRUCTION INTELLIGENCE

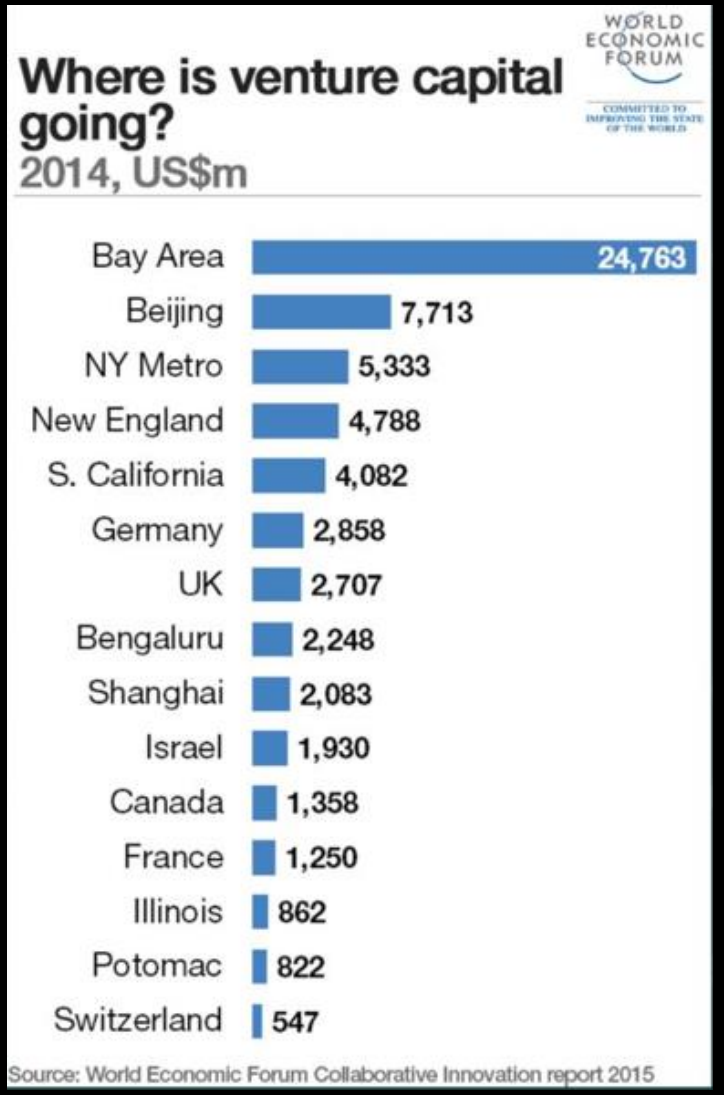
Applied AI disrupting Inspection, Maintenance & Testing…



The battle for AI world dominance is on…

VC Capital invested in 2014…





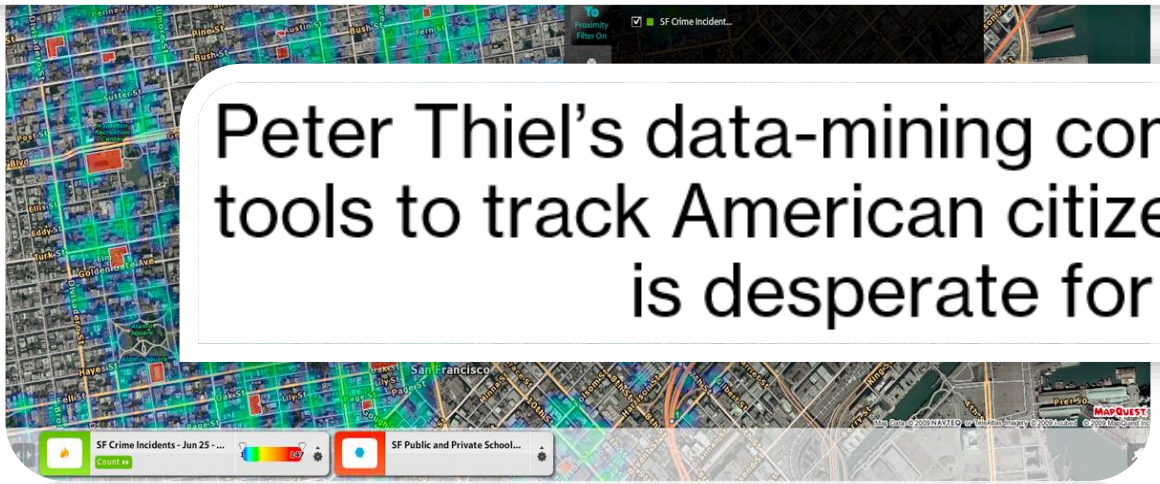
Global investments in Artificial Intelligence in 2017: $15,2 billion

