Webinar for the consortia applying for the Pathfinder challenge on generative AI for cancer could leverage the EUCAIM infrastructure

09/06/2025

# Leveraging EUCAIM to Support Early-Stage Generative AI Innovation in Cancer Research



Co-funded by the European Union







- 1. Introduction to the EIC Pathfinder Challenge (7 min) [F. Zanca]
- 2. Overview of EUCAIM and the Cancer Image Europe Platform (12 min) [L Marti-Bonmatí]
- 3. What EUCAIM Offers to Early-Stage Innovators applying for the pathfinder (12 min) [I. Blanquer]
- 4. EUCAIM's Broader Contribution to Multimodal AI Research (12 min) [L. Cerdá-Alberich]
- 5. Use Cases & Engagement Opportunities for Innovators (12 min) [A. Alberich-Bayarri]
- 6. Discussion & Q&A (35 min)





## GENERATIVE-AI BASED AGENTS TO REVOLUTIONIZE MEDICAL DIAGNOSIS AND TREATMENT OF CANCER

## Federica ZANCA

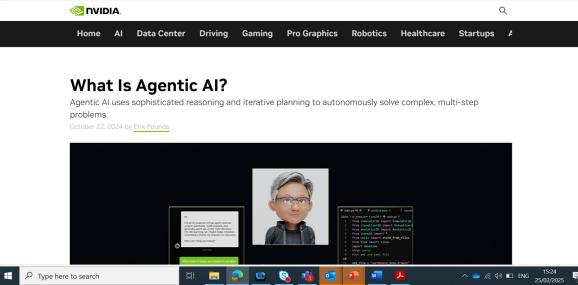
Program Manager Medical Imaging and AI in HealthCare

European Innovation Council and SMEs Executive Agency (EISMEA)





• Agentic AI refers to artificial intelligence systems that possess autonomous decision-making capabilities, enabling them to independently analyze challenges, develop strategies, and execute tasks without human intervention. These systems are designed to handle complex, multi-step problems by employing sophisticated reasoning and iterative planning.



# Scope of the Challenge



- Support population-level real-world data multimodal multidimension learning
- Enable streamlining tasks like determination:
  - of clinical pathway,
  - patient risk assessment,
  - prediction of disease progression,
  - assessment of **personalized treatment**
- Address data scarcity, biases, and privacy concerns for AI applications

## Specific objectives of the Challenge



#### **AREA 1: Technological**

- i. AI-based tools and architecture for Integrating Multimodal Multidimensional Data
- ii. AI-based tools for Medical Data Augmentation
- iii. AI-based tools and architecture for Medical Knowledge Representation and Integration

#### AND\*

## AREA 2 Clinical (exploiting info from area 1)

- i. Autonomous agents for Predictive Diagnosis
- ii. Autonomous agents for personalized Treatment Selection



Ethics, AI Trustworthiness & Model Transparency
 Bias Detection & Mitigation
 Regulatory Compliance & Clinical Validation
 Cost-effectiveness and Economic Impact

The AI models developed under this Challenge are expected to comply with the EU concept for Trustworthy AI, relevant ethical principles, and the AI Act.

- <u>https://digital-strategy.ec.europa.eu/en/library/ethics-guidelines-trustworthy-ai</u>
- https://www.europarl.europa.eu/RegData/etudes/BRIE/2019/640163/EPRS\_BRI(2019)640163\_EN.pdf
- <u>https://www.europarl.europa.eu/topics/en/article/20230601STO93804/eu-ai-act-first-regulation-on-artificial-intelligence</u>

## Portfolio Considerations in EIC Pathfinder

European Innovation Council

- EIC does not fund standalone projects—it builds collaborative portfolios.
- Funded projects are part of a **Challenge Portfolio**, working toward a **common vision**.
- Projects interact, share knowledge, and contribute to collective goals.

## Step 2: Portfolio creation





#### Category 1: Type of Cancer considered by a proposal.

As defined by WP, each proposal should focus on one (and only one) of the following diseases: breast cancer, cervical cancer, ovarian cancer, prostate cancer, lung cancer, brain cancer, stomach cancer or colorectal cancer.

#### Category 2: Type of clinical area covered with possible values:

- i. Predictive Diagnosis.
- ii. Personalized Treatment Selection.

