The Disruption of Healthcare... The collision of IT with MT

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Stanford University

A MedTech Europe event
The MedTech Forum
bringing HealthTech stakeholders together

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The Rapidly Changing world of Healthcare

The Collision of
e & the
Era

Brussels, 2017

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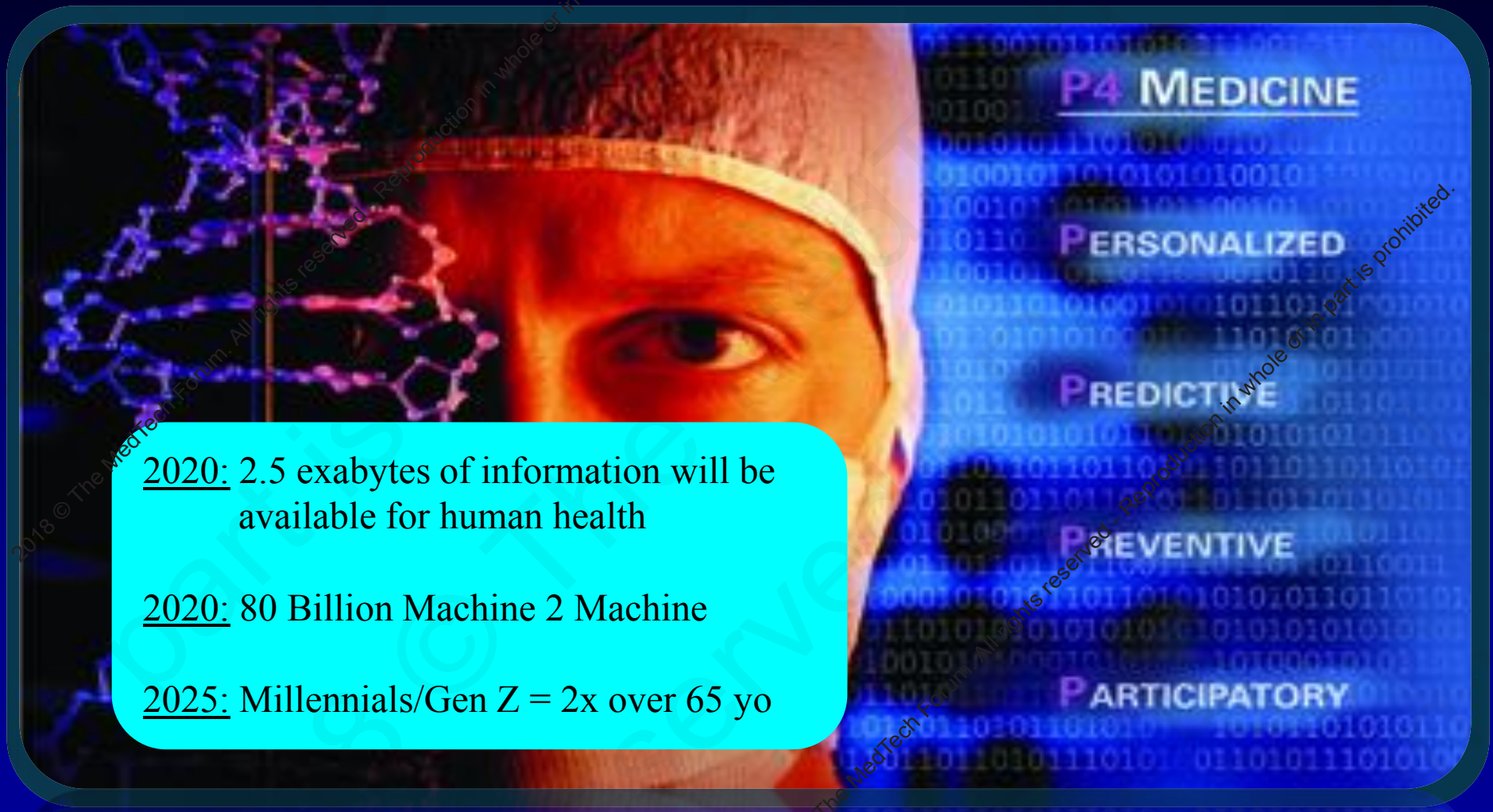
Digital Healthcare…a revolution is coming

(Patients, Payors, Physicians and Practices)

Transforming Health "Care" & Health "Cure"

biodesign

The Era of Global Digitization



2020: 2.5 exabytes of information will be available for human health

2020: 80 Billion Machine 2 Machine

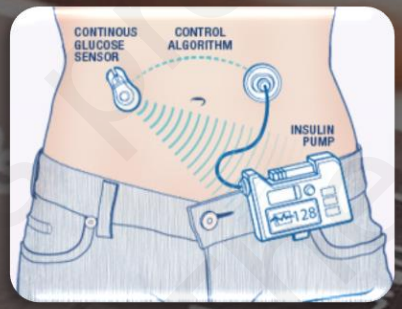
2025: Millennials/Gen Z = 2x over 65 yo

The next generation of Med Tech

bDASH

Big Data

Smart
Devices

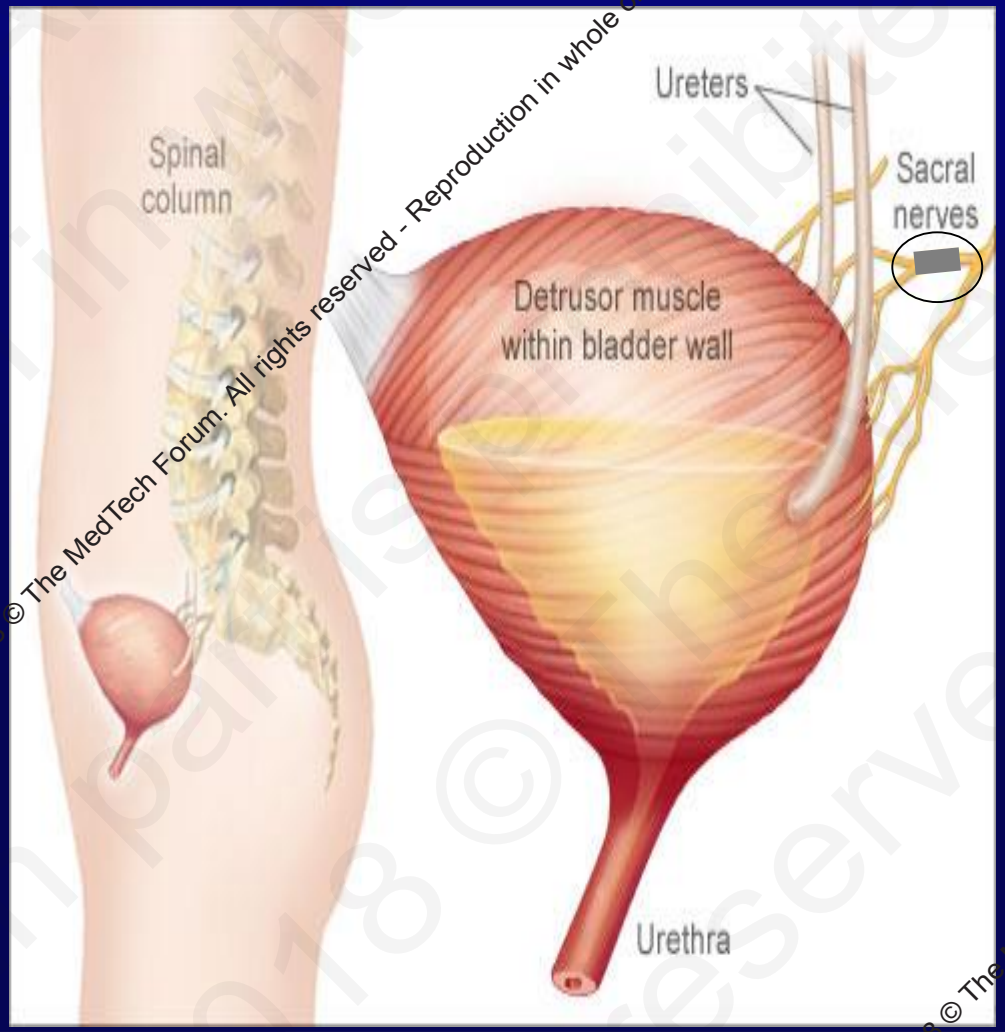


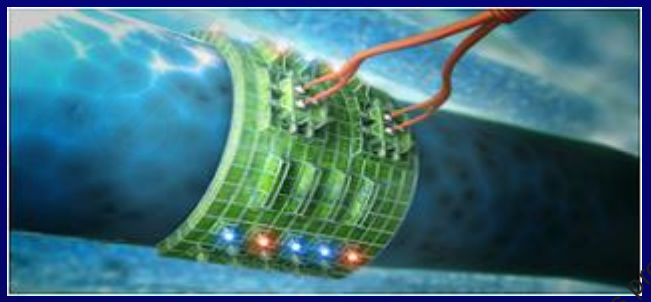
AI

Security in
Healthcare

"The patch that communicates…"

"Programing OAB with mobile"





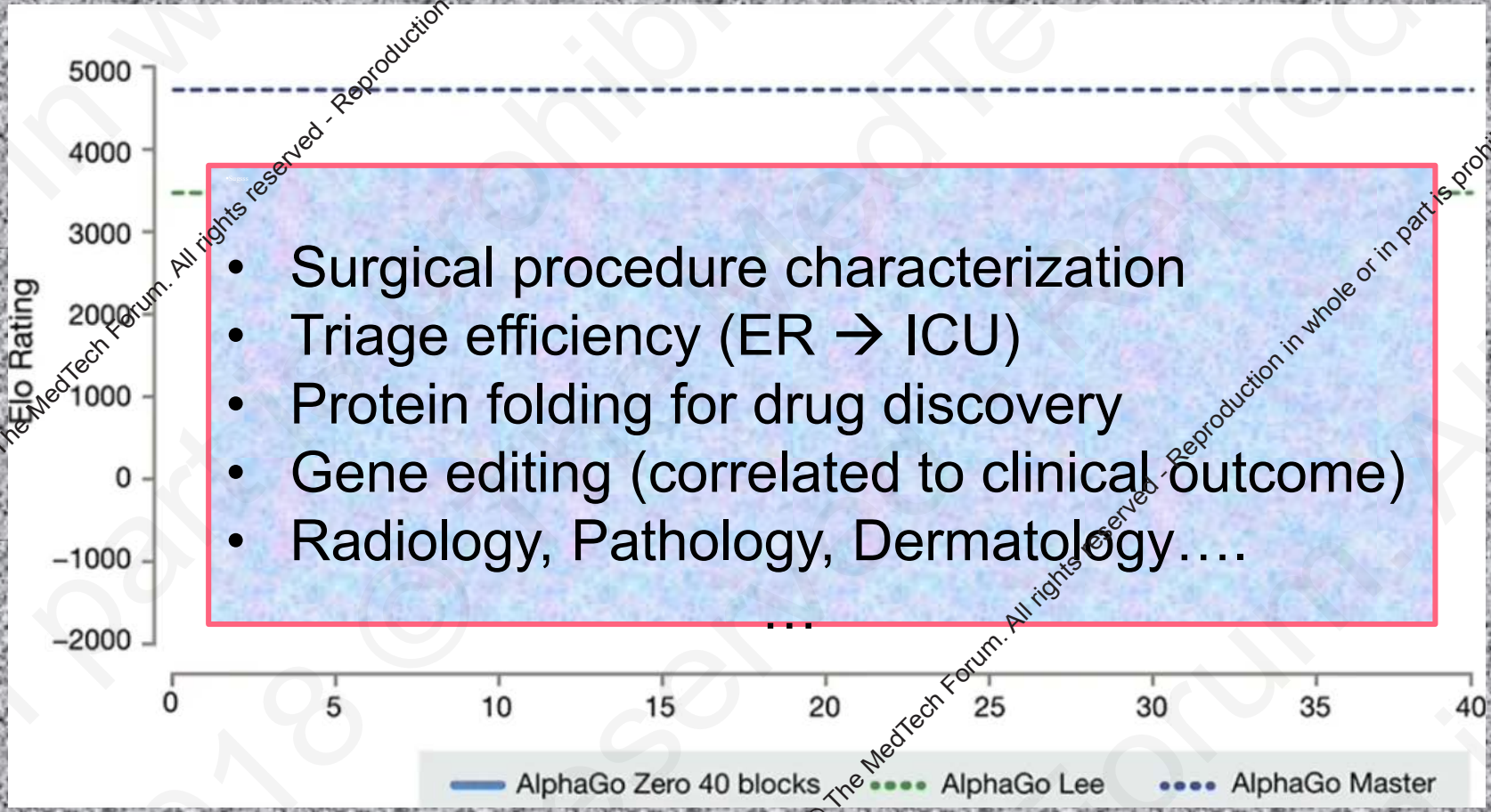
- Amplitude (voltage)
- Duty cycle (sec.)

