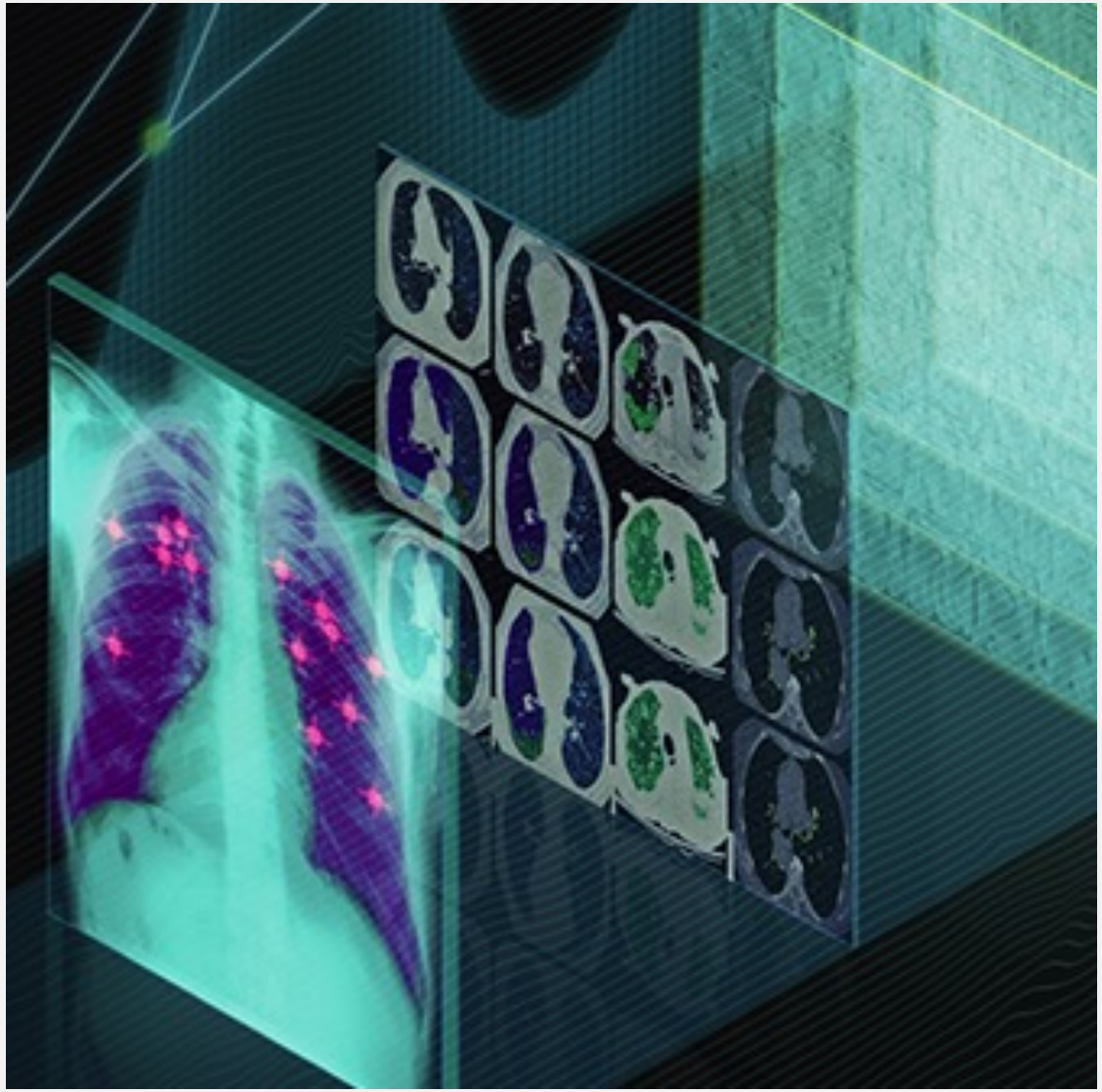
UNIVERSITÄT BIELEFELD
Faculty of Technology