#### Category 3: Technology area

Which technological approach is used in the proposal. The three possible values are:

- i. GenAI-based tools (or other advanced AI technologies) for Integrating Multidimensional Multimodal Health Data
- ii. Medical Data Augmentation
- iii. Medical Knowledge Representation and Integration.

Category 4: Access to Infrastructure, data and ecosystem integration

What are the research infrastructures and clinical facilities that the proposal aims to use, which large datasets do they have access to, and what are their partnerships with hospitals or research institutions for clinical validation.

#### !!!!

Projects covering all subcategories of Categories 2 and 3 will be preferred, as they best align with the holistic approach sought by the challenge.



#### In support of the European AI Strategy<sup>1</sup>, the Cancer Plan for Europe<sup>2</sup> and the Cancer Image Europe platform<sup>3</sup> <sup>1</sup>European approach to artificial intelligence | Shaping Europe's digital future (europa.eu) <sup>2</sup>A cancer plan for Europe - European Commission (europa.eu) <sup>3</sup> <u>https://cancerimage.eu/</u>, <u>https://digital-strategy.ec.europa.eu/en/policies/cancer-imaging</u>

#### Access to infrastructure and data:

- Connection to Existing European Research and Clinical Infrastructures, e.g. Testing and Experimentation Facilities (TEFs), Euro-BioImaging, Cancer Image Europe platform\*, the future UNCAN.eu platform, etc.
- National Cancer/Screening Registries and Open Databases.

 Collaboration with Leading Clinical Institutions focused on oncology is KEY. The projects should be clinically driven

 seek complementarity and synergies with other activities already funded or in the funding pipeline in the framework of the Health cluster of Horizon Europe or Innovative Health Initiative Joint Undertaking





## Important!!!

10



# Thank you!

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# **Overview of EUCAIM and the Cancer Image Europe Platform**

Luis Martí Bonmatí (HULAFE) EUCAIM Scientific Coordinator



# **Project overview**



## Research infrastructure developed by the EU-funded EUCAIM project

- Coordinator: EIBIR
- Scientific Director: Luis Martí-Bonmatí
- Consortium: 76 partners (14 countries)  $\rightarrow$  94 partners (17 countries)
- Runtime: January 2023 December 2026
- Funding: 35.6 m€ (50% co-founded)  $\rightarrow$  39,42 m€

## • Flagship activity of the European Cancer Initiative







### Artificial Intelligence for Health Imaging: where EUCAIM started

chaimerean	EUCAN IMAGE	ProCAncer-I	INCISIVE	Medical insiging Artificial intelligence Childhood cancer research	
2020 - 2025	2020 - 2024	2020 - 2025	2020 - 2024	2018 - 2022	
Pan-European repository of health imaging data to validate AI solutions in cancer management	Develop large- scale cancer imaging platform with Al tools for diagnosis and treatment	Leverage AI to improve prostate cancer imaging through robust data integration	Develop Al solutions for cancer imaging analysis with a federated, interoperable platform	Al-driven medical imaging tools for pediatric cancer diagnosis and prognosis	



# **Partners and Stakeholders**





# Main goals



Address the fragmentation of the existing cancer image repositories

Atlas of Cancer Images

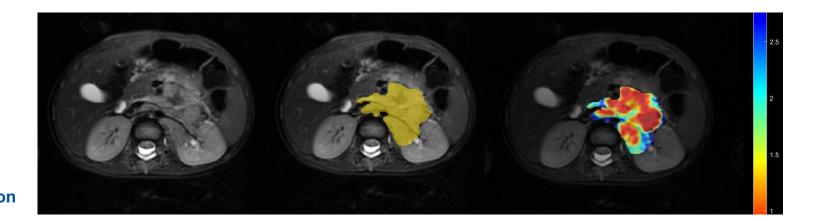
>60 million of anonymized cancer images

Accessible to clinicians, researchers and innovators

Enhance cancer diagnosis and treatment through Imaging Biomarkers, Models and AI tools

Development & Benchmarking of AI tools and Models toward Precision Medicine

Create a Federated Secure Processing environment for deploying observational studies