A.I. at a glance

- Very Narrow (domain specific)…
- Requires very large data sets (source constraints)
- Data sets must be objectified (contexture)
- Objective characteristics must have endpoints
- Large computing power for machine learning

…

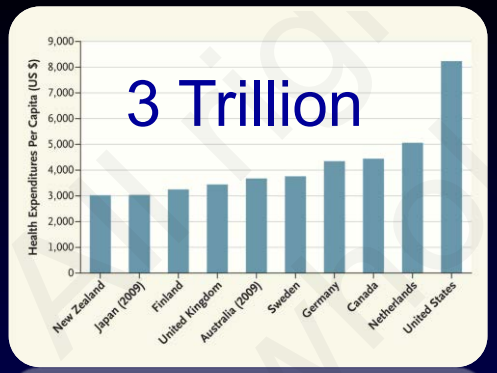
Evolution of Machine Learning
Google AI "AlphaGo"



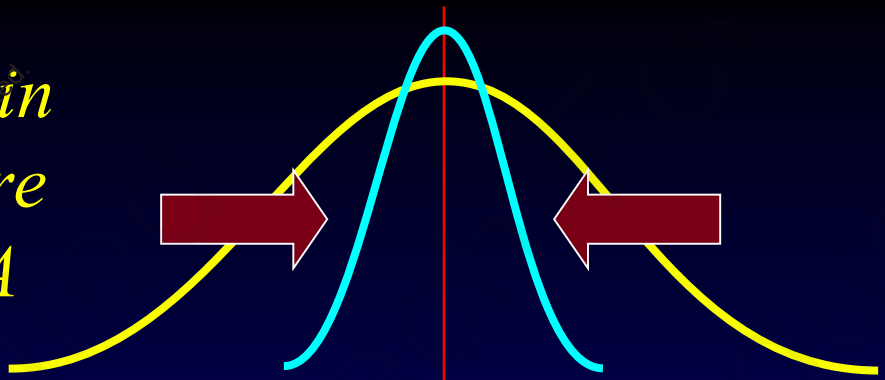
- Surgical procedure characterization
- Triage efficiency (ER → ICU)
- Protein folding for drug discovery
- Gene editing (correlated to clinical outcome)
- Radiology, Pathology, Dermatology….
- …

Convergence of Medtech & Hi-Tech

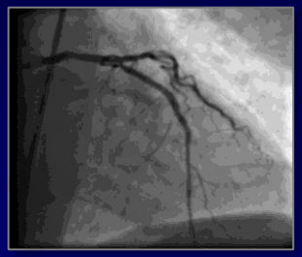
- IoT + Big Data + Machine Learning + AI = Opportunity for tech players to introduce new platforms for "people"
- Convergence = strategic opportunities for startups beyond traditional medtech



Variability in Patient Care In the USA



Diagnostics



Treatments

Inventory

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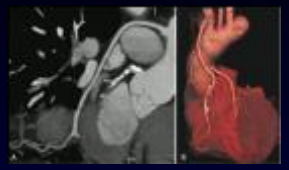
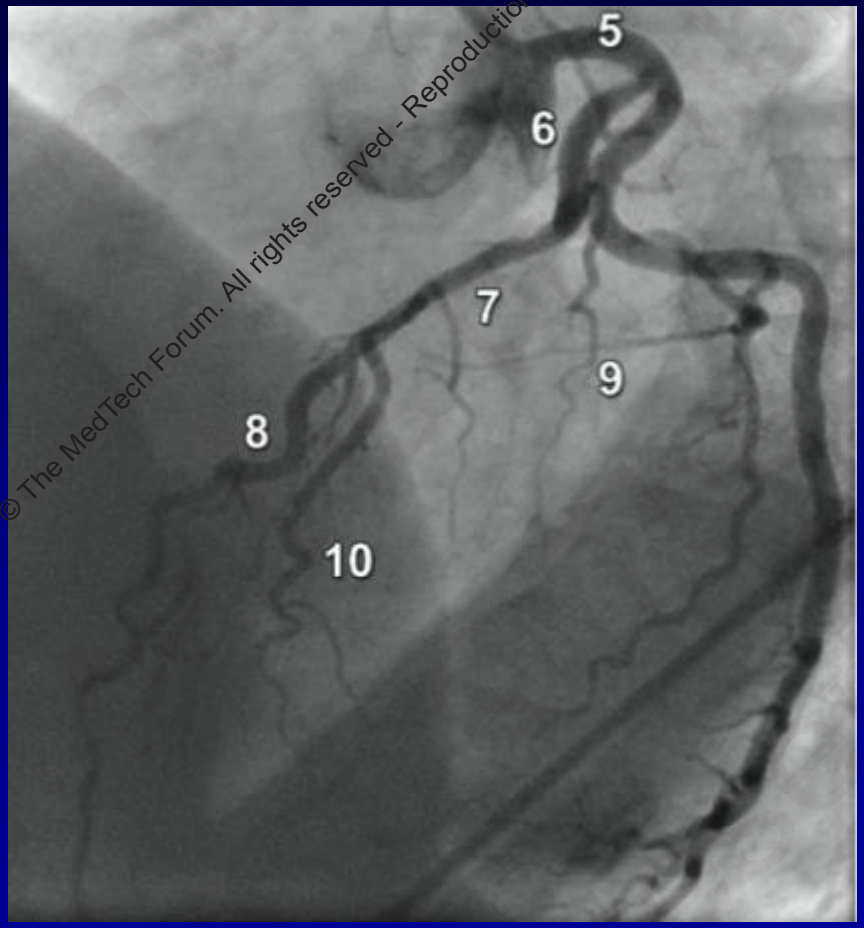
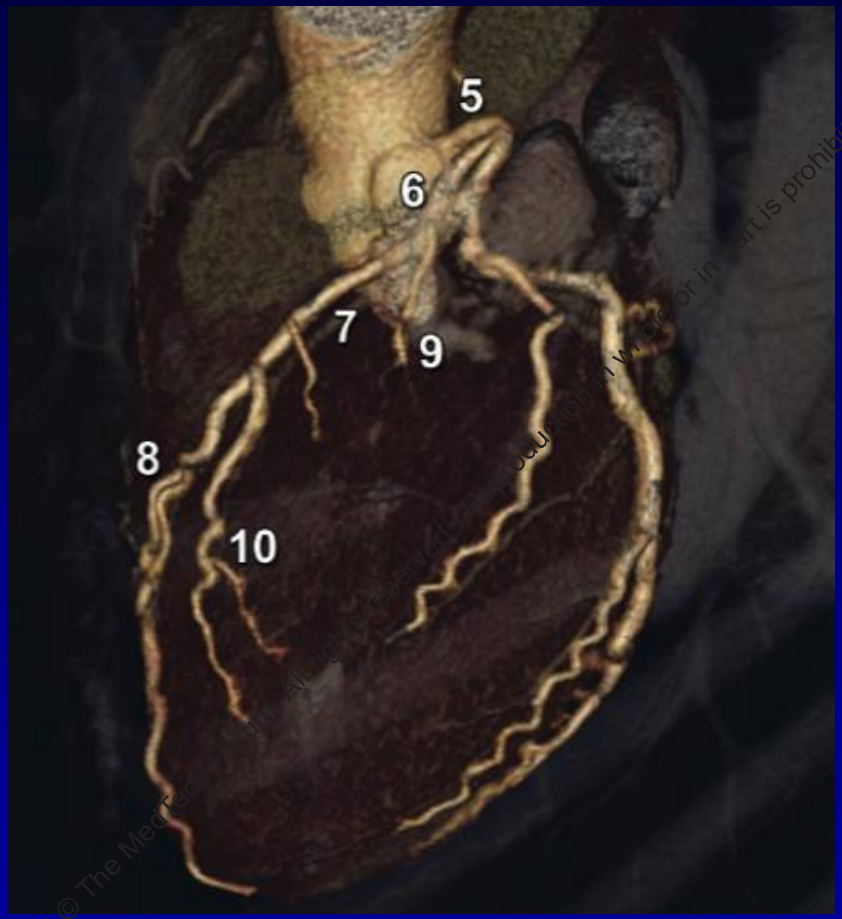


Computed Tomography Angiography (CTA)

…the quest for accurate out patient Dx





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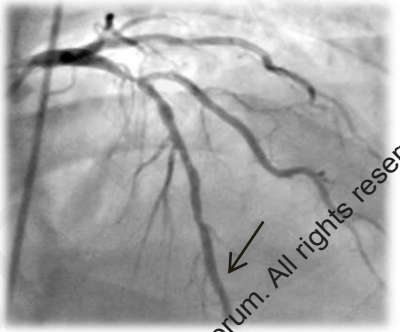
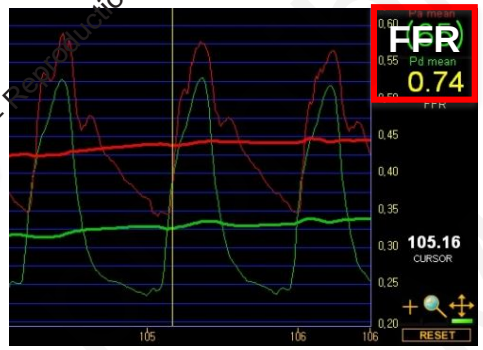
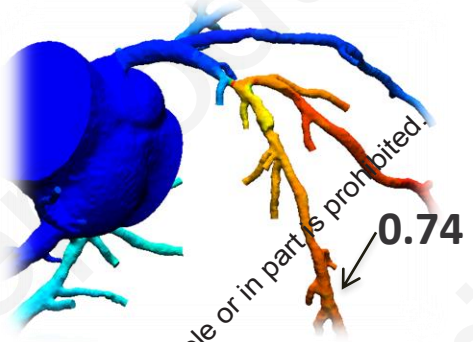
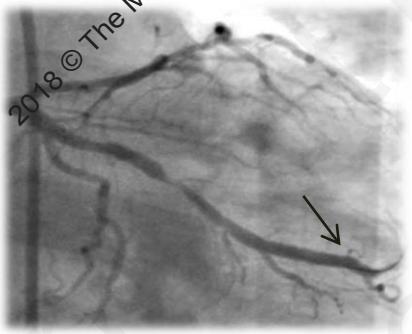
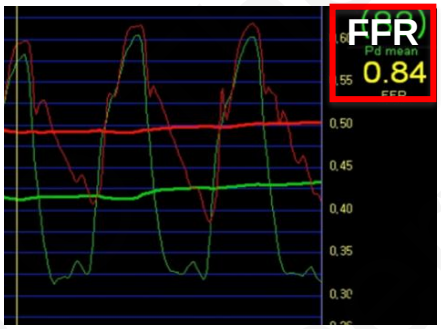
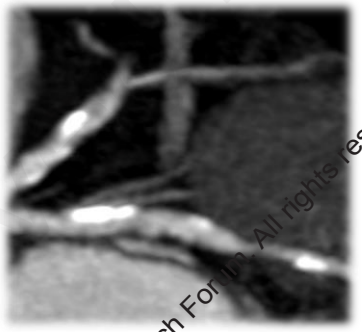
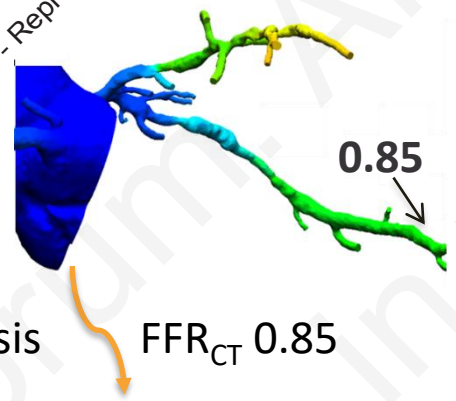
HeartFlow