Source: CB Insights

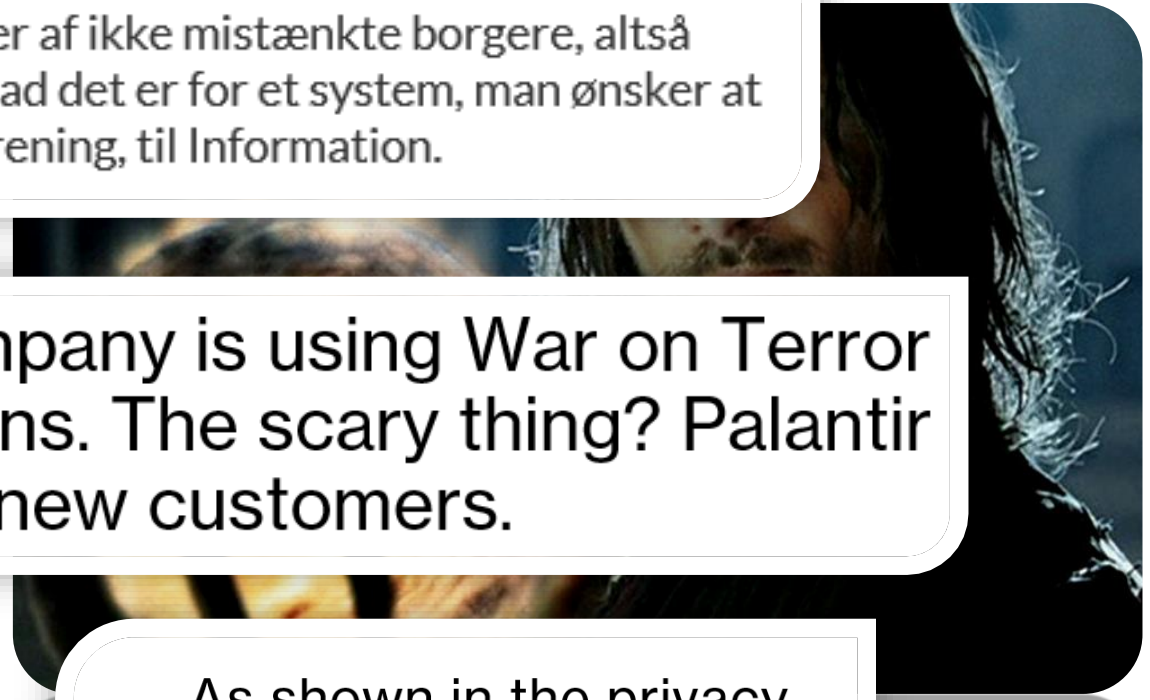
"Turning Data into a Timeless Competitive Advantage"

Palantir

»Det er et firma med et meget dårligt ry blandt borgerretsorganisationer, fordi Palantirs systemer typisk bruges til håndtering af oplysninger om store grupper af ikke mistænkte borgere, altså masseovervågning. Det gør mig meget skeptisk overfor, hvad det er for et system, man ønsker at købe,« siger Jesper Lund, der er formand for IT-Politisk Forening, til Information.

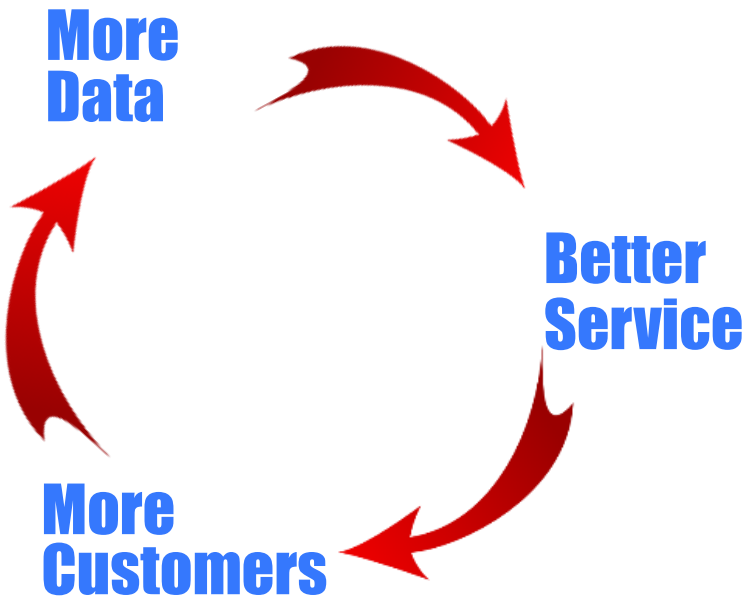


Peter Thiel's data-mining company is using War on Terror tools to track American citizens. The scary thing? Palantir is desperate for new customers.



As shown in the privacy breaches at Facebook and Cambridge Analytica, the pressure to monetize data at tech companies is ceaseless

Why this thirst for data?



