

AI-Driven Holistic Healthcare Platform for Genomics and Digital Pathology

ICSC Spoke 8 – Innovation grant ERADICATE

24/06/2024

Agenda

1. Objectives
2. Data lakehouse
3. Genomics tools
4. AI & Digital Pathology
 1. Slide Viewer
 2. Telepathology
 3. AI Tools
5. Next steps and open points



Goals

A solution for collecting and visualising aggregated clinical, genomic, proteomic, and pathological images of cancer (pancreatic and colorectal) patients for healthcare management

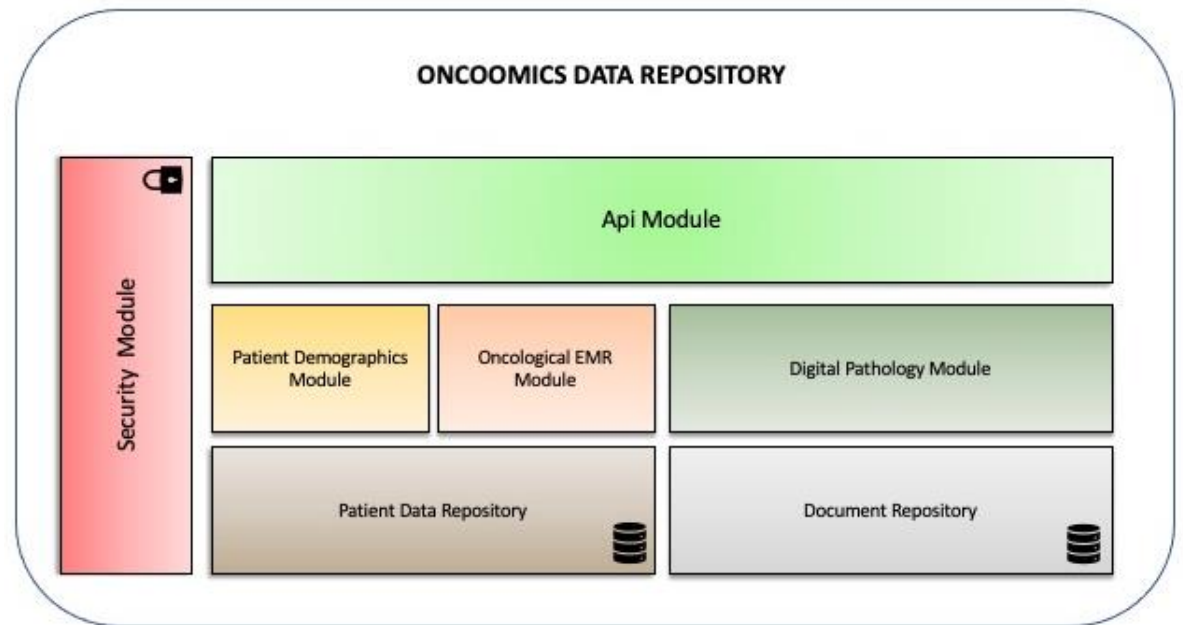
- AI-supported web-based **Holistic Healthcare Management Platform** (H2MP)
 - Histopathologic images viewer
 - Aggregated clinical-omics data visualization
 - Tele-consulting
- **Data lakehouse** for onco-omics data and digital pathology images



Clinical data lakehouse – oncoomics data repository

A solution for a flexible management of **structured and unstructured health-related data**, to archive unprocessed data whilst enabling internal processing, making data fit for use.

- Patients' demographic and medical history, omics data, histopathological images.
- HL7/FHIR **standard API** for data exchange.
- Investigation of Mobile access to Health Documents (MHD) Profile to standardize interfaces to **share health documents**.
- Integration of data sharing protocols suited for secure **large files transfer**.
- **Scalable** solution for large-sized data.
- GDPR compliance.
- Investigation of federation mechanisms (at design time) with other health data ecosystems.



