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Health Sciences

Artificial Intelligence in Clinical Trials

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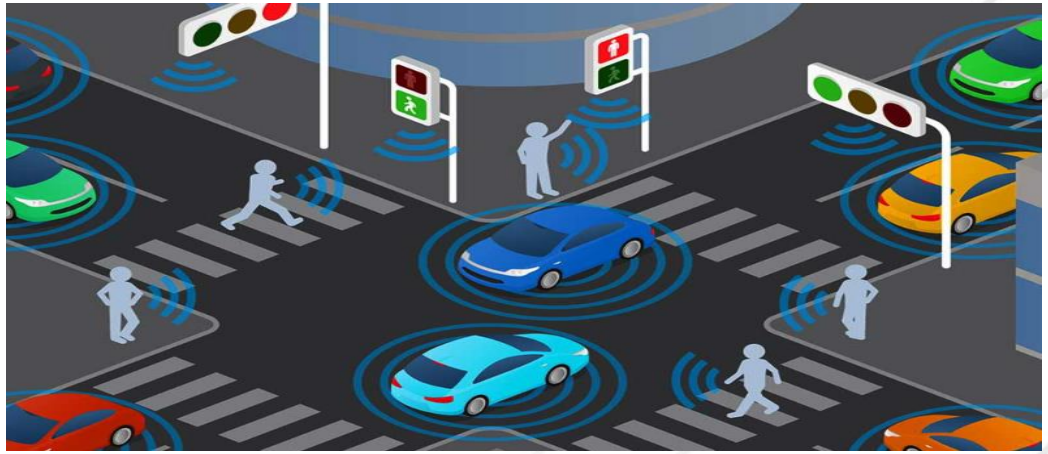
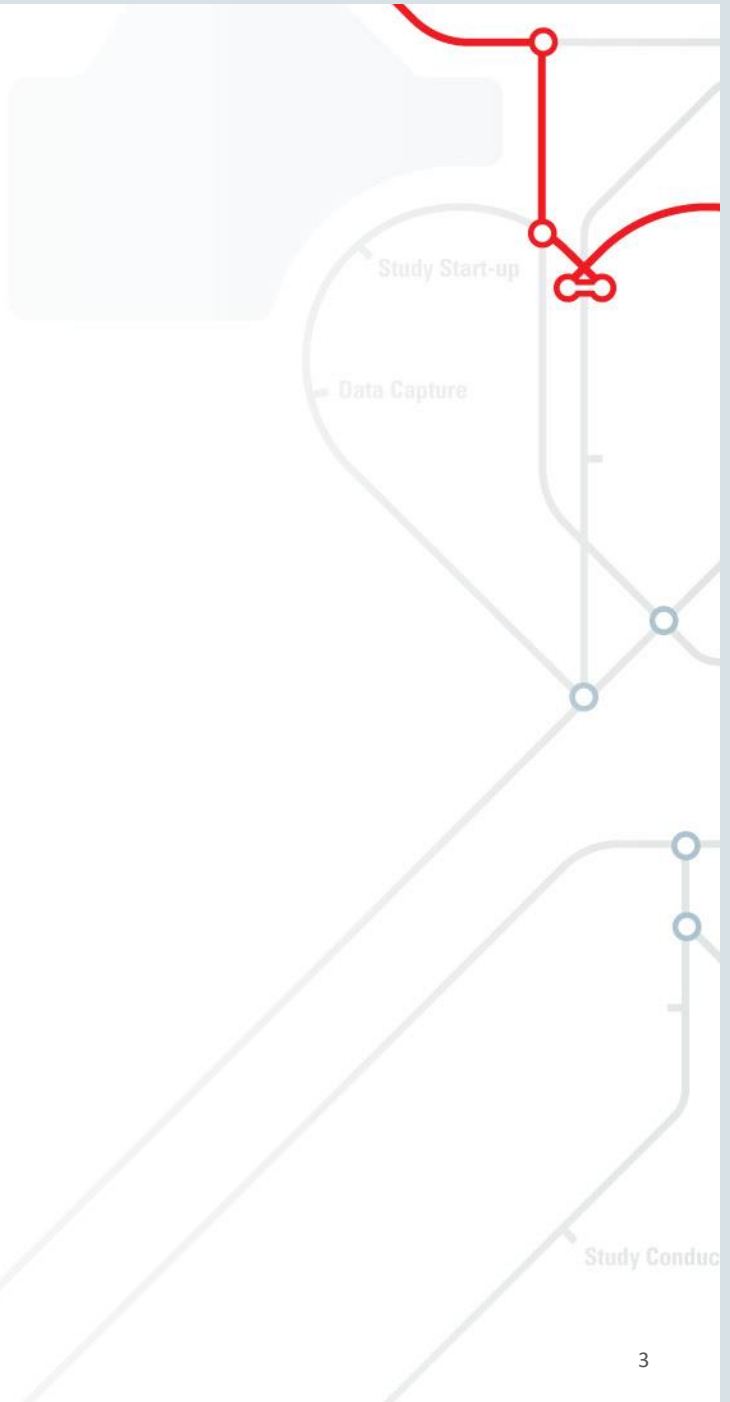
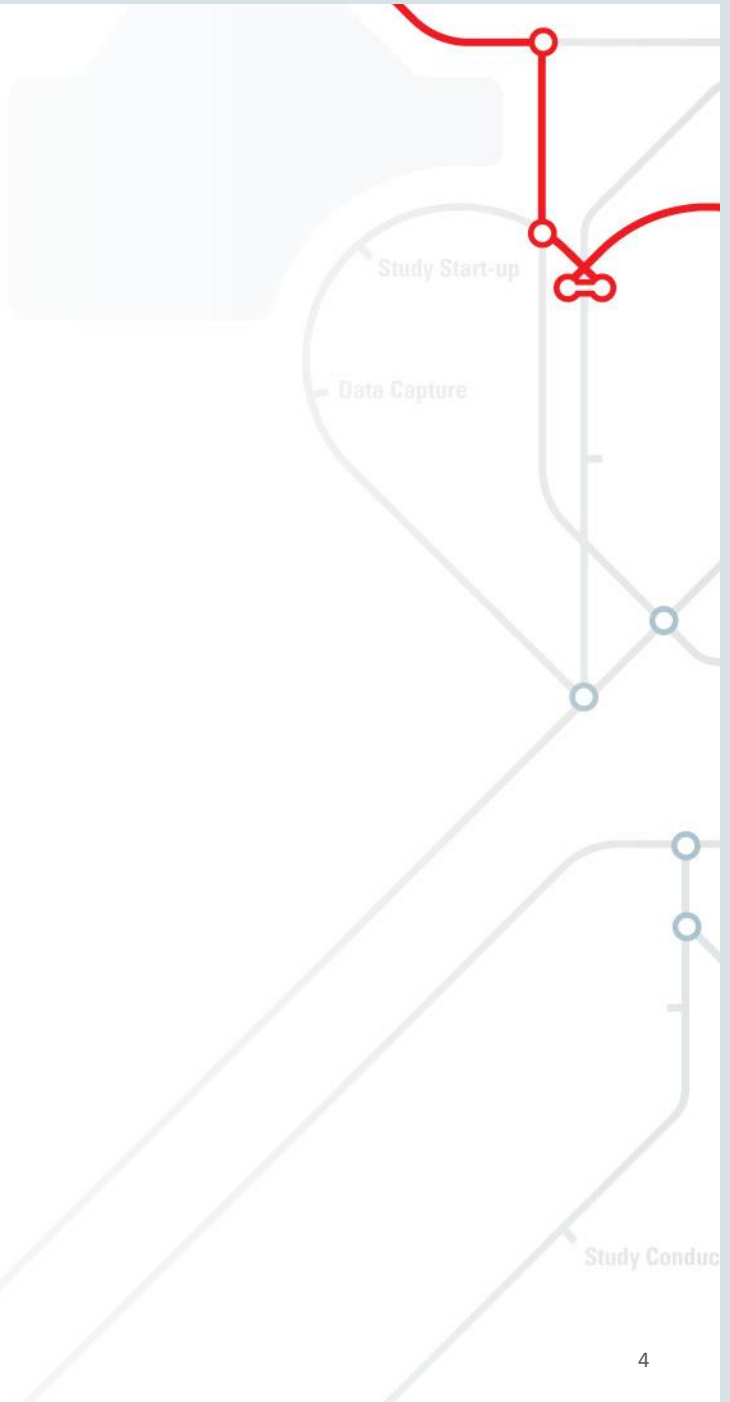
Artificial Intelligence – Embedded in our lives