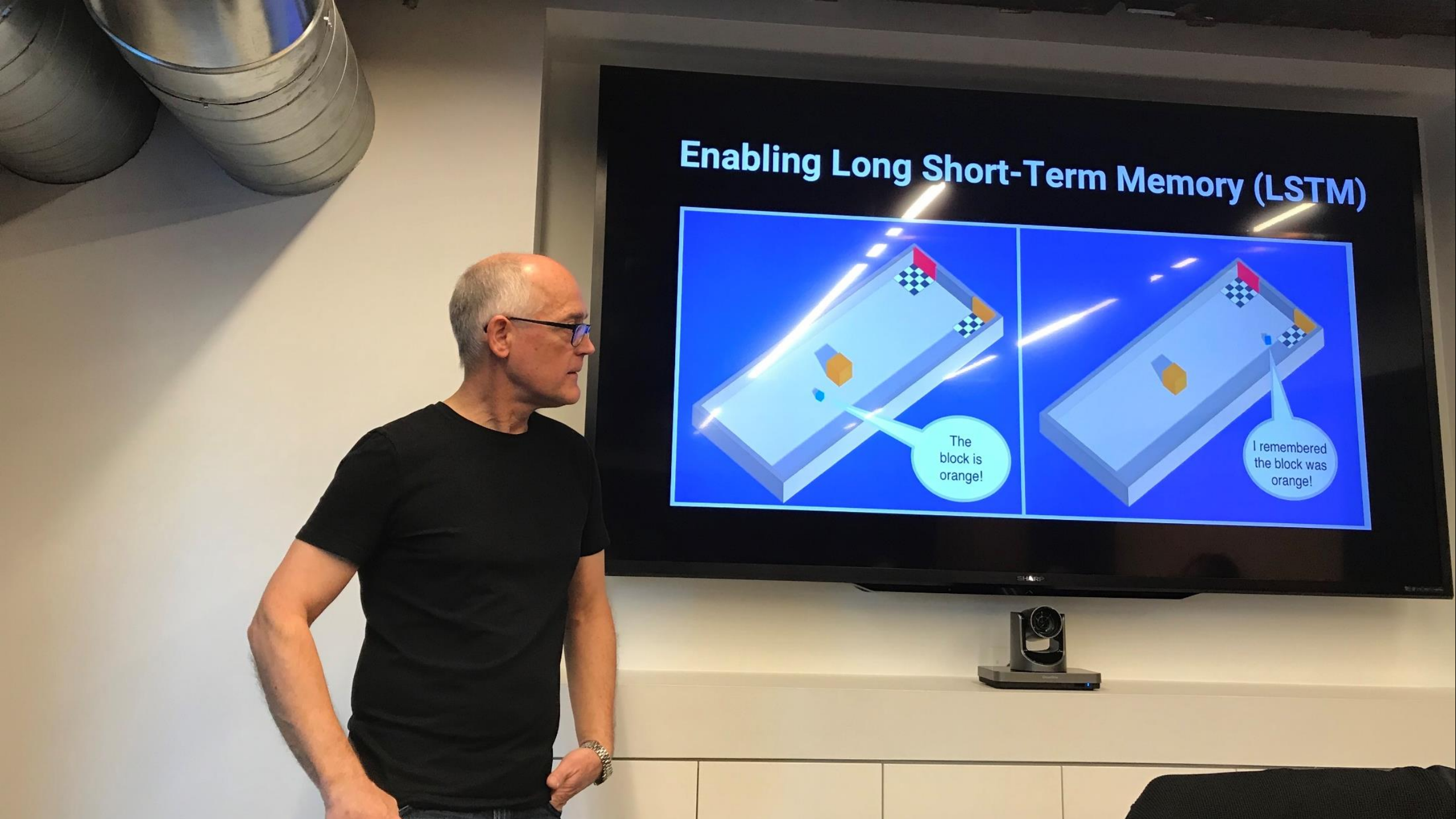
STAY AHEAD!

Google

amazon

UBER

"Bringing AI to
every Corner of
your Organisation"
unity


Enabling Long Short-Term Memory (LSTM)
The block is orange!
I remembered the block was orange!

About Unity Technologies

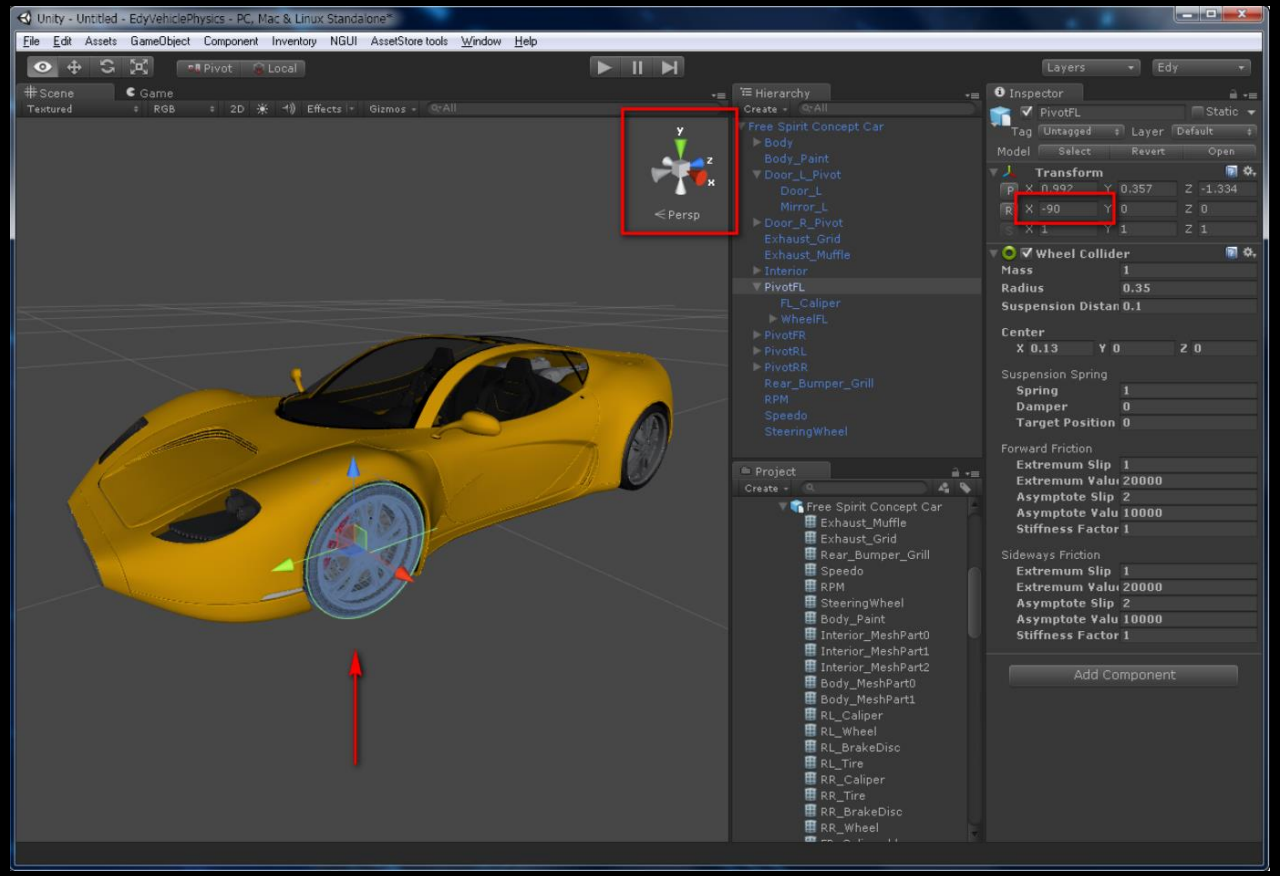
- Real-time 3D Development Platform
- Game, AR/VR, film, automotive
- 60% of top 1,000 games
- On over 3 billion unique devices
- 1.5 billion monthly active players
- 2,000 employees with HQ in San Francisco