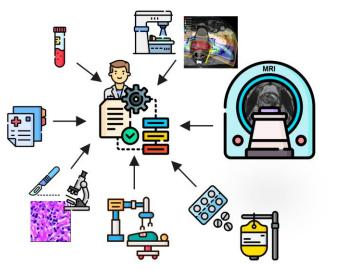
# **Harnessing the Power of Data**











Data

Tools

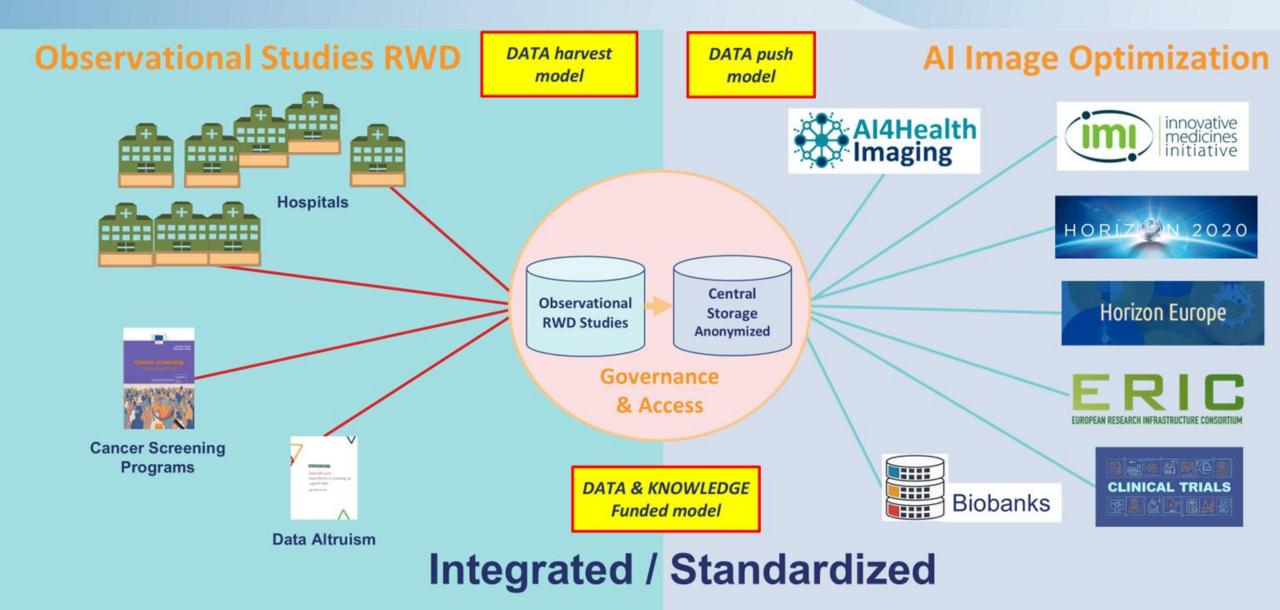
## Communities

Actionable Biomarkers and Models

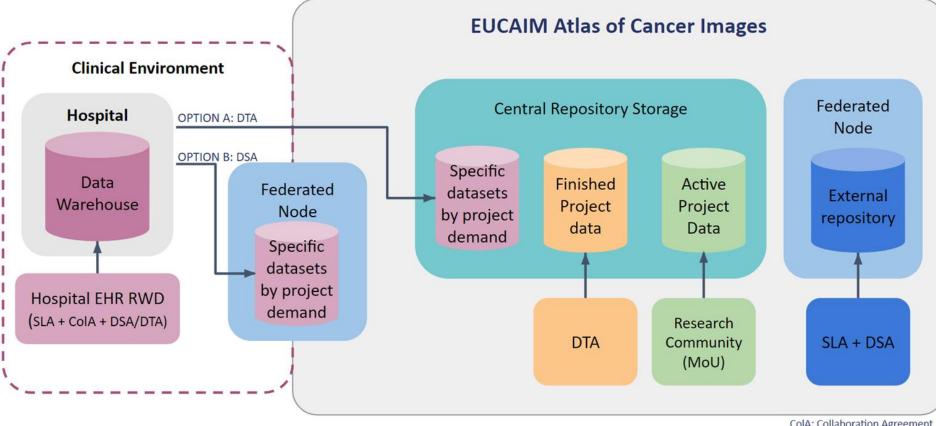


## **Hybrid platform: Atlas of Cancer Images**





# Hybrid platform: Atlas of Cancer Images EUCAM

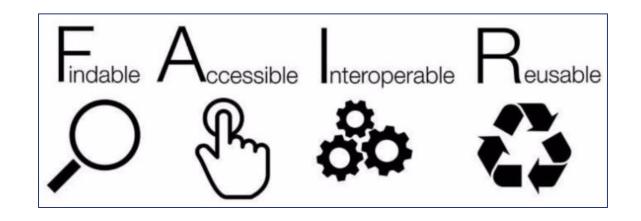


ColA: Collaboration Agreement DSA: Data Sharing Agreement DTA: Data Transfer Agreement MoU: Memorandum of Understanding SLA: Service Level Agreement



# **FAIR requirements**





Cancer Images DICOM / NIfTI

