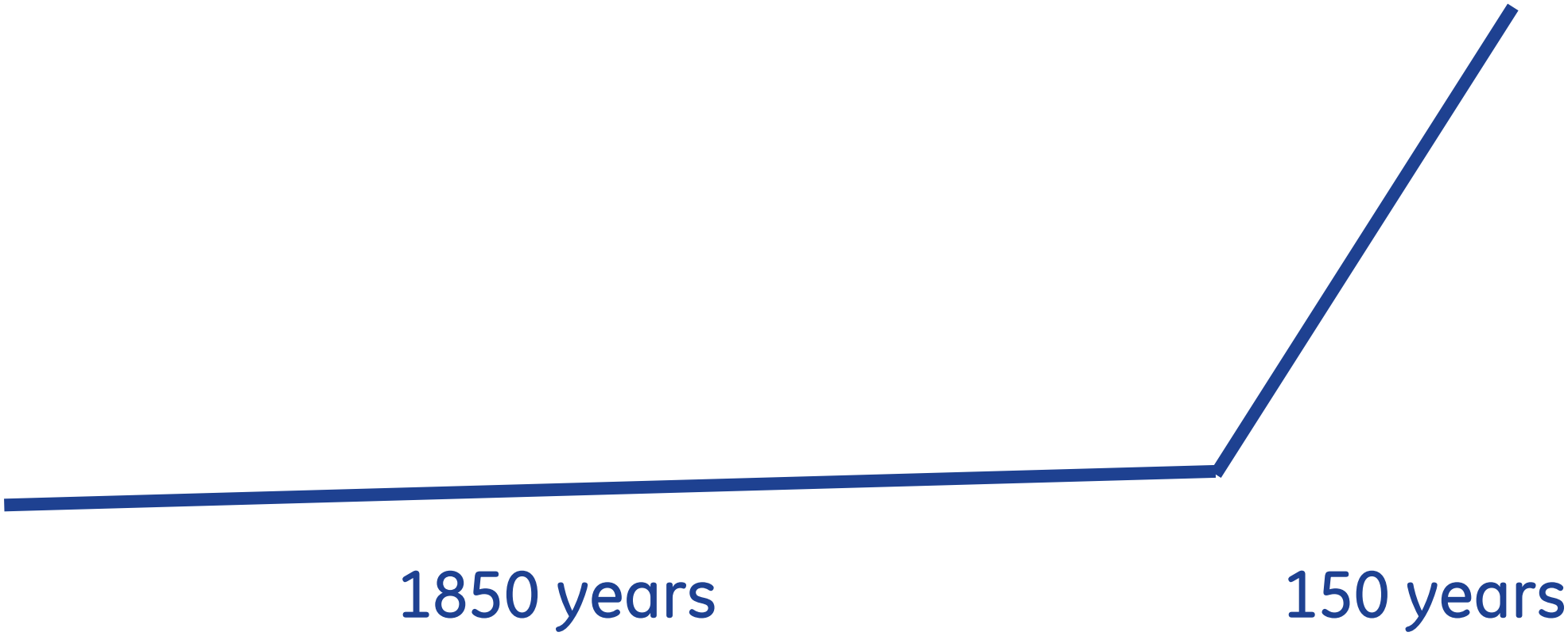
Industry 4.0: An industrial view

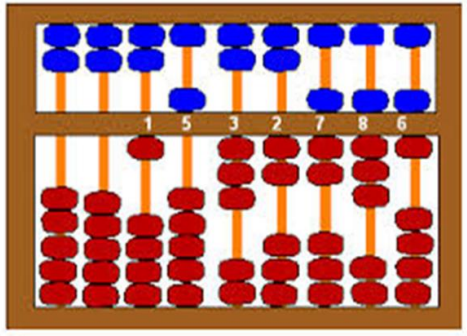
Joerg Bauer
President, GE Hungary

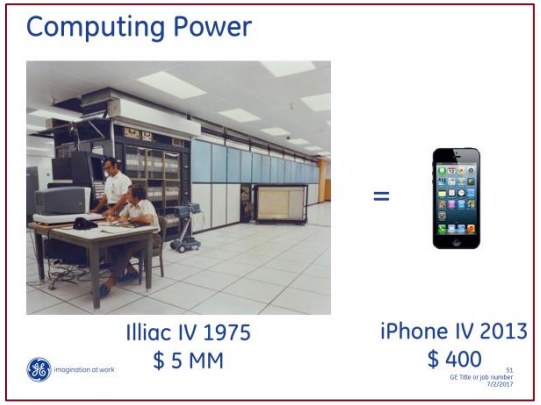
20 September 2017

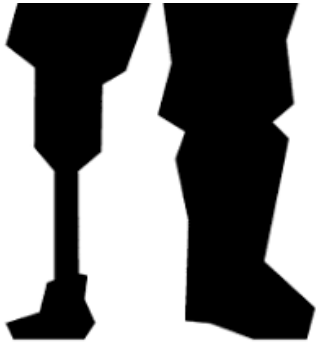
Standard of Living in the last 2000 years