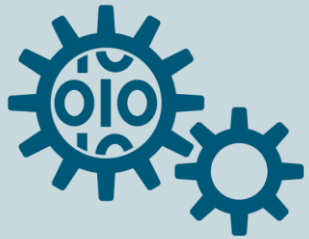
Artificial Intelligence & Machine Learning

ARTIFICIAL INTELLIGENCE

Any technique which enables computers to mimic human behavior

MACHINE LEARNING

AI techniques that give computers the ability to learn without being explicitly programmed to do so

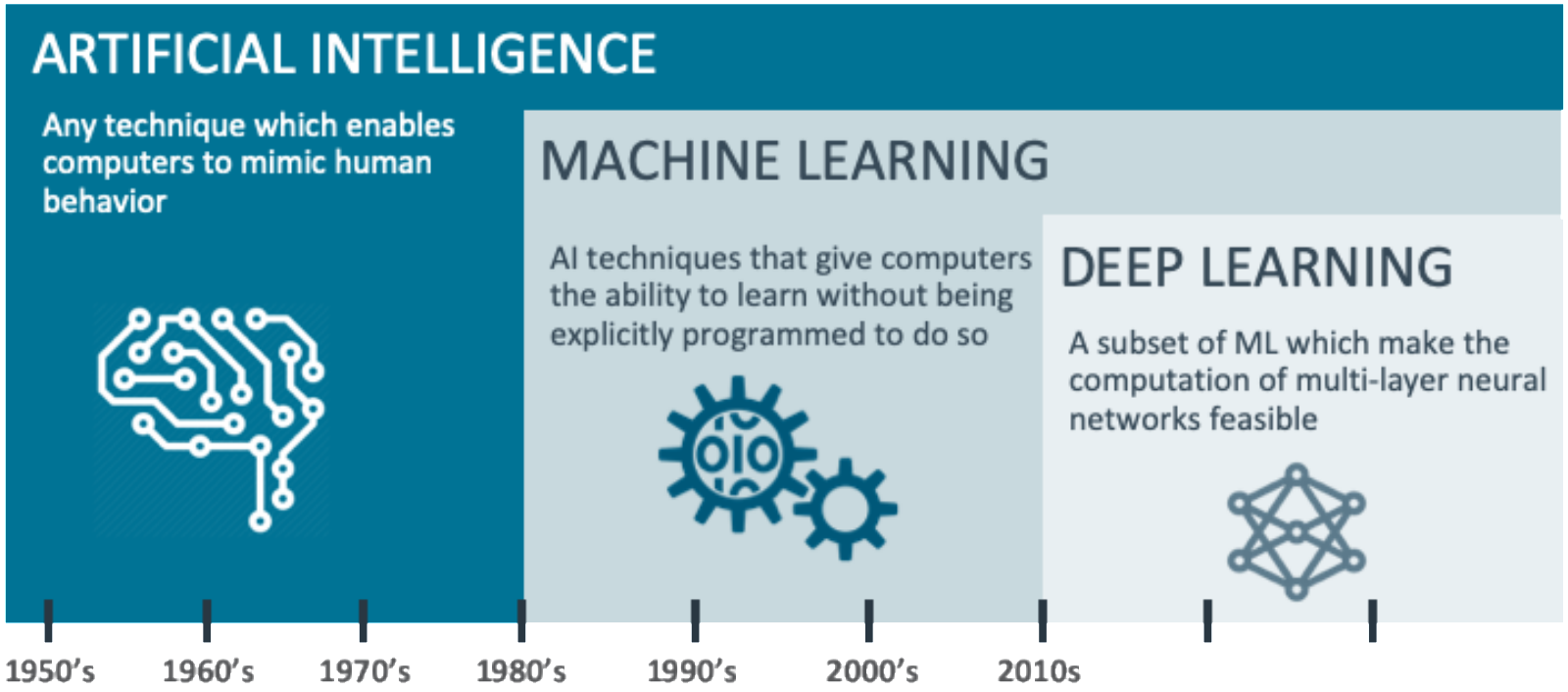


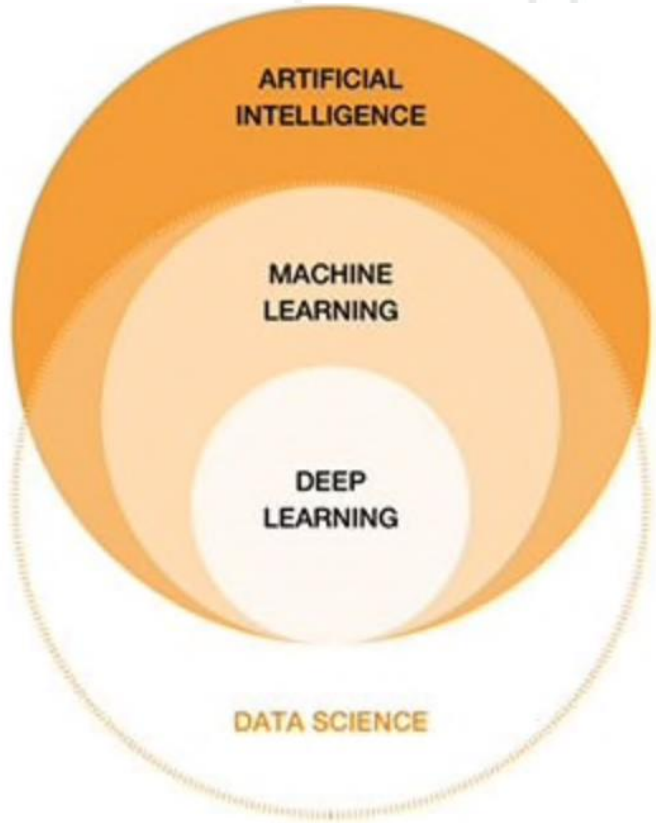
DEEP LEARNING

A subset of ML which make the computation of multi-layer neural networks feasible

1950's 1960's 1970's 1980's 1990's 2000's 2010s

Artificial Intelligence & Machine Learning

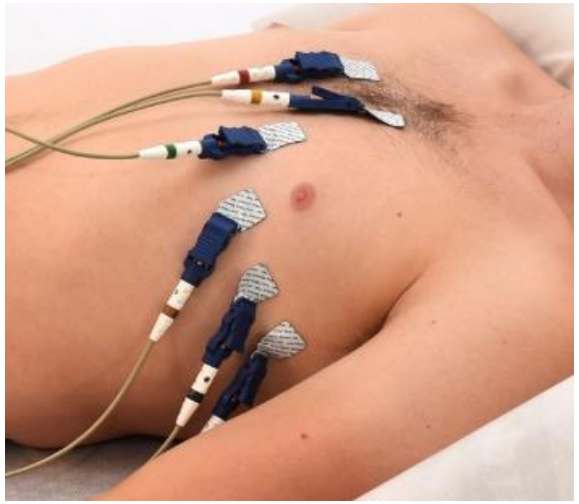




Mapping to Machine Learning Terms

Term	We used	Data scientist might use
Technique	Classify (fruit)	Classification, clustering, time series. etc.
Algorithm	“Deep learning neural network” in your brains	Neural network, decision tree, k-means clustering, etc.
Training Data	The initial basket of fruit	Data set supplied by IT, often setup and cleaned up by data scientist
Model	This is what identified the fruit	Look at the data and score, classify, etc.
Training the model	You figured it out	Adjust different parameters in response to the data to make it more accurate
Testing the model	The left over fruit	Always reserve some data that the model hasn’t seen to test.
Model deployment	Sent you to fruit packing line	Make model available to app developers, execs, analytics tools etc.
Model update	Brought you back for more training	Build a new model or re-train the old on additional data. Must re-deploy

EKG/ECG – From Bed to Pocket



Blood Pressure Monitoring – Evolution to Disruption

1 in 3 American Adults have High Blood Pressure

Cuffed

OMRON

Cuffless, Continuous

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Digital Clinical Trials

Disruptive Change is Happening Now

Investigator

Therapeutic Lead

Clinical Operations

PATIENT

Data Management

Data Scientist

Commercial

1. Medication Adherence
2. Remote Patient Monitoring
3. Decentralized / Virtual Trial
4. Real World Evidence / Outcomes
5. Digital Therapy