Outpatient Anatomy and Physiology

Invasive angiography	FFR	Coronary CTA	FFR_{CT}
			
>50% diameter stenosis	FFR 0.74 → ischemia	>50% diameter stenosis	FFR_{CT} 0.74
			
>50% diameter stenosis	FFR 0.84 → no ischemia	>50% diameter stenosis	FFR_{CT} 0.85

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SaaS model

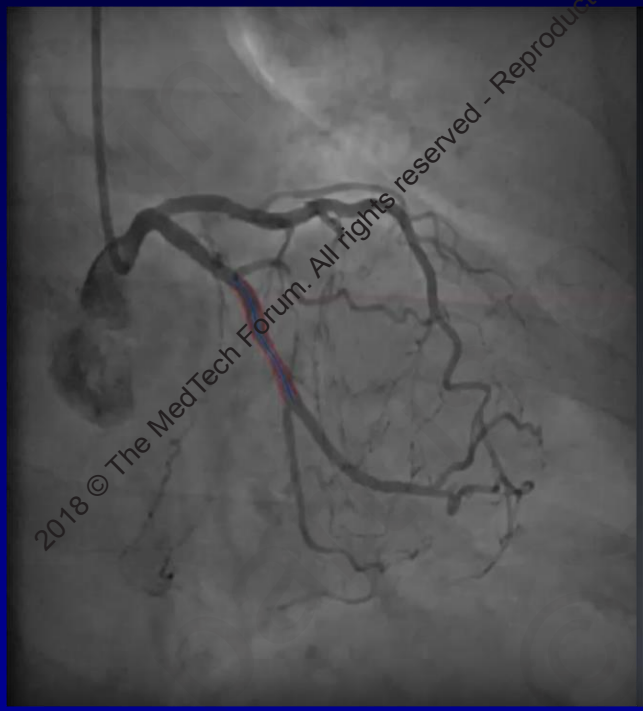
Non-Invasive Flow parameters– derived from 64 slice CTA

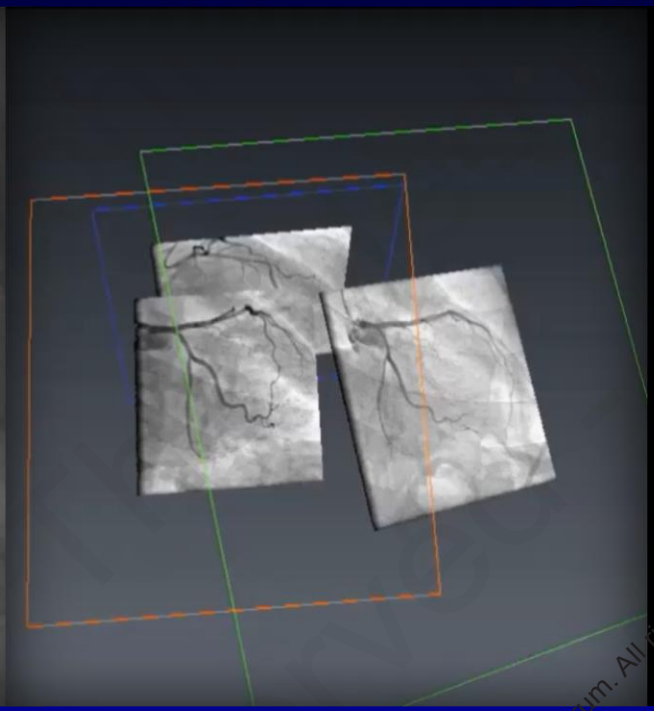
HeartFlow™

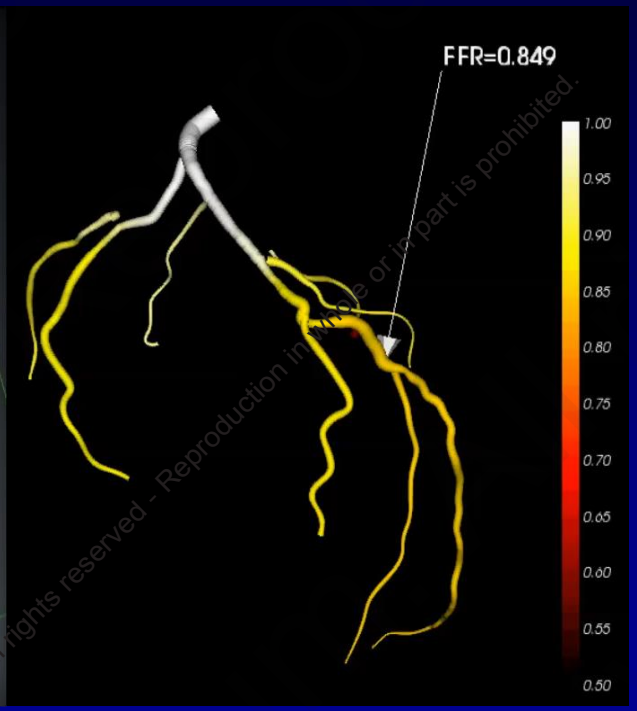
simulation

This is possible in the Cathlab as well…

SaaS; Cloud-based algorithms







Routine angiograms

3D tree & Flow analysis

FFR_{Angio}

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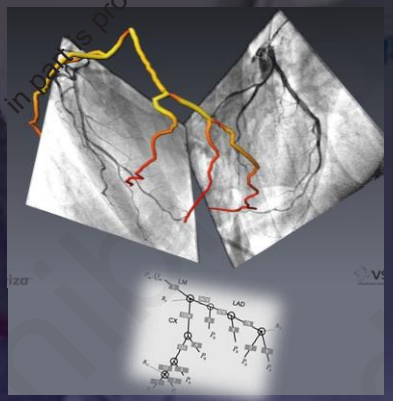
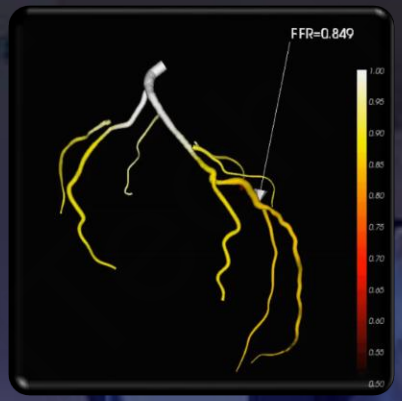
"Wireless" FFR





Routine angiograms → 3D tree & Flow analysis → FFR_{Angio}

"Cloud" Wireless

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Haptics meets Catheter motion

Gaming Industry: "Wii" of Medicine

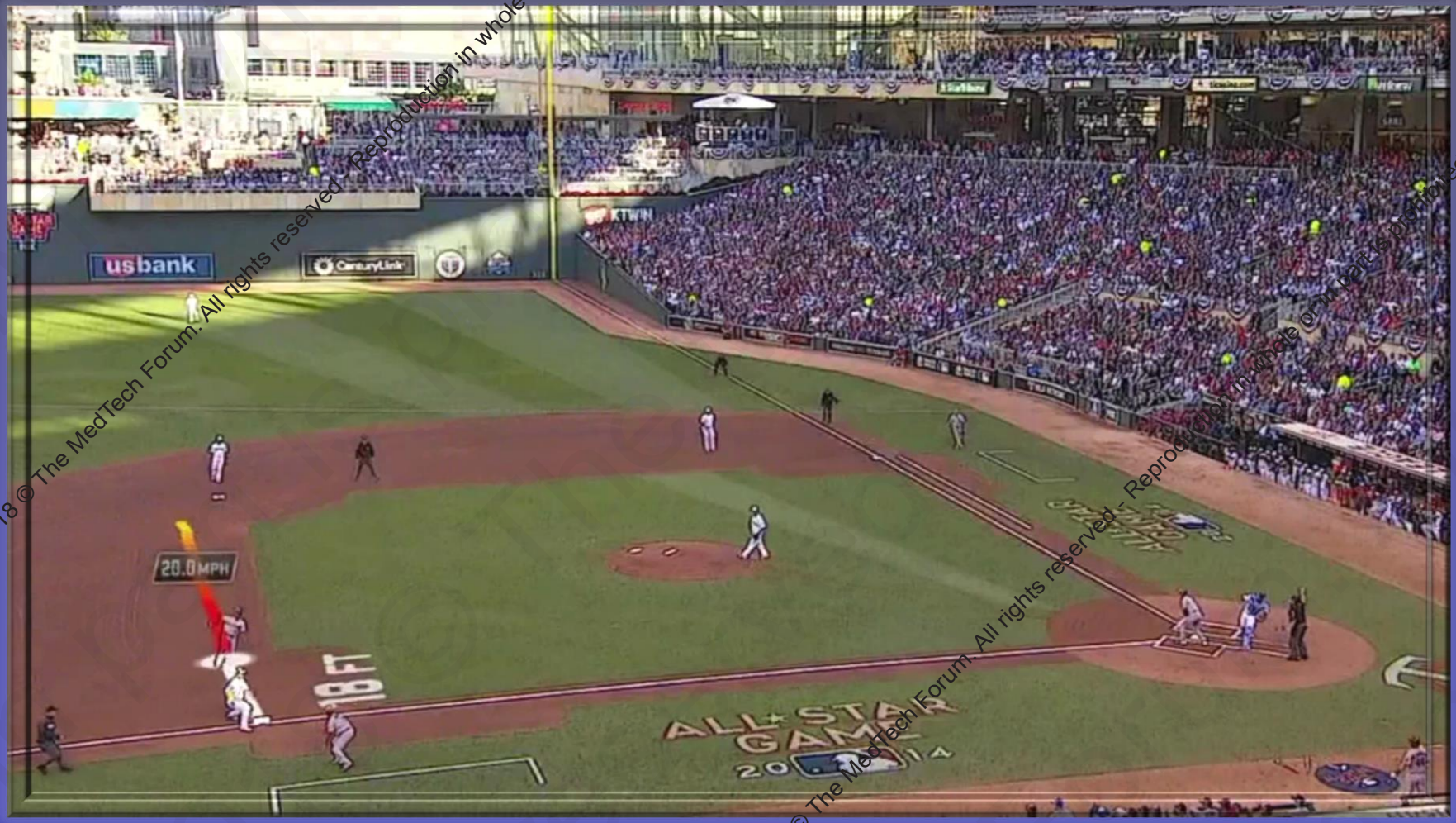
Today's 30 yo is much better at "hand-eye"

