



The Fourth Industrial Revolution and Occupational Health



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- 1. Introduction and Definitions**
- 2. 4IR**
- 3. Artificial Intelligence**
- 4. Applications in other health fields (with OH examples)**
- 5. Implications and Applications in Occupational Health#**
 - a) HCP/Other risks
 - b) Musculoskeletal
- 6. Conclusions**

Citations

- Chia, G, Lim, SM, Sng, GKJ, Hwang, YJ, Chia, KS. **Need for a new workplace safety and health (WSH) strategy for the fourth Industrial Revolution.** *Am J Ind Med.* 2019; 62: 275– 281. <https://doi-org.uplib.idm.oclc.org/10.1002/ajim.22960>
- Howard, J. **Artificial intelligence: Implications for the future of work.** *Am J Ind Med.* 2019; 62: 917– 926. <https://doi-org.uplib.idm.oclc.org/10.1002/ajim23037>
- **Artificial intelligence (AI) and global health: how can AI contribute to health in resource-poor settings?** Brian Wahl, Aline Cossy-Gantner, Stefan Germann, Nina R Schwalbe

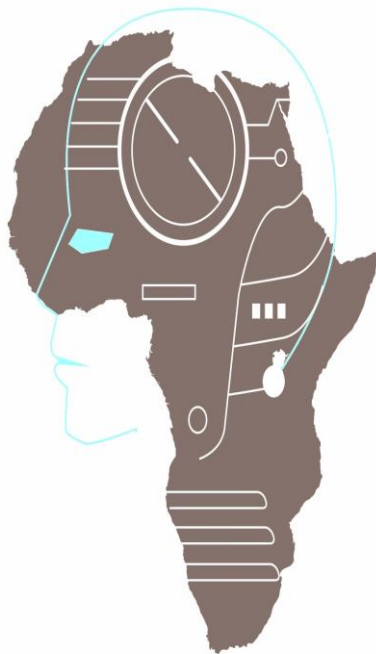
What exactly is the 4IR?

Prof. Claus Schwab WEF 2016

- Physical
- Biological
- Digital



- Internet of Things
- Artificial Intelligence
- Cyber-physical systems
 - Robots/Cobots
 - Sensors
 - 3D Printing (Additive Manufacturing)



AI in Africa

What is AI?

AI is the branch of computer science that deals with the simulation of intelligent behaviour in computers.

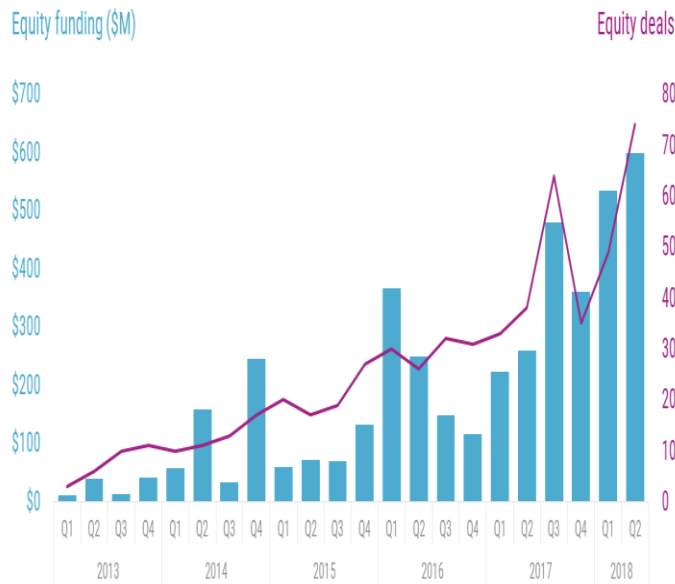
Something ‘acts intelligently’¹ when:

- (1) what it does is appropriate for its circumstances and its goals;
- (2) it is flexible to changing environment and changing goals;
- (3) it learns from experience; and
- (4) it makes appropriate choices given its perceptual and computational limitations.