Modern Data Science Technologies in Healthcare

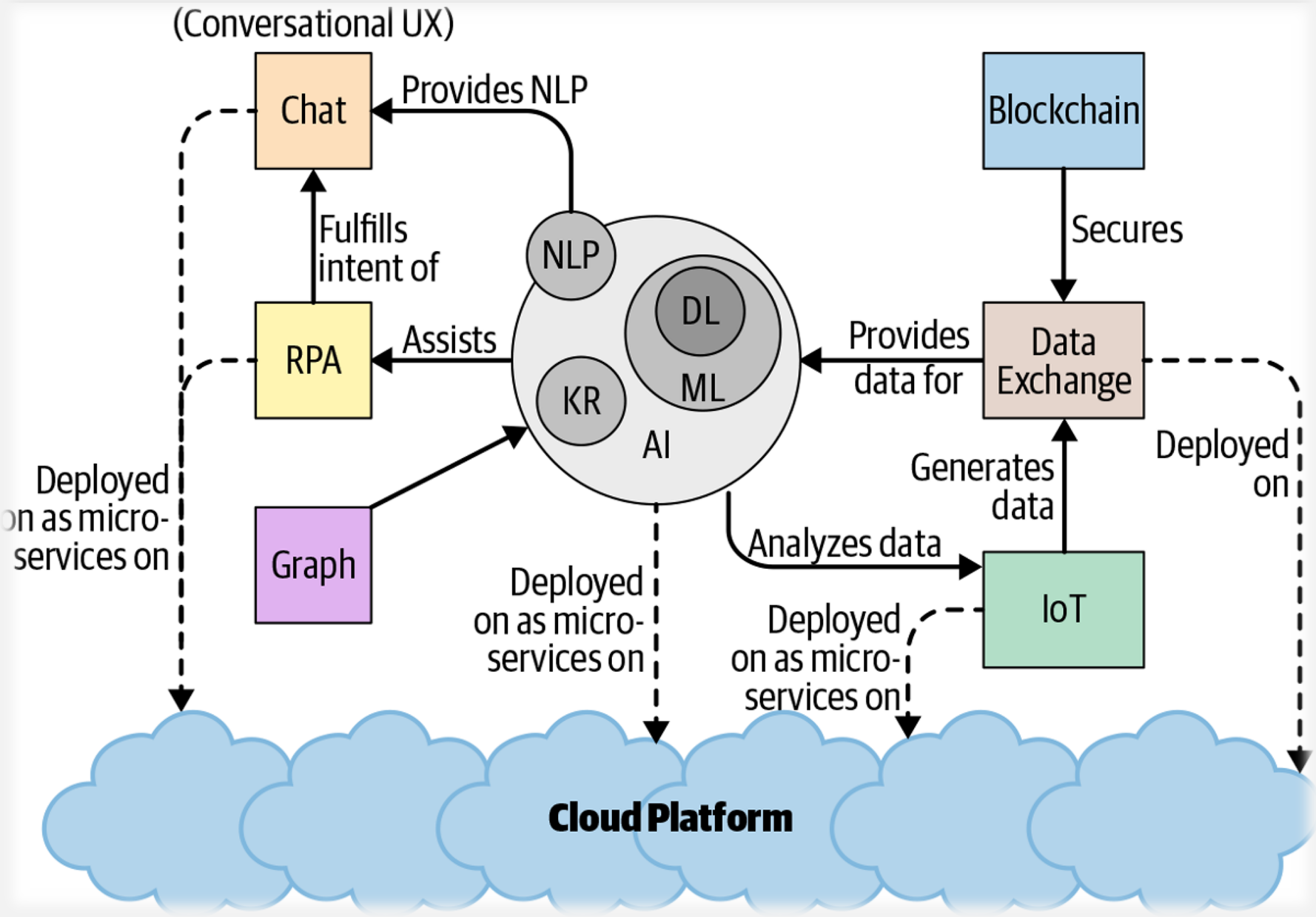


Prof. Dr. Alexander Schönhuth
M.Sc. Maren Knop
Genome Data Science

Introduction

Healthcare sector:

- Complex ecosystem
- Fragmented healthcare data stored in diverse sources and formats
- Complex healthcare and privacy regulations
- New technologies intruder on caregiving
- Reluctance of clinicians and providers to trust new technologies


(Conversational UX)
Chat
Provides NLP
Blockchain
Fulfills intent of
Secures
NLP
DL
ML
KR
AI
RPA
Assists
Provides data for
Data Exchange
Deployed on as micro-services on
Graph
Generates data
Deployed on
Analyzes data
Deployed on as micro-services on
Deployed on as micro-services on
IoT
Cloud Platform

Organizational Matters

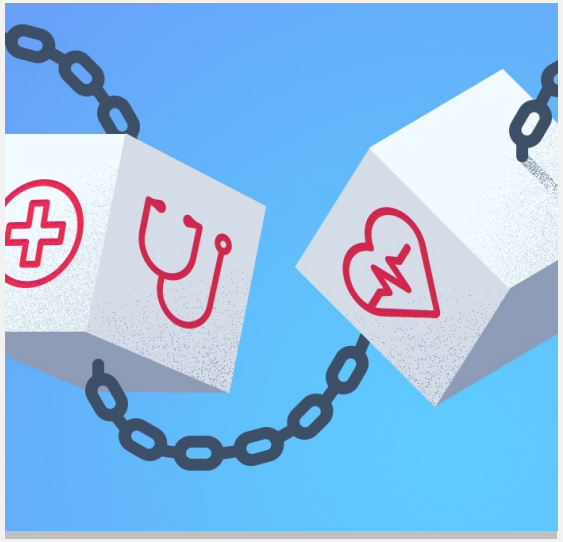
- Groups of two people
- Presentation of one key technology
- Present a paper
  - https://pubmed.ncbi.nlm.nih.gov
  - https://www.biorxiv.org
  - …
- Choose a date until Dec. for your presentation (latest: Feb. 4, 2022)
- Upload slides until Feb. 25, 2022

Presentations:

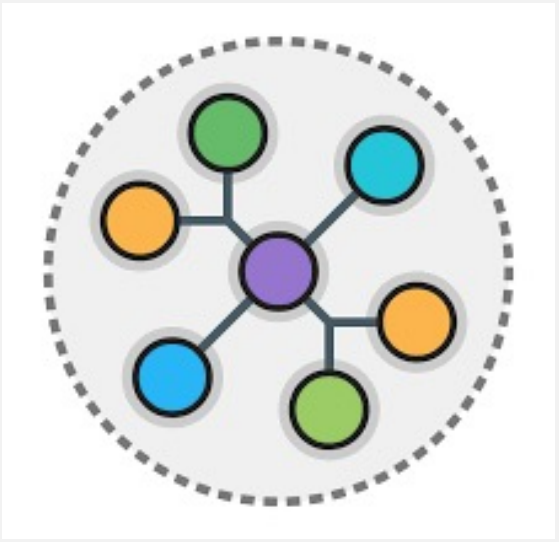
- 40 minutes + discussion
- **Explain technology**
- Example of technology in Healthcare (Use Case)
- Drawbacks and future perspectives