#### **Metadata** *Catalogue DCAT-AP*

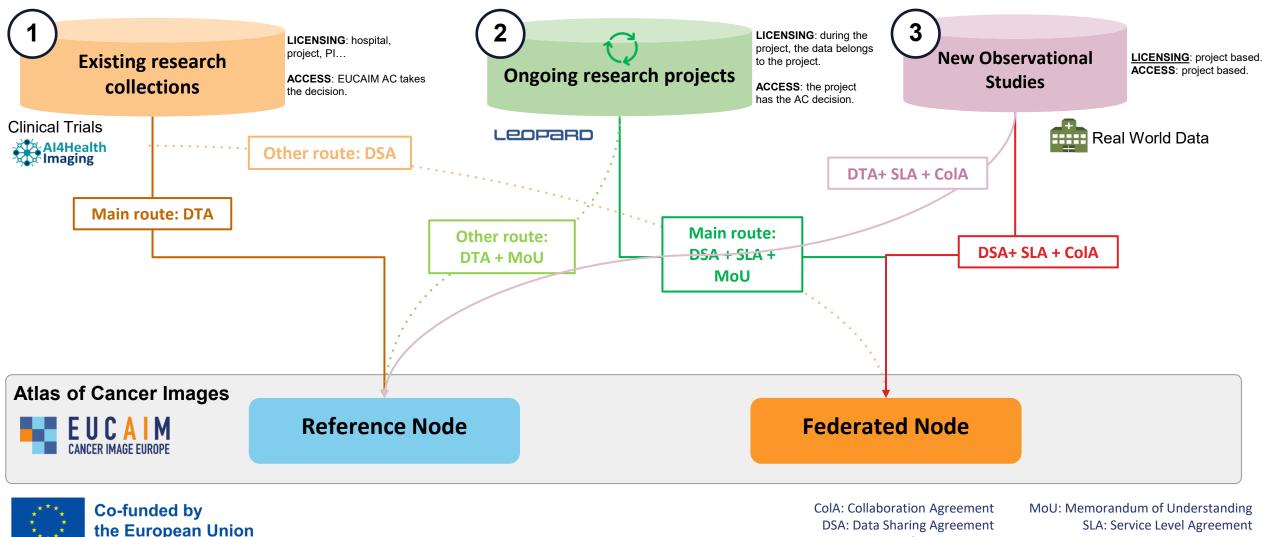
#### Clinical data CDM mCODE

#### Hyper-ontology Unified framework



## Main scenarios for Stakeholders (DH, SP: data and tools provision):





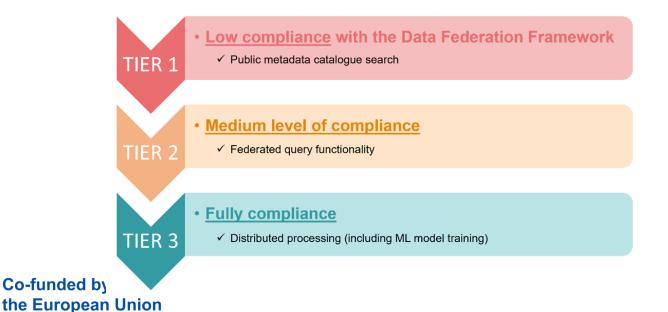
DTA: Data Transfer Agreement AC: Access Committee

# **TIERs** maturity level questionnaire

## **Three Tiers of Data Compliance**

To accommodate different levels of data compliance, three technical tiers have been established. They are scalable, allowing partners to upgrade with new developments and new research projects.