Deep Learning ; Augmented Reality (Consumer applications → healthcare)

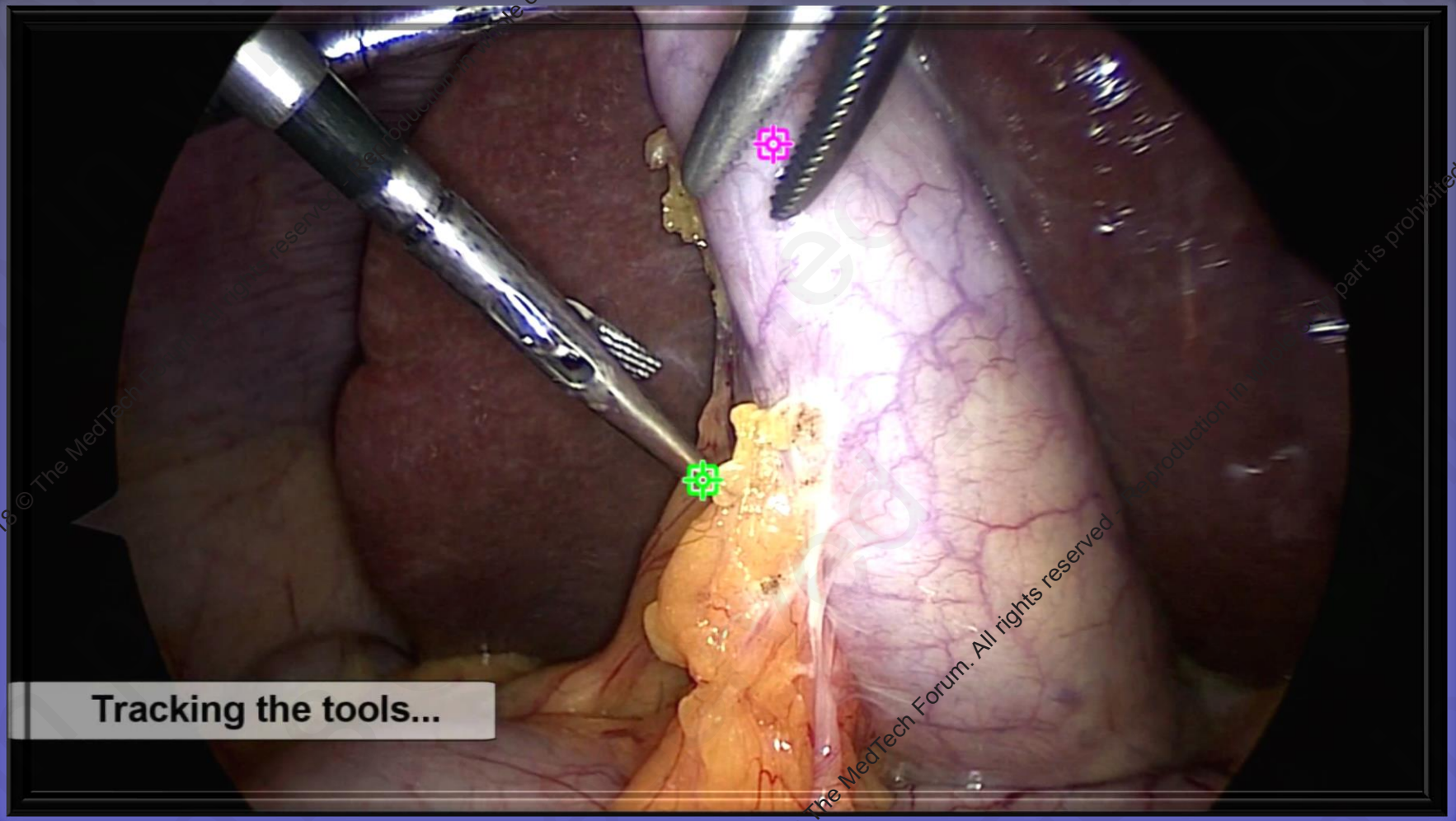
Remote Robotics: Treatment in Time

Minimal Latency

Consumer quantification…consistency is key (AWS)

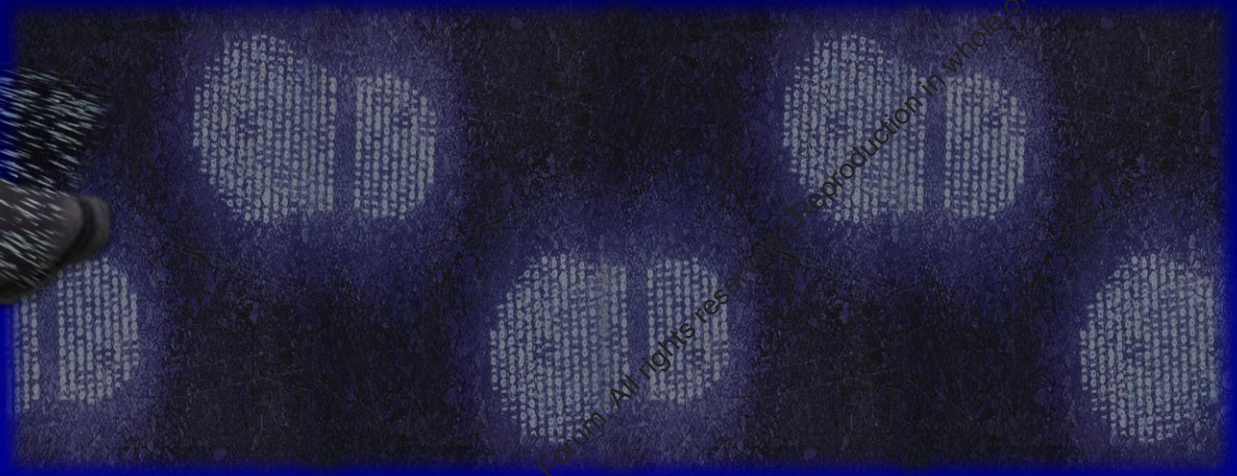


Consumer quantification…consistency is key



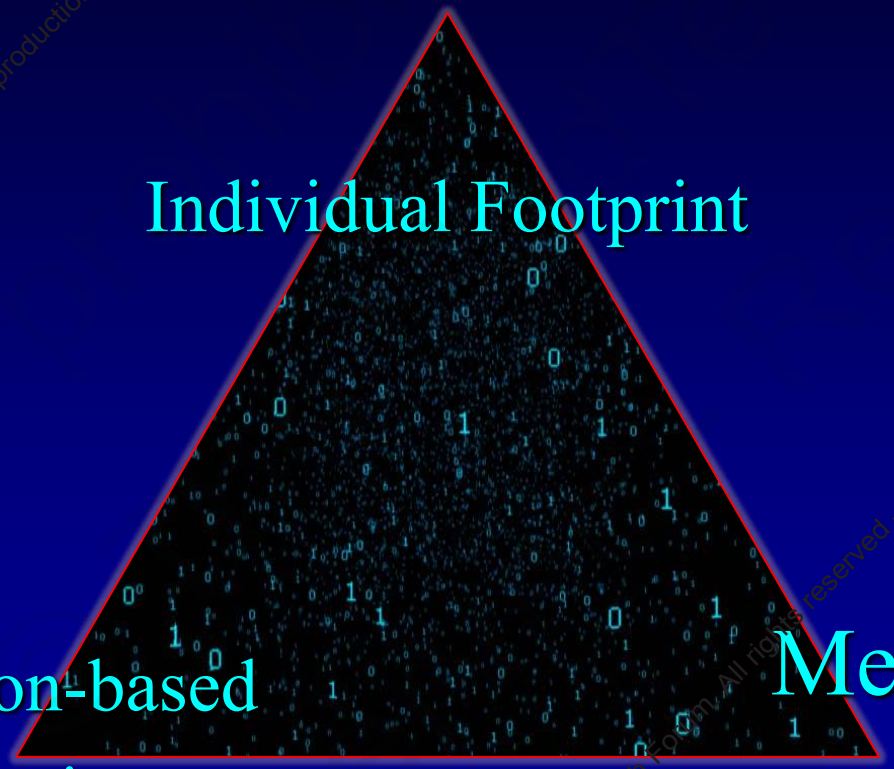
The Wave of Digital Data Will Change Healthcare

…we are becoming uniquely characterized with our digital exhaust and footprints…

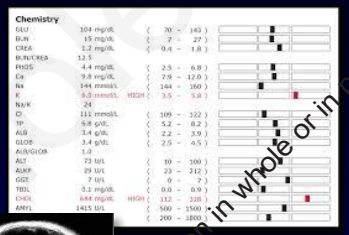


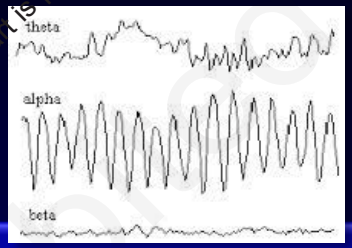
Digital exhaust from phones, wearables, and implants…

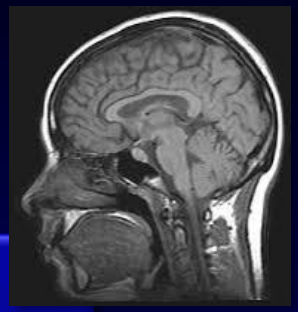
"Bermuda Triangle" of Digital Data across the continuum of life…

