Artificial Intelligence and Big Data

in Health Care and Research

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Outline

1) AI is Everywhere, also in Health

2) Data, Health Data, Big Data

3) Data Science, Machine Learning and AI

4) Success stories, Challenges and Limitations

5) Not to talk about Ethics

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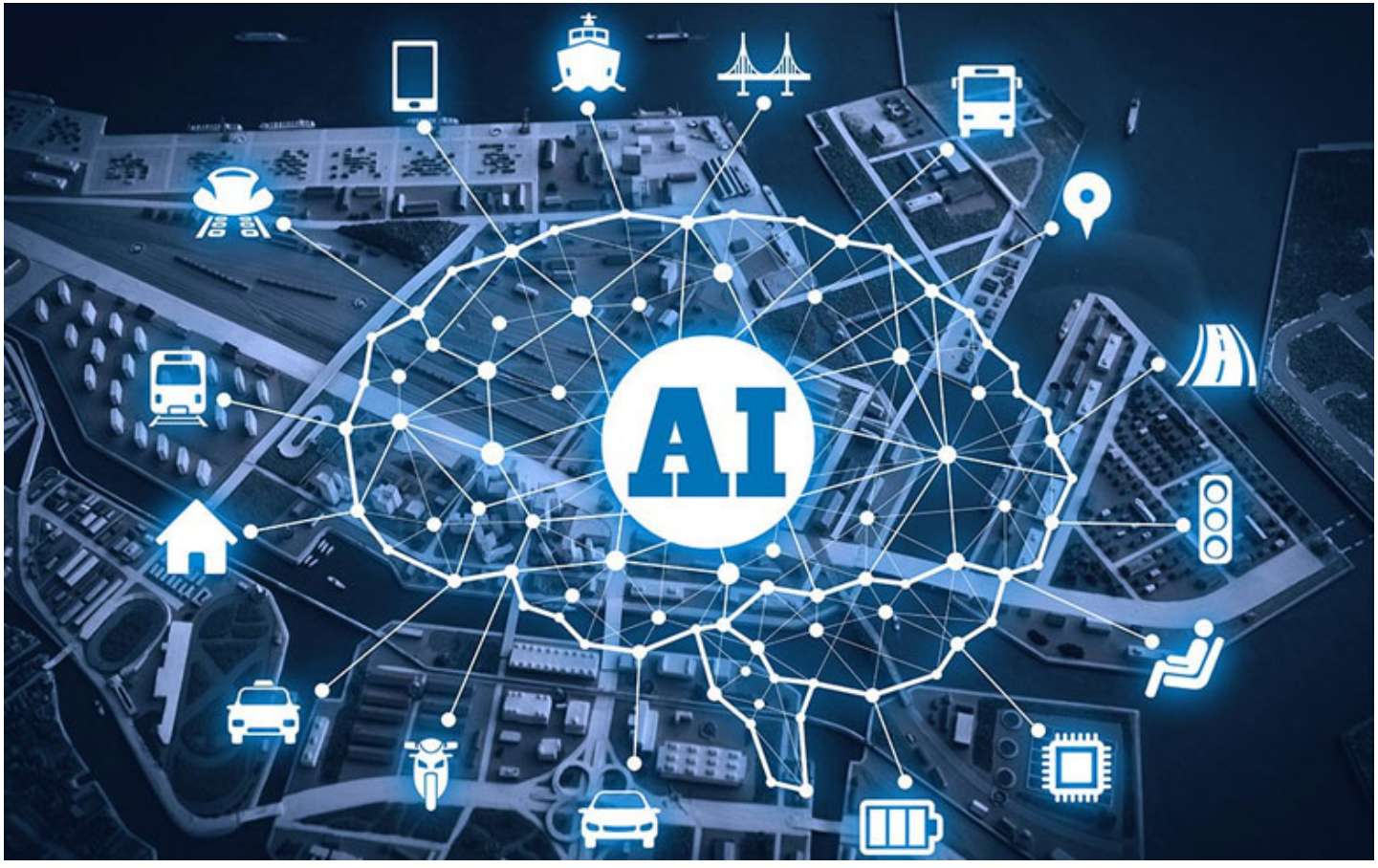
Artificial Intelligence Everywhere, also in Health