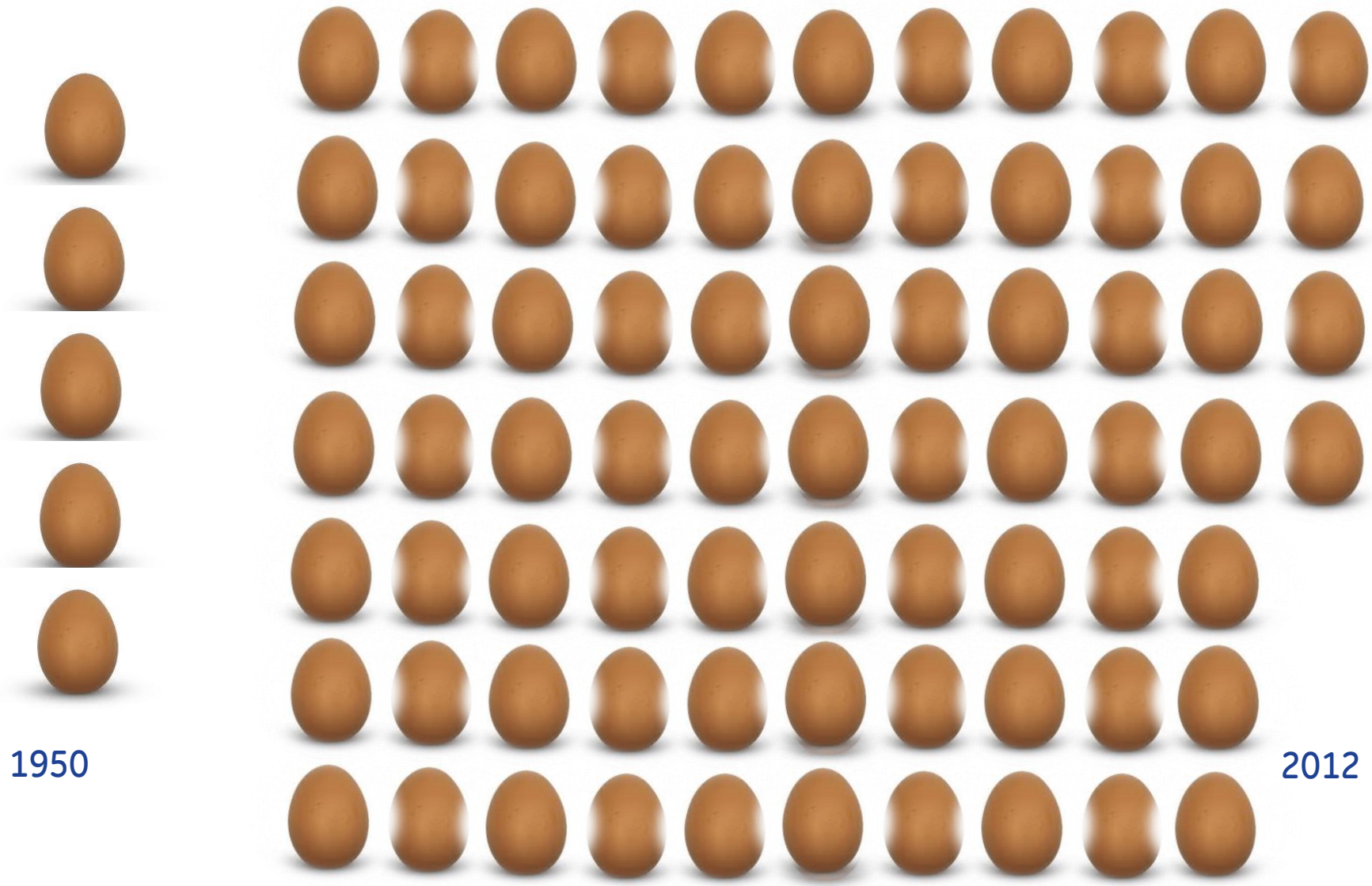
Human Augmentation – physical & cognitive



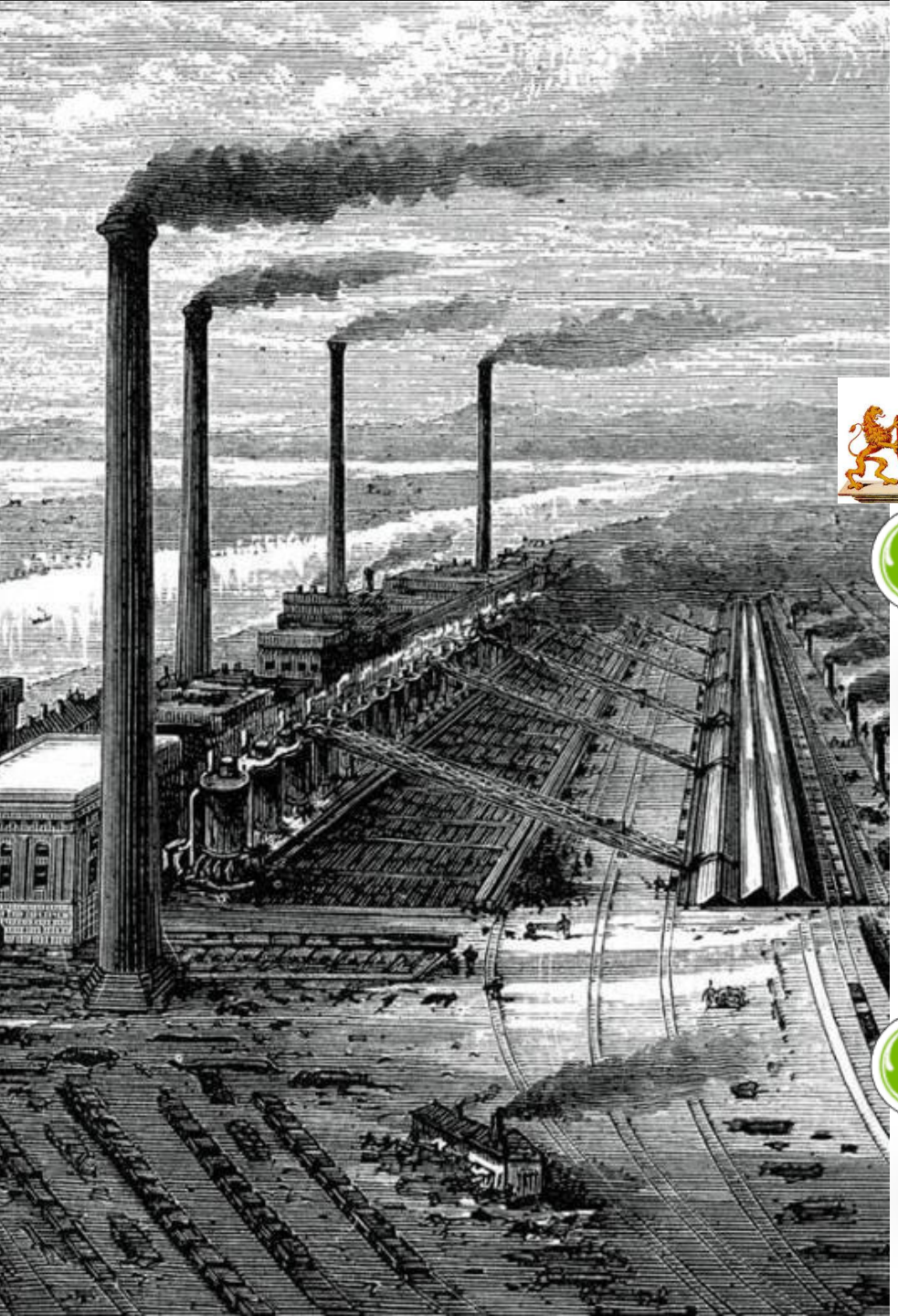




How many eggs for one hour salary?*



(*in Germany, source DIW: http://www.iwkoeln.de/de/infodienste/iw-dossiers/beitrag/kaufkraft-der-nettoverdienste-20280)



