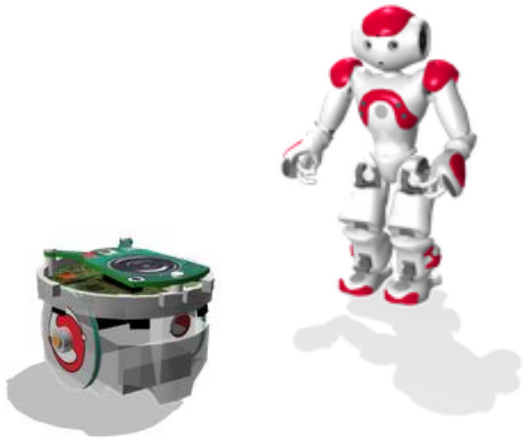
Ostbayerische Technische Hochschule
Amberg-Weiden

Use of AI in medical applications and medical technologies

Russian Bavarian Workshop „Artificial Intelligence and Law“

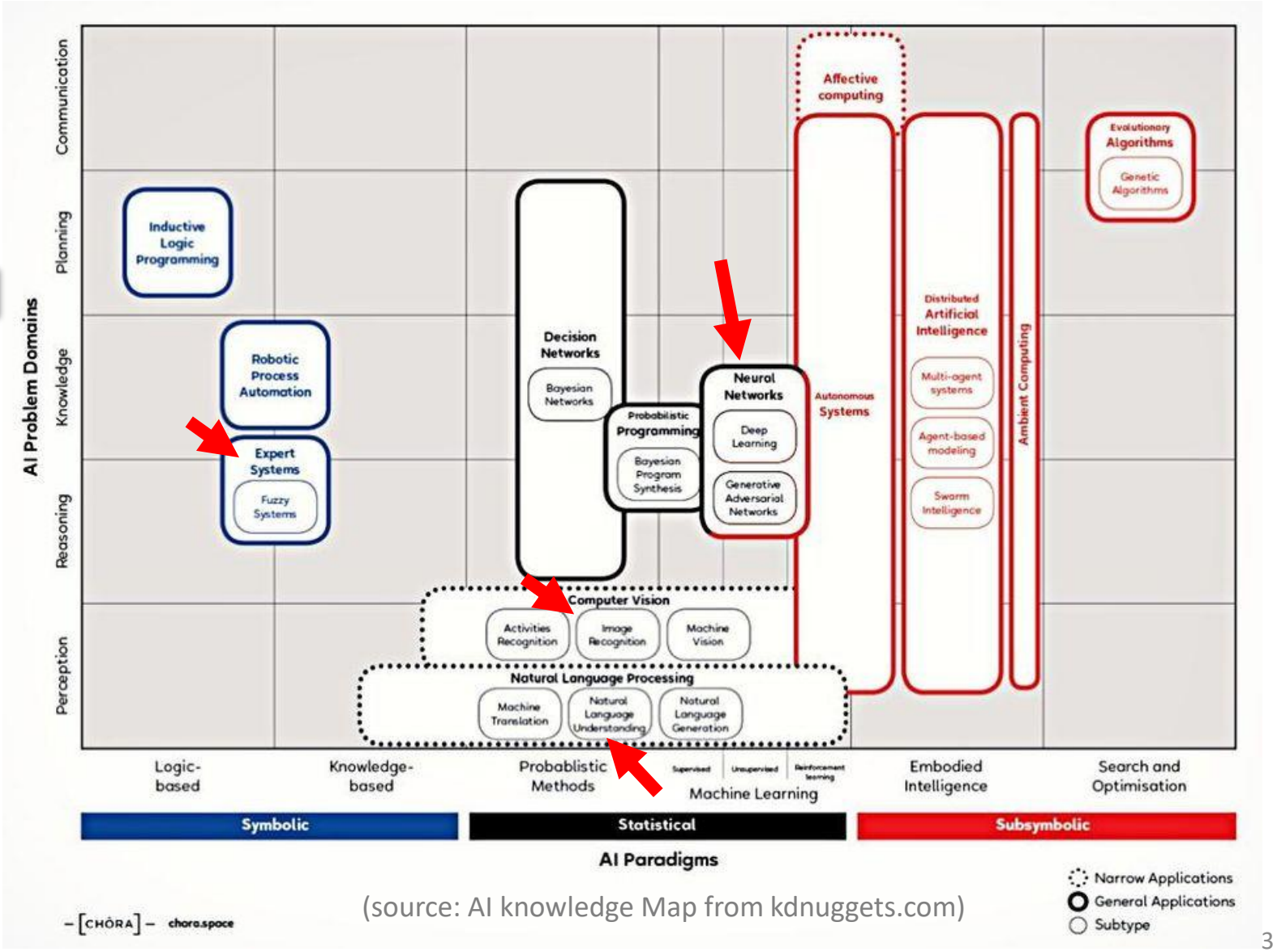
Prof. Dr. Michael Wiehl, OTH Amberg-Weiden