AI : Everyone talks about it



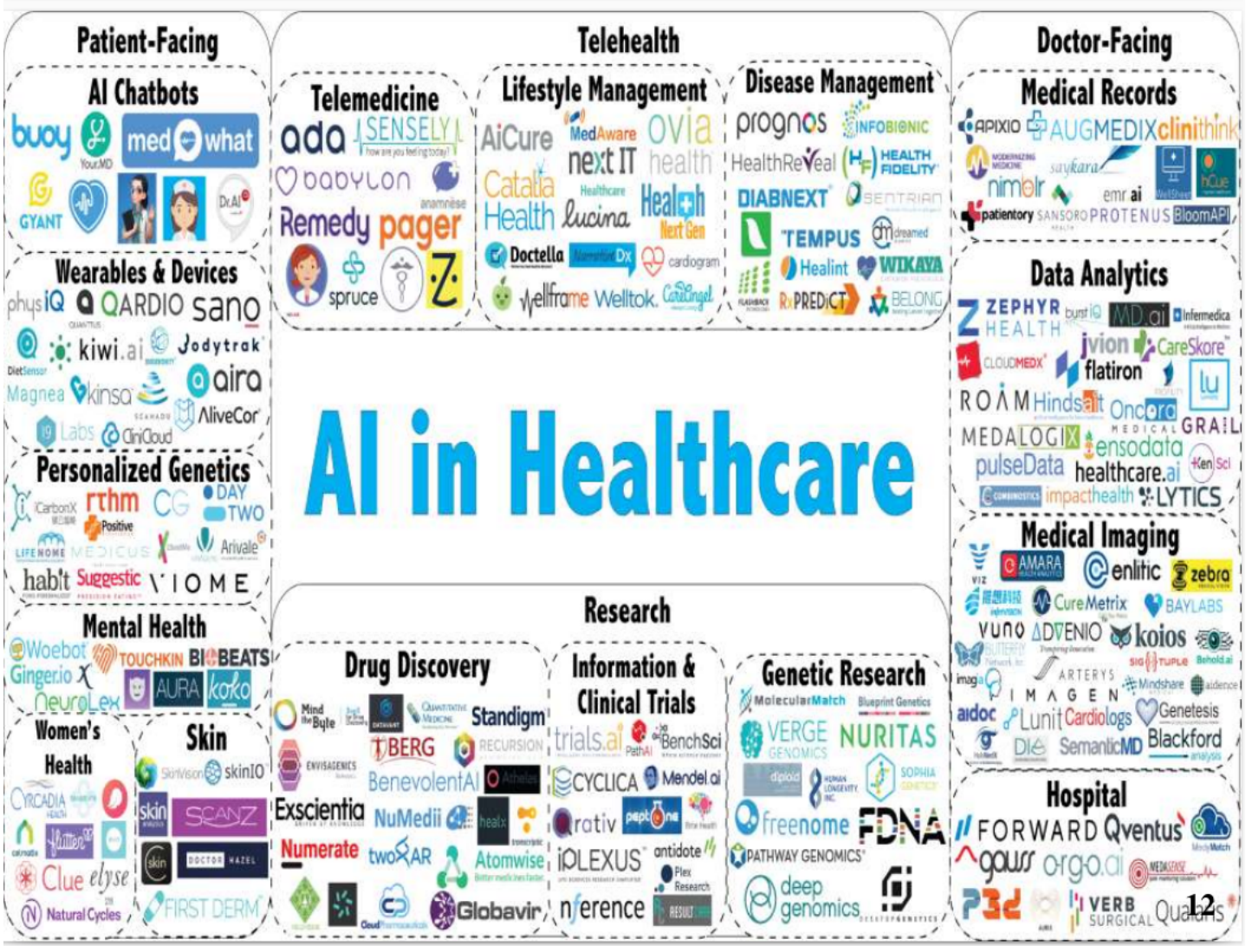
AI : Everyone talks about it

- AI is a broad term that refers to *any technology that enables a machine to perform tasks that would typically require human intelligence*, such as **learning**, **problem-solving**, and **decision-making**.
- AI is present in many different technologies and applications that we use every day, such as smartphones, social media, and personal assistants like Siri and Alexa.
- As a result, AI has become *an integral part of our daily lives*, and it is increasingly being used in a wide range of industries and applications.