Budapest

1896 (Dow Jones)

1.0 | **1784** | based on mechanical production equipment driven by water and steam power

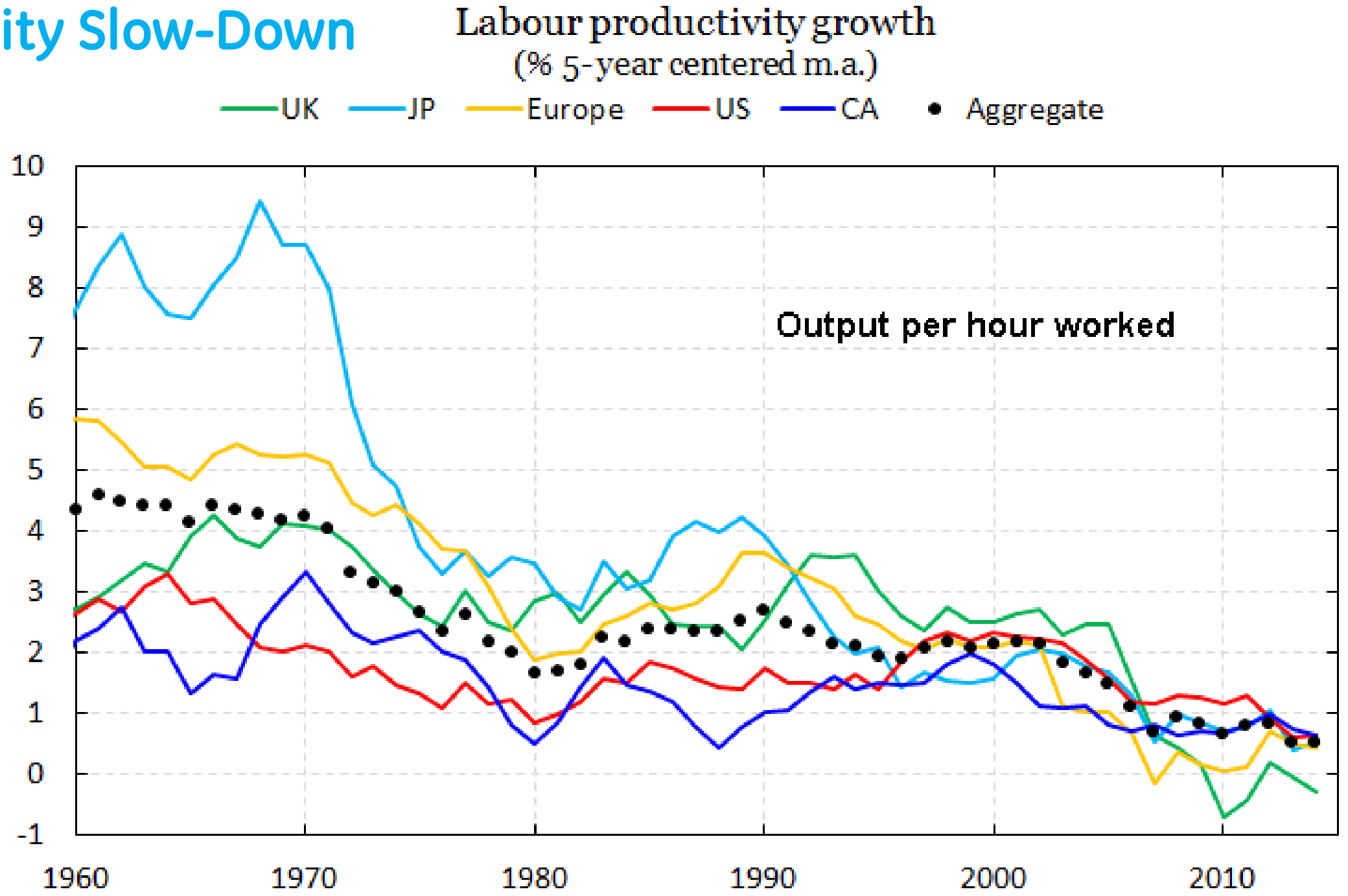
2.0 | **1870** | based on mass production enabled by the division of labor and the use of electrical energy

3.0 | **1969** | based on the use of electronics and IT to further automate production

