

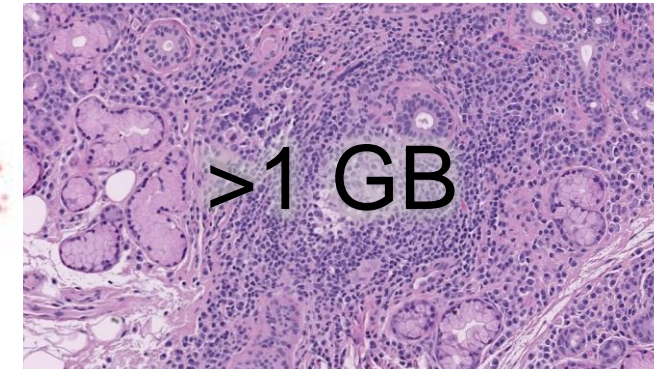
Central repository of digital pathology slides to support the development of artificial intelligence tools

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14.06.2019 • IMI webinar

Digital Revolution in Pathology



Minor Salivary gland
Mild inflammatory infiltrate
Acinar atrophy
Suggestive of Sjögren's syndrome
FOCUS score = 4



Automated Gleason grading of prostate cancer tissue microarrays via deep learning

Erni Arvand^{1,2*}, Kim S. Fricker^{1,2}, Michael Monet¹, Niels J. Rupp², Thomas Hermann², Christian Fankhauser², Norbert Wey², Peter J. Wild^{2,3}, Jan H. Rueschhoff² & Manfred Claassen^{1,2*}

Classification and mutation prediction from non-small cell lung cancer histopathology images using deep learning

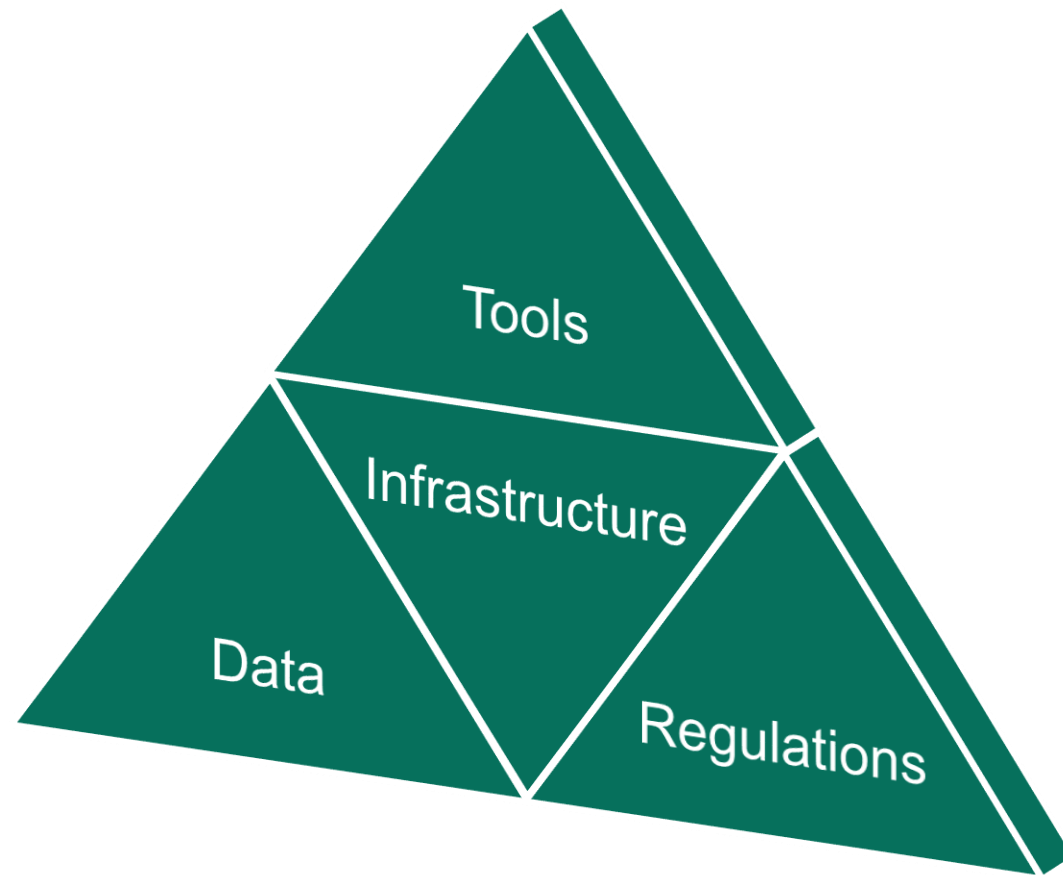
Nicolas Coudray, Paolo Santiago Ocampo, Theodore Sifopoulos, Kayvan Mafarji, Mehdi Snuderl, David Peryé, André L. Moreira, Sargis Razafimanantsoa & Aristotelis Tsirigos