Genomics tools /1

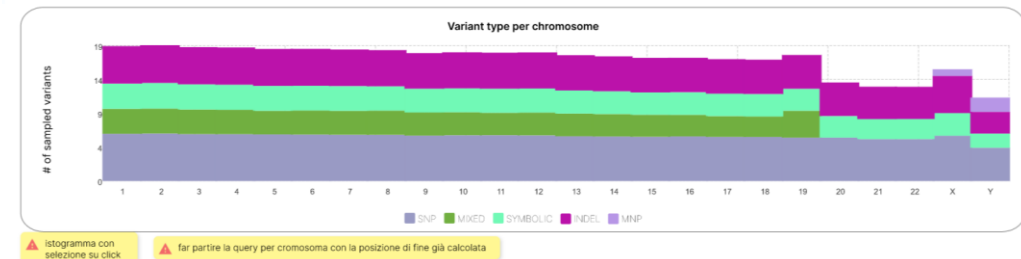
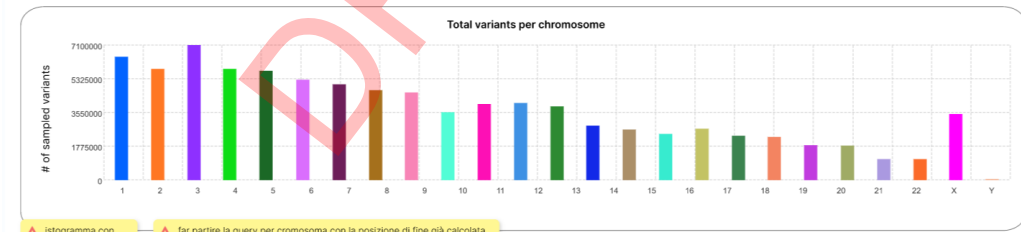
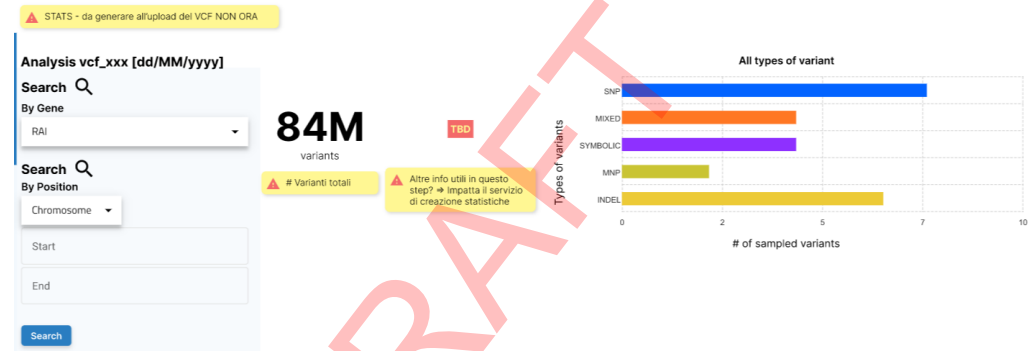
- **Tools** for geneticists, labs and researchers
- **Integration** of genomics data in clinical records for primary usage
- **Exploitation** of genomics data together with clinical data for research purposes via API

pat_er_001
Women
45 y/o

Please, select an analysis from the table

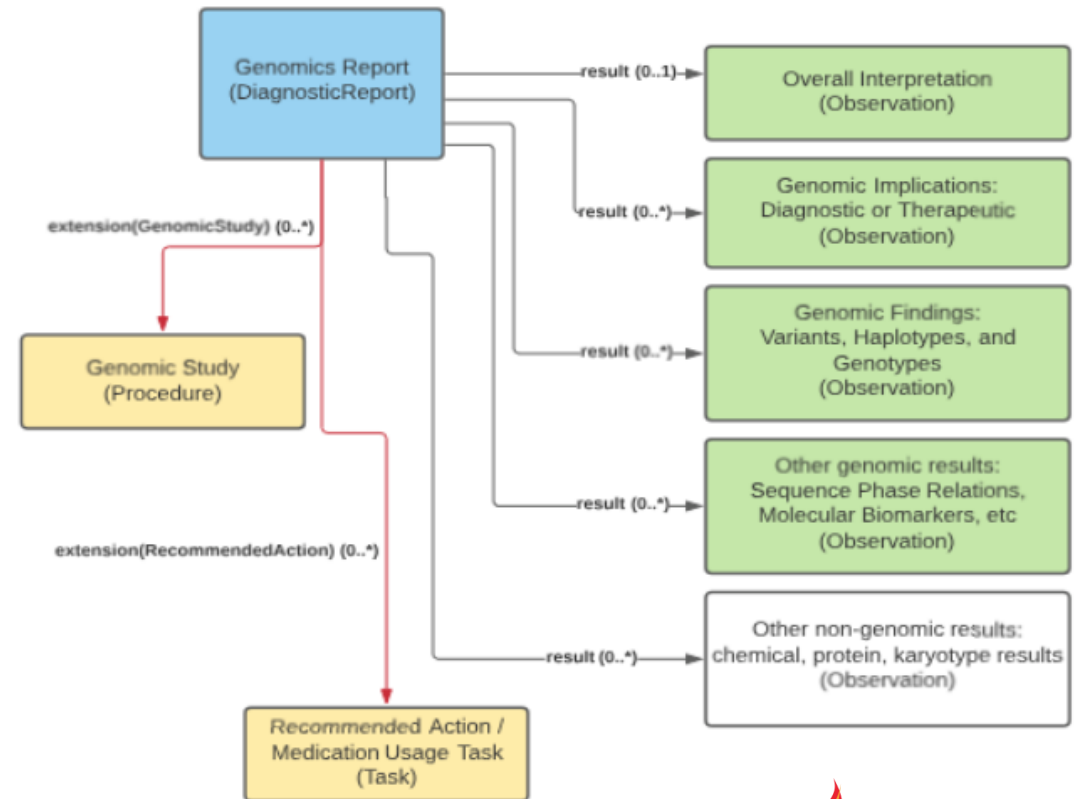
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vct_68	Healthy	WGS	30x	16/02/2020	ClinVar v1.72
vct_506	Healthy	WES	100x	06/02/2020	MedGen
vct_656	Diseased	WES	100x	13/06/2019	Solrad