4.0 | **tomorrow** | based on the use of cyber-physical systems

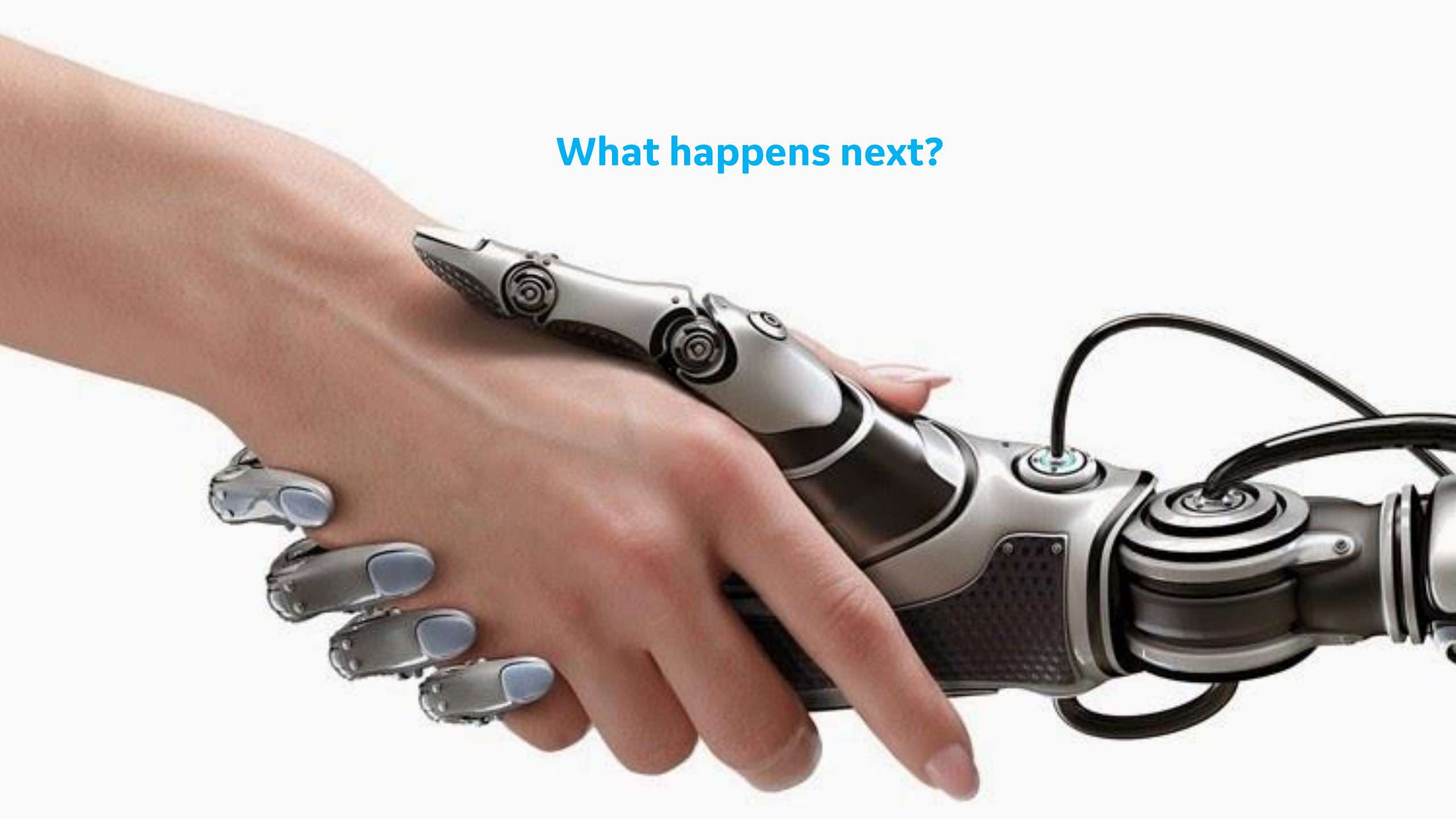

For a true revolution,
we must rethink
the process

Productivity Slow-Down



Source:
http://blogs.ft.com/gavyndavies/2014/10/26/is-economic-growth-permanently-lower/

What happens next?



Gartner Inc.: Hype Cycle for Emerging Technologies, 2015

http://www.gartner.com/newsroom/id/3114217?xid=nl_daily

Example: Automotive Industry

Disruption by convergence of technologies & trends: example Automotive Ecosystem (selected impacts)

Electric Mobility

- No combustion engines
- No Filling Stations
- No Refineries
- **No CO2 (pending energy source), generally higher efficiency**

- Need batteries
- Need electric energy (or hydrogen fuel cells)
- Less demanding to produce (vs. Combustion)

+

Artificial Intelligence

- Enables **Autonomous Driving (& Automation)**
- Enables connected cars / traffic management

- No chauffeurs
- No more accidents (no more airbags, etc.), enables simpler cars
- No need for traffic signs, lamps, barriers
- No more traffic jams
- Travel time reduced and usable for other activities

+

Shared Economy

- Together with e.g. smart phone and eCommerce, enables **Individual transport as a service**
- No more private ownership of cars
- No need for public transport
- No more parking needed
- **=> 80% less cars**
- Drastic industry consolidation likely

+

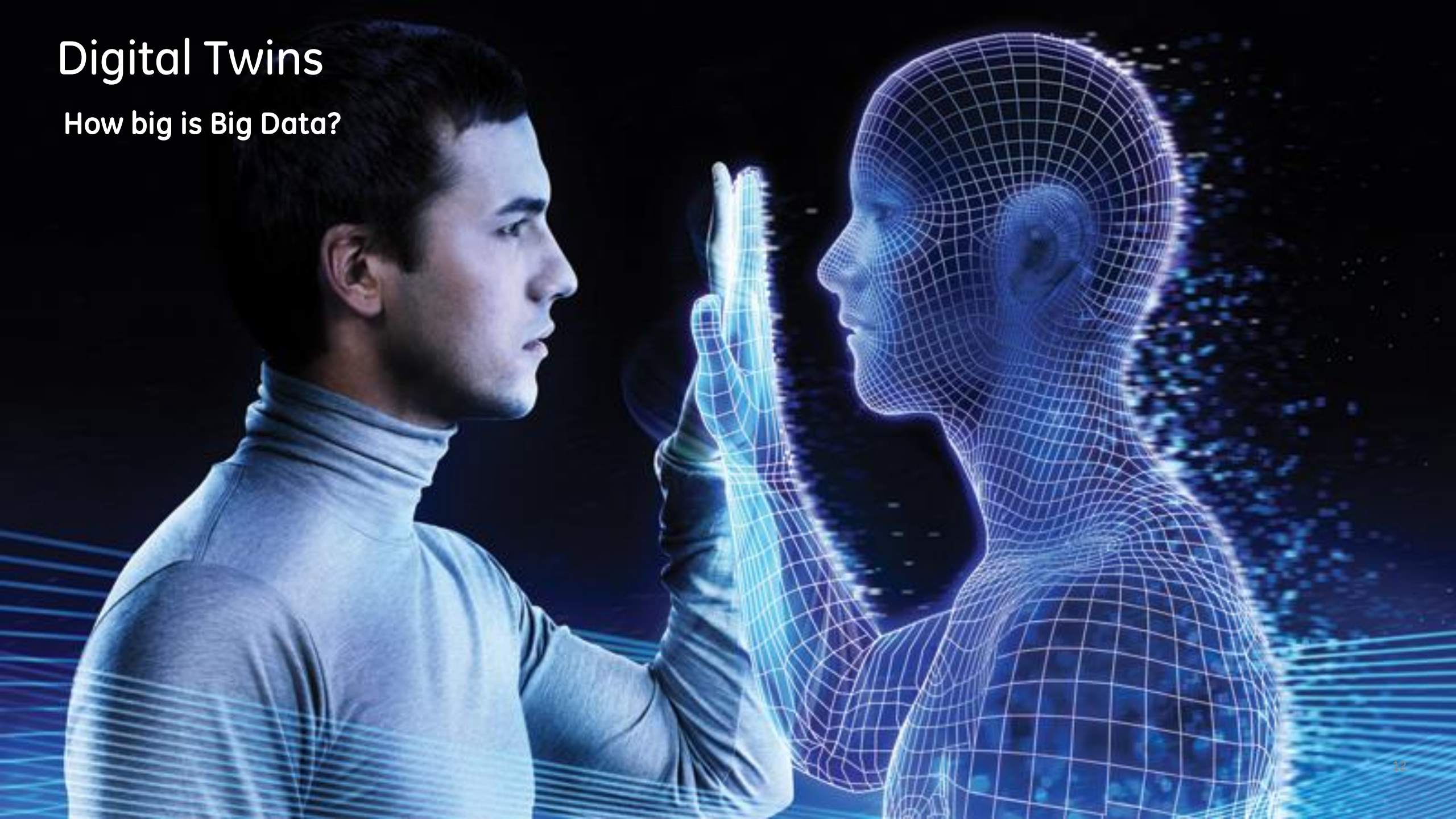
3D Printing

- Together with robotics and automation will change automotive supply chain (all others, too)
- Lighter, less parts per car
- New materials
- Less suppliers
- Completely new car concept possible
- **What does it mean for a given country's economy?**