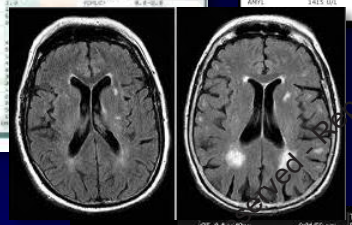


Clinical Diagnosis and Treatment Strategy

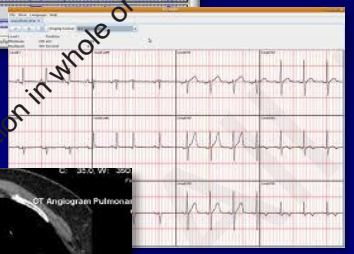


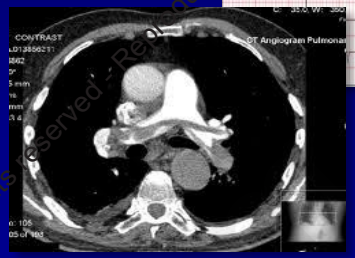


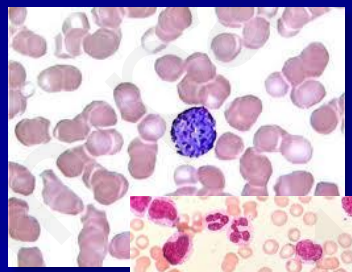


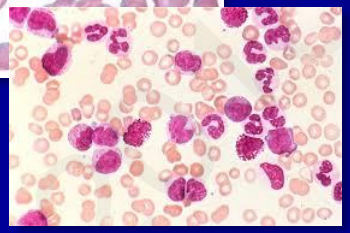


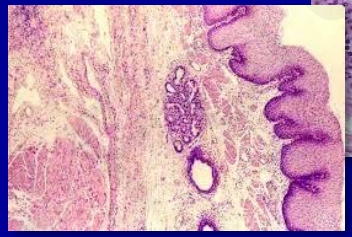
Patient: L.J.Y.
Age 37

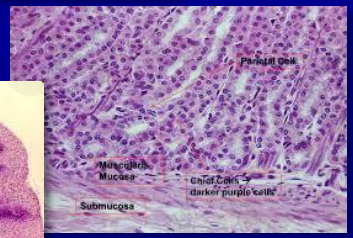












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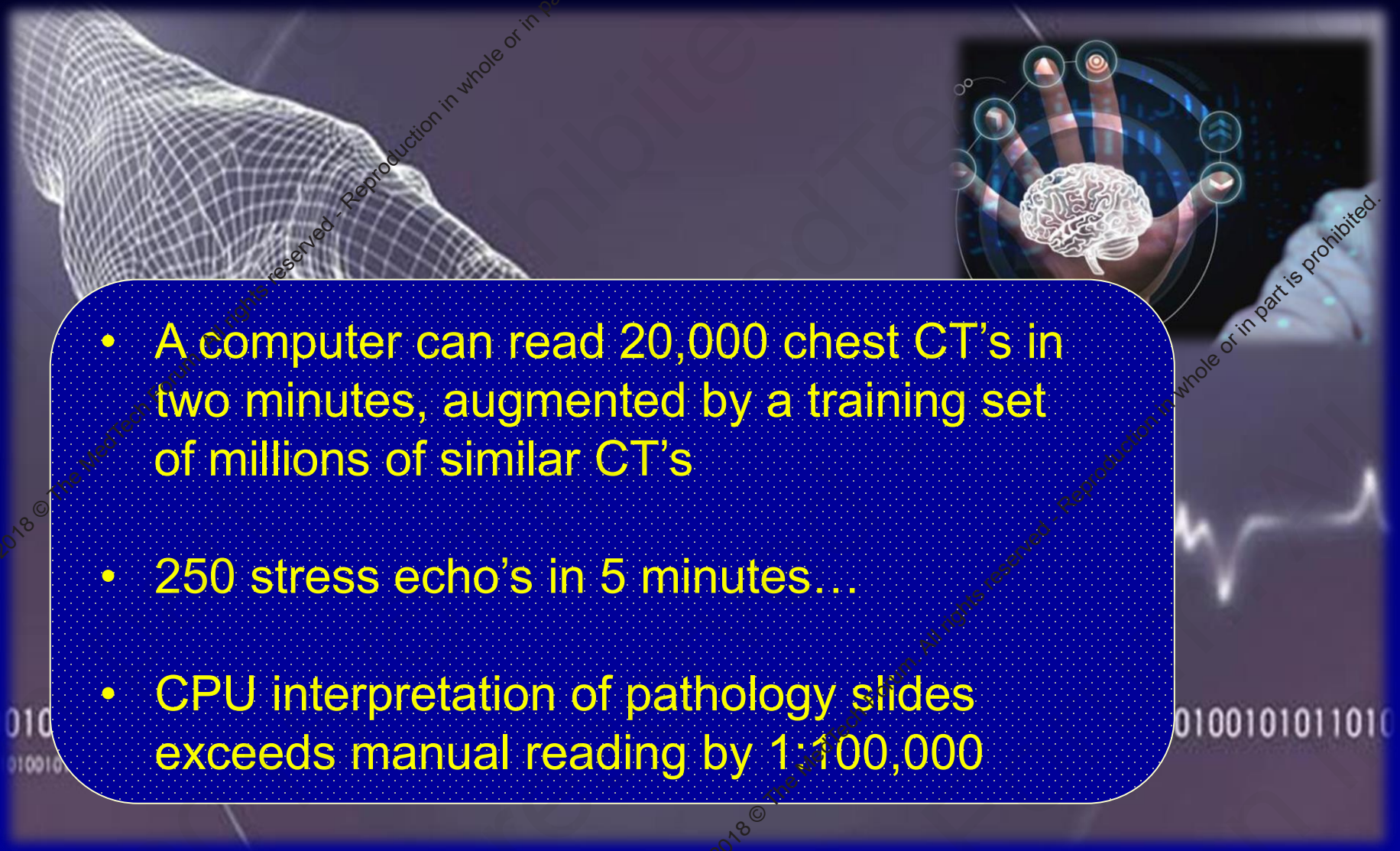
The era of deep learning, decision analytics and compassion collide in Medicine



- A computer can read 20,000 chest CT's in two minutes, augmented by a training set of millions of similar CT's
- 250 stress echo's in 5 minutes…
- CPU interpretation of pathology slides exceeds manual reading by 1:100,000

The Algorithm will now see you..

"A.I versus M.D."

Still need doctors for sure….

- ***Computers can determine actionable items***
- ***But Doctors need to turn those items into action***

The New Yorker; April 3, 2017; Siddhartha Mukherjee (Emperor of All Maladies)

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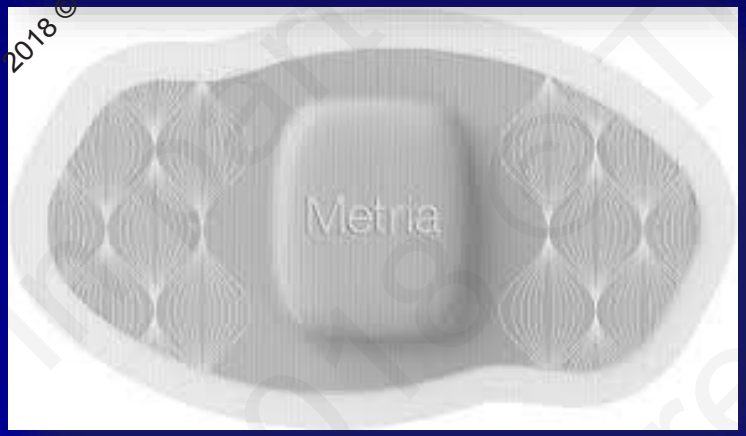
The Wearable Decade

…from watches, patches and tattoo's

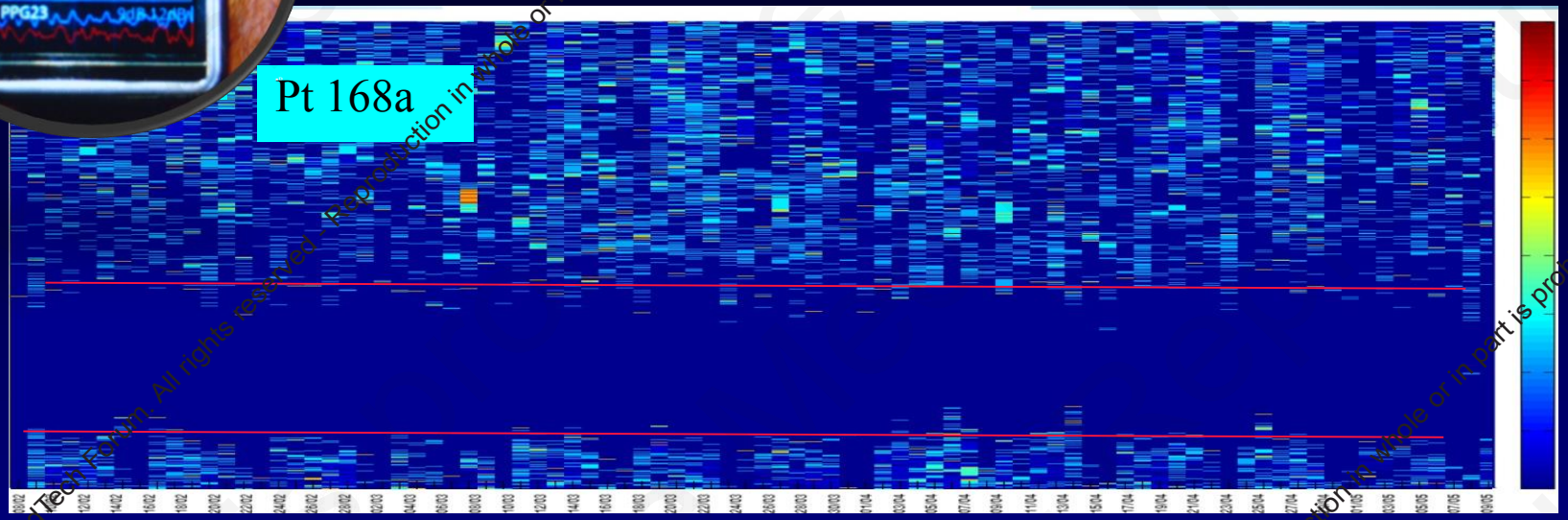


Cardiac Index "dashboard" (HRV & Blood Pressure)

HRV

80

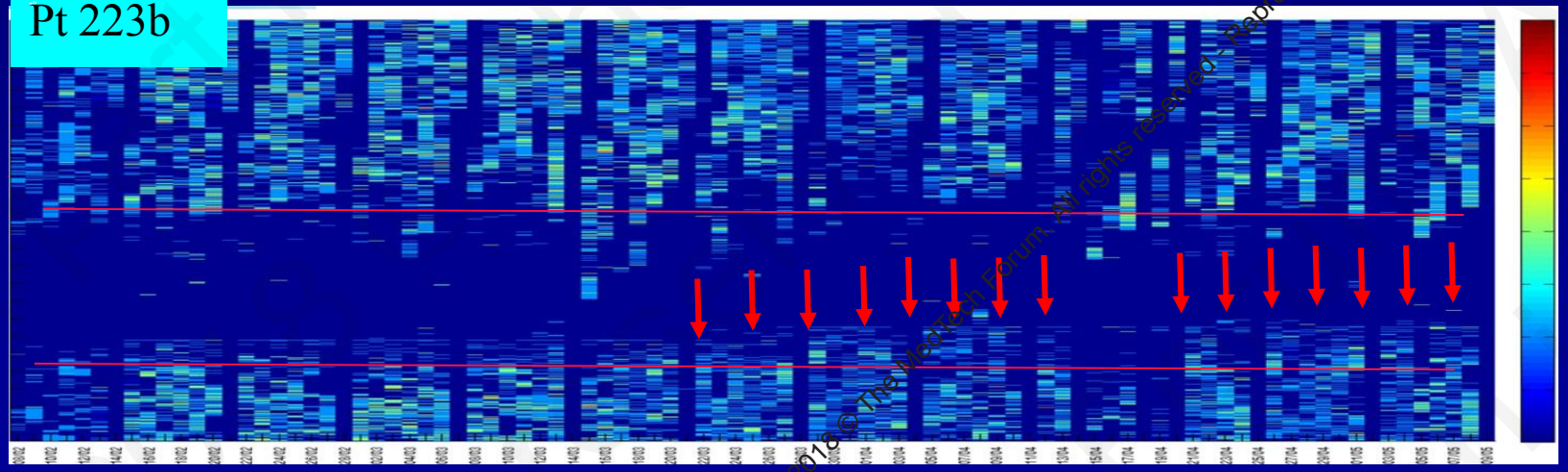
Pt 168a



Pt 223b

HRV

80



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"Wearables will become Terribles"…unless

It's not the Product…it's the Process in Healthcare

Analytics as the vortex…

Sensors

Service

ML/AI algorithms

Solution

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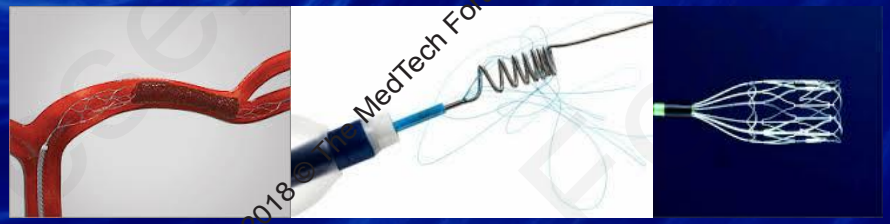
It's not the Product...its the Process in Healthcare