UNITY 3D: One Game Engine to Rule Them All

Before: 3D objects from AUTODESK -> UNITY (games)

Future: 3D engine in AUTODESK -> simulate physics in real time and realistically directly in AUTODESK

Will AUTODESK be able to make designs in the future based on machine learning from thousands of previous designs and physical laws?



So how does AI work?

And how mature is the technology?

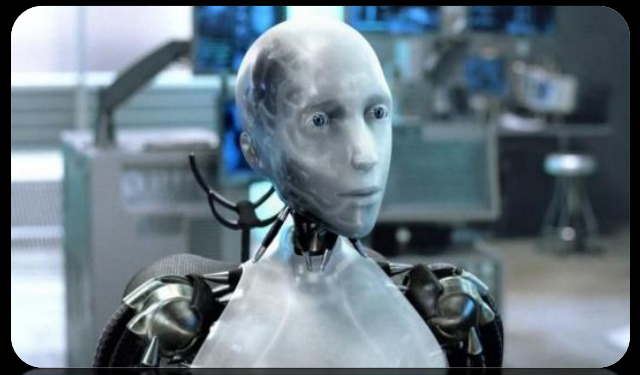
REGZA
It might
look goofy ...
TOSHIBA

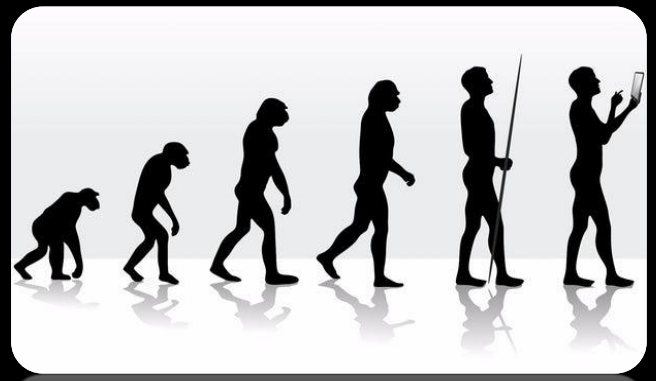
Machine learning resembles Human learning

=

⇩

⇩





So how widespread is AI today?

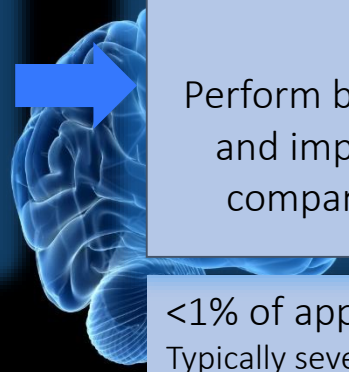
AI stages:

Artificial Narrow Intelligence (ANI)

Execute specific focused tasks, without ability to self-expand functionality

99% of applied AI

Typically Machine Learning
e.g. image and speech recognition, regression modelling, play chess etc.



Artificial General Intelligence (AGI)

Perform broad tasks, reason and improve capabilities comparable to humans

<1% of applied AI

Typically several machine learning models co-working and removing human bias.
E.g. on-line job interviews with massive ML functionality than detects sentiments, moods, lies etc.

Artificial Super Intelligence (ASI)