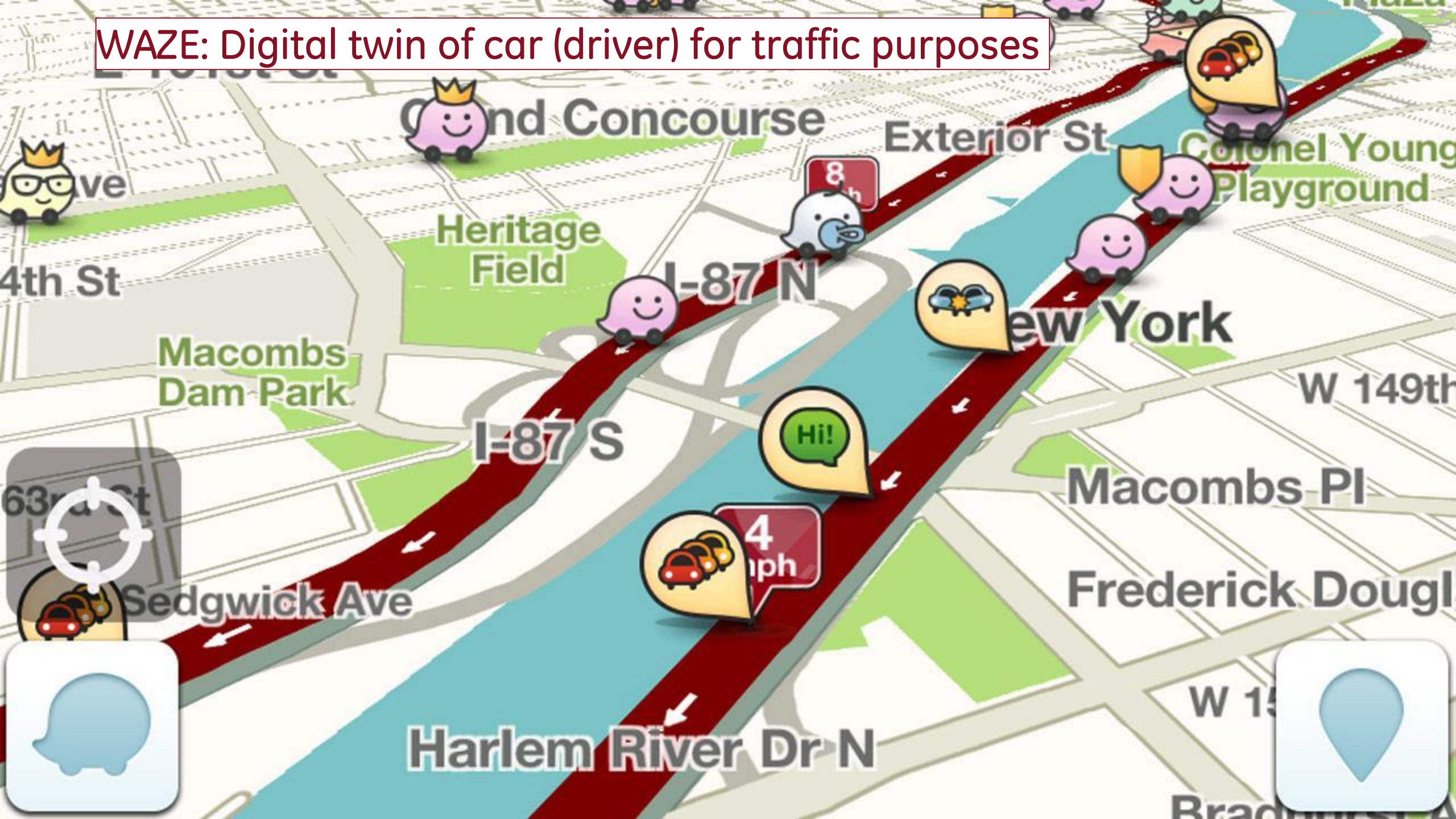
Can we lift up cars by 10 cm from the ground?

Digital Twins

How big is Big Data?