AI in healthcare funding hit a historic high in Q2'18

Disclosed equity funding, Q1'13 - Q2'18



Source: cbinsights.com

CBINSIGHTS

No universally accepted classification of AI sub-fields relevant to health exist², although **usually used in combination:**

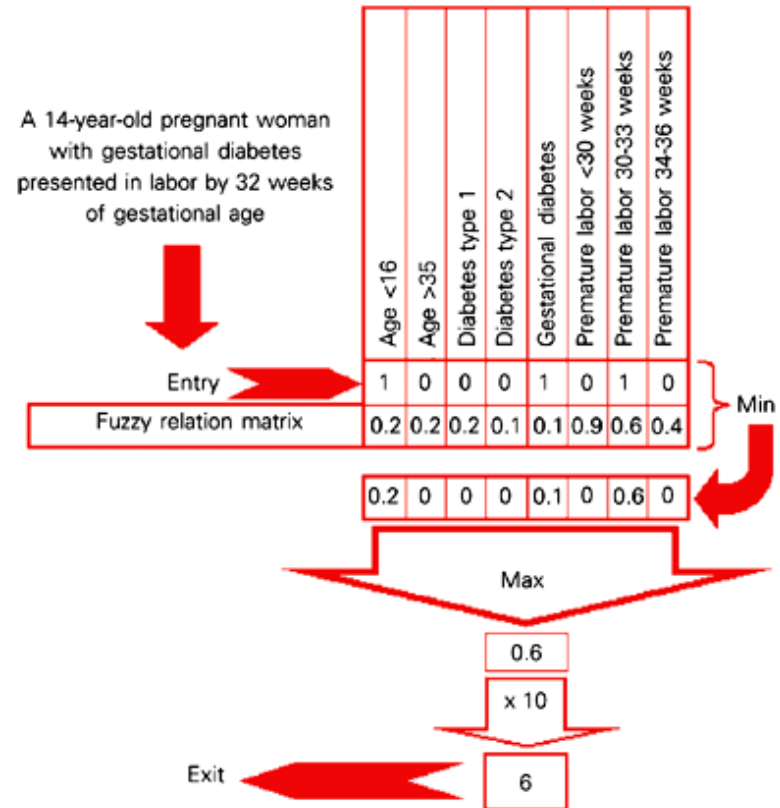
1. Expert systems
2. Machine learning
3. Natural language processing
4. Automated planning and scheduling
5. Image and signal processing



Expert systems

Expert Systems

- Act in place of a human expert, based on existing knowledge e.g. Framingham, PLH calculation, Spirometry, ECG, (Fitness Assessment), birth asphyxia prediction based on a risk score
- Diagnosis and treatment plans

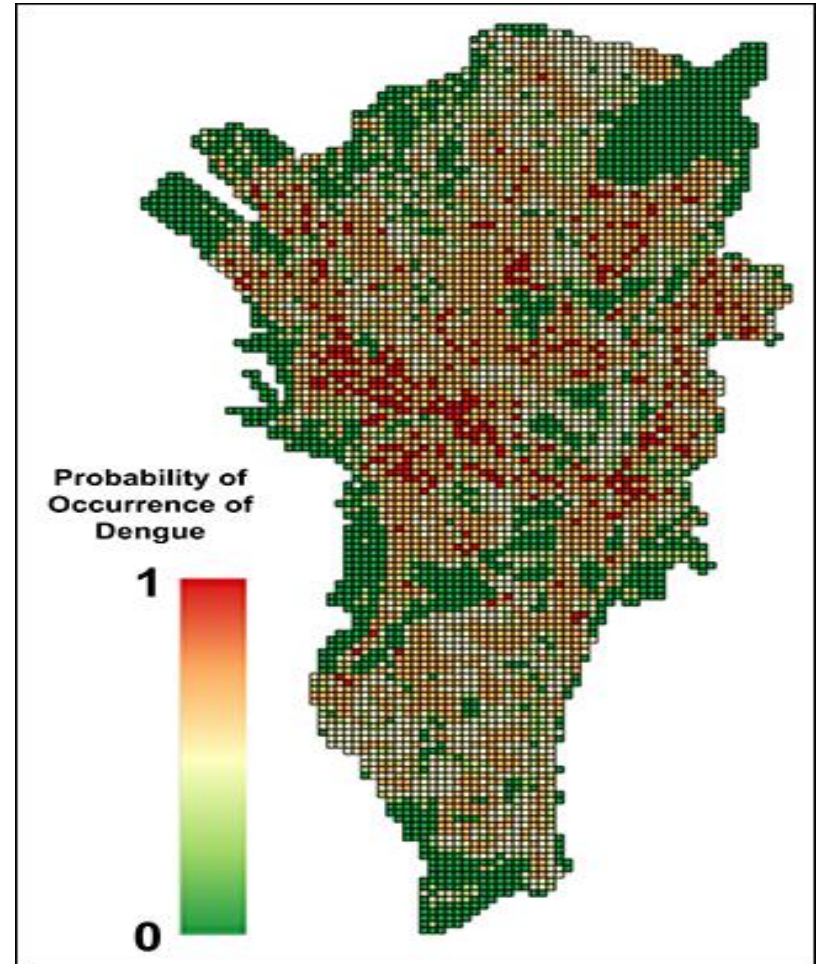




Machine Learning

Machine learning

- Uses existing information to learn, and apply to new situations:
 - Epidemic prediction, modelling and prevention, e.g. using weather and land use patterns to predict Dengue Fever transmission (HEG and disease prediction, rock type, machine type in NIHL and Silicosis, Fitness Assessment, XR Reporting)
 - Guide cancer treatment (with NLP) e.g. IBM Watson