Each tier offers increased visibility and usability of the data within the EUCAIM community.



#### Questionnaire MINIMUM REQUIREMENTS

Request of general information	
<ol> <li>Please, provide details on the clinical cases available in your dataset:</li> </ol>	Cancer type N° of cases/cancer type
<ol> <li>In case you provide multiple datasets, are they following the same level of compliance? (If no, please fill all this questionnaire for each one of your datasets)</li> </ol>	C Yes
3. Which TIER level do you aim to achieve within the EUCAIM project?	<ul> <li>TIER 1: At the registry level</li> <li>TIER 2: At the data exploration level</li> <li>TIER 3: At the data processing level</li> </ul>
4. Which method will be used for data handling?	The data will be transferred to the reference nodes. The data will be shared directly from the local node infrastructure.

EUU

CANCER IMAGE EURUPE

In order to help you to identify your **TIER's starting point**, please fill the following checklist which includes the mandatory requirements for each tier level:



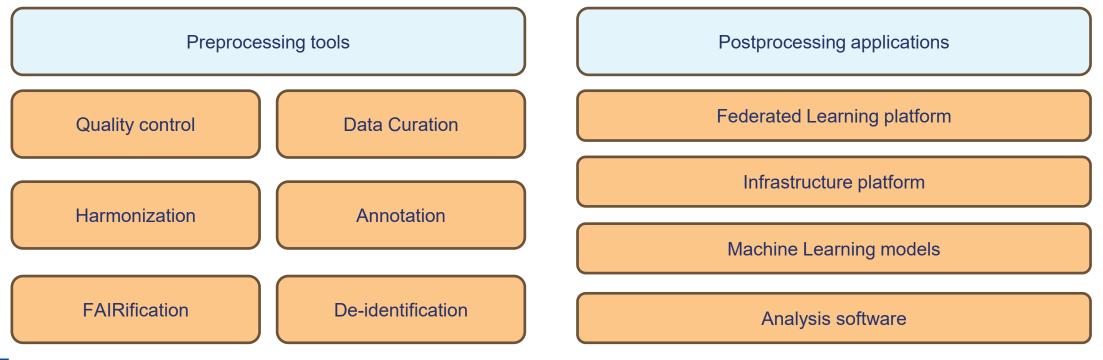
# **Software Marketplace**



Definition: A catalog of software/tools that can be used for pre- and post-processing data within the EUCAIM infrastructure.

Objective: Configure an integrated **toolbox** for the infrastructure. Build or adapt the selected tools to be able to perform in a distributed environment.

These tools are provided by the **Software Providers**.





# **EUCAIM Pre-processing tools**

**De-identification tools** Follow GDPR and national and international legislation

#### Harmonization tools Increase the comparability among different providers, scanners and acquisition protocols

#### **Annotation tools**

**CANCER IMAGE EUROPE** 

Use of AI to reduce existing inter-/intraobserver variability of human processes

#### **FAIRness tool**

FAIR EVA: Evaluator, Validator & Advisor is developed in the EOSC Synergy project; checks the FAIRness level of digital objects Data quality and curation tools Data completeness and consistency, identification of corrupted/missing files



## **Data Holders and Data Users have large benefits**



- Collaborate on multidisciplinary teams (the Research Community, including physicians, data scientists, engineers, and AI specialists).
- Collaborate in guidelines and publications.
- Simplify access and technical support (to data, tools, and standards on hospital health data spaces).
- Participate in internal challenges (validate AI tools, validate annotated data collection).
- Benchmarking of AI tools against established methods.
- Access to first notifications on the construction of funded research projects within the Community.
- Collaborate with Enterprises for regulations and standards (recognition, licensing data).
- Contribute to the European AI governance and European Health Data Space definition and construction.
- Simplify access to Data, Tools and Internal Procedures documentation within the EUCAIM Platform.
- Being (individuals, institutions) academically recognize as part of the EUCAIM Community and Platform.