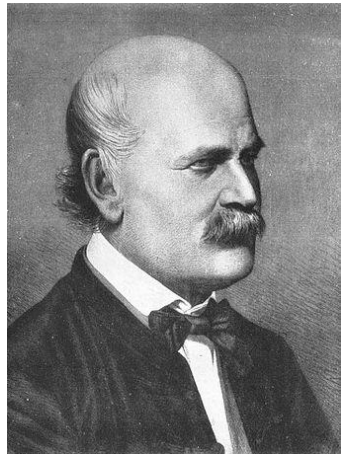


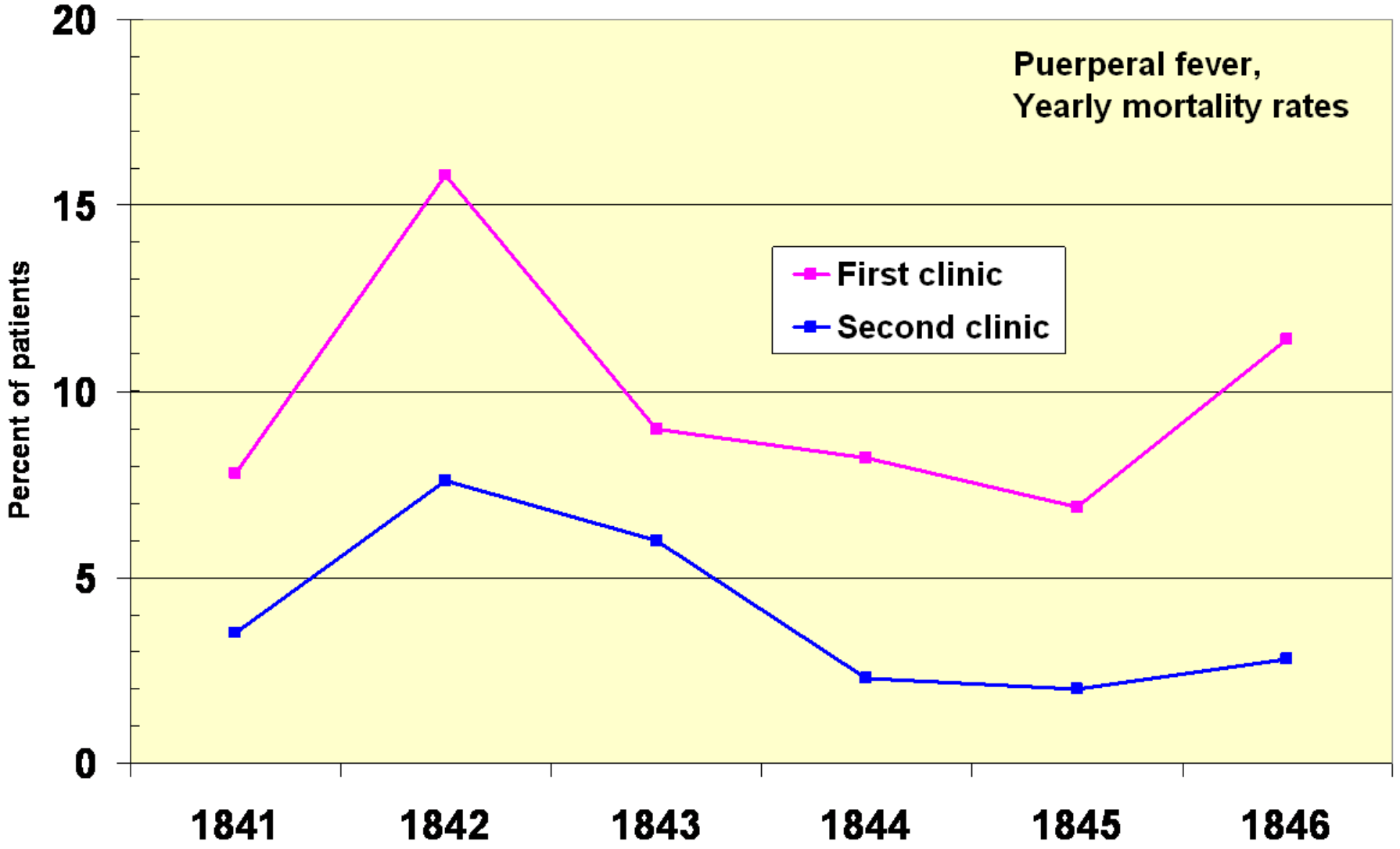

CYBORG!


WAZE: Digital twin of car (driver) for traffic purposes
Exterior St
Colonel Young
Playground
Heritage
Field
I-87 N
I-87 S
Macombs
Dam Park
Macombs Pl
W 149th
Hi!
4
Sedgwick Ave
Harlem River Dr N

Personalized Medicine / Precision Medicine

1st Hungarian Data Scientist: Semmelweis – Correlation vs. Causality





"Yearly mortality rates 1841-1846 two clinics" by Power.corrupts - Own work. Licensed under Public Domain via Commons - https://commons.wikimedia.org/wiki/File:Yearly_mortality_rates_1841-1846_two_clinics.png#/media/File:Yearly_mortality_rates_1841-1846_two_clinics.png

How BIG Is Big Data?

We have got enough ...(data)