Technology overview

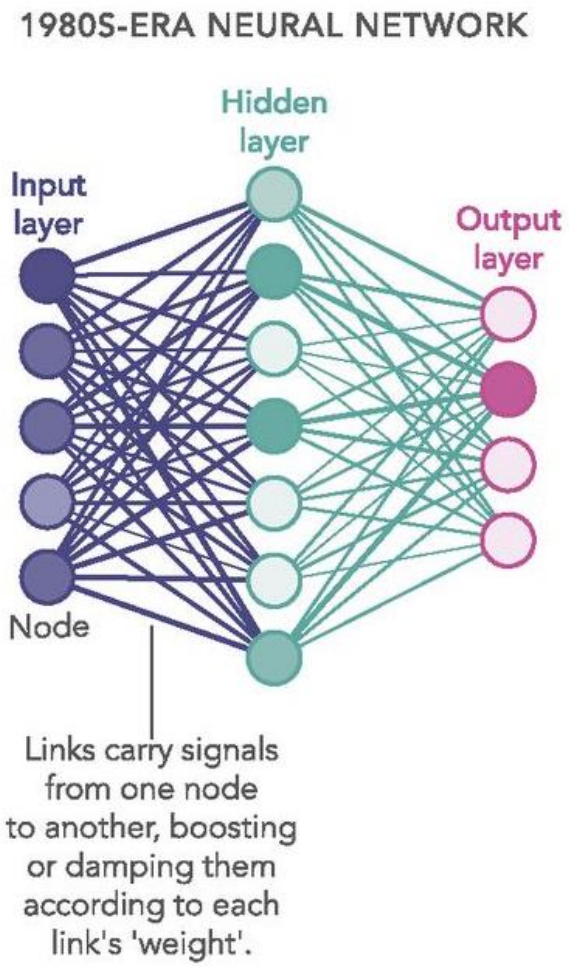
Overview AI technologies by approach

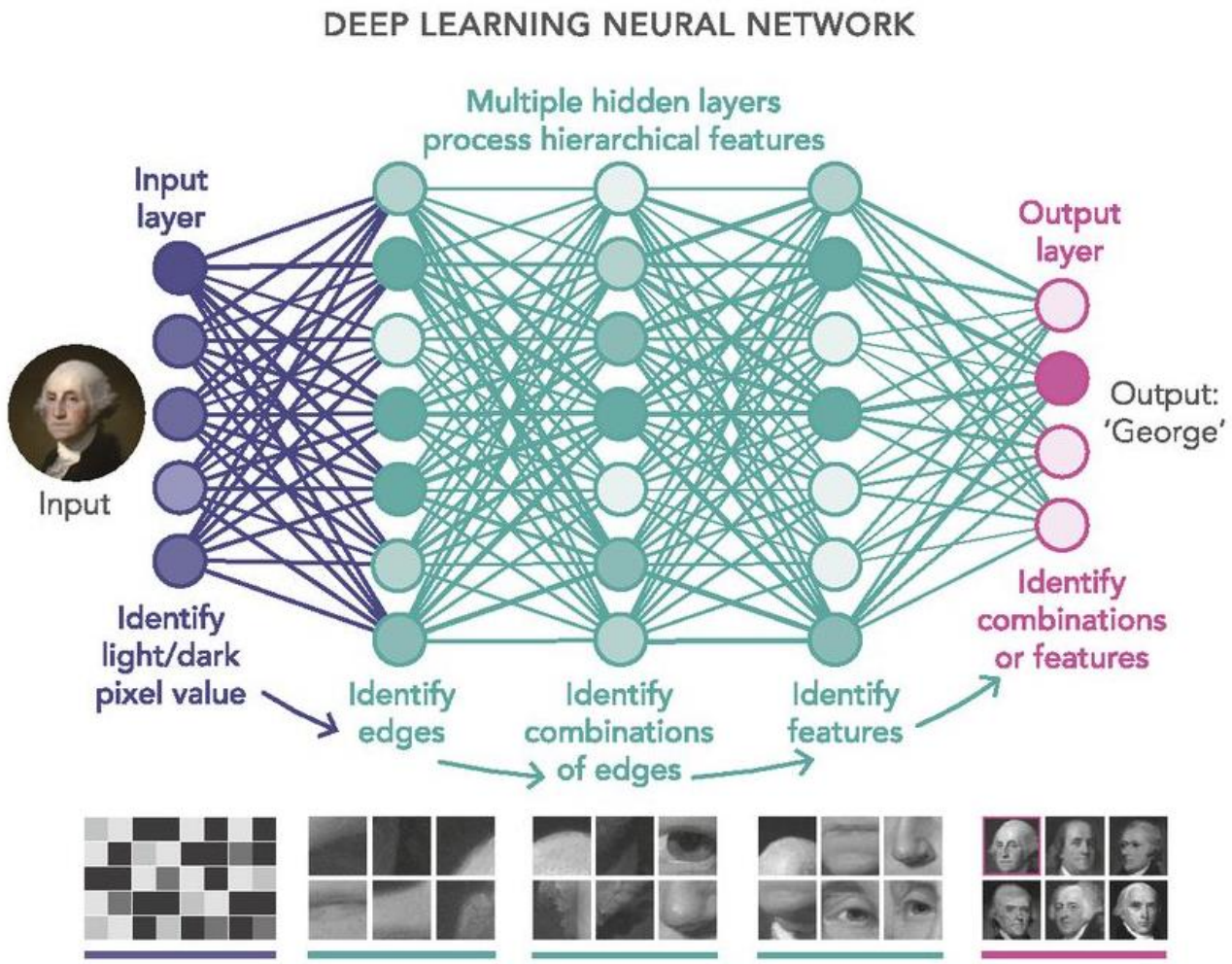
Neural Networks
Expert systems
Image recognition
Natural language Processing (NLP)



(source: AI knowledge Map from kdnuggets.com)

Neural networks and Deep learning





(source: newworldai.com)