Deep learning can predict microsatellite instability directly from histology in gastrointestinal cancer

Jakob Nikolas Kather¹, Alexander T. Pearson, Niels Halama, Dirk Jäger, Johannes Krause, Sven H. Lossen, Alexander Marx, Peter Baur, Frank Tacke, Ulf Peter Neumann, Heiko I. Grabsch, Takaki Yoshikawa, Hermann Brenner, Jenny Chang-Claude, Michael Hoffmeister, Christian Traubwein & Tom Luedde

Nature Medicine (2018) | Download Citation &

Objectives of the full project



Infrastructure

Data Centre



Annotations/Meta data



Honest Broker



Format



- Aperio (.svs, .tif)
- Hamamatsu (.vms, .vmu, .nd)
- Leica (.scn)
- MIBAX (.mibax)
- Phillips (.tiff)
- Sakura (.svslide)
- Trestle (.tif)
- Ventana (.bif, .tif)
- Generic tiled TIFF (.tif)

BIO-FORMATS

Portal



Data

Preclinical

- Toxicology
- Models

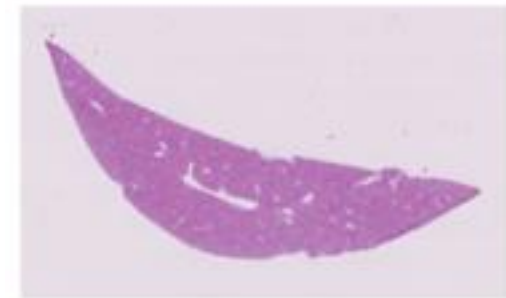
2 Mio Slides



Clinical

- Trials
- Series
- Archives

1 Mio Slides



Data

Tools

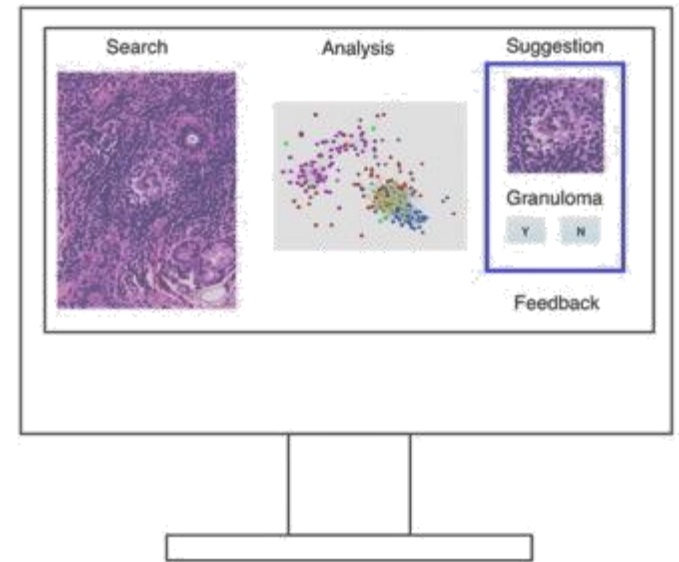


Access

Visualisation



Augmented intelligence



Regulations



Submission



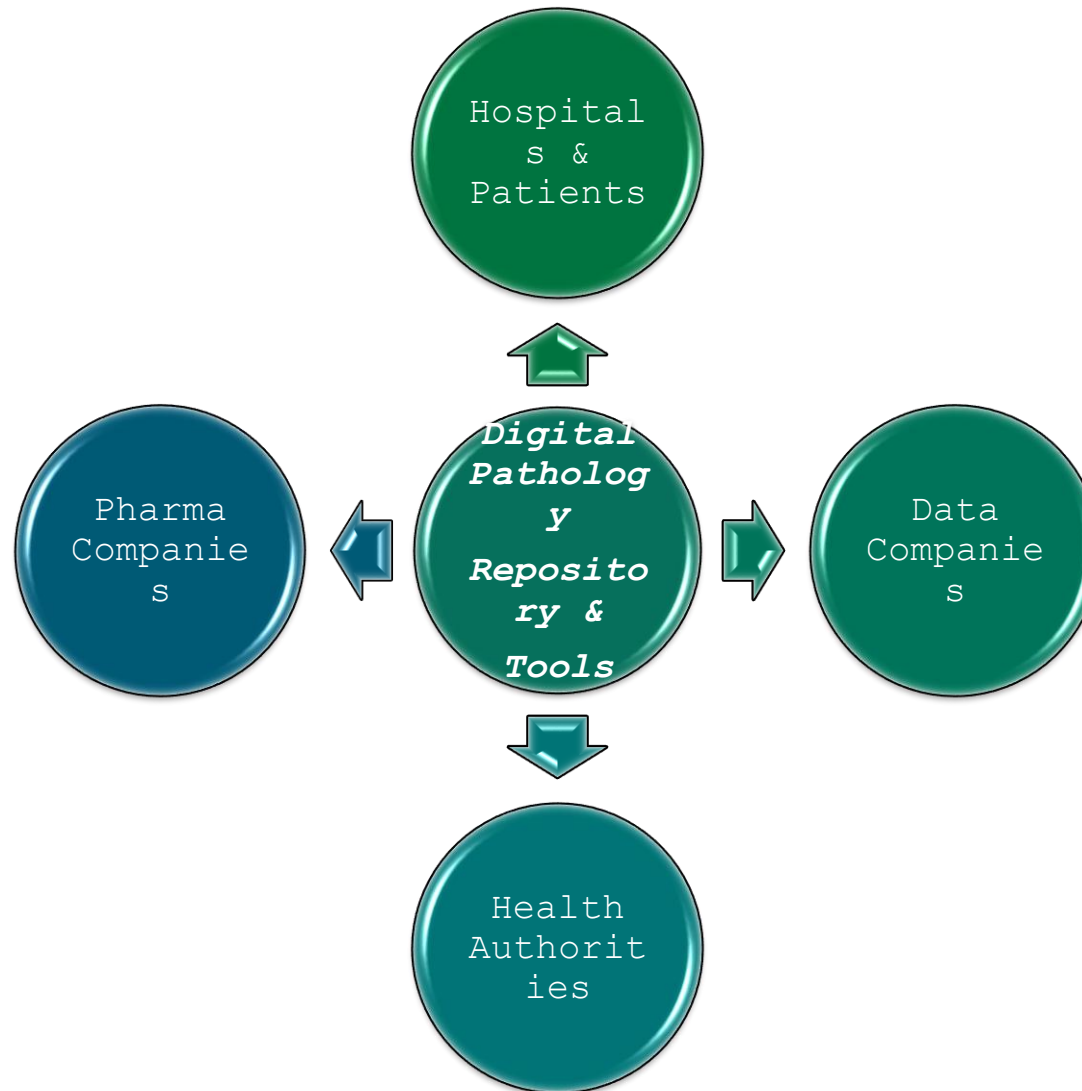
Litigation



Sustainability



Expected impact



Suggested architecture of the project

Phase 1:

Establish an honest broker and infrastructure.

Phase 2:

Data collection, tools for access and visualisation.

Phase 3:

Artificial intelligence models and tools for morphological data mining and assisted diagnosis.

Temporal overlapping to ensure optimal use of the resources

Work packages

- 1 – Project management, coordination, and sustainability
- 2 – Infrastructure and database hosting
- 3 – Data collection & management
- 4 – Tools for accessing, annotating and mining digital slides
- 5 – Regulatory framework for digital slides and AI-based methods

Work package 1 – Project management, coordination, and sustainability

Industry:

- Assurance of the coherence of consortium activity
- Supervision of project management
- Project risk management
- Communication and dissemination

Applicant:

- Detailed follow-up and tracking
- Regular work package reports
- Early reports of any unexpected organisational or structural issues or delays

Work package 2 – Infrastructure and database hosting

Industry:

- Advice for the harmonisation of metadata associated with the digital slides