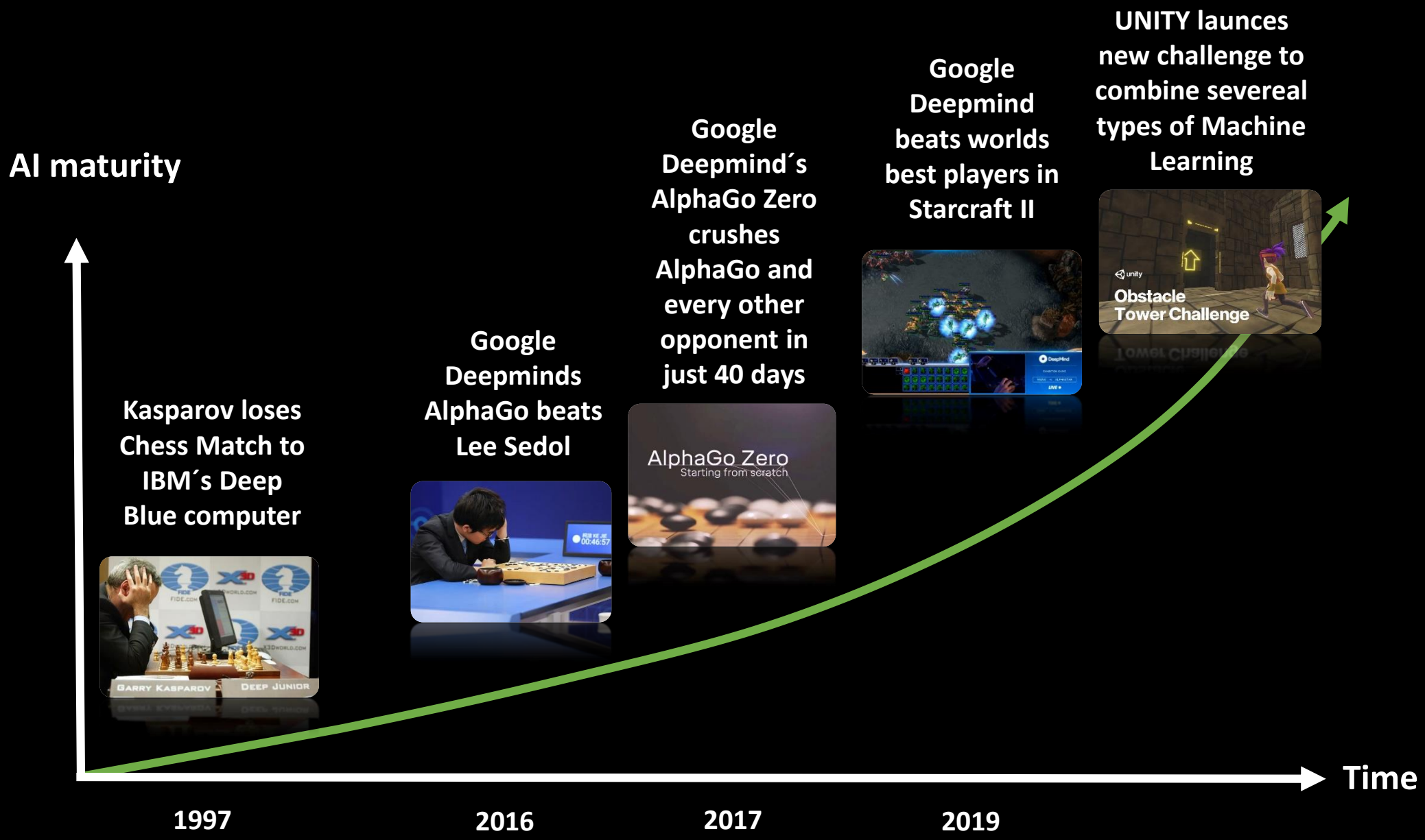
Demonstrate intelligence beyond human capabilities

Not applicable… yet

Even narrow AI can struggle…

The Chihuahua vs. Muffin challenge

The Gaming Industry is leading AI development…



"No scalable AI without
solid data management"

"3D models of the
future will be intelligent"

"AI today is mostly machine
learning in a narrow application"

Conclusions on PART 1

"Anything that can be
automated will be automated"

"Most AI algorithms are open source/free,
data is the asset you want to protect"

PART 2

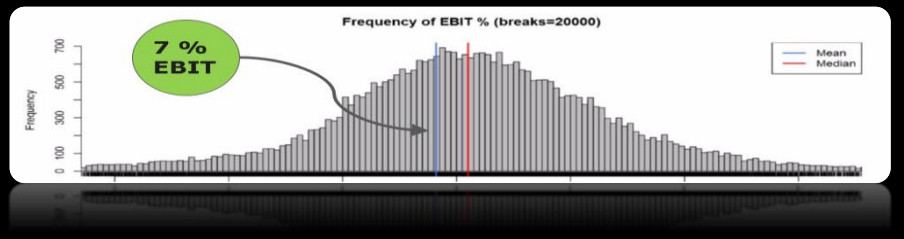
Application of AI in Danish Engineering Consultancy

The Application of Machine Learning – 3 cases:

Predictive maintenance of sewer systems
- HOFOR and Energi Viborg, NIRAS

Prediction of High Shallow Groundwater
- Region Midt, COWI/GEUS

Prediction of Project performance
based on ERP data – COWI internal



Predictive maintenance of sewer systems

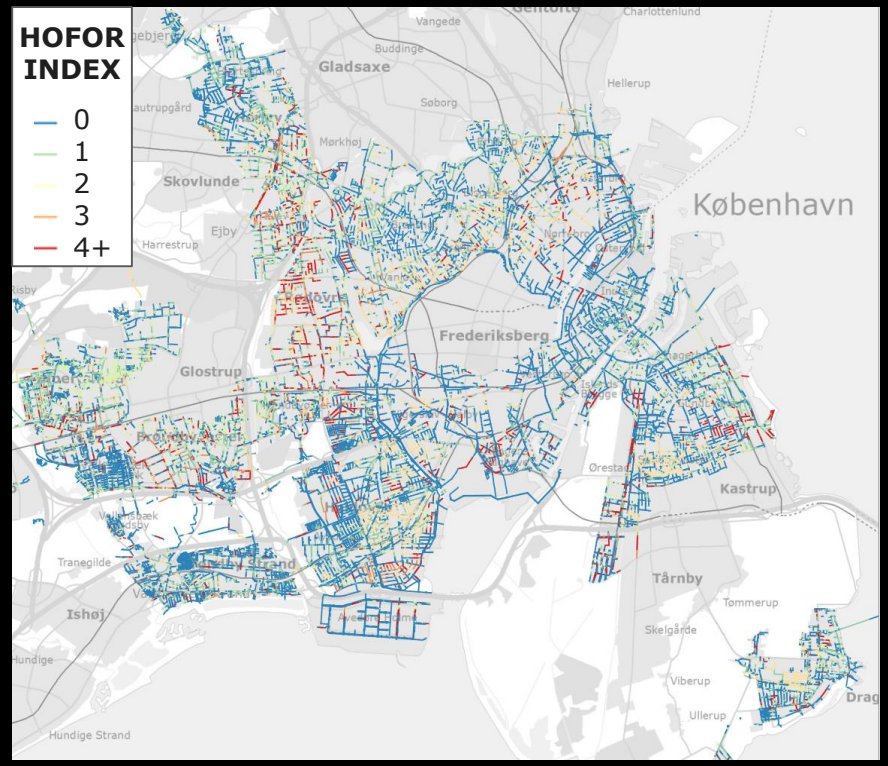
What sewer pipes need urgent replacement?

For **all** sewer pipes we have "asset data":

- Metadata (age, material, dimensions, length)
- Information about groundwater, soil type etc.
- Proprietary information (BBR etc.)

For **most** sewer pipes we have:

- TV-inspections (ground truth) =>
  used to calculate a physical index.

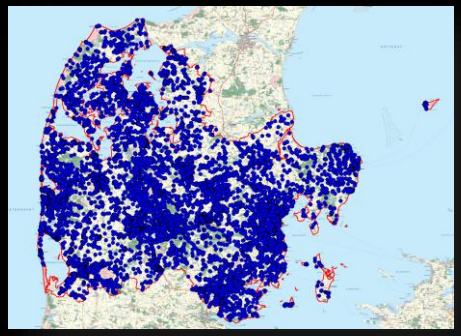


We have trained ML algorithms by combining "asset data" and TV-inspections to:

- Calculate a physical index where TV-inspection have never been done
- Update a physical index based on age extrapolation of the pipes

Prediction of High Shallow Groundwater

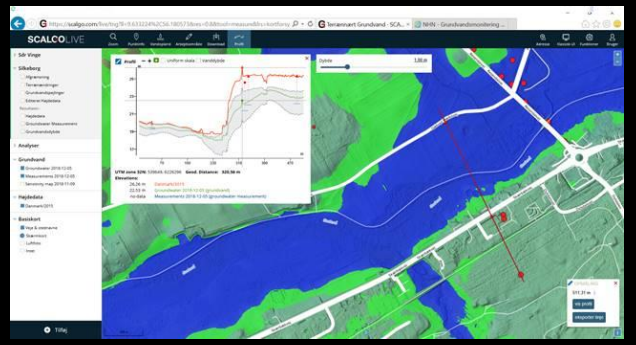
Water levels from +15.000 sampling points
Heavy statistical computation/normalisation of data (COWI Connect platform)



Patterns in areas with data is used to predict water levels in areas with no data (Random Forrest ML)

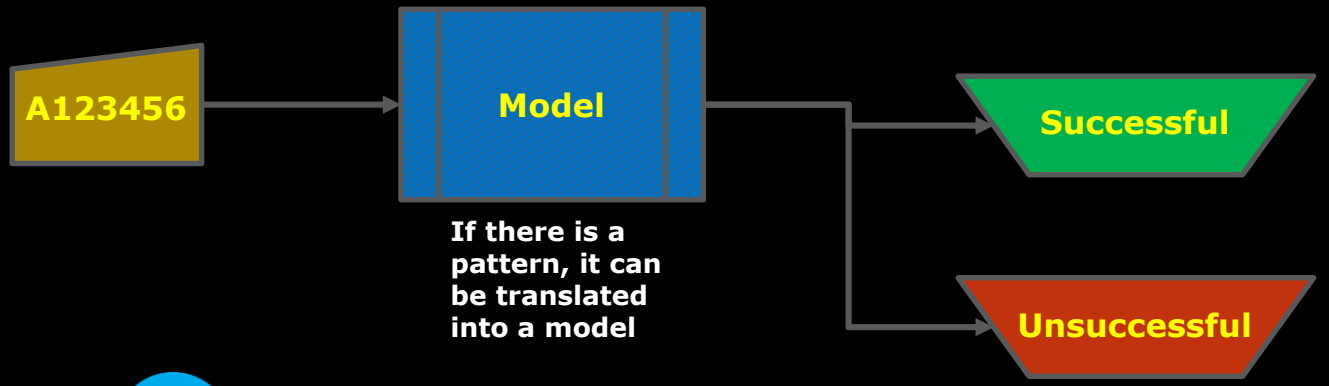
GEUS

Flooding prediction using a highly advanced 3D terrain flooding model (SCALGO LIVE)



Prediction of Project Performance based on ERP data

Is it possible to find a pattern identifying successful projects?