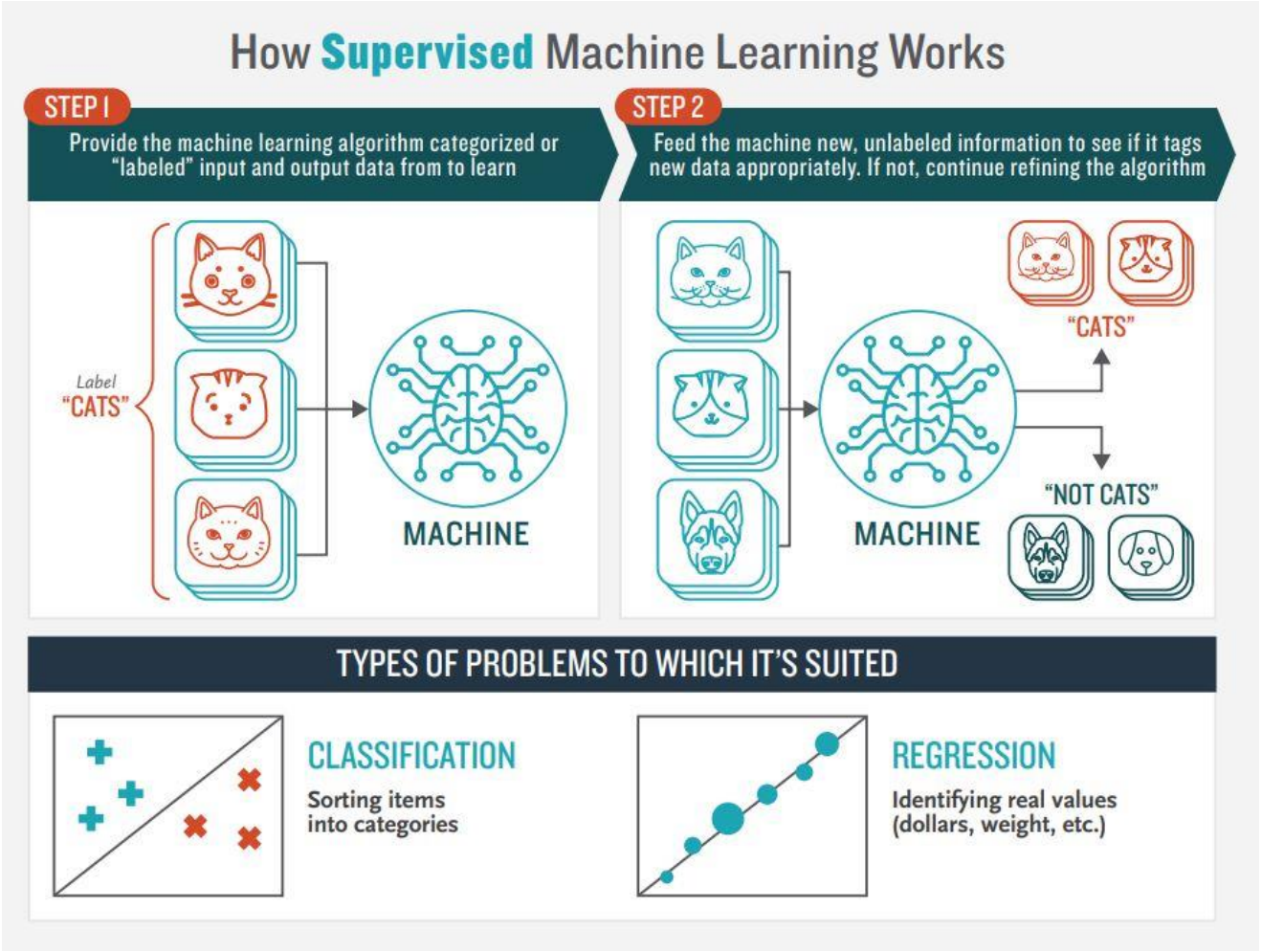
Sub set of machine learning algorithms:

More than one hidden layer ➔ **deep learning**

Neural networks and Deep learning

- Step 1: data (p.ex. images) are labelled and given to algorithm ➔ parameters of algorithm are adapted (called „weights“)
- Step 2: algorithm can classify data by itself