Technologies

- Genomics



- Blockchain



- Graph Databases

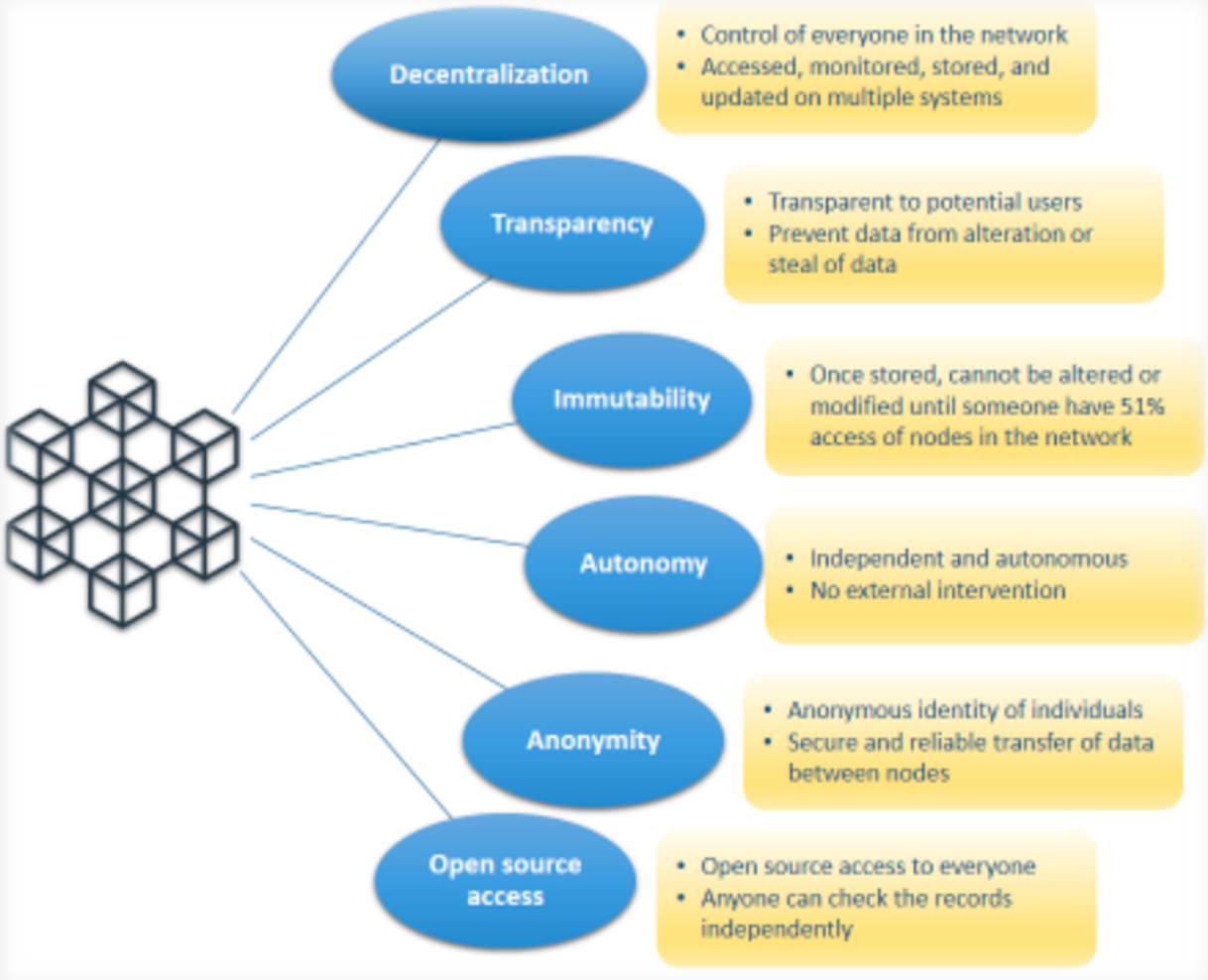
- Graph Neural Networks

Genomics

- First sequenced human genome:
  - $3 billion
  - 13 years
- Today:
  - costs in range of $1,000
  - Hours
- Precision and personalized medicine
- Comprehensive view of patients
- Predict disease, monitor health