Using standard Microsoft Azure ML tools on 50.000 executed projects, we got a 75% prediction accuracy indicating that:

1. Who is **Project Manager** matters most
2. Who is **Customer** matters a lot
3. Which **COWI region** matters
4. Effect of the **degree of distributed work** is uncertain

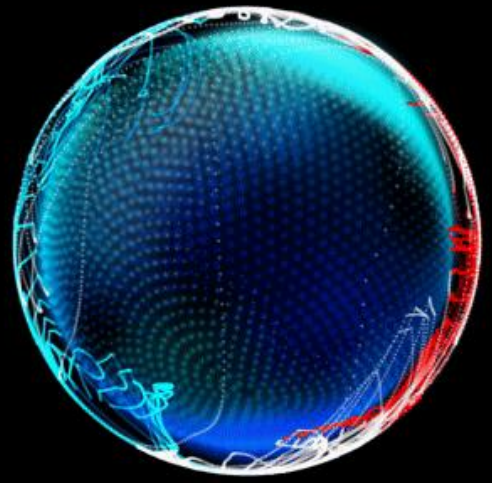
The role of Engineering Consultants today

Key Players

Investors	Clients	Facility Owners
Architects	Engineering consultants Planning, Investigation, Design, Supervision/Construction	Operators
Developers Asset=Money	Contractors Asset=Physical	Data Scientists Asset=Data

Development phase

What is The Future for Engineering Consultancy?



Trend 1: Acquisition of Architect Companies

Key Players

Investors	Clients	Facility Owners
Architects	Engineering consultants Planning, Investigation, Design, Supervision/Construction	Operators
Developers Asset=Money	Contractors Asset=Physical	Data Scientists Asset=Data

Development phase

Trend 2: Contractors take up Design and Supervision

Key Players

Investors	Clients	Facility Owners
Architects	Engineering consultants Planning, Investigation Design, Supervision/Construction	Operators
Developers Asset=Money	Contractors Asset=Physical	Data Scientists Asset=Data

Development phase

Trend 3: Engineering Consultants acquire Data Science

Investors	Clients	Facility Owners
Architects	Engineering consultants Planning, Investigation, Design, Supervision/Construction	Operators
Developers Asset=Money	Contractors Asset=Physical	Data Scientists Asset=Data

Key Players

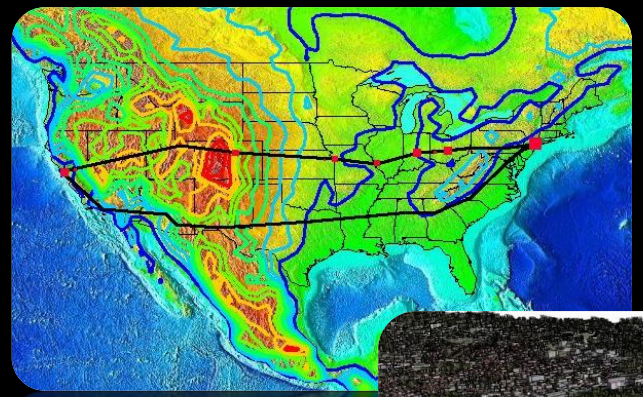
Development phase

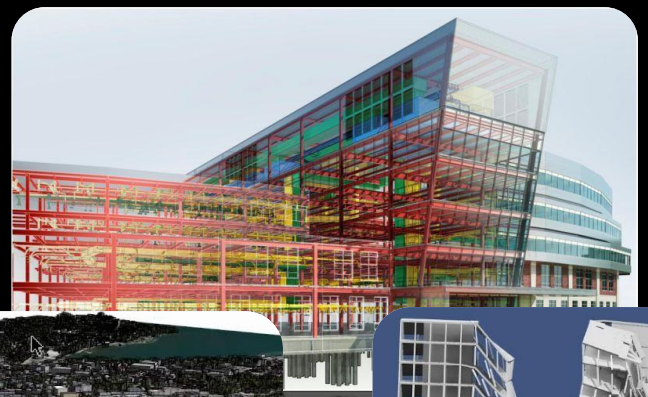
Data Science

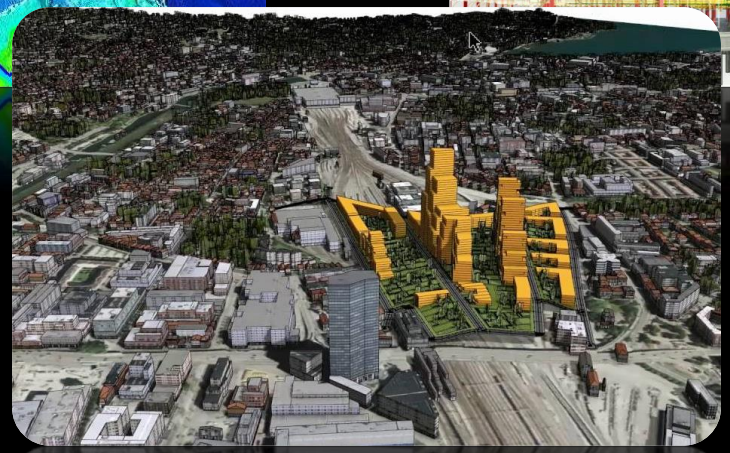
Digital Partnerships that will change the world of engineering…