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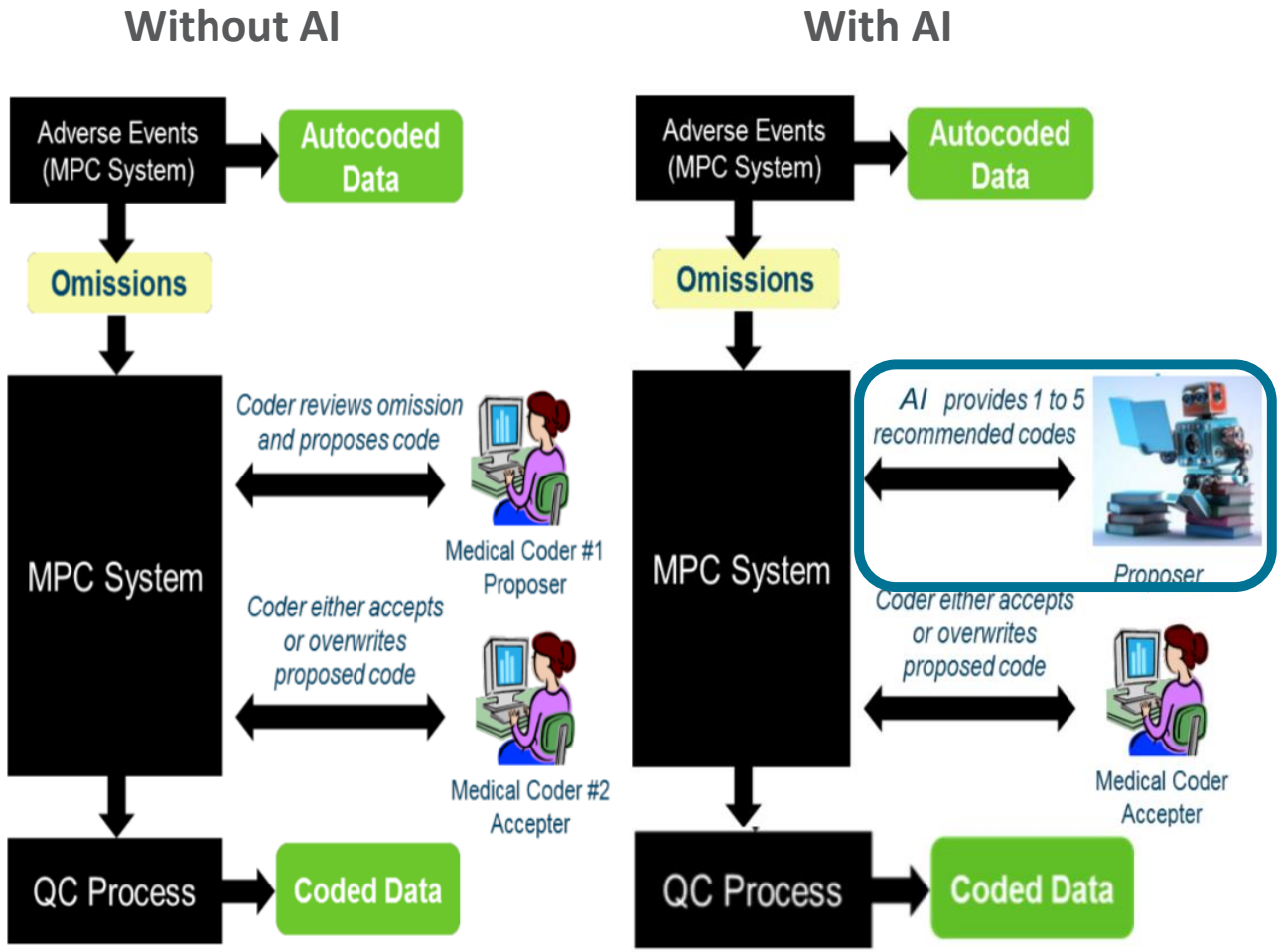
Medical Coding



- Central medical coding team
  - Clinical trial data and PV cases
  - Increased workload
  - Skilled resources hard to find/train
- AI Solution
  - Trained with Bayer data
  - Substitutes the Proposer role
  - MPC (Bayer core coding platform) sends omission to be coded
  - AI returns suggestion
  - Coder accepts or overwrites

Remote Cervical Cancer Screening in Cameroon

- The Problem
  - Large country, widely distributed population
  - Severe lack of pathologists/medical staff per region
  - Ultimate diagnosis too late in disease progression

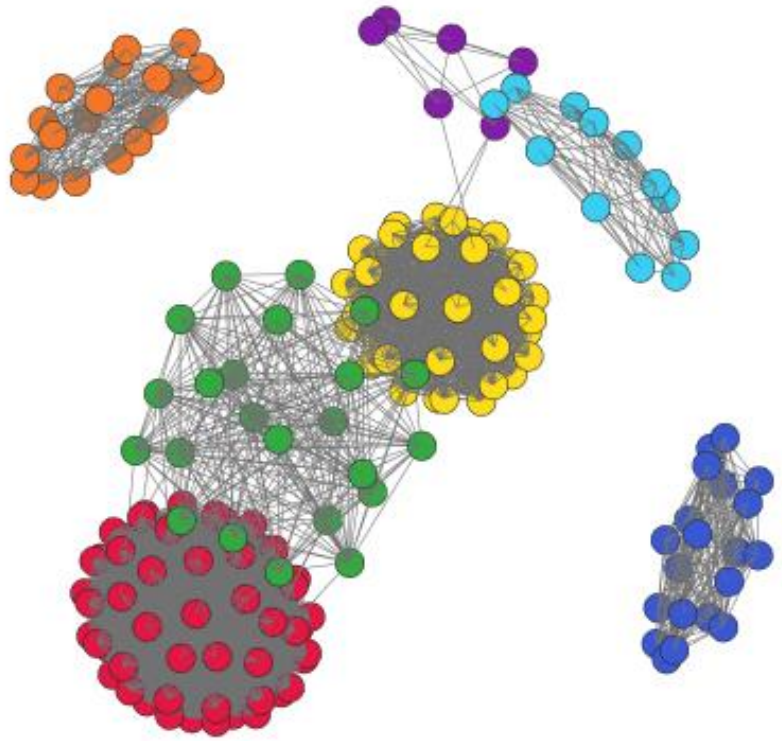
- AI Solution
  - Mobile clinics perform photocervicography
  - Magnified real time image stored in database
  - AI helps triage images for early detection

University of Alabama Medical Center & Cameroon Women's Health Program

Safety Case Management

- Automated Document Classification
- MedWatch, Literature, VAERS, social media, AE forms, etc
- Classify and Categorize data to identify relationships and signals

