

Transforming healthcare with AI

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Artificial intelligence (AI)

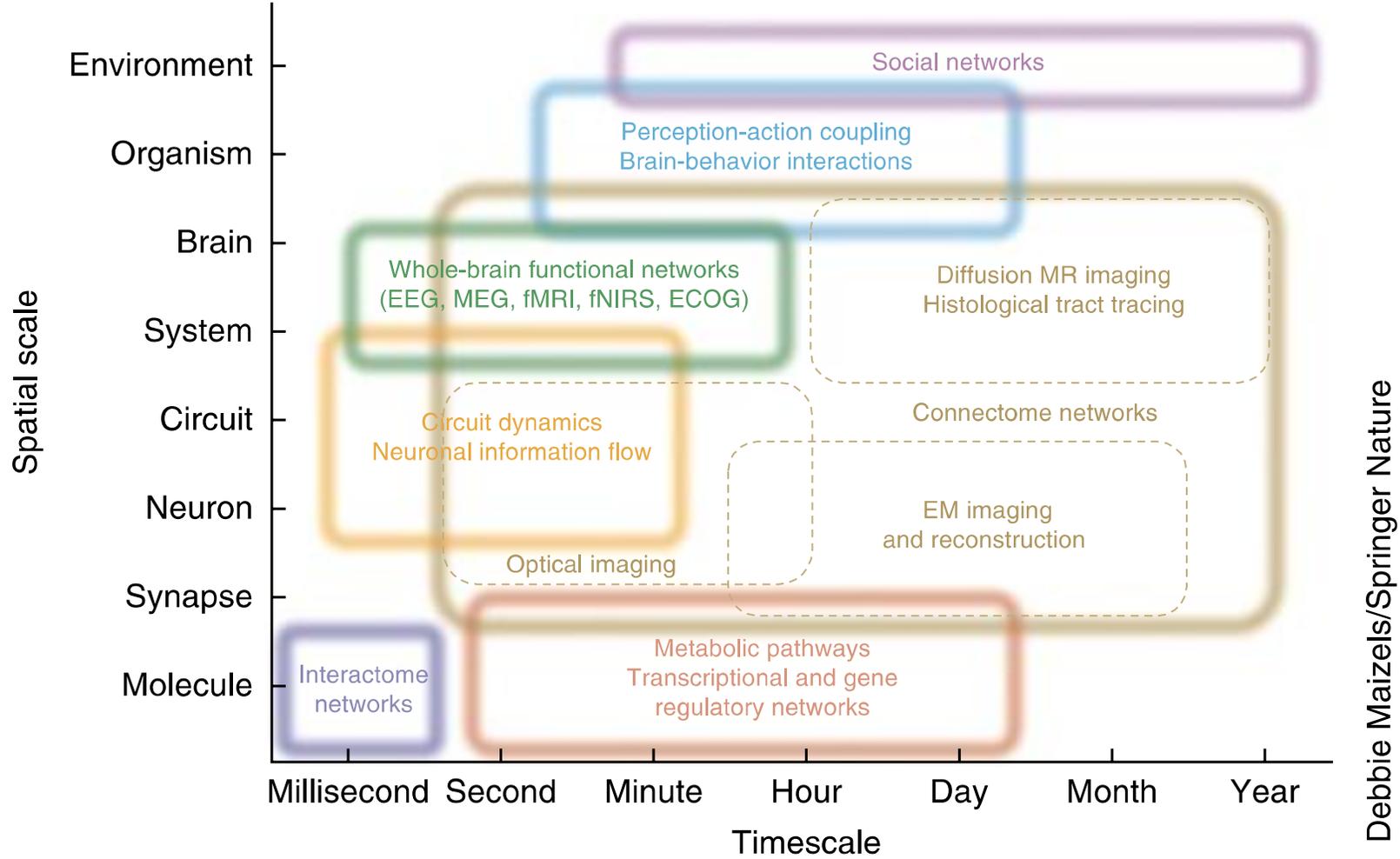
“Artificial intelligence is the future, [...] for all humankind. It comes with colossal opportunities, but also threats that are difficult to predict. **Whoever becomes the leader in this sphere will become the ruler of the world.**”



AI is the capability of a computer program to perform tasks or reasoning processes that we usually associate with intelligence in a human being.



Capturing the biological complexity



Debbie Maizels/Springer Nature

AI and its potential to transform healthcare

Artificial intelligence and its first and second cousins, machine learning and robotic process automation, will fundamentally change how almost everyone working in hospitals and health systems will do their jobs in the future.