NLP and AI Planning

Natural Language Processing

- Detect and map outbreaks using online and social media sources (Global Health Monitor)
- Support clinical decision making or track health disparities (Somalia), adverse drug reactions

AI Planning and Scheduling

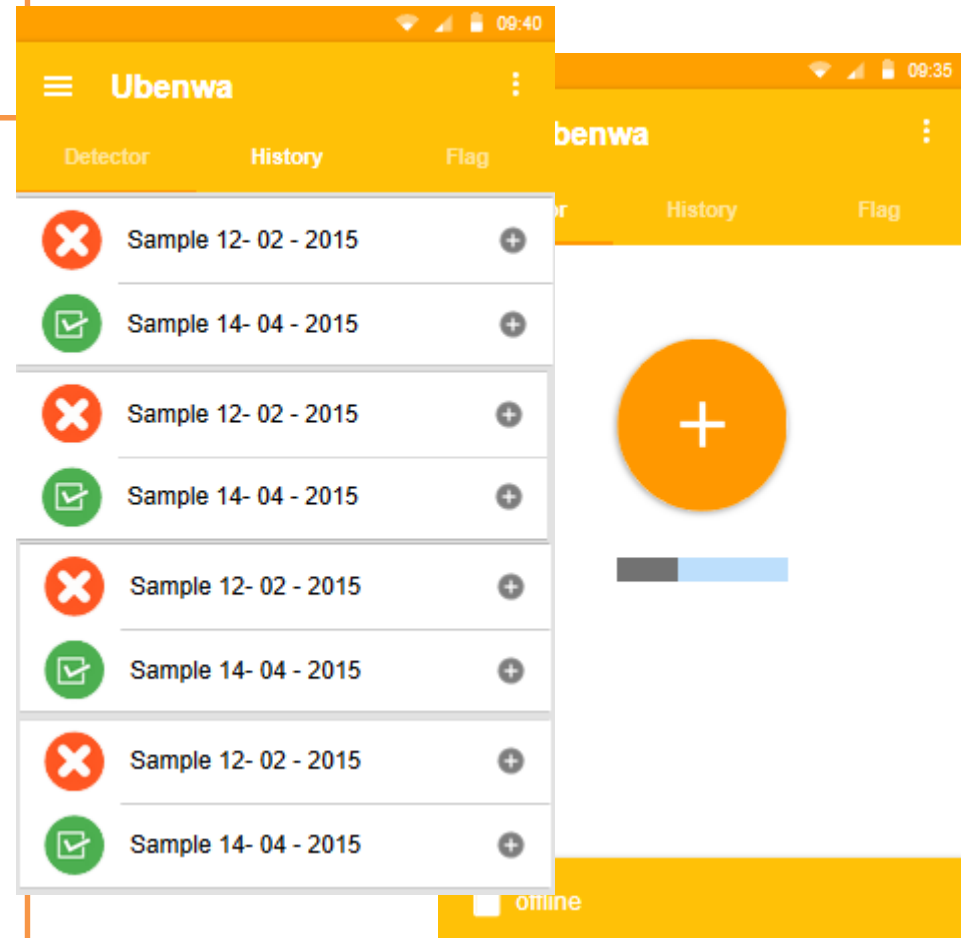
- Immunisation
- Supply chain
- Scheduling, for example: Community Health Worker Visits
- (medical surveillance, machine maintenance)



Signal and Image Processing

Signal and image processing

- Wearables
 - pulse
 - arrhythmia
- Radiology e.g. MBOD
- Dermatology
- Pathology
- OAE



How is the 4IR expected to change OH?