AI/Machine learn

Head CT's

Service

Solution



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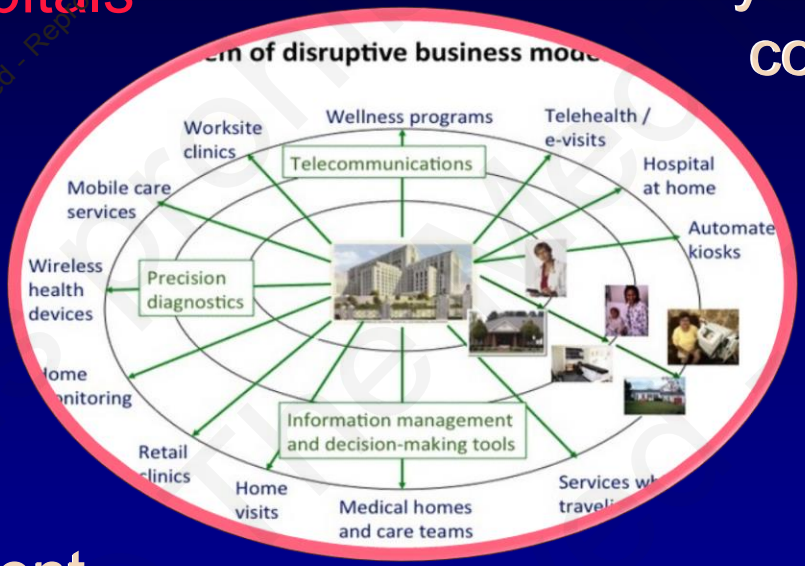
Who Pays ?....Key to deploying new technology in healthcare

Hospitals

Payors/Insurance companies

Patients ("pop")



Pharma Companies/PBM's

Government "Medicare"

Retail health (CVS, Walmart, Walgreens)

Employers (HR)

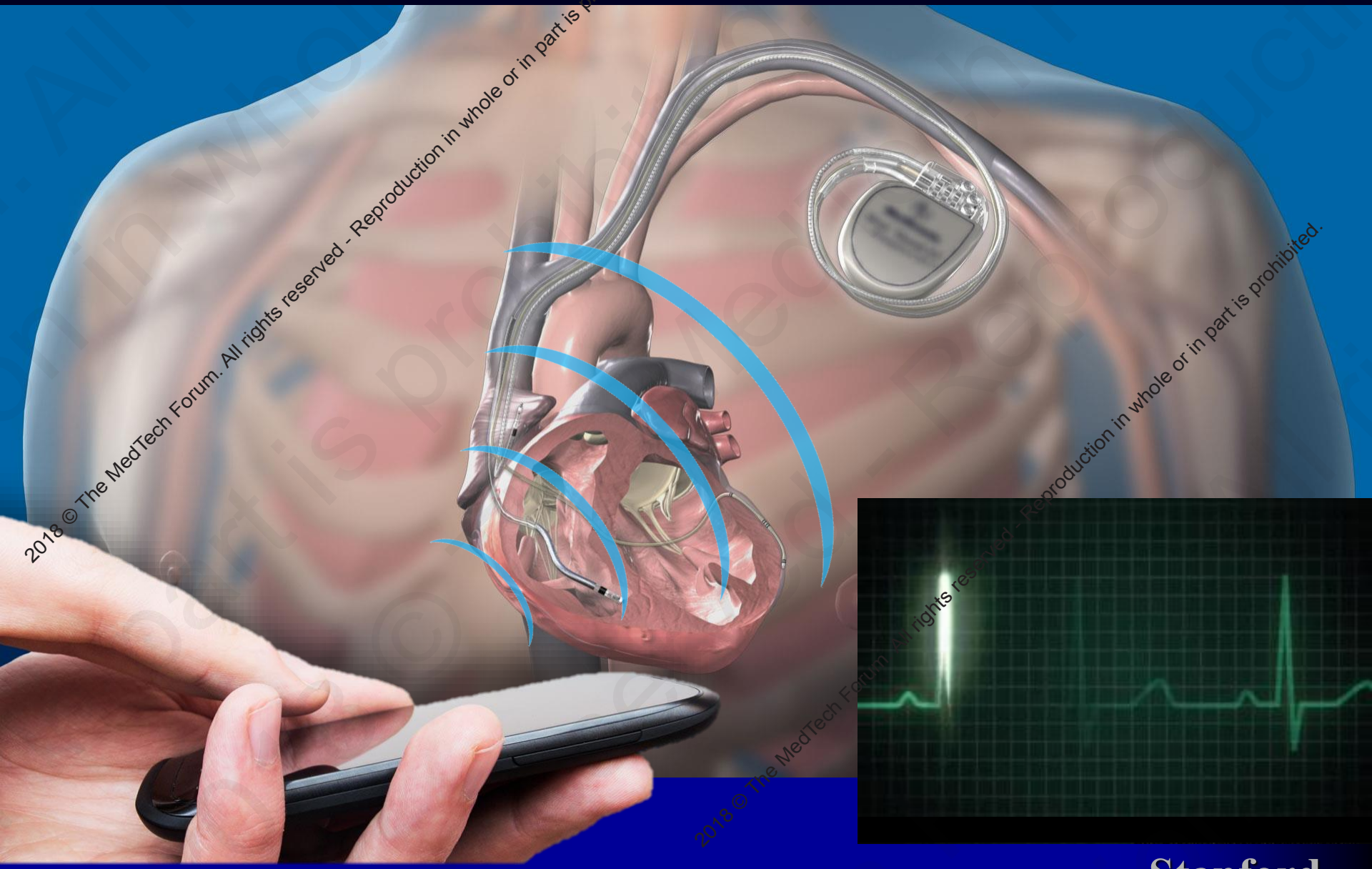
Healthcare is undergoing an exponential transformation

- ***Alexa self diagnosis with one-hour pill delivery***
- ***Chatbots to make ER's and clinics improve***
- ***A.I. to aid rapid diagnosis and treatment***
- ***Biosensors dash boards for care continuum***
- ***POC/Liquid Bx at retail centers (CVS, Walmart)***

June 2017

BUT, there is a dark side: IT Vulnerability

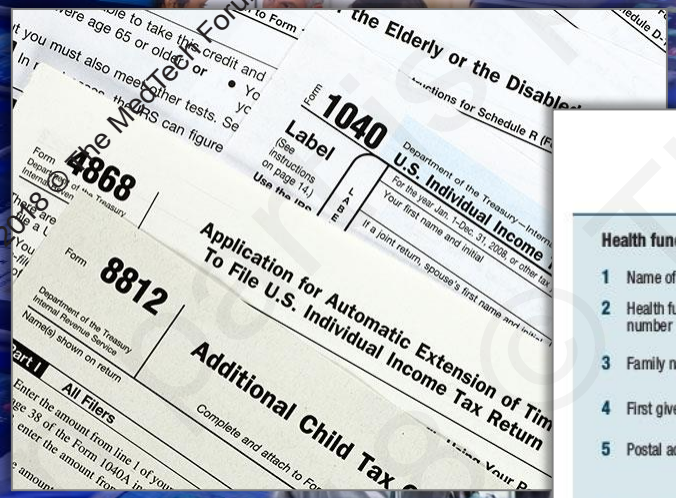
Cybersecurity….an real emerging need

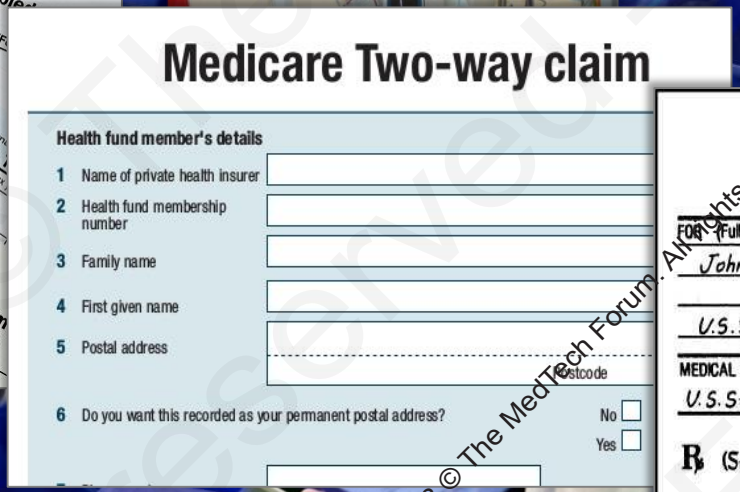


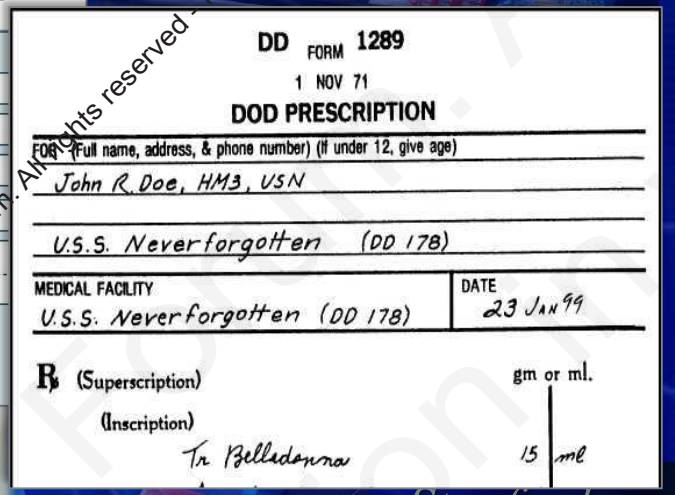
Cyber Security: It's All About Nodes

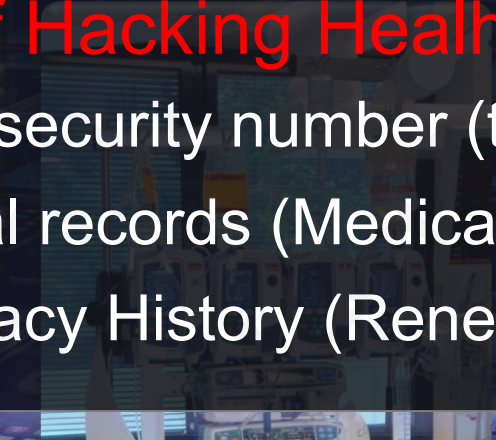
The Value of Hacking Healthcare Records

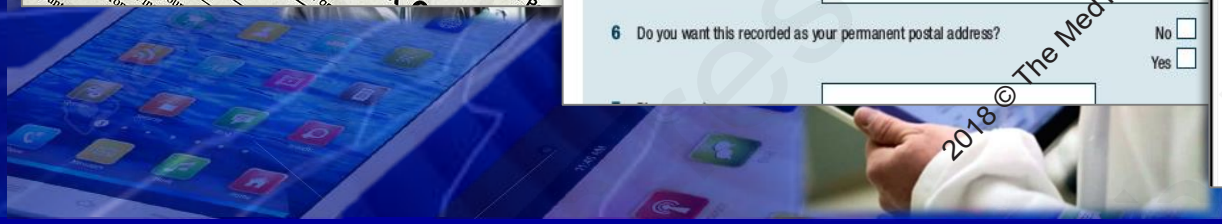
- Social security number (tax returns)
- Medical records (Medicare billing)
- Pharmacy History (Renew scripts)