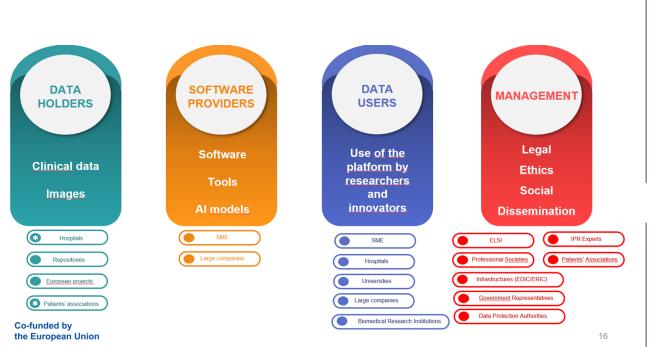
# **Stakeholders in EUCAIM**



Data Users Person or entity that wants to explore the catalogue and request access to data for research.

#### Sofware providers

Entity that would like to contribute with processing **tools, services, or applications** to the EUCAIM's marketplace.



Data holders Natural or legal person, including entities, bodies, and research organizations in the health or care sectors, who has the right to make certain data available.

#### Management-related

Legal, ethical, policy makers, dissemination.



# **Becoming a Stakeholder**



**MY PROFILE** 

HOME PUBLIC CATALOGUE

#### EUCAIM Dashboard

#### 📲 E U C A I M

#### Become a Stakeholder of EUCAIM

#### 1. Join EUCAIM as a Stakeholder

If you are looking to actively contribute to EUCAIM, whether in research or clinical initiatives, consider becoming a stakeholder. EUCAIM stakeholders include hospitals, cancer screening programs, clinical trials, imaging biobanks, societies, universities, infrastructures and other institutions with approved projects or research initiatives. Companies in the pharmaceutical or medical imaging industries are also welcome. Essentially, any organization seeking collaboration by sharing valuable data and tools, or simply looking to be part of a network to initiate new projects, can become a stakeholder.

To join us as a stakeholder, you need to complete an Expression of Interest with your entity's contact information, description, experience, and capabilities. Additionally, a Collaboration Agreement between parties must be signed.

Depending on whether you're a general stakeholder, a hospital, a cancer screening program, or a research project, please check out the following documents for more information.

- General Collaboration
- Collaboration with Hospitals
- Collaboration with Cancer Screening Programs
- Collaboration with Research Projects

Co-funded در the European Union BECOME A STAKEHOLDER

## **Engagement and requirements analysis**



Questionnaire for evaluating the status of the existing health information systems for secondary use of data (secure processing environment)

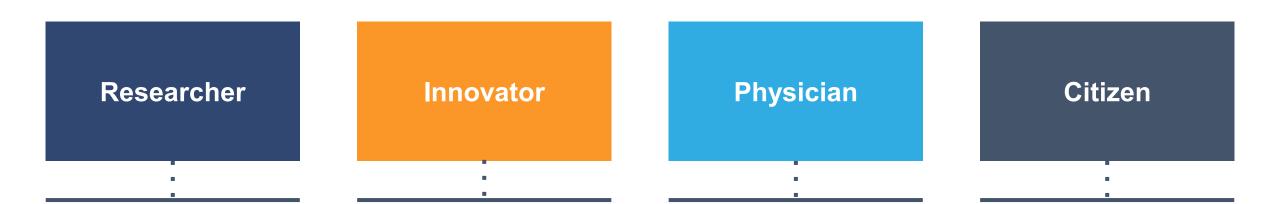
<ol> <li>Objectives</li></ol>	. 3
4. Questionnaire	. 4
4.1. Technical Characteristics.	. 4
4.2. Data Storage and Analytics	. 6
4.3. Standards, Common Data Models, and vocabularies	. 6
4.4. Data Accessibility	7
4.5. Data Governance	7
4.6. IT policies	8
4.7. Privacy, Security and Legal requirements	. 8