New (and no) hazards of
job displacement and the
human-machine interface

Psychosocial
Physical
Biological



Health surveillance

'system of
systems'



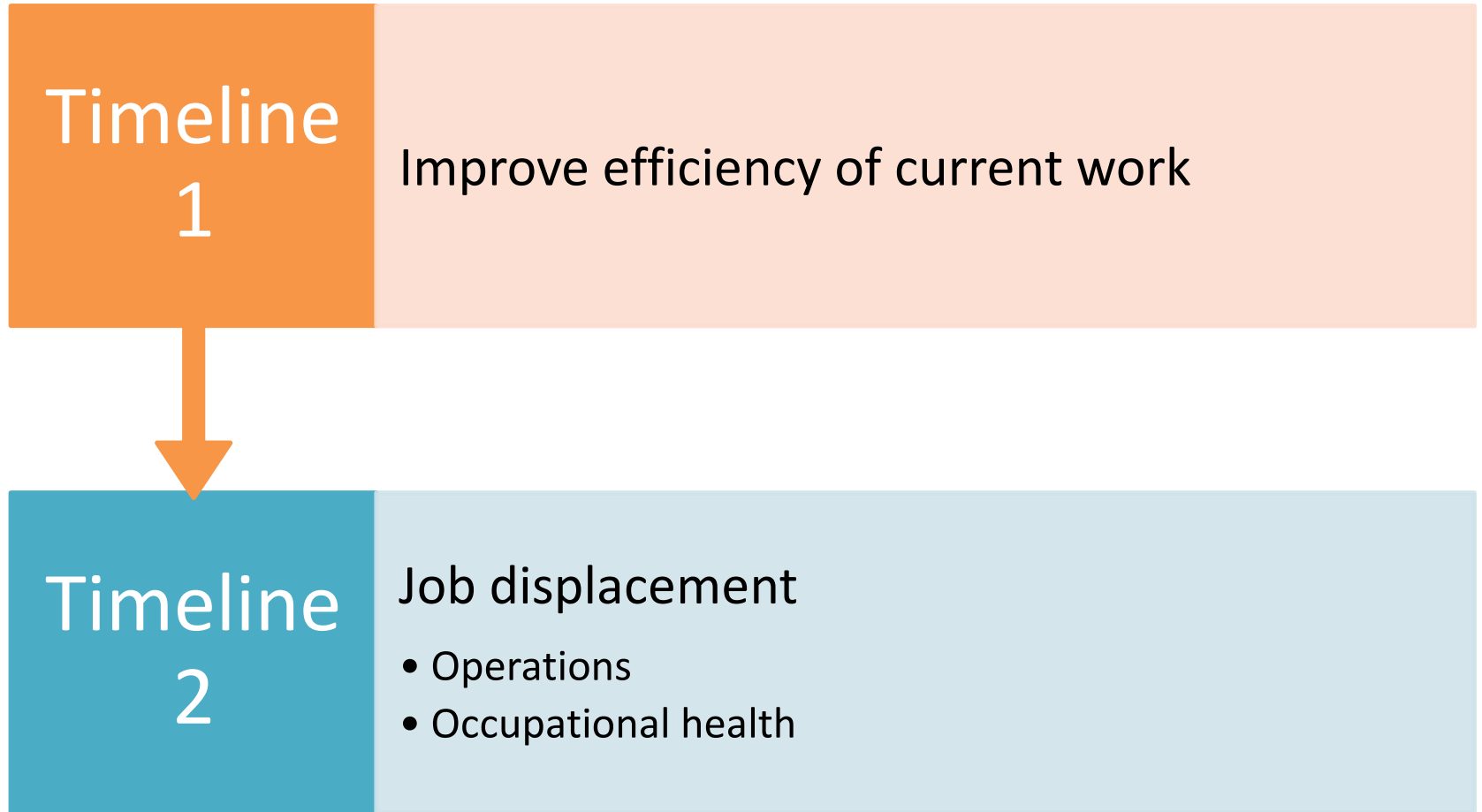
Risk assessment



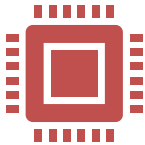
Control

VR for training
AI Safe

Timeline approach



Use case: Hearing Conservation (and any other risk) in Mining



HIRA

AI Scheduling: Machine replacement, maintenance, tag-out

Signal and image processing: Machine noise, material types



Control

(VR in training)

Signal and image processing: HPD use, sensors mounted in HPDs



Medical surveillance

Expert systems: Current audiology

AI scheduling

Machine learning

Use case: Clinic Management



SIGNAL AND IMAGE
PROCESSING



EXPERT SYSTEMS



NLP



MACHINE
LEARNING



AI SCHEDULING



Challenges

Expert Systems

- Require a clear definition of the clinical problem
- Acquiring and updating the knowledge base
- Accuracy tracking and trust
- Integration of various AI systems
- Do all disease domains require expert systems?

Machine Learning, NLP and AI for Planning/Scheduling

- Quality, variety and quantity of datasets for diseases/supply chain of interest
- Different record structures and linguistic content
- Better diagnoses do not equate to more appropriate or quality treatments
- Bandwidth requirements
- Privacy, data ownership, security, consent
- **Risk of bias and ‘black box’, exacerbation of inequity**
- Clinical efficacy research

Questions and
Comments?