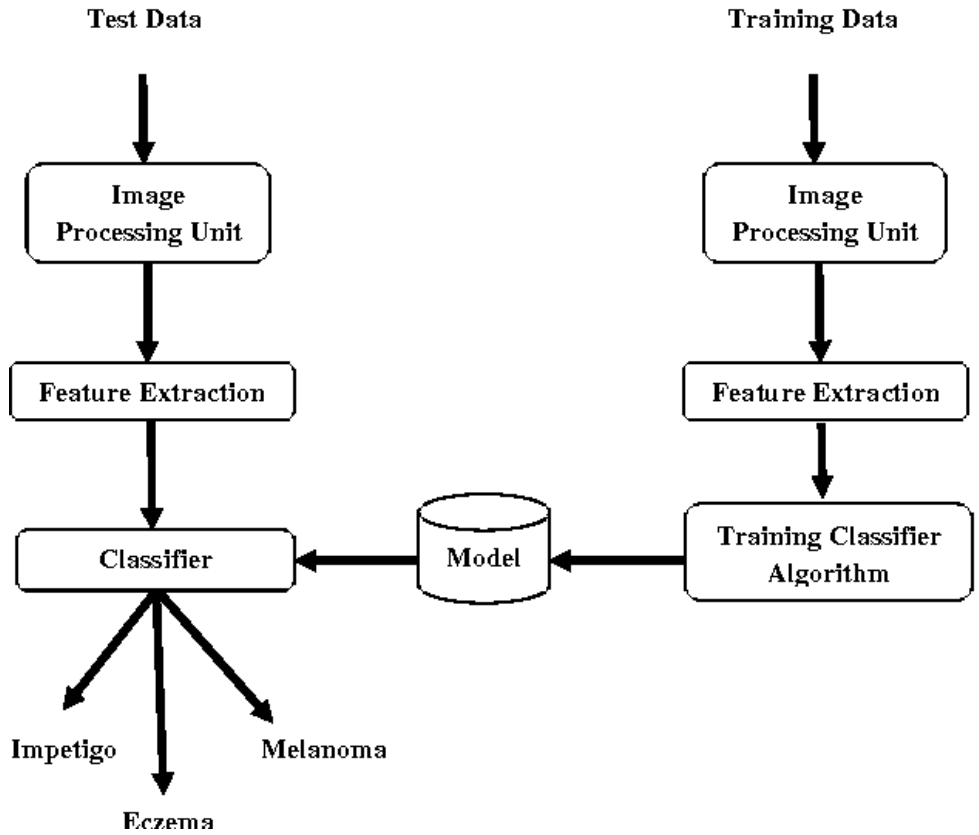
- high accuracy ➔ big data is needed



(source: newtechdojo.com)

Expert System

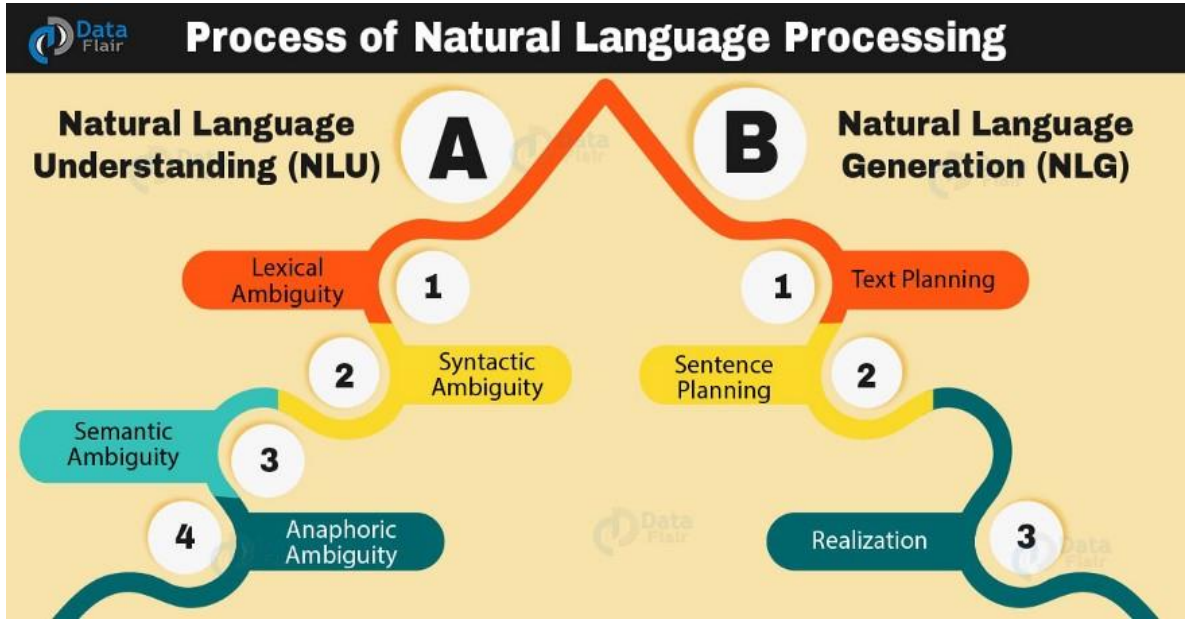
- solve complex problems by reasoning through bodies of knowledge
- expert systems were among the first truly successful forms of artificial intelligence (AI) software
- can be done with decision tree
- **current approaches use machine learning and data mining**



(source: Amarathunga et al.; Expert System for diagnosis of skin disease, Int. Journal of Scientific & Technology Research, 2015)

Natural language processing (NLP)

- enables machines to
  - understand human language
  - generate human language
- can be vocal or written text
- process typically involves machine learning