- Uses Machine Learning, NLP, Clustering



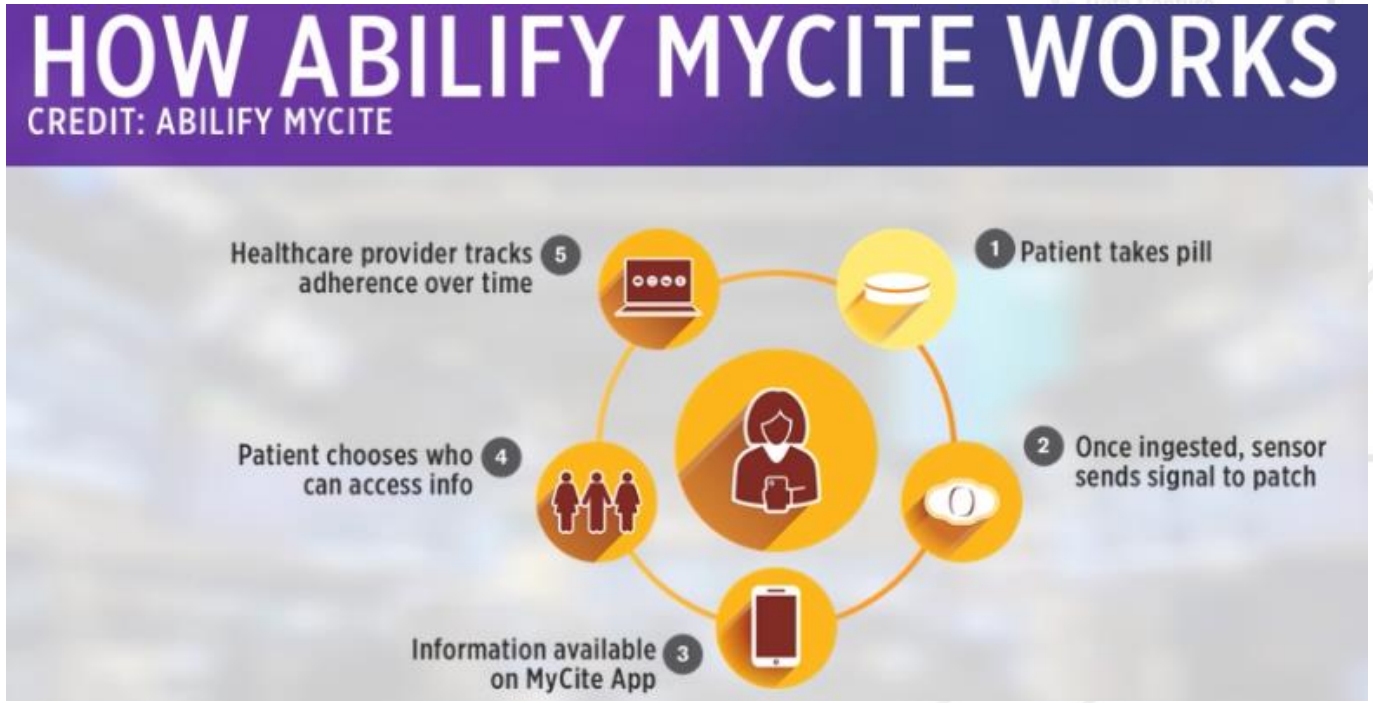
Each dot represents a document

Medication Adherence

Increased Adherence / Increased Retention / Reduced Fraud

Medical Ingestion Recognition – AI Cure

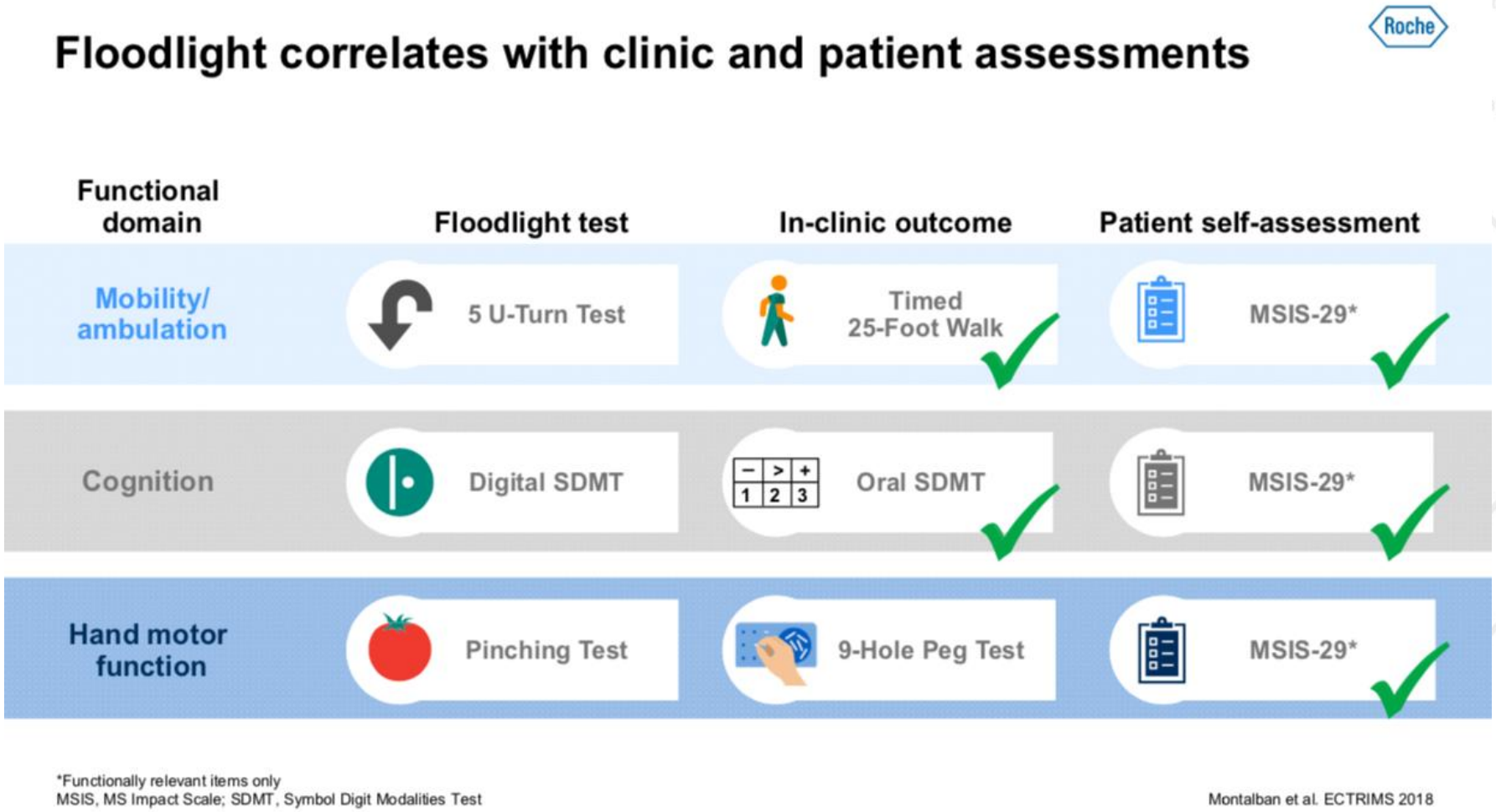
Smart Pill – Otsuka Abilify



The Washington Post

This $1,650 pill will tell your doctors whether you've taken it. Is it the future of medicine?