Items per page: 5 | 1-5 out of 5



Genomics tools /2

- **Automatic** genomics **annotation**
 - Automatic **on-demand** annotation features
 - **Dynamic** selection of genomics annotations
 - Support for selection and study of **non-coding** regions
- Adoption of most **common standards** for genomics data exchange/usage
 - e.g. HL7/FHIR, VCF, OMOP



Genomic Report Overview



AI & Digital Pathology

- Slide Viewer
- Telepathology Portal for a Second Opinion
- AI Tools for Digital Pathology



Slide Viewer

- A software for viewing and managing digital histopathological images and digital slides from laboratories and healthcare facilities.
- Main functionalities:
 - Viewing and comparison of images, navigation on 3 axes
 - Zoom, overlay, flipping, rotation
 - Brightness, contrast, and gamma adjustment
 - Insertion of annotations and comments on analyzed images
 - Measurement of objects within the image
 - Capture and save snapshots
 - Maintains tracking of digital slide observations
 - Real-time session sharing



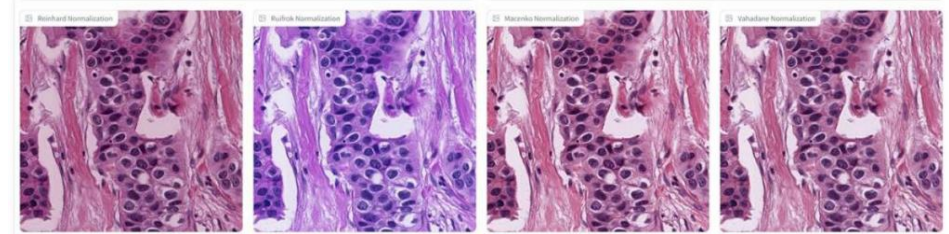
Telepathology portal for a second opinion

- Pathologists can
 - Request a second opinion on complex cases through the portal and obtain a consultation with experts from various medical specialties without the need for meetings.
 - Share patient data, anonymized if consent for telepathology has not been given.
 - Attach documents and images.
 - Sign digitally.
- Other pathologists receive the second opinion requests and can:
 - Examine digital slides and attached documentation.
 - Send a report with observations and diagnosis, digitally signed.
 - Forward the request to third parties.
 - Initiate chat or video call for further consultation with the requester.

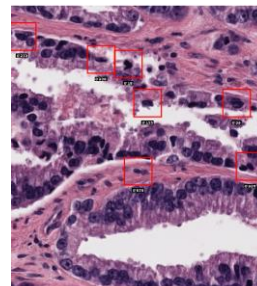
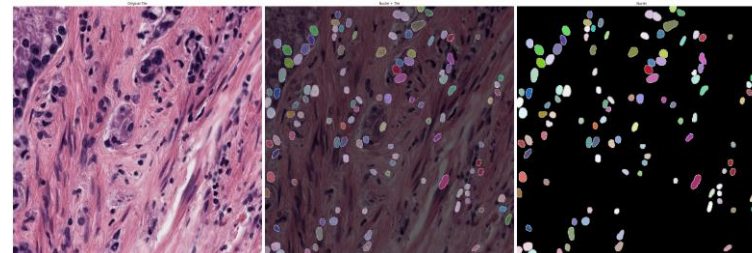
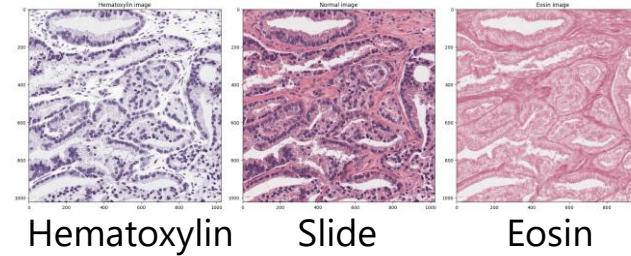


AI tools – Preprocessing and nuclei detection models

- Preprocessing models
 - Whole Slide Images (WSI) segmentation
 - WSI normalization of imaging parameters
 - Stain normalization: separation of pre-treatment stains for the exclusion of slide pre-treatment using "hematoxylin and eosin"
- Nuclei detection models
 - Cell Detection: to identify and locate nuclei into an image
 - Cell Segmentation: delineate edges of each cell into the image
 - Cell Classification: Discern tumor cells from normal ones



Original slide and examples of normalizations



Next steps

- Oncoomics data repository extensions for large-sized genomics files and histopathological images
- Support to latest version of FHIR Genomics Reporting Implementation Guide
- Advancement in development of annotation tools
- Advancement in development of genomics visualization tools
- Advancement in development of digital pathology tools
- Starting development of AI models for pathological image processing

Open points

1. Proteomics data are targeted by the initial proposition. Will proteomics data be produced and provided? Are the requirements for proteomics data usage well defined?
2. How engagement of Spoke8 partners for necessary collaboration should happen? If not, how to deal with activities that requires collaborations?
3. When the infrastructure [required for platform verification] will be available?



Thank you for your attention

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