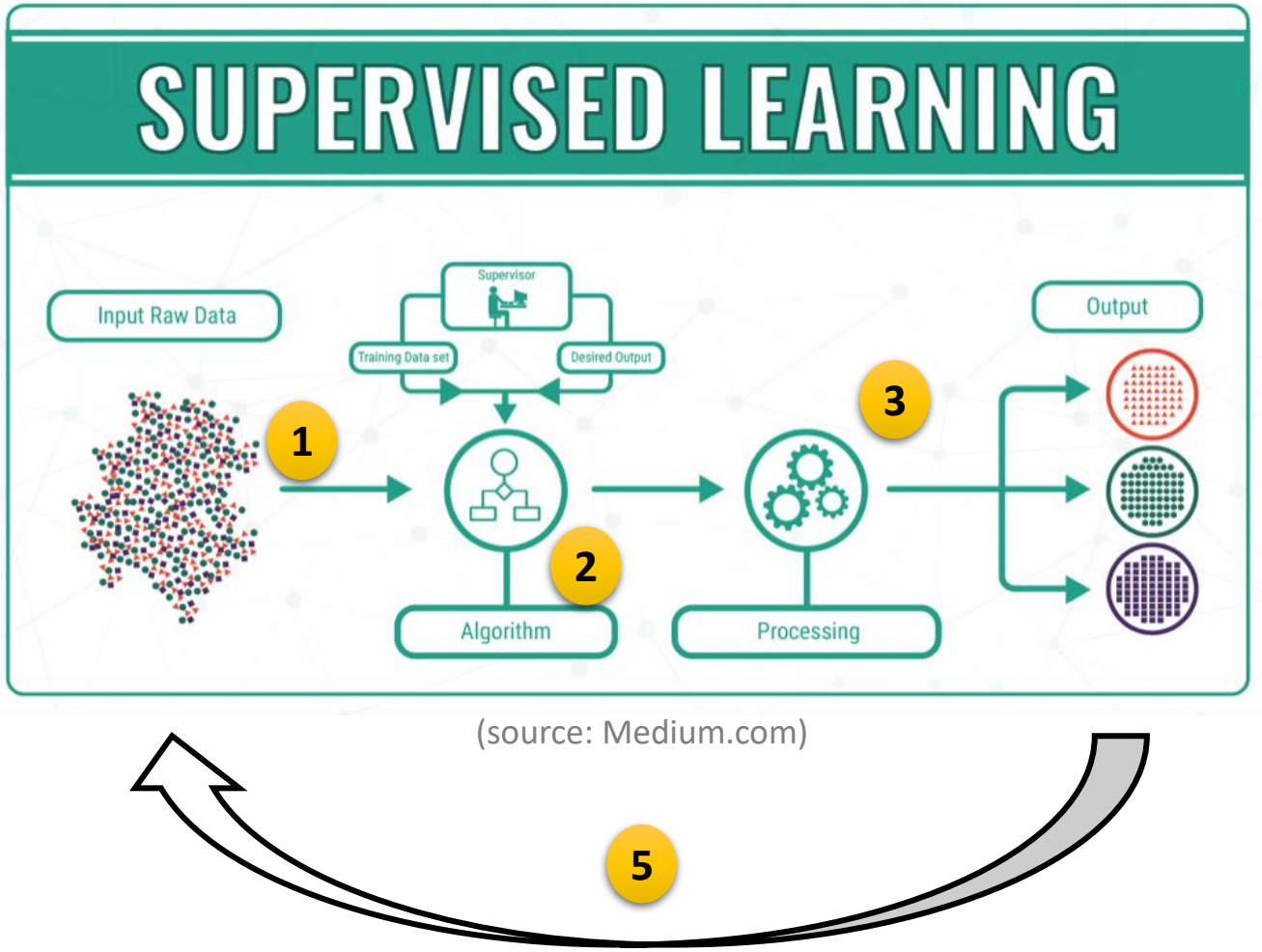
(source: DataFlair Web Services Pvt Ltd)

AI and Big Data

- Knowledge based and statistical AI technologies need a lot of data to be effective, these enable the following:
  - AI can **recognize patterns** - AI can see patterns that humans don't
  - **Detecting anomalies** - AI can analyze artificial intelligence data to detect unusual occurrences in the data.
    For example, having a network of sensors that have a predefined appropriate range. Anything outside of that range is an anomaly.
  - **Probability of future outcome** - Using known condition that has a certain probability of influencing the future outcome, AI can determine the likelihood of that outcome