# **Benefits of EUCAIM**



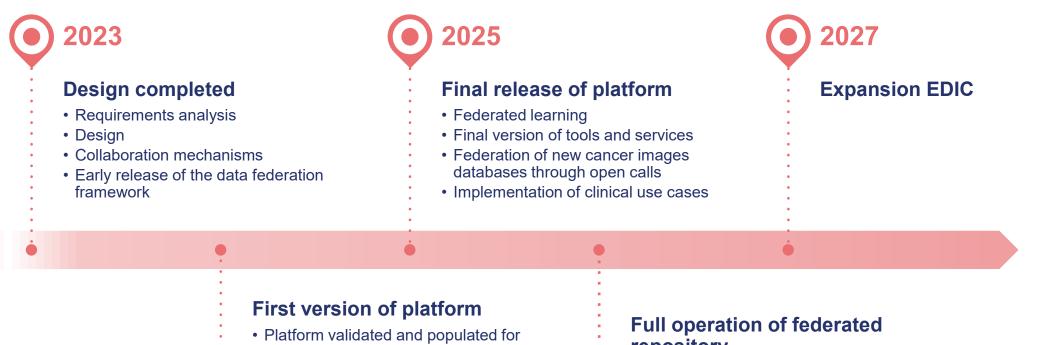


Infrastructure and Opportunities to access, share and process pan-European cancer imaging data **Reference** *framework* with *standardized catalogue* of data and tools to facilitate *certification*  **New Tools** for the diagnosis, prognosis and treatment of cancer patients to evaluate and clinically validate Improved Quality of Life, early diagnosis, personalized treatment, better prognosis



# Timeline





external production

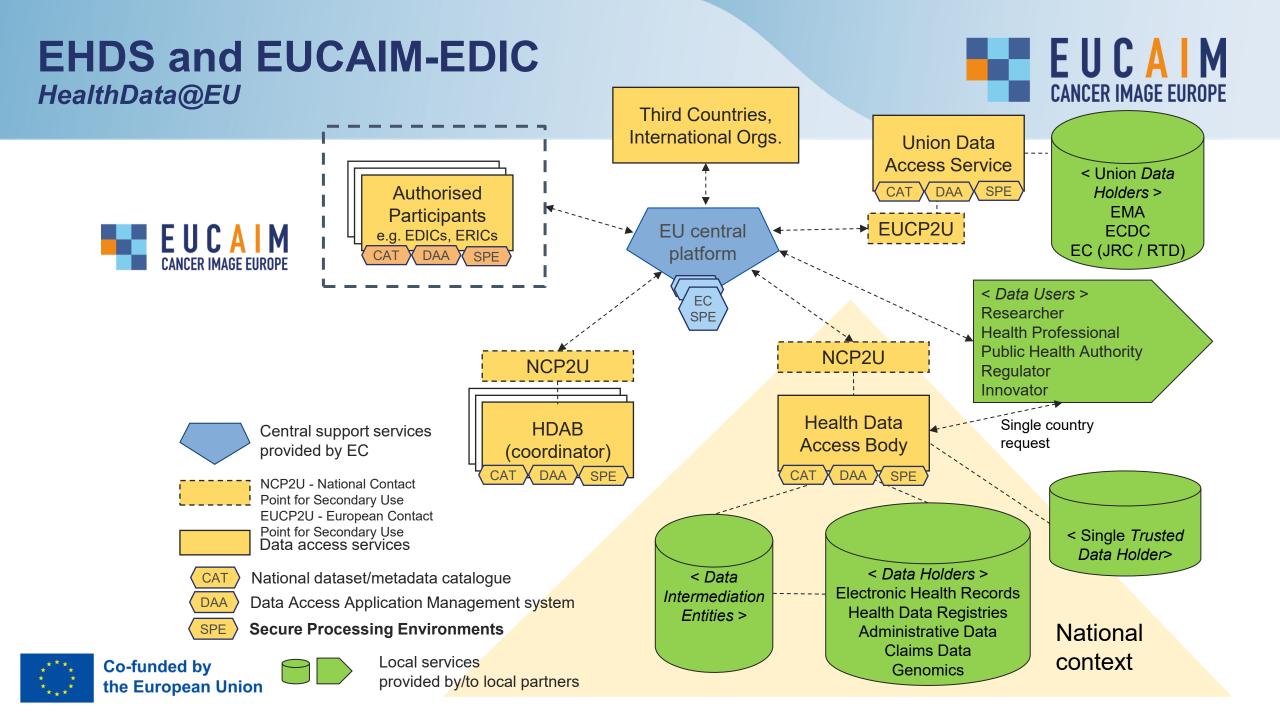
- Data providers connected
- Prototype for federated learning
- Benchmarking platform



## repository

- Integration with other data infrastructures
- Piloting of the business model
- · Legal and operation model finalised

2026





# What EUCAIM Offers to Early-Stage Innovators applying for the pathfinder

Ignacio Blanquer (UPV) EUCAIM Central Hub coordinator