Applicant:

- infrastructure (data centre) to host three million digital slides and implement a database to register the corresponding files and associated metadata.

Work package 3 – Data collection & management

Industry:

- ~ 2 Mio glass or digital slides from nonclinical toxicology studies, animal models of diseases, or clinical trials
- Corresponding metadata, compliant with INHAND/ICD nomenclature, structured under the standardisation for exchange of nonclinical data (SEND) format.

Applicant:

- honest broker:
 - database, encoding mechanisms and registering of digital slides
 - removal of sensitive information
 - information security/ access rights/ encryption/ retrieval
- digital or glass slides from clinical series (1 Mio) with metadata (e.g. ICD)
- scanning of glass slides

Work package 4 – Tools for accessing, annotating and mining digital slides

Industry:

- defining the functionalities required
- guiding the development of tools to ensure implementation according to required functionalities
- testing tools and providing feedback.

Applicant:

- tools to interact with databases and managing digital slides & metadata
- end-user applications for the visualisation, annotation, and analysis of digital slides
- deep learning models for histopathology (CNNs)

Work package 5 – Regulatory framework for digital slides and AI-based methods

Industry:

- Guidance for the interaction with health authorities with respect to the qualification of digital and computational pathology in drug development.

Applicant:

- engage health authorities
- lead discussions for the adoption of frameworks or roadmaps:
 - digital slides as surrogate of glass slides
 - validation/qualification of AI tools
 - use of clinical archives to develop AI tools
 - regulatory context for the sharing of rare cases or published cases series

Key deliverables of the full project

- sustainable infrastructure to host a large series of digital slides
- mechanisms for managing with digital slides and associated data
- nonclinical slide collection
- clinical slide collection
- open-source, cross-platform software tools
- AI models
- engagement with regulatory authorities
- sustainability plan



Thank you

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