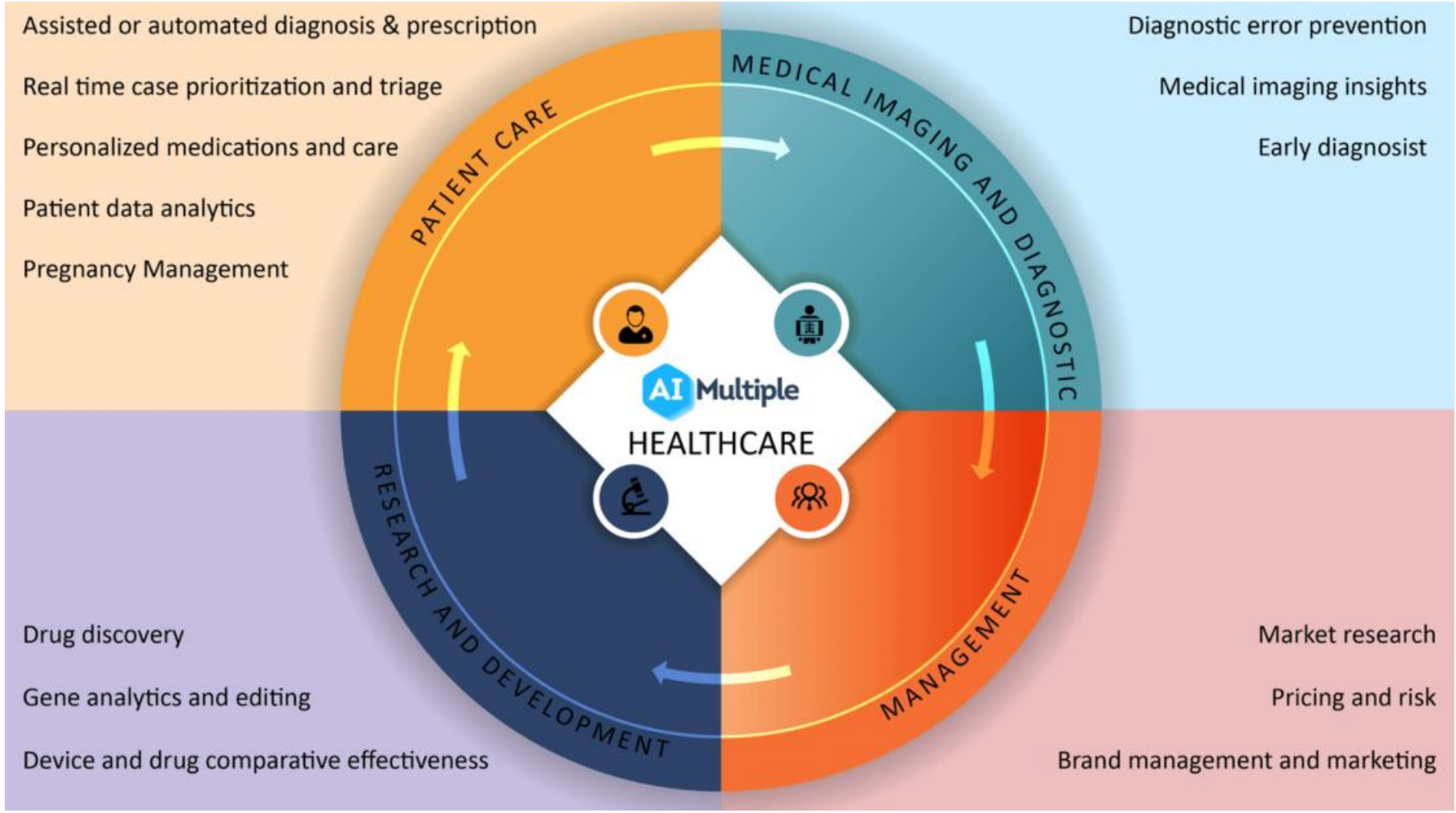
AI and Big data

1. Data is fed to the AI
2. AI becomes smarter because of the data
3. Less human interaction is needed as AI becomes smarter
4. Fewer people are required for AI to run
5. AI feeds new data to itself



(source: Medium.com)

AI applications in Healthcare

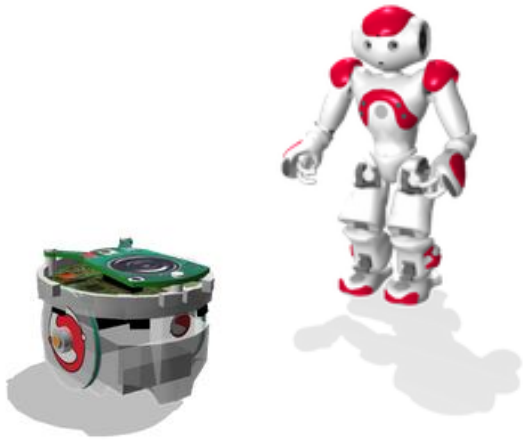


(source: AIMultiple)

Benefits and risks of AI in healthcare

- Improve precision of decisions, reduce errors
- Assist doctors during diagnosis process
- Offer patients immediate help with virtual asisstance
- Improve daily routine processes in clinics and reduce costs

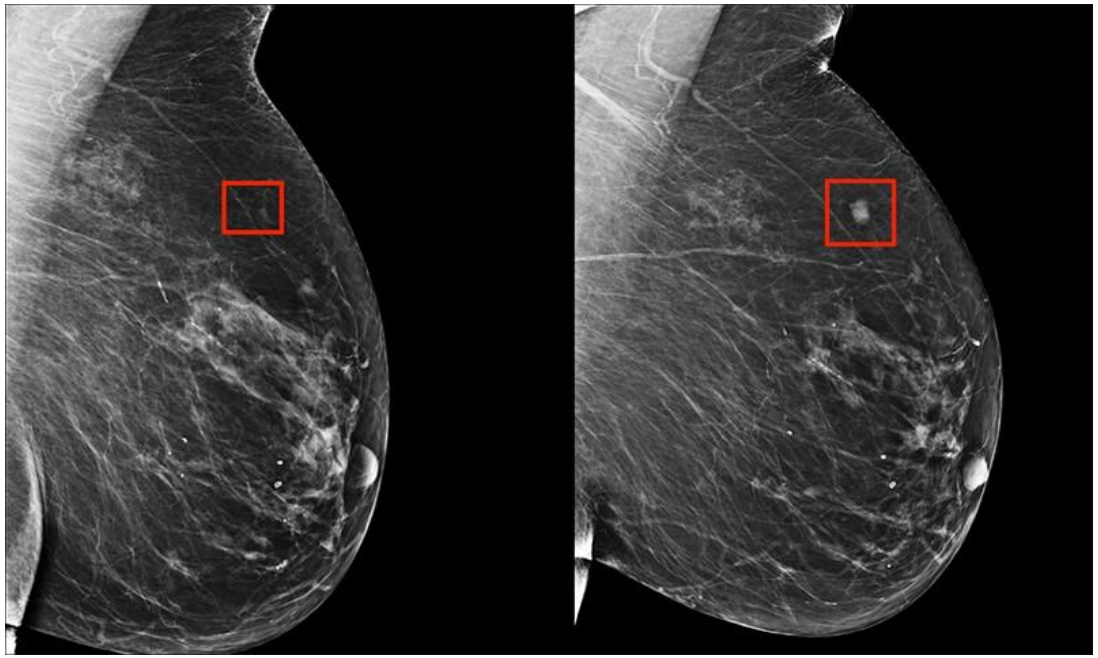
- doctors rely on AI technology
- fewer contact to people ➔ less care quality