American Hospital Association, 2019

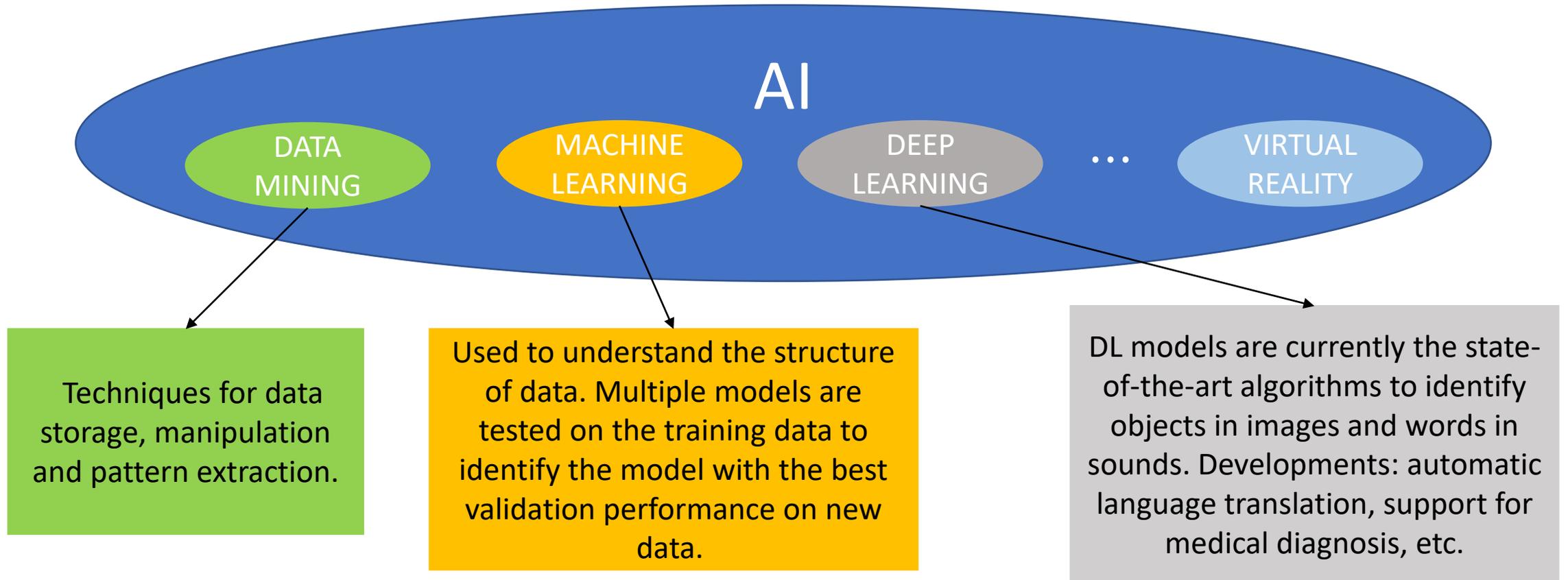
Healthcare as a sector, with all the longitudinal data it holds on patients across their lifetimes, is positioned to take advantage of what data science and AI have to offer. From diagnostics, interpretation of lab tests and scheduling appointments, to personalising care, finding cures to conditions, and creating new and innovative solutions to long-standing problems – the opportunities are endless.

World Innovation Summit for Health (WISH), 2018

Selected use cases along the AI in healthcare framework

- ✓ **Self-care, prevention and wellness** (AliveCor – Personal Electrocardiogram (ECG))
- ✓ **Triage and diagnosis** (Symptom checkers such as Babylon, Mediktor, Ping An Good Doctor, Ada Health, K Health)
- ✓ **Diagnostics** (Arterys, an AI-enhanced medical image-analysis platform with several applications including LungAI for lung- nodule analysis allowing for the early detection of lung cancer.)
- ✓ **Clinical decision support** → Software as a Medical Device → DeepMind (a UK-based AI company owned by Google)
- ✓ **Care delivery** (Amelia – Virtual Health Agent Platform)
- ✓ **Chronic care management** (Sensely’s avatar-based chronic-care platform provides personalised conversational content)
- ✓ **Improving population-health management** (Mount Sinai Health Systems – Risk prediction for hospital emergency admissions)
- ✓ **Improving healthcare operations** (Qventus is an AI-based software platform that solves operational challenges that occur in the hospital.)

Practical Artificial Intelligence with ICT



Although all these methods have the common goal of extracting information, patterns and relationships that can be used to make decisions, they have different approaches and functionalities.