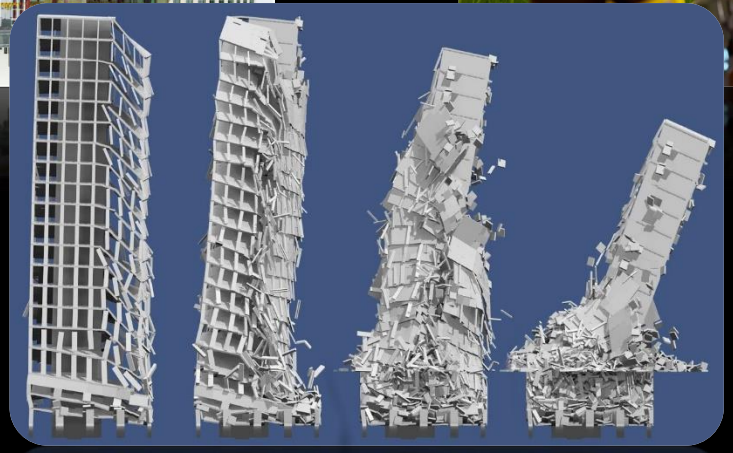
esri
THE SCIENCE OF WHERE™

unity

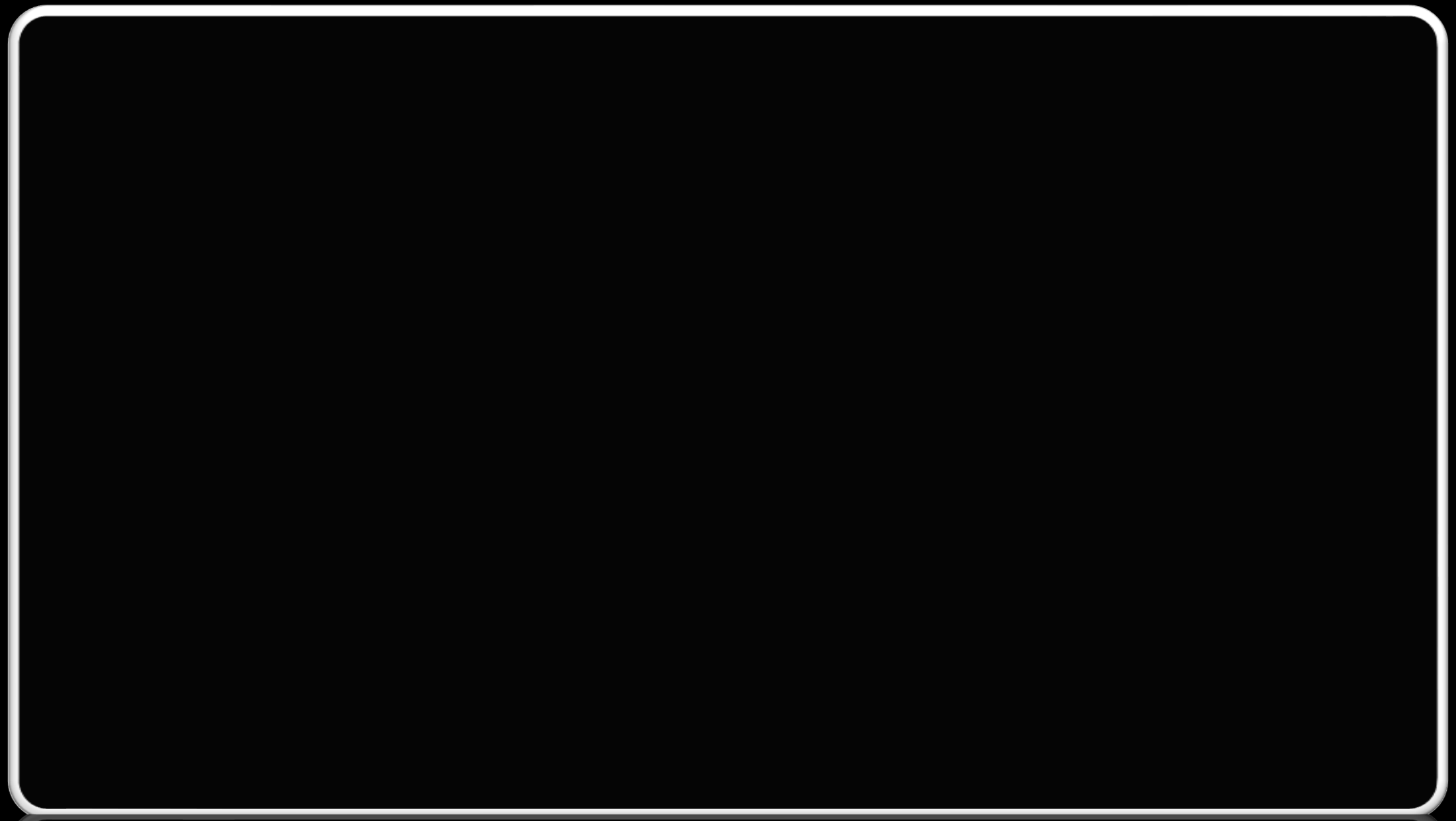








This will ultimately lead to a complete “digital twin world”



The Digital Development is changing the Business Landscape…

… so we need to find new ways of moving forward

"Machine learning can compete with traditional modelling"

"Traditional Engineering Consultancy will be challenged by both Tech Companies and Management Consultants"

"Most Engineering Consultants are broadening their digital value chain"

Conclusions on PART 2

"Data Science capabilities will be in demand – both internally and as consulting services"

"Digital partnerships between AUTODESK, ESRI and UNITY is going to change the E&C industry dramatically"

And remember…
No Industry…
No Organisation…
No Individual…
- will be left untouched by Artificial Intelligence
THANK YOU

And remember…
No Industry…
No Organisation…
No Individual…
- will be left untouched by Artificial Intelligence
THANK YOU

Machine Learning is a lot like teenage sex…

Everybody talks about it.
Only some really know how to do it.
Everyone thinks everyone else is doing it.
So, everyone claims they are doing it.