Medical applications

Diagnosis assistance: Cancer diagnosis

- multiparametric magnetic resonance imaging (MRI), in which different types of MRI scan
- highly trained radiologists don’t always agree on what they’re seeing in the images
- Example [1]
  - 400 MRI scans were used to feed FocalNet
  - AI found 79,2% cancer lesions, experts found 80,7%

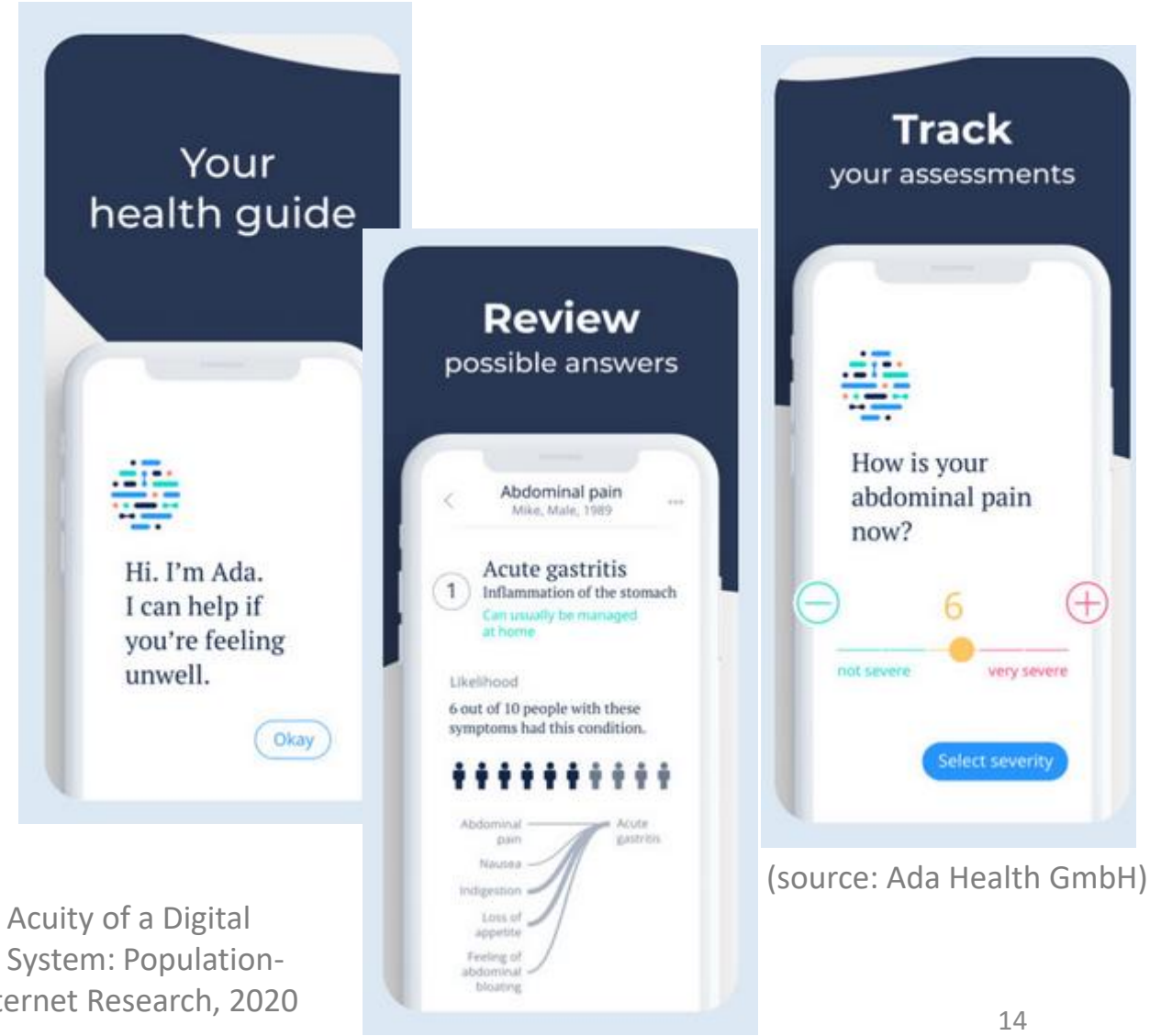


An AI system identified a woman’s potential breast tumour four years (left) before it developed (right) (source: Adam Yala)

[1] Savage, Neil; How AI is improving cancer diagnostics, nature, 2020

Customer Service Chatbots

- Patients can query bot for appointment, bill payments, current **patient illness and symptoms**
- Example:
  - Ada app was developed by > 100 doctors & scientists
  - triage recommendations were comparable to those of nurse-staffed telephone triage lines [1]