Examples of AI in everyday life

- **Smartphone personal assistants**, Siri and Google Assistant.
- **Social media algorithms**, to recommend content and customize user experiences.
- **Virtual assistants**, Amazon's Alexa and Apple's HomePod.
- **Autonomous vehicles**, such as self-driving cars, which use AI to navigate roads and make driving decisions.
- **Fraud detection systems**, which use AI to analyze transactions and identify potential fraudulent activity.
- **Customer service chatbots**, which use natural language processing to provide answers to customer inquiries.
- **Healthcare systems**, which use AI to analyze medical images and assist with diagnosis and treatment planning.
- And many other such as: **Online education platforms**, **Video game AI** or **Recommender Systems**.

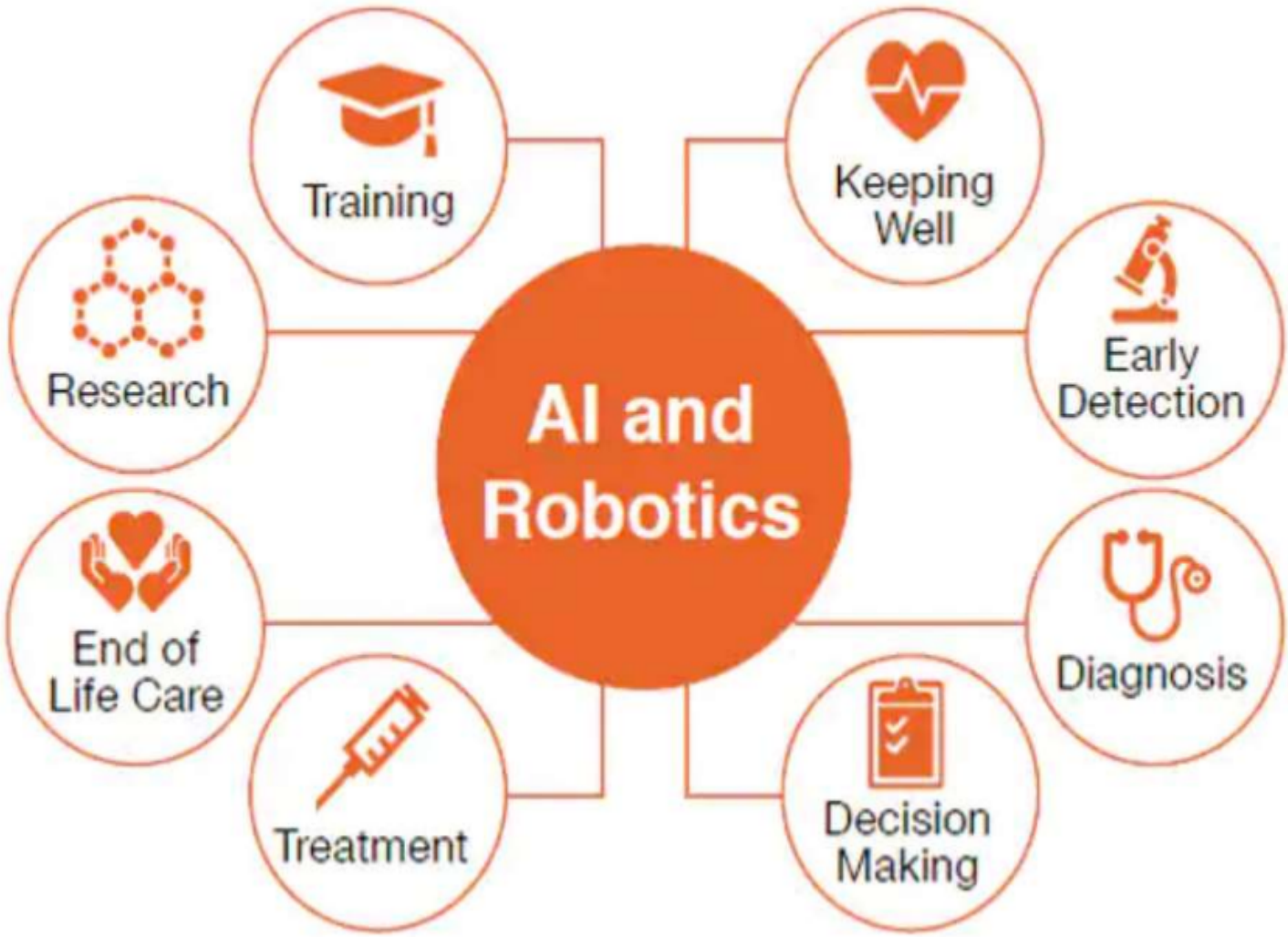
AI in Health care



AI will (mostly) help, not replace

- A common concern is *Will AI replace humans?*
- AI advocates don't think so, instead they talk of *complement*, *enhance*, support...
- This concern also exists in medicine
  - Some AI experts claim that in 3-5 years radiologist will not be necessary anymore.
- Dr. Eric Topol in his book Deep Medicine:
  - Introducing AI in Healthcare is good
  - It lets the machine do the machine work
    - Fill forms, Scan images
  - With more efficiency and new workflows.
  - And the doctor has more time for patients.

AI is not future, it is here now



AI in Health (1): Keeping Well

- AI powered monitoring gadgets, such as bracelets, smart watches and many other have become common.
- Some, such as the Apple Watch allow for continuous heart-rate monitoring and are inteded to detect potential CV incidents.
- Many potential benefits:
  - Motivation for exercise
  - Real time data for detection / prevention