Increase in device data and self assessments



UK National Health Service
Digital Strategy

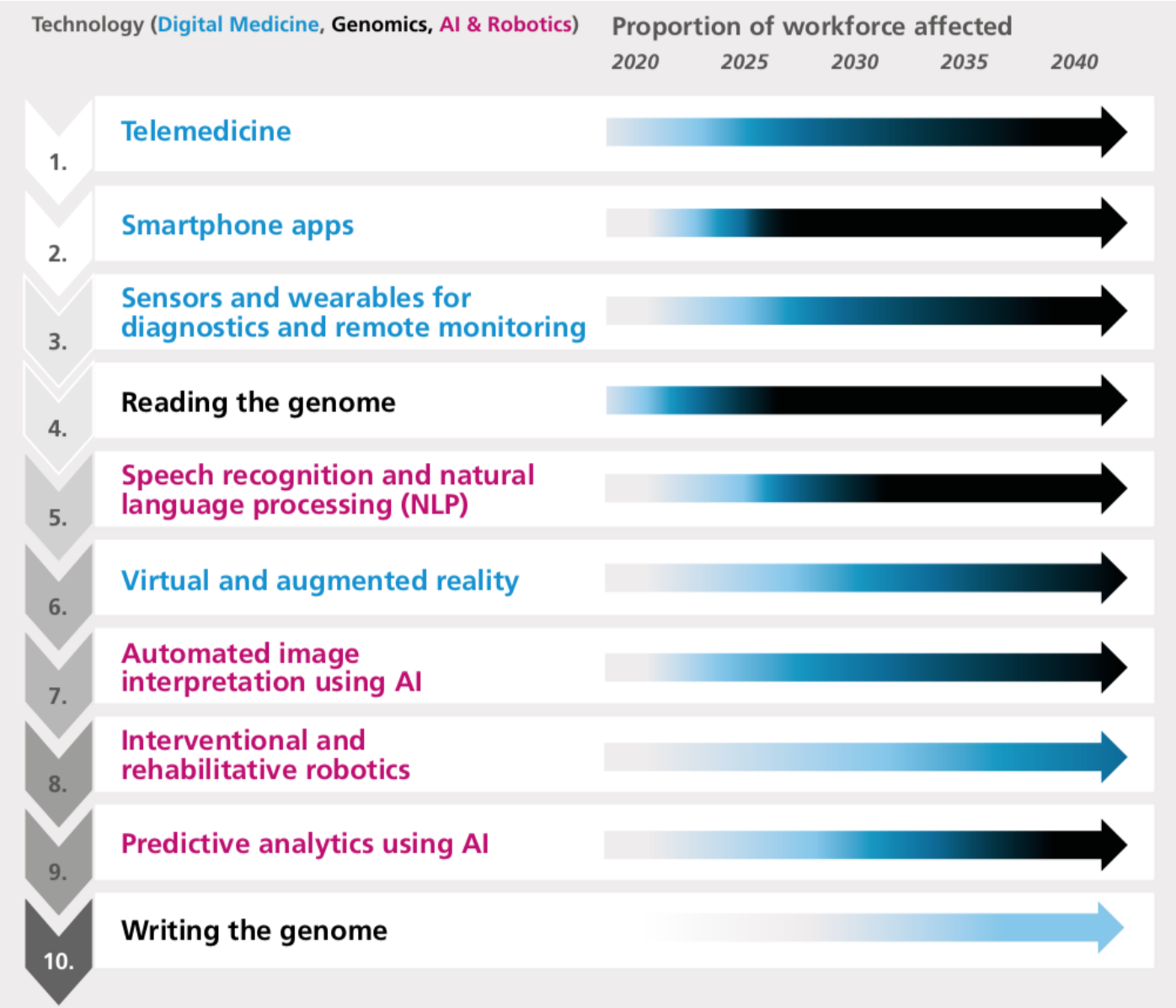
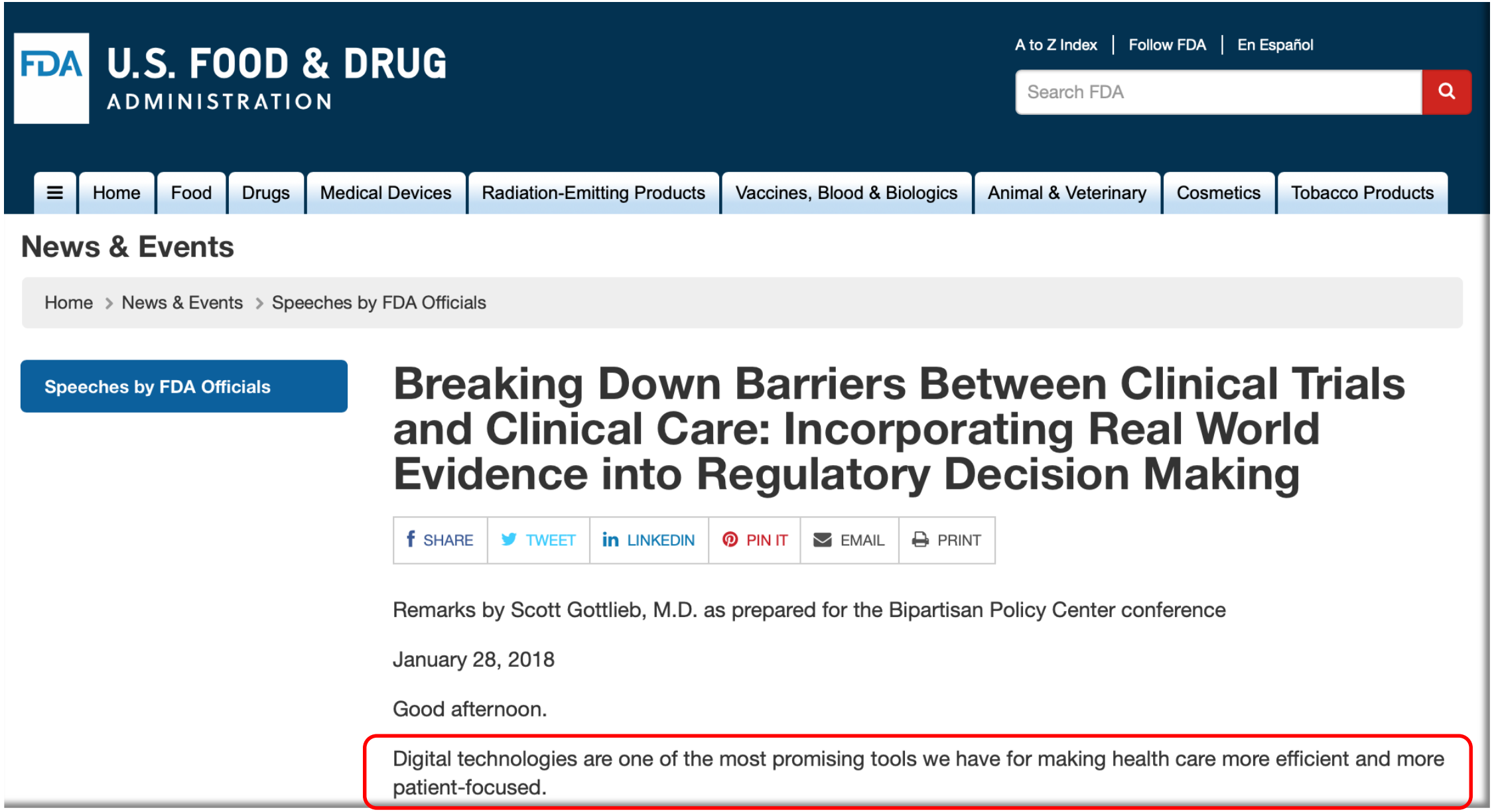