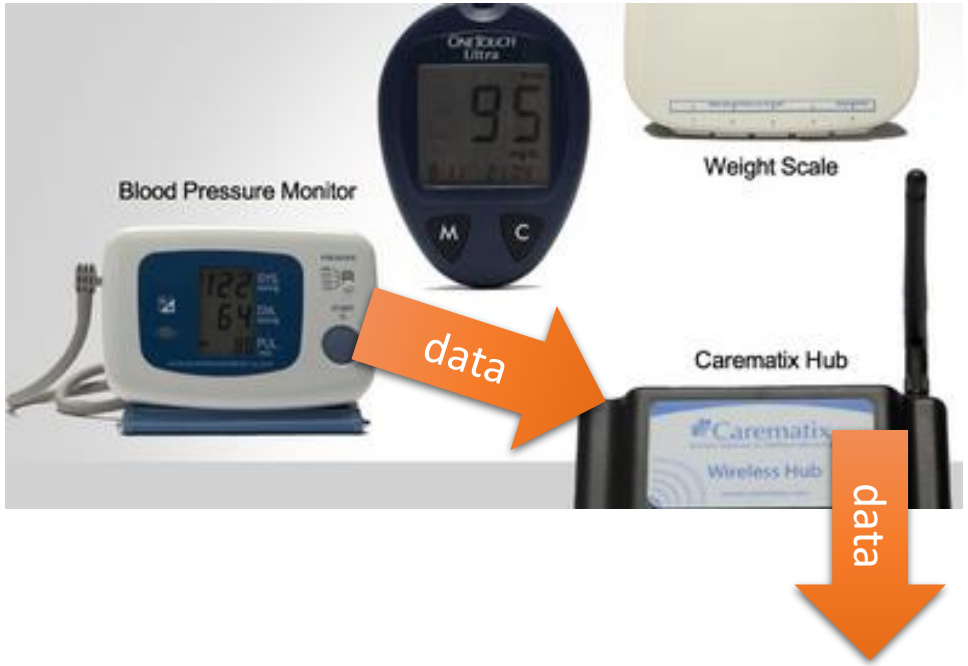


(source: Ada Health GmbH)

[1] Morse et al.; Use Characteristics and Triage Acuity of a Digital Symptom Checker in a Large Integrated Health System: Population-Based Descriptive Study, Journal of Medical Internet Research, 2020

Telemedicine: Remote patient monitoring

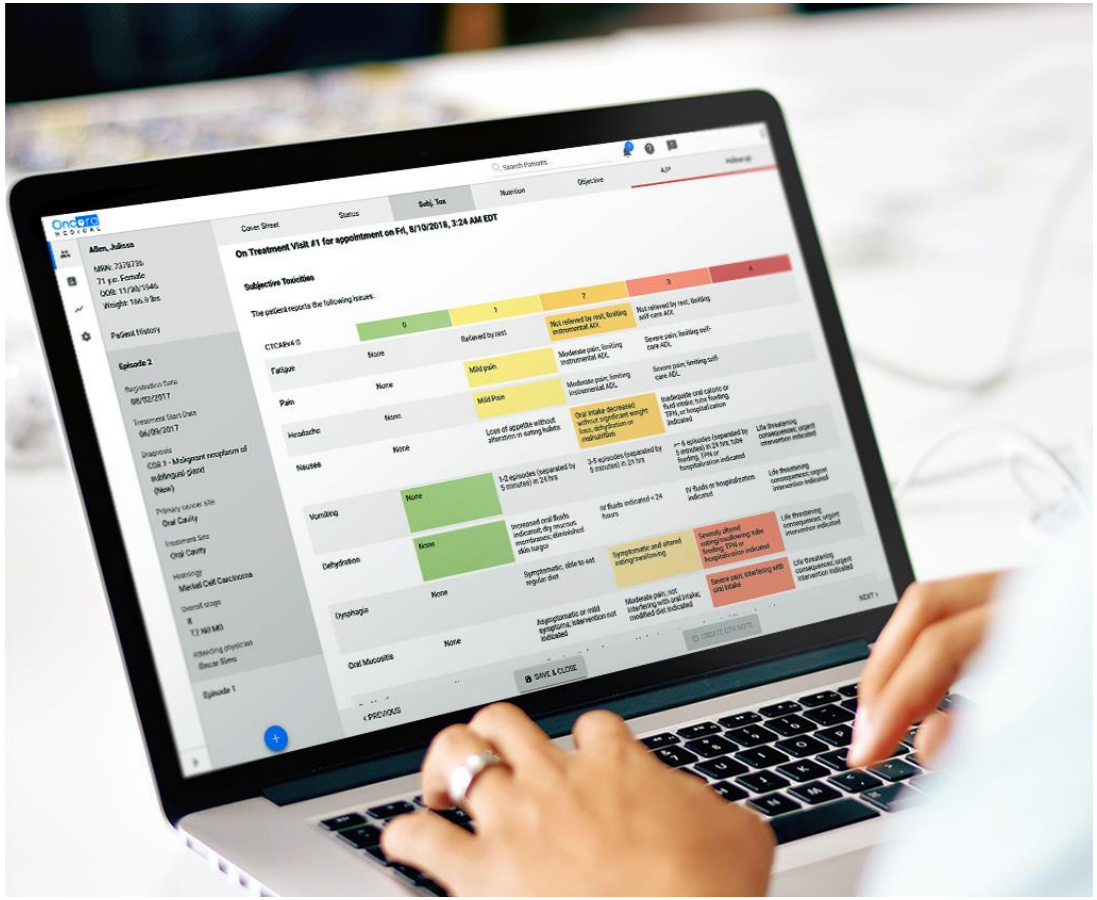
- Enables tele monitoring of patients
- Outlook: Machine Learning can detect anomalies and reported to doctor
- Example: Carematrix
  - supports in >20 clinical trials
  - offers dashboard to supervisors
  - patients can be warned automatically



(source: Philips / Carematrix)

Therapy optimization

- personalized treatment improves success rate
- software can structure, analyze and learn from the data
- Example: Oncora Patient Care
  - adaptive data capture technology collects the most important oncology data elements for each patient
  - Software can predict mortality for different treatment methods



(source: Oncora Medical)

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