Computational Neuroscience

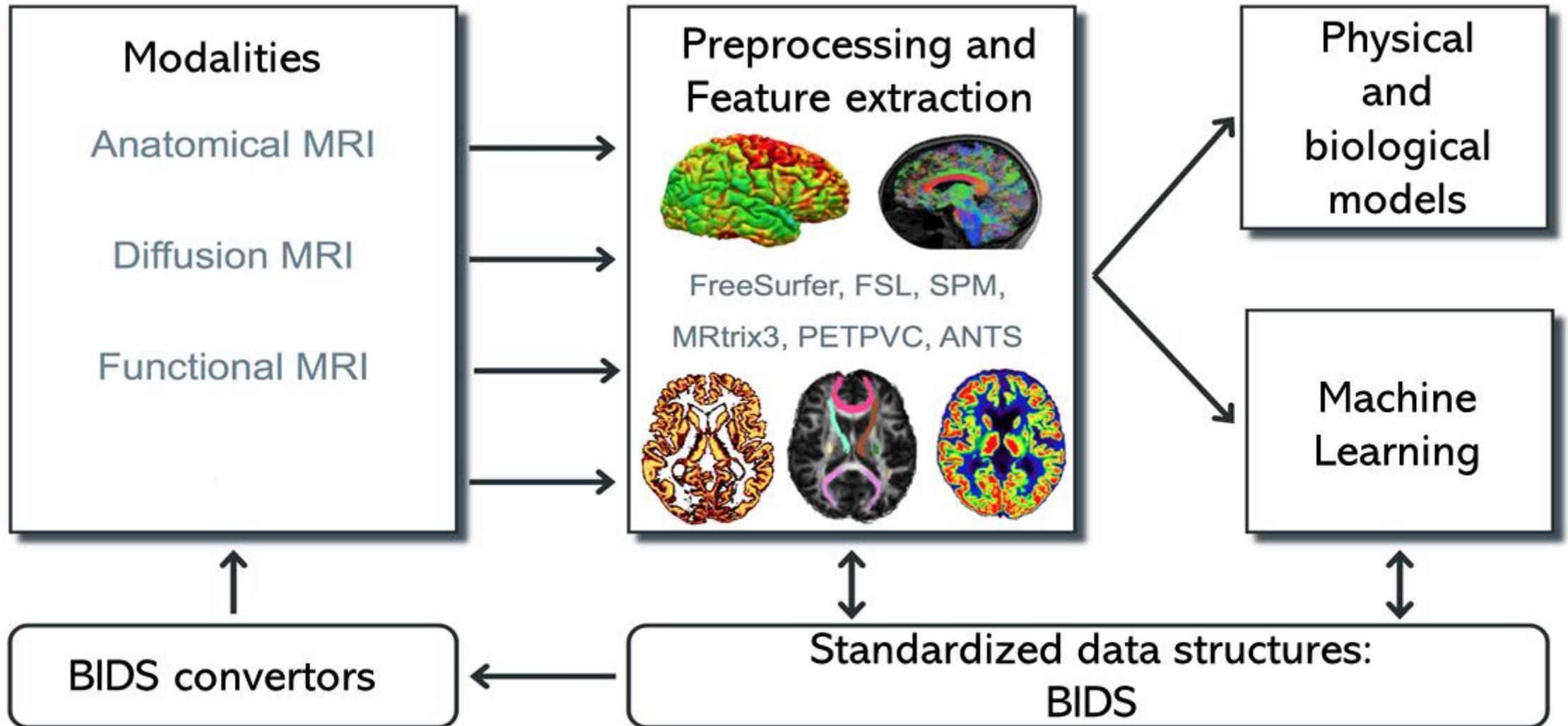
Neuroimaging is receiving increasing attention from the international scientific community for:

- investigation of **physiological ageing of the brain and cognitive decay** (increase in the average age of the population, particularly the western population)
- study mechanisms of **neurodegenerative diseases** (24 million people today suffer from dementia with 4-6 million new cases annually).