Figure 1: Top 10 digital healthcare technologies and their projected impact on the NHS workforce from 2020 to 2040

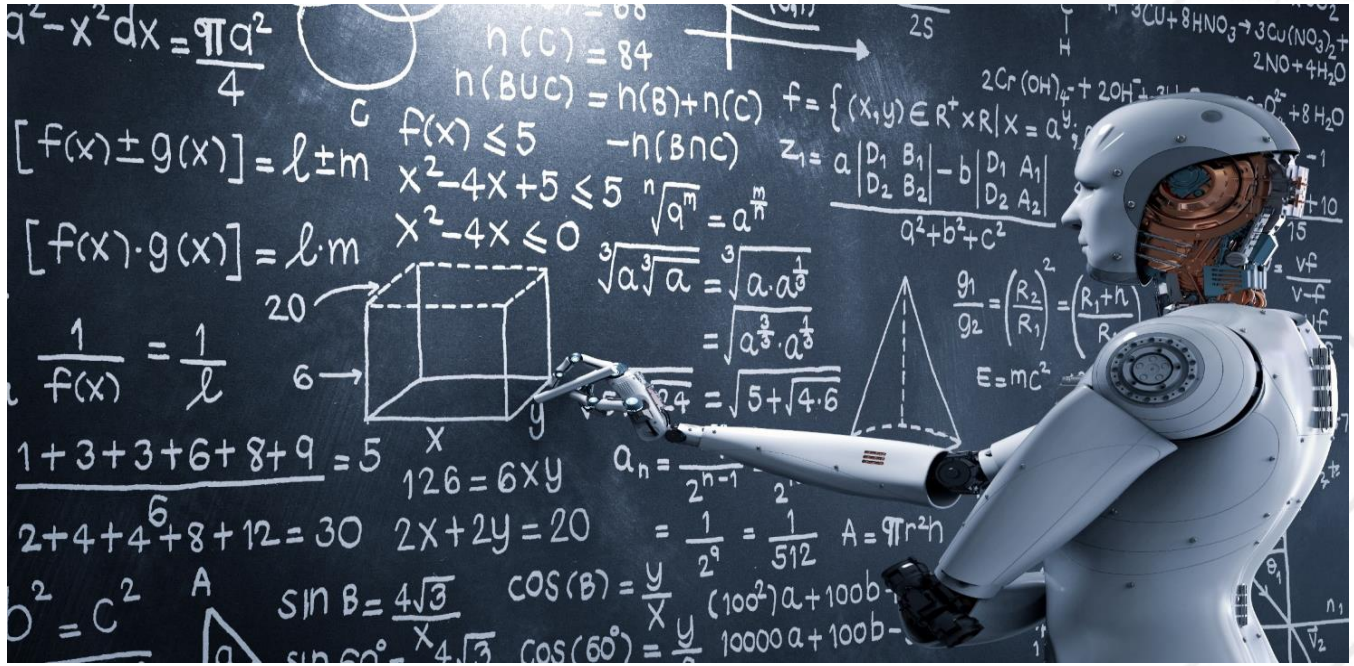
Arrow heat map represents the perceived magnitude of impact on current models of care and, by inference, on the proportion of workforce affected

<20% 20% 50% >=80%



And more

- Trial Design
- Recruitment
- Behavioral Analysis
- Real World Evidence
- Medical Sensors
- Assisted Diagnostics