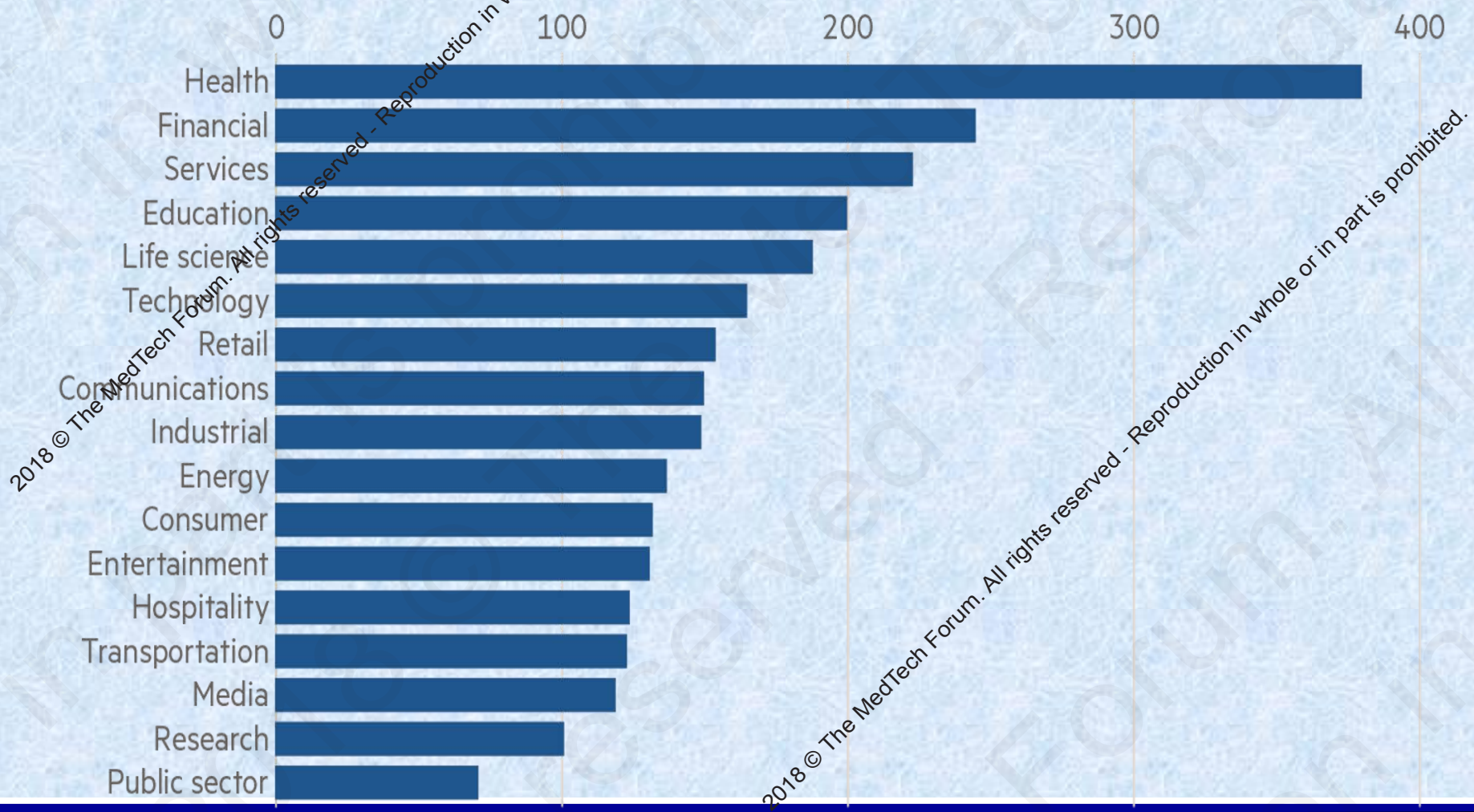




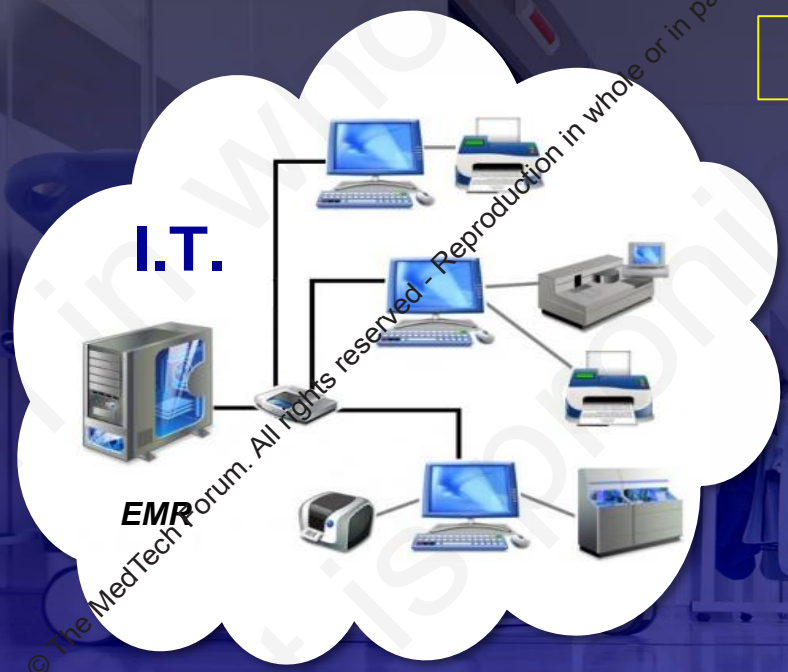


Data breach cost per capita

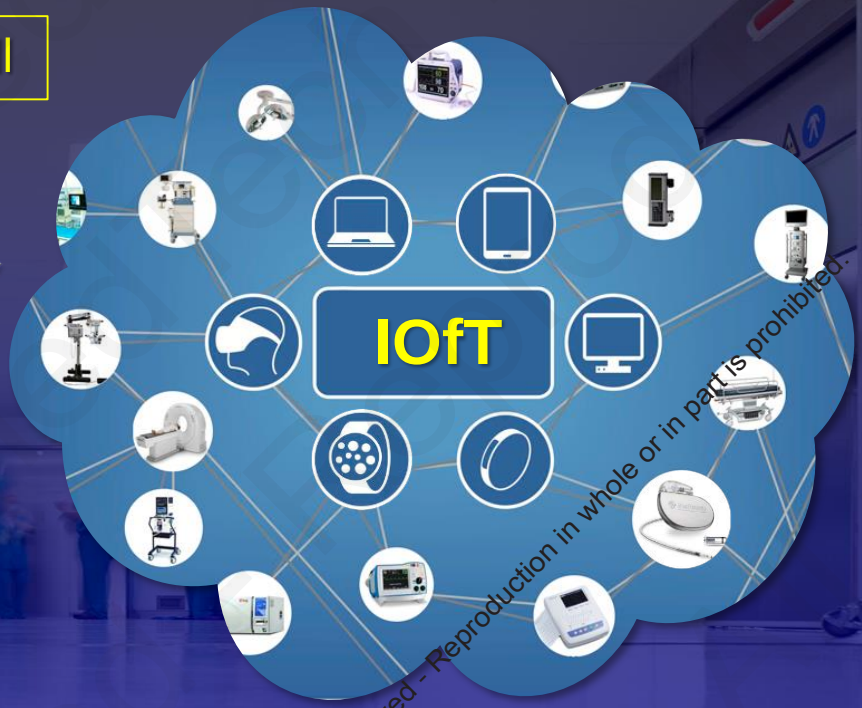
By industry classification, 2017 ($)



Hospital Networks: A True Security Vulnerability



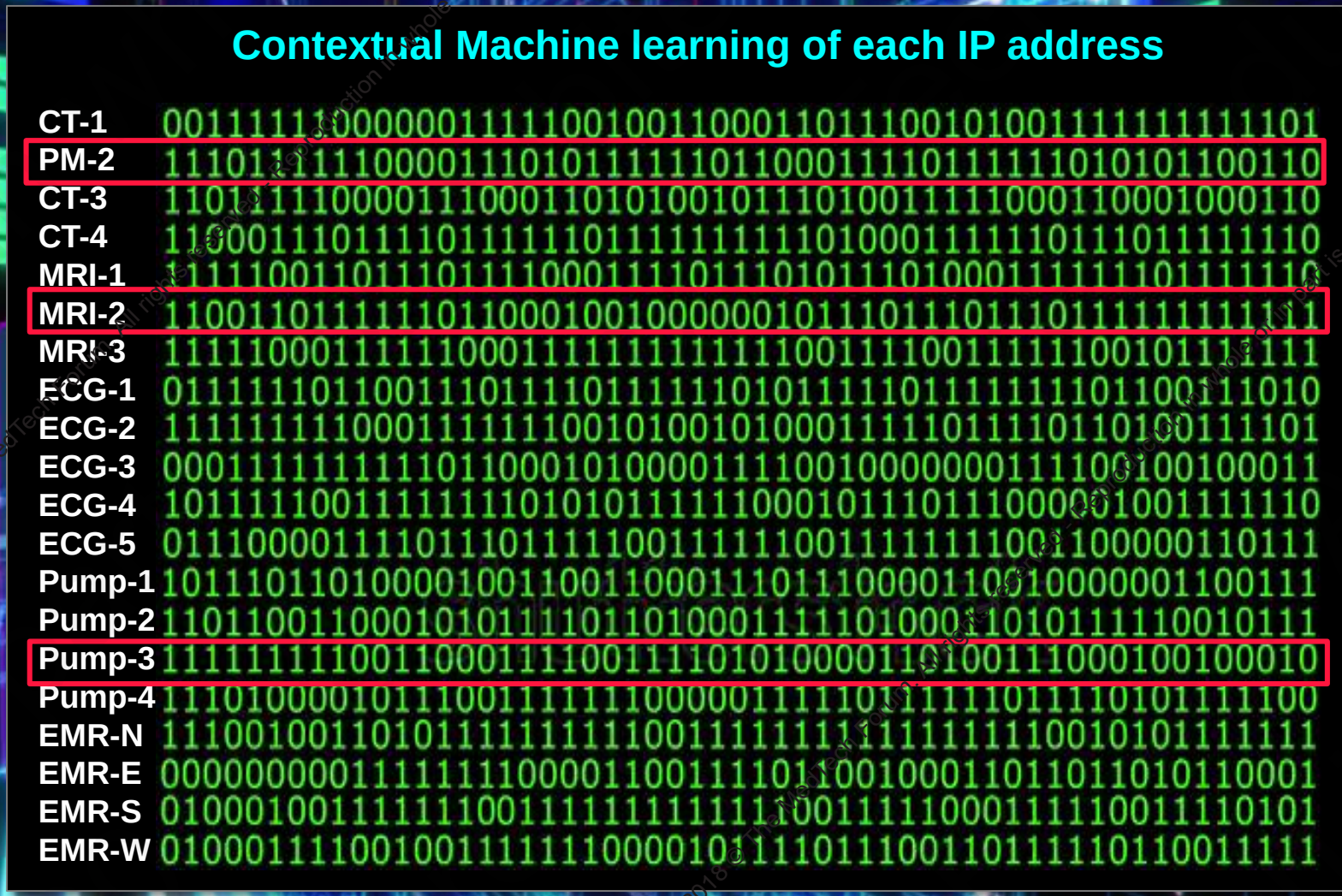
Firewall



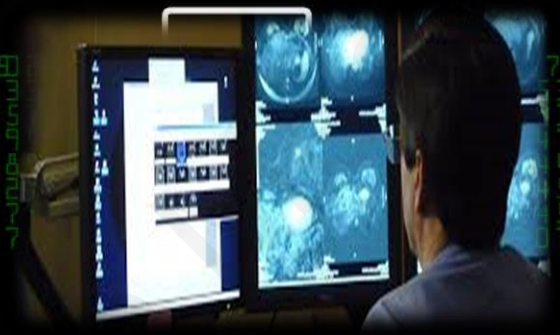
IoT

…Needs cyber protection

Hospital Networks: A True Security Vulnerability



Visibility forms the basis for Protection



Thousands of IP addresses doing thousands of things...