- But not free from problems
  - Lack of standarization and credibility
  - Potential data protection issues when sahring data

AI in Health (2): Early detection

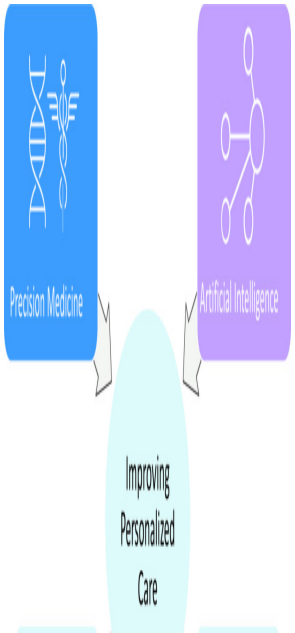
- AI, particularly through image analysis with deep learning, is being used to detect diseases, such as cancer, more accurately in early stages.
- Automatic detection can be faster and highly accurate
- It can reduce false positives and unnecessary biopsies.
- Not free from problems
  - Gender or race biases exist
  - Somee tumours that would never progress arre included causing unnecessary alert

AI in Health (3): Diagnosis

- Machine learning algorithms are being used in many fileds for classification (diagnosis) and prediction (prognosis).
- Some may work like black-boxes (less intuitive than some statistical models),
- Under the appropriate circumstances, enough data, and *correctly used* may be very accurate.
- Typical scenario is analysis of medical imaging data or real time monitoring signals.

Dermatologist-level classification of skin cancer with deep neural networks

AI in Health (5): Treatment design



- AI empowered systems may be used to analyze EHR, Images and reports from a patient's history to help select the correct, individually customized treatment path.
- Data availability, combined with AI tools allows shifting from:
  - *Treatments for populations* where medical decisions are taken based on a few similar physical characteristics among patients, to
  - *Preventive, Personalized, Precision* medicine to provide the specific treatment for a specific patient. Precision Medicine, AI, and the Future of Personalized Health Care

AI in Health ():

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References and Resources

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