Medical Imaging as a Case Study of the Use of Metadata in Health Research Data Management

Jos Lehmann[1,2] // Philipp Schader[2] // Lucas Kulla[1,2] // Klaus Maier-Hein[1,2] // Marco Nolden[1,2]

[1] Hub Health
Helmholtz Metadata Collaboration //
[2] Division of Medical Image Computing
German Cancer Research Center
(Deutsches Krebsforschungszentrum, DKFZ)

Background

- Metadata-enabled functionalities identified in HMC [1., 2.]

  Multi-, Inter-, Trans-disciplinary Indexing and Retrieval

  Versioning

  Provenance tracking

  Data Contextualization

  Workflow Reproduction

  Compliance Assessment

  Publication

  Machine Learning Trainability and Explainability [a.]

- Metadata characterization [5.]

  Intrinsic Metadata

  e.g. Column Properties, Cardinalities, Patterns, Correlations, Data Rules. Semantics etc.

  Extrinsic Metadata

  e.g. Provenance, Privileges, Location, Completeness, etc.

- References & Literature

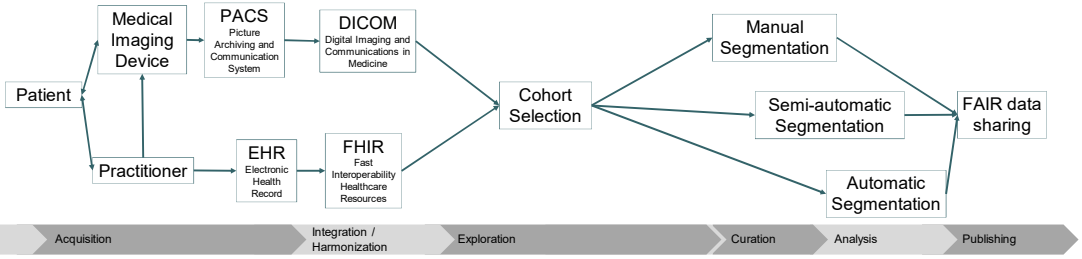
1. HMC Cross-cutting topic 1 - Mapping, "HMC Community Survey 2021" 2022.
2. HMC Cross-cutting topic 3 - FAIR concepts and implementation, "An interpretation of the FAIR principles to guide implementations in the HMC digital ecosystem" 2022.
3. M. Ligero et al. "A CT-based Radiomics Signature Is Associated with Response to Immune Checkpoint Inhibitors in Advanced Solid Tumors", Radiology 2021; 00:1–11
4. J. Scherer et al. "Joint Imaging Platform for Federated Clinical Data Analytics ", JCO Clin Cancer Inform 2020 Nov;4:1027-1038.
5. F. Schomm-von Auenmüller, "Profiling Data and Beyond: Gaining Insights from Metadata," 05 2018. (Doctoral Dissertation) https://d-nb.info/1213805287/34

a. A. Flynn, C. et al. "The Knowledge Object Reference Ontology (KORO): A formalism to support management and sharing of computable biomedical knowledge for learning health systems" *Eur Radiol Exp*, vol. 6, no. 29, 2022
b. H. Kondylakis, E. Ciarrocchi, L. Cerda-Alberich, I. Chouvarda, L. A. Fromont, J. M. Garcia-Aznar, V. Kalokyri, A. Kosvyra, D. Walker, G. Yang and E. Neri, "Position of the AI for Health Imaging (AI4HI) network on metadata models for imaging biobanks," *Learning Health System*, vol. 2, no. 2, 2018

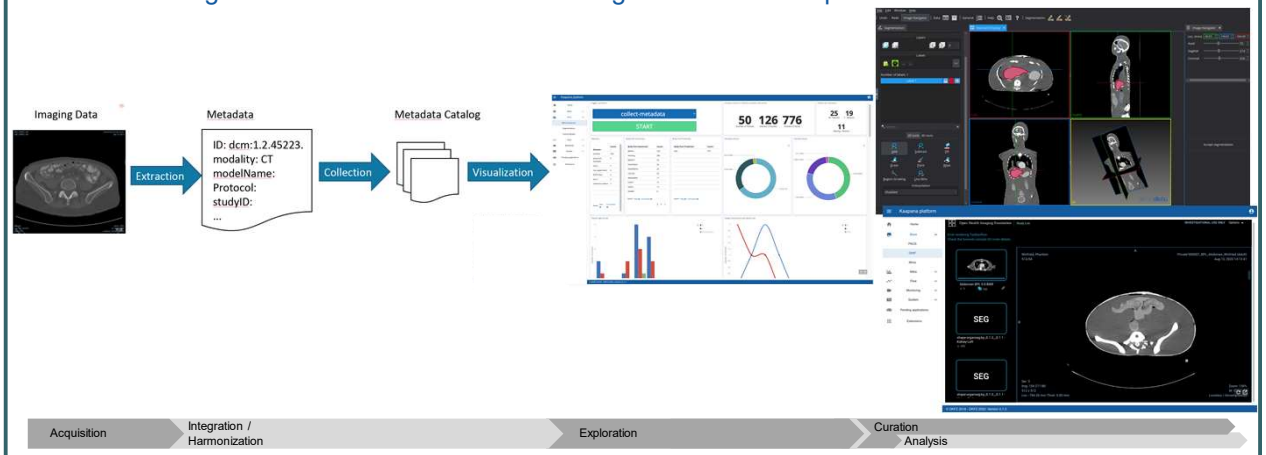
Framework for metadata use cases in health data analysis

- Data and Metadata Workflow [b.]

- Example: segmentation workflow

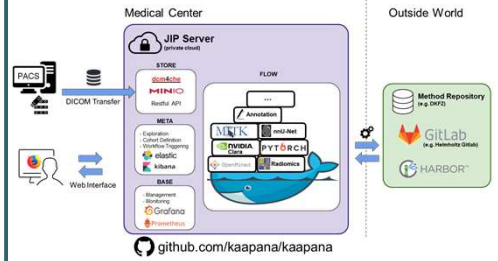


- Benchmarking the use of health metadata for segmentation in Kaapana [4.]

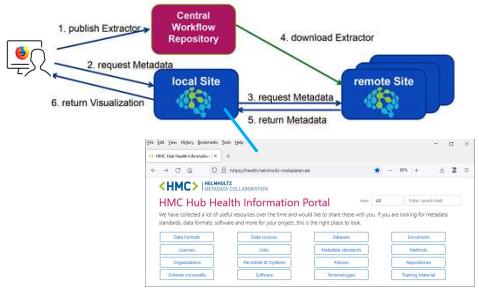


Application in Projects

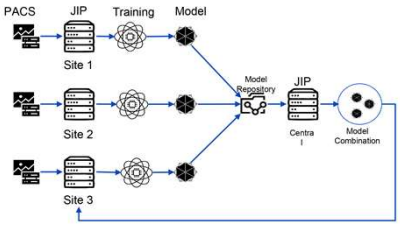
- Architectural base: Kaapana [4.]



- Remote Metadata Extraction
  (e.g. via Hub Health Information Portal and/or BioPortal)



- Federated Learning [3.]



https://helmholtz-metadaten.de/en/health/overview
https://helmholtz-metadaten.de/en/health/hub-health-contact
hmc-health@dkfz-heidelberg.de