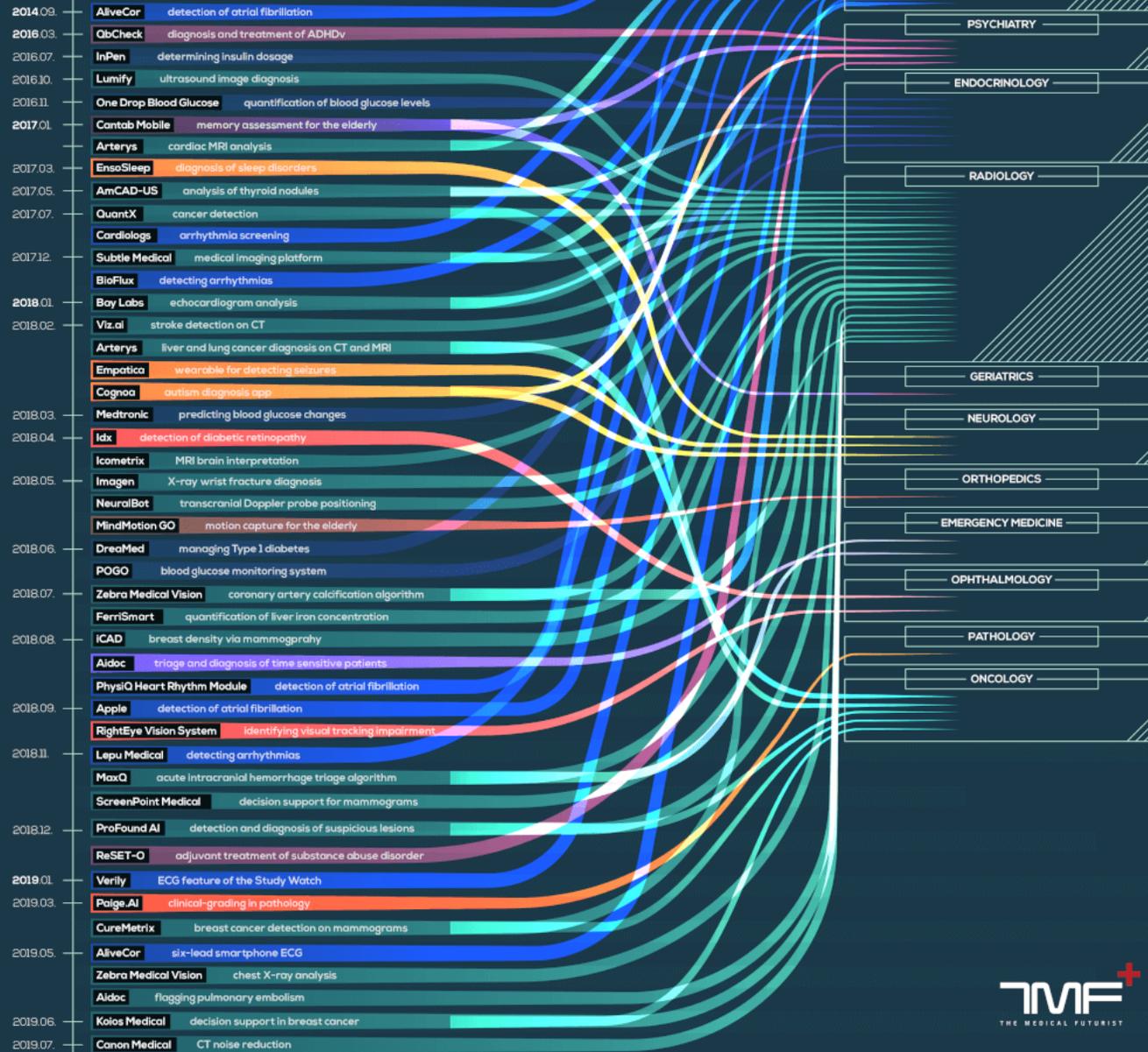
Recent advances in neuroimaging analysis are supported by:

1. high-throughput analysis of large amounts of data;
2. big data open sharing brain imaging repositories;
3. huge computational resources.

Multidimensional neuroimaging processing



FDA APPROVALS FOR ARTIFICIAL INTELLIGENCE-BASED ALGORITHMS IN MEDICINE



From AI today to AI tomorrow

Phase 1: near term

The low-hanging fruits of AI in healthcare will come with image recognition, triage and helping people with chronic diseases to manage independently and live well.

Stefan Vlachos, Karolinska University Hospital

Phase 2: midterm

The most promising area of technology is how to optimise patients going home and having the right alert systems in place. Machine learning is helping define the right trigger points for alerts. We cannot serve all these people in hospital anymore.

Monique van Dijk, Erasmus MC

Phase 3: longer term

The future will bring further integration of data, including the relevant context of the patient, which will help to create an enriched “digital twin” of the patient that will help decide on the optimal therapy outcome for each specific patient – and maybe help to predict the risk of developing a disease or complication.

Hans Hofstraat, Philips Chief Technology Office

Conclusions

- Healthcare is one of the success stories of our times. It is also in crisis. Huge advances in public health and prevention, biomedical knowledge, healthcare delivery and technology have all helped raised life expectancy, and expectations from healthcare itself. But as healthcare costs continue to rise exponentially, outpacing GDP growth, we need to deliver care that is better, faster and more cost-efficient, and provide more and better services to more people.
- The pace of change in healthcare AI has accelerated significantly over the past few years due to advances in algorithms, computing power and the increasing breadth and depth of data that can be used. In response, countries, health systems, investors and innovators are all now sharply focused on the topic.
- The implications of AI in healthcare settings on the work of practitioners are starting to emerge. The research highlights that healthcare is one of the sectors least prone to automation.
- **What role could Europe play?** Europe's strength lies in its collective energy, compared to other leading players in AI such as the US or China.

Thank you for your attention

<http://medphys.ba.infn.it/>