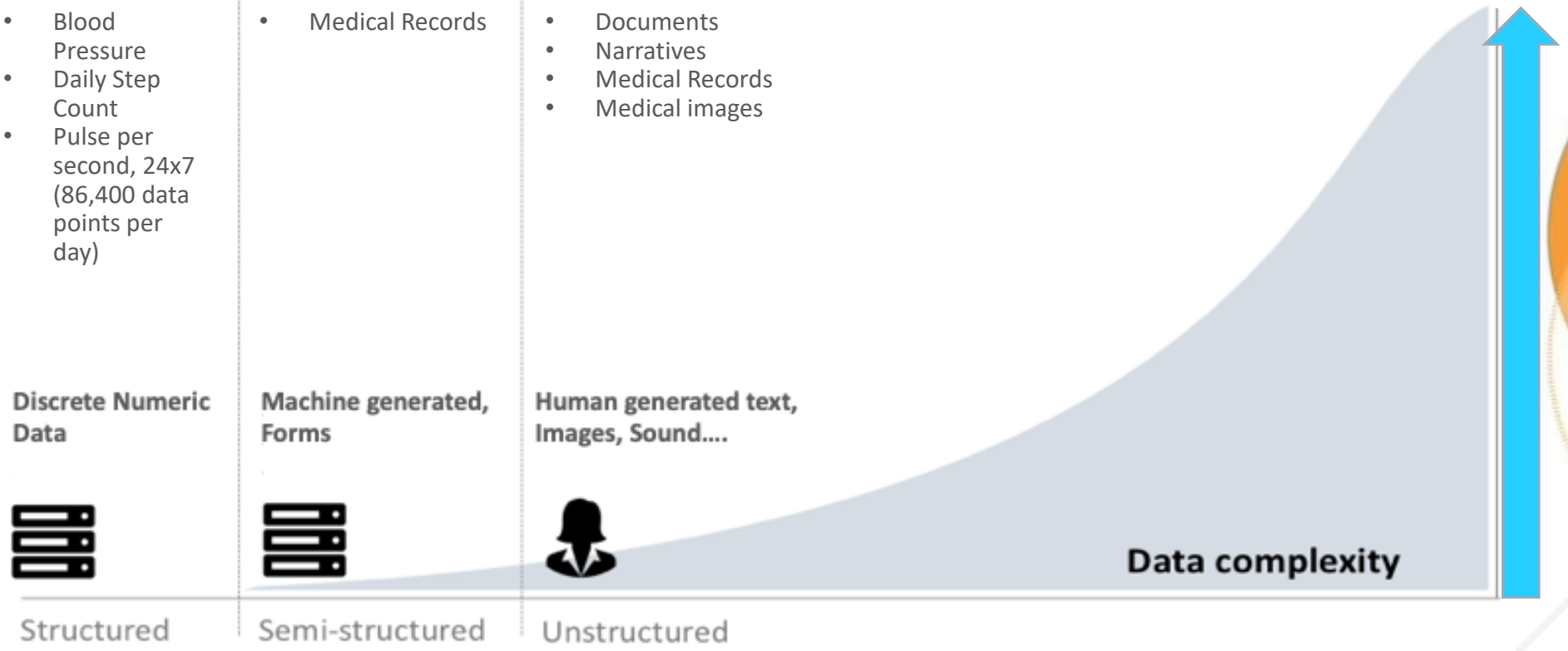


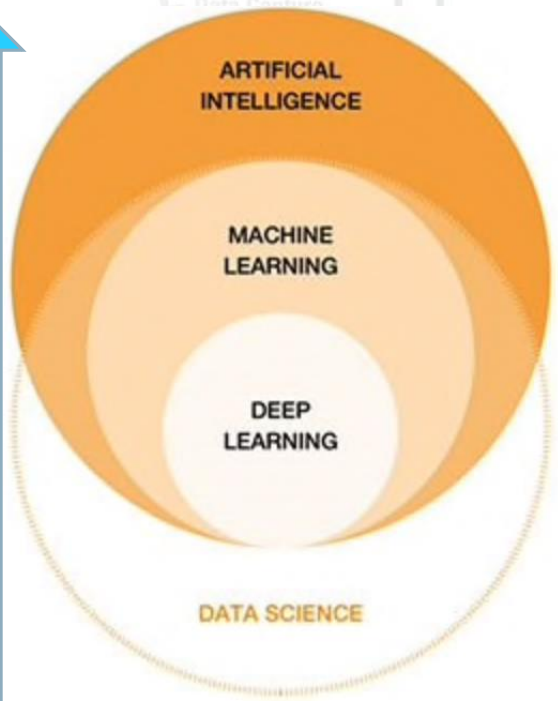
Data Complexity vs AI Complexity

- Blood Pressure
- Daily Step Count
- Pulse per second, 24x7 (86,400 data points per day)

- Medical Records

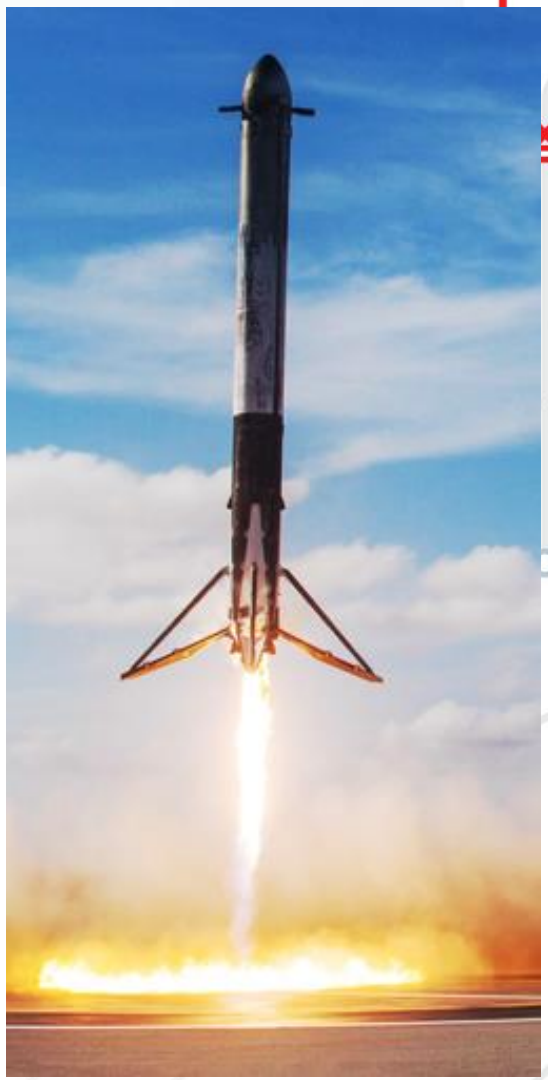
- Documents
- Narratives
- Medical Records
- Medical images





Considerations

- AI/Machine Learning requires training
  - Only as good as the training data
- Some use cases more suited than others
  - Discrete numeric data easier than unstructured text
- Validation
  - Methods widely used in other mission critical industries
  - Train with broad set of data
  - Test with unseen data



Data Driven Clinical Research needs Data Science

- Adoption of AI/ML/Data Science is critical
  - Biosensors
  - Medical Records
  - Images
  - Genomics
  - ….
- *Augmented* Intelligence
  - More meaningful way to consider AI
- Patients need better treatments
  - Better Science needs Data Science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