LAB

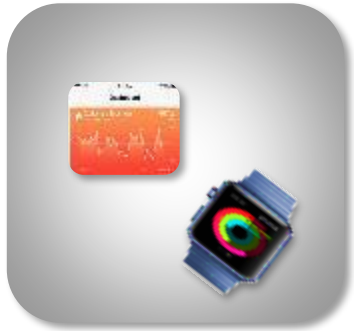
1.6 B sequenced genomes 2017

IMG

15 B medical images per year (2015)

Health

35 ZETTABYTE* Health data 2020

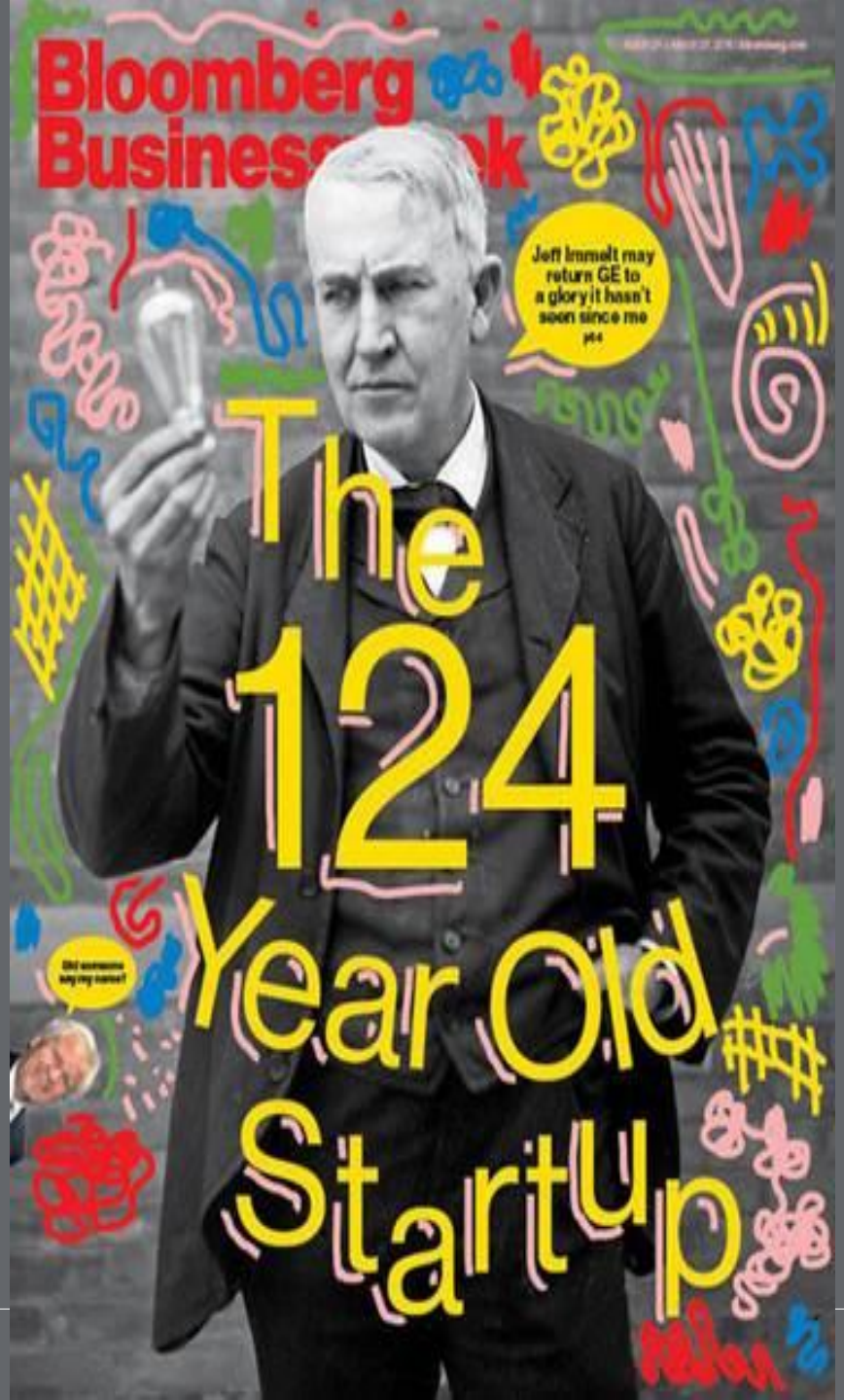


WEARABLE

91 M wearable devices 2016

1 ZB: 45 MM years 24h/day HD Titanic movie
1 ZB: all mankind is tweeting for 100 years

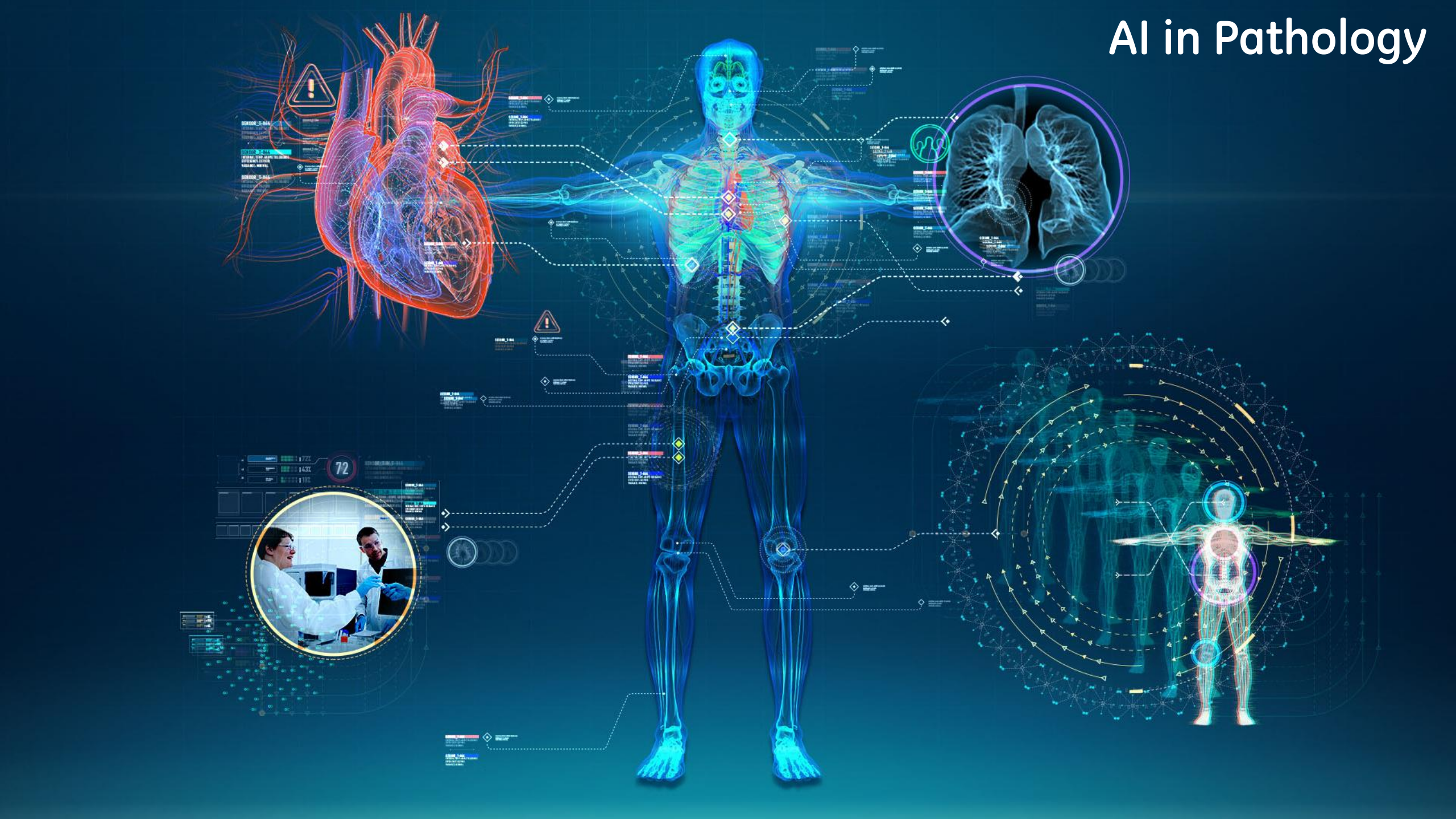
*1 Zettabyte = 1bn Terrabytes



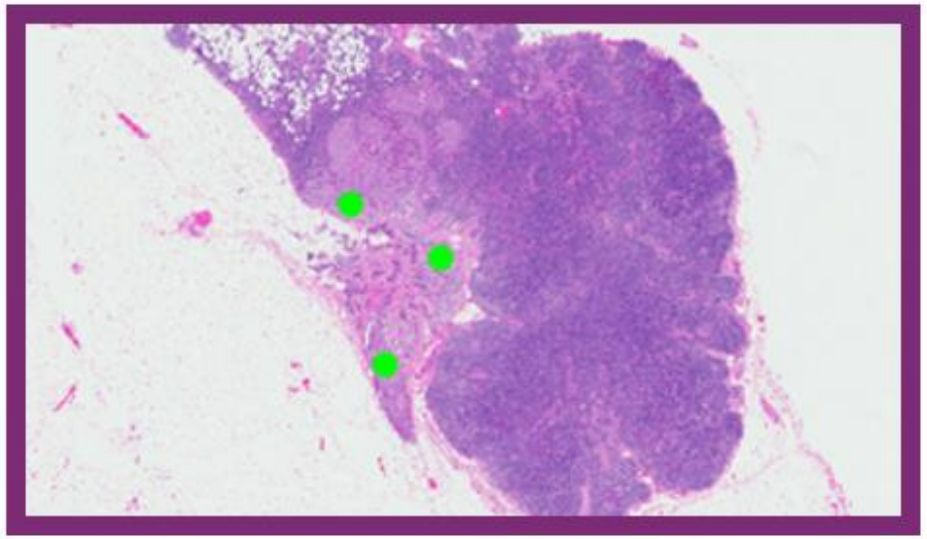
GE is the world's premier Digital Industrial Company

What does GE do?

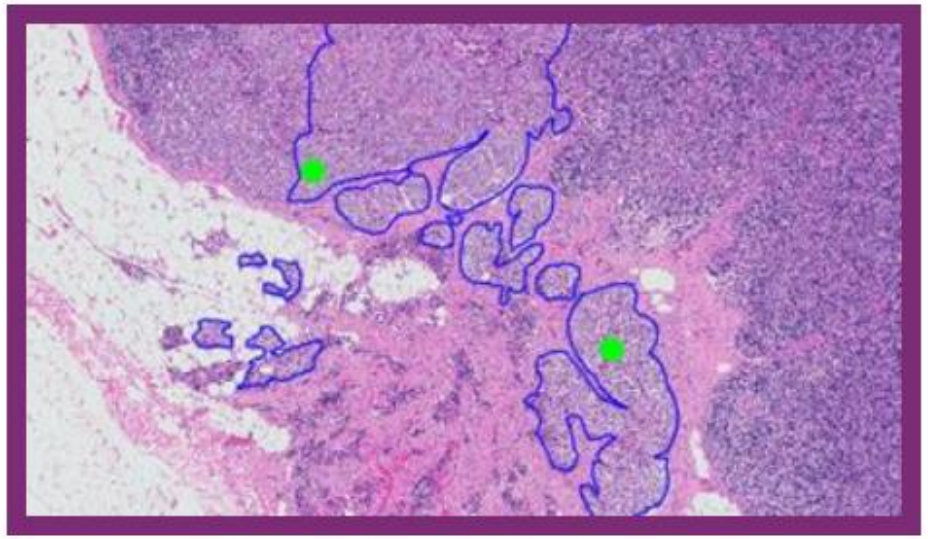
AI in Pathology



Pathology and Deep Learning



- Prescreening algorithms can identify areas of potential malignancy on lymph nodes helping to minimize search time and maximize diagnostic effort.



- As pathologists zoom into regions identified by Informed Detection more detail is available.

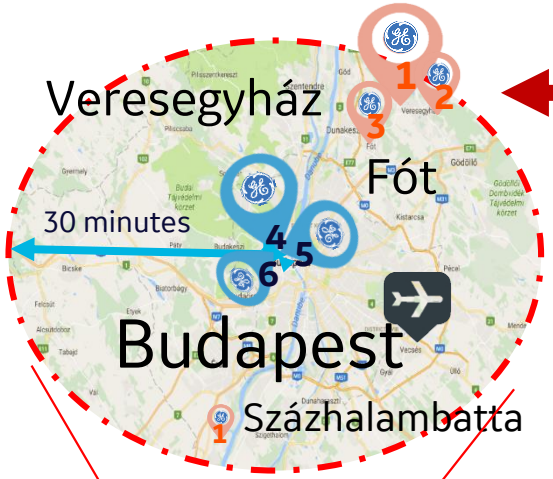
Where does it work?*

nuclei segmentation, epithelium segmentation, lymphocyte detection, mitosis detection, lymphoma classification, necrosis detection, tumor load

*Madabhushi et al., *J Pathol Inform* 2016, 1:29; courtesy of Inspirata, Inc

GE Hungary – Digital Industrial GE

globally unique collocation of Digital, Advanced Supply Chain and Services in two strongly integrated eco systems



3.5 MM people

Budapest, 7th EU city

Ideal global timezone

SUPPLY CHAIN CLUSTER, ~3,500 employees

- **1. GE Power:** Multi-Modal Factory; largest facility outside of North America
- **2. GE Aviation**: Aircraft engine component repair facility
- **3. BHGE (Oil&Gas)**: TM & Digital Solutions manufacturing, European customer service center, collocated with new **GE Healthcare Europe** parts repair and harvesting center