Stanford

Medicine tracts consumer trends…just later

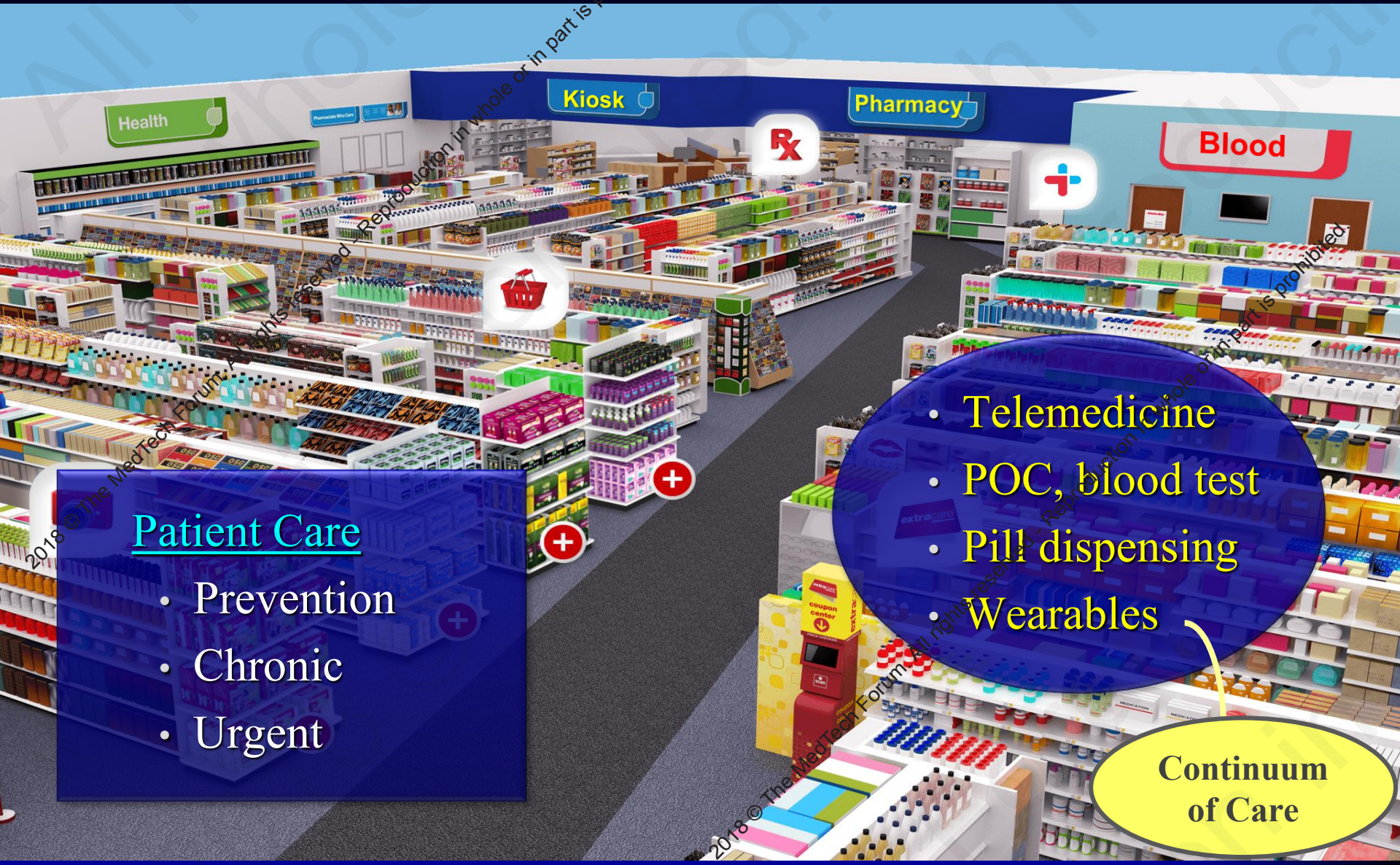
The Display of Digital Disruption

- Worlds largest taxi company owns no taxis (Uber)
- Largest accommodation provider owns no real estate (Airbnb)
- Largest phone companies own no telco infra (Skype, WeChat)
- Worlds most valuable retailer has no inventory (Alibaba)
- Most popular media owner creates no content (Facebook)
- Fastest growing banks have no actual money (SocietyOne)
- Worlds largest movie house owns no cinemas (NetFlix)
- Largest software vendors don't write the apps (Apple & Google)

The Largest Hospitals may have the fewest beds in the future

Stanford

Pharmacy taking a stake in health evolution…



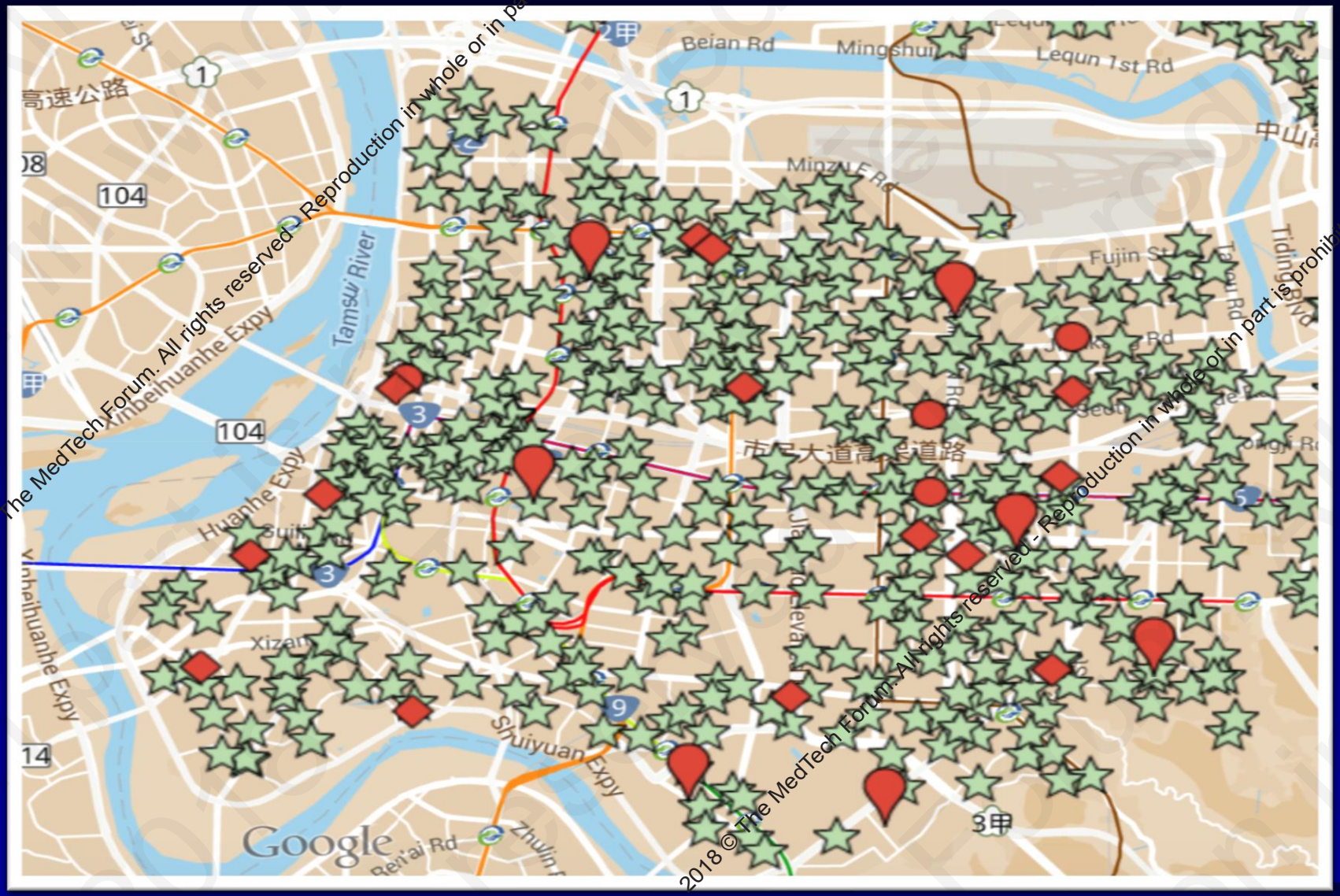
Drug stores- an important Health HUB

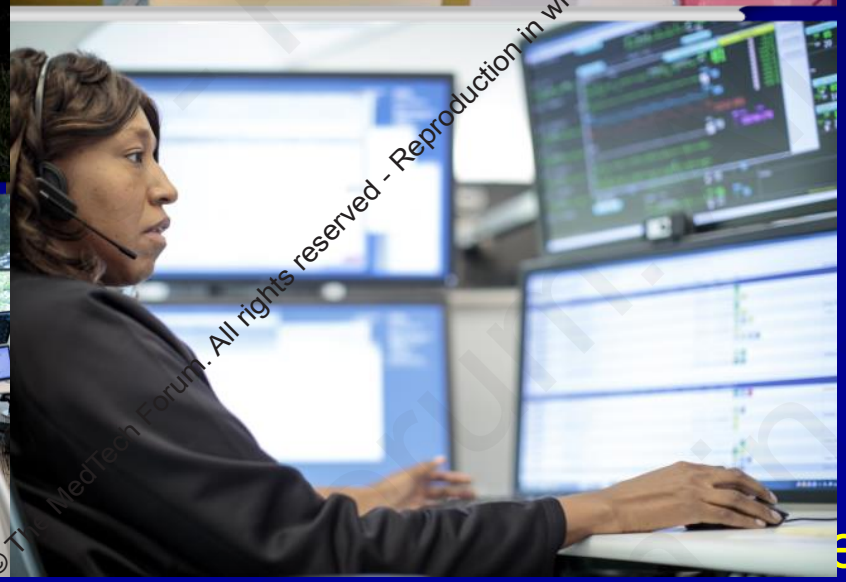
22 Million Members

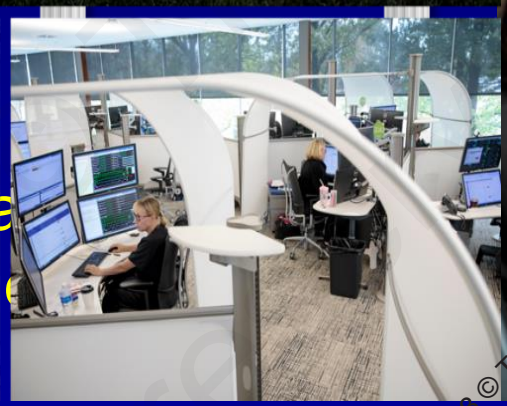
10,000 locations

Retail Health…like the “Genius Care Bar”

The "Uberization" of Health







security

Medicine & the integration into the "IT/Digital" generation

- Innovation in Medicine is thriving-- we just need to think different in digital era
- Med Tech and IT are integrating at a very fast pace… (Imaging, Decision analysis/AI, Cybersecurity)
- Variability will narrow (Re-F ML, Haptics, Data analytics)
- Hospitals will decentralize, Care will centralized in the community, for Preventative, Urgent and Chronic care…..

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