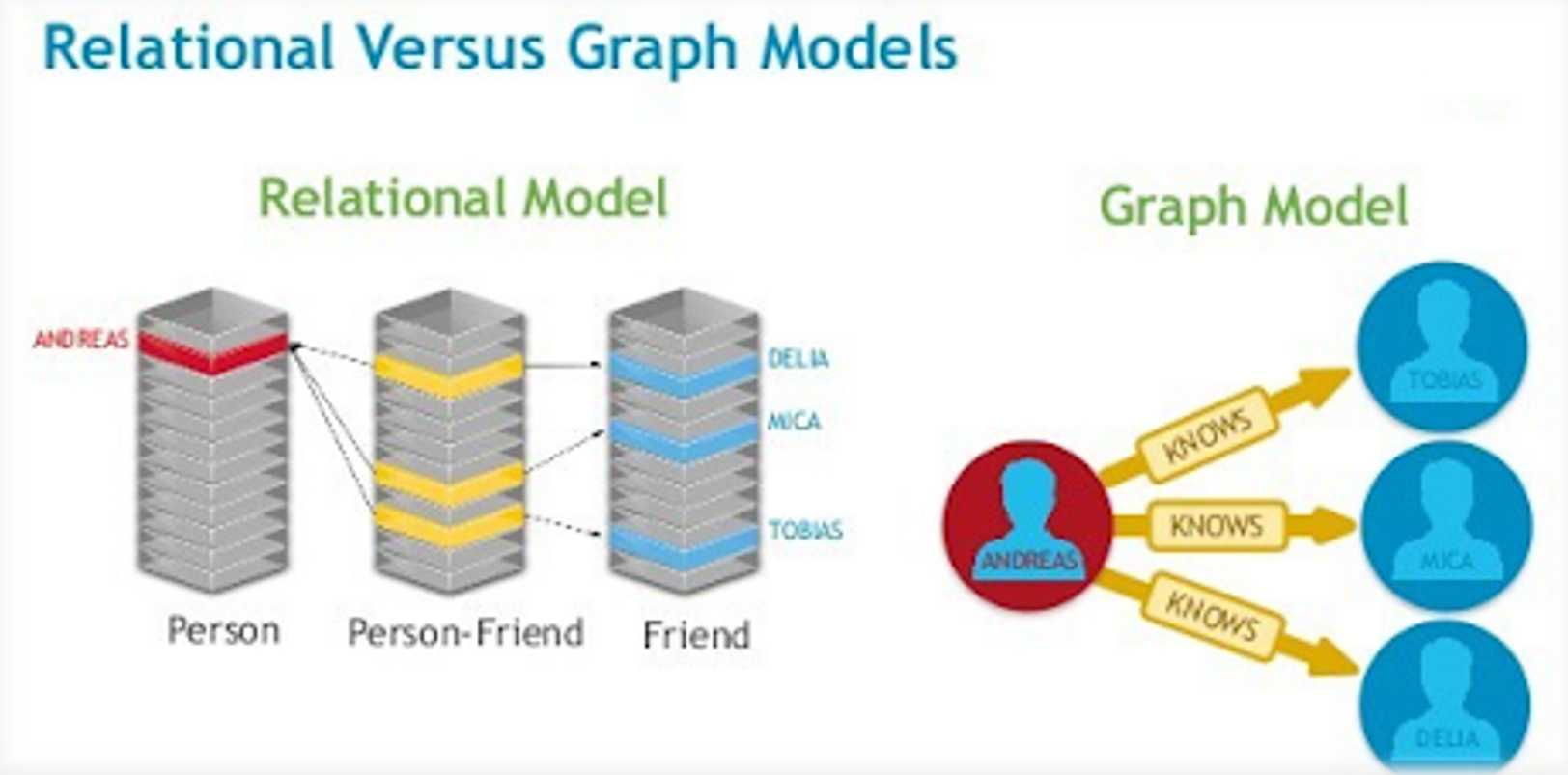
Blockchain

- Dedicated to the exchange of a new virtual currency called Bitcoin
- Ledger on which transactions are chronologically recorded in a cooperative and tamper resistant manner
- Rising complexity of data
- Clean, safe and secure data sharing