BUDAPEST GE CAMPUS, ~ 3,500 employees

- **4. GE Global Operations** Europe & RCIS, **Working Capital Solutions,** > 40 languages, >50 nationalities, supports > 1,200 GE companies
- **5. GE Hungary Digital HUB**: Supply Chain, Services, Global Operations, Virtual Robots; leverages unique collocation with Supply Chain Cluster within 30 minutes drive & Global Operations and Healthcare Software in the same campus
- **6. GE Healthcare:** Regional CEE HQ & Training Center, Software COE with Deep Learning, AI, Analytics; strong partner of Hungarian academia, EIT Health member

1,500 established GE suppliers, 6,000 in CEE

Conclusions

- **Establish the impact and opportunity** of converging technologies and trends

  - automation (e.g. robotics, AI)
  - disruptive technologies or applications, e.g. 3D printing, autonomous driving
  - global trends, like shared economy, aging society

  on the region taking into account local economic factors, geographic location, etc.

- **Which sectors are today strong in Hungary & CEE**? Potentially focus resources on a few sectors, like Sports as an industry, Healthcare/pharma, advanced manufacturing, advanced services, laser technology, etc.

- What needs to be done in education, infrastructure and governance to become a **digital industrial country or region** that leads in certain sectors, rather than falls victim to the changes? How can public induce investment and support start ups, e.g. by sharing public data?

- **Build integrated eco systems** around innovating investors to advance e.g. local SME to higher levels of competitiveness and make them future ready

Can Hungary & CEE again leapfrog like 120 years ago?