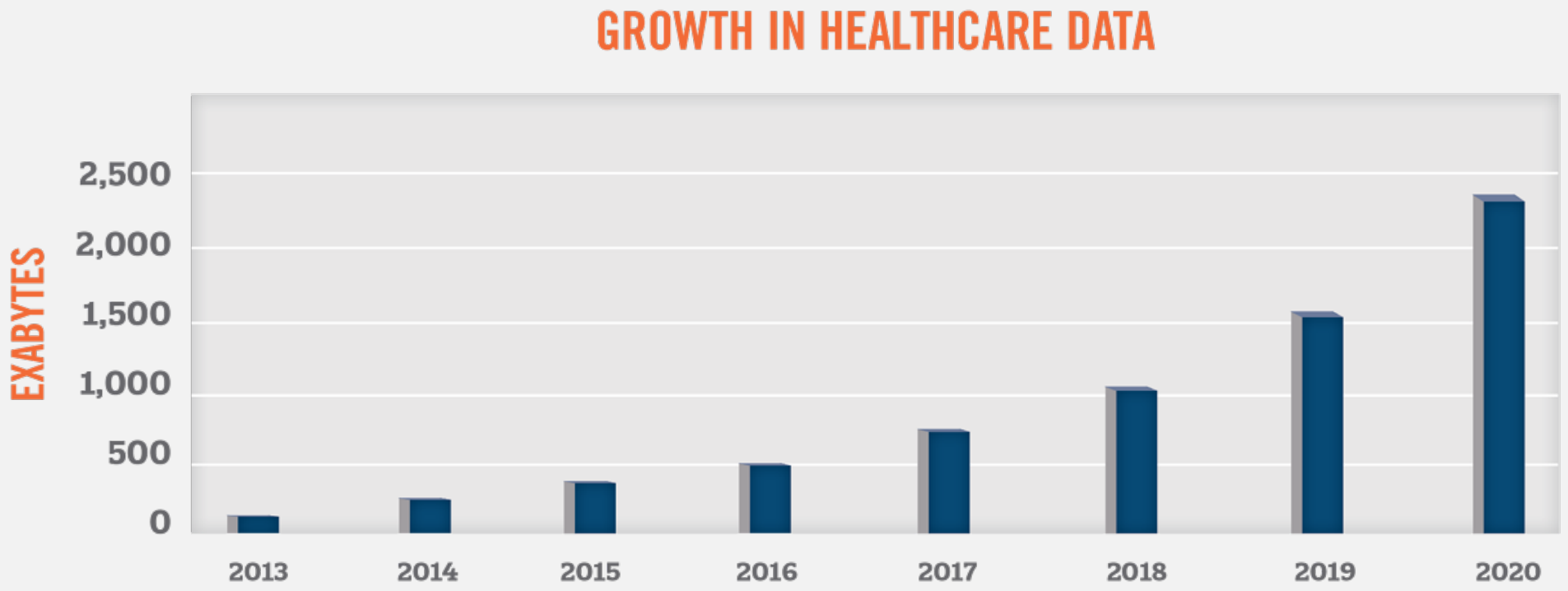


Graph Databases

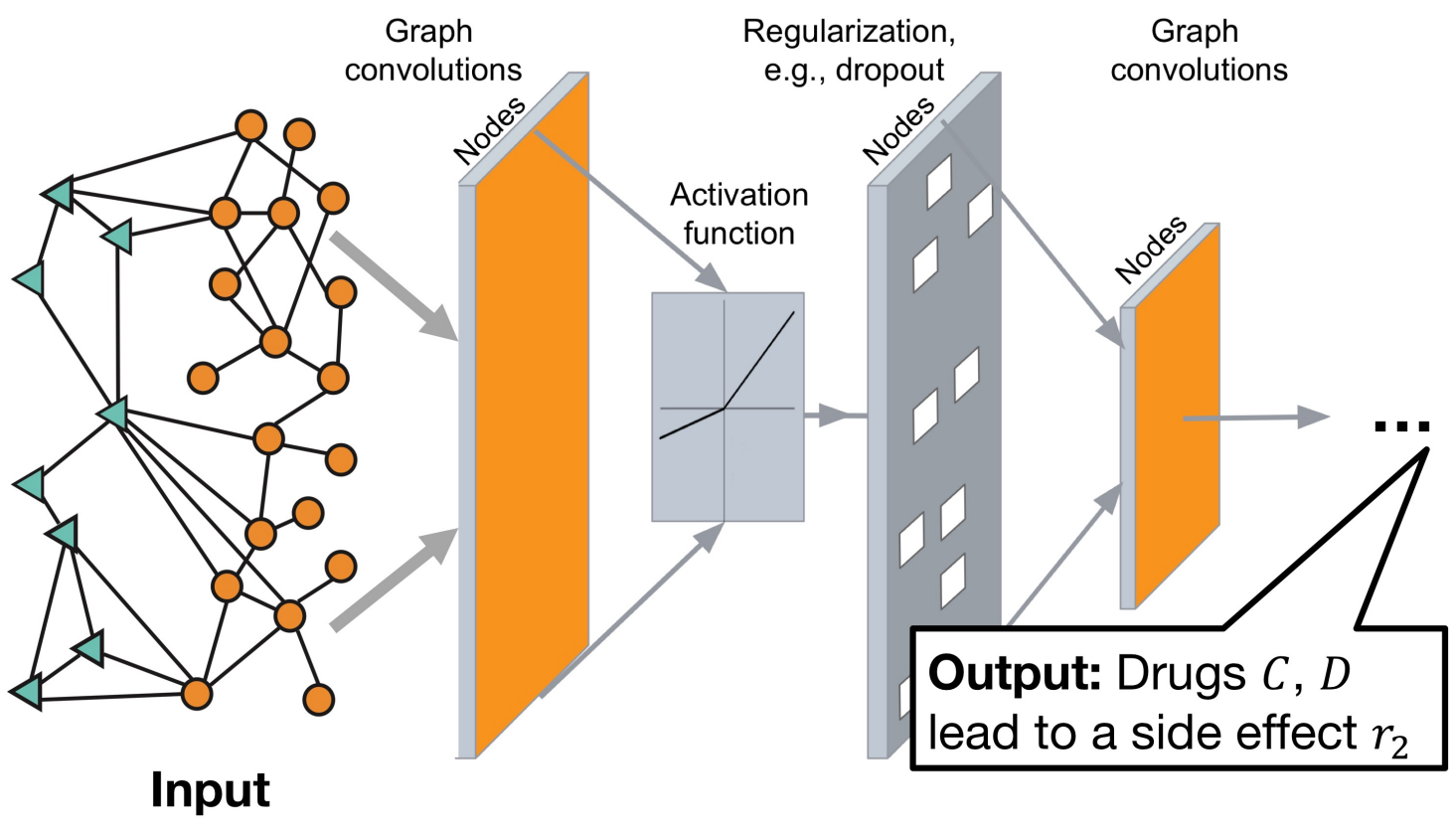
- Healthcare data is complex:
  - many relationships
  - high variability
- Rapid flexible changes to the organization of the data



Artificial Intelligence



Graph Neural Networks



Paper

- **Blockchain**
  - Realizing the potential of blockchain technologies in genomics (2018)
  - Blockchain distributed ledger technologies for biomedical and health care applications (2017)
- **Graph Databases**
  - Use of Graph Database for the Integration of Heterogeneous Biological Data (2017)
  - Learning a Health Knowledge Graph from Electronic Medical Records (2017)
- **Graph Neural Networks**
  - Drug-disease Graph: Predicting Adverse Drug Reaction Signals via Graph Neural Network with Clinical Data (2020)
  - Heterogeneous Similarity Graph Neural Network on Electronic Health Records (2021)

Contact

Lernraum+: https://lernraumplus.uni-bielefeld.de/course/view.php?id=11547

Wiki: https://gds.techfak.uni-bielefeld.de/teaching/2021winter/health

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Further Literature

- State of Healthcare Technology, Kerrie L. Holley, Mike Jacobs, … (2020)
- Bitcoin and Cryptocurrency Technologies, rvind Narayanan, Joseph Bonneau, … (2016)

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Thank You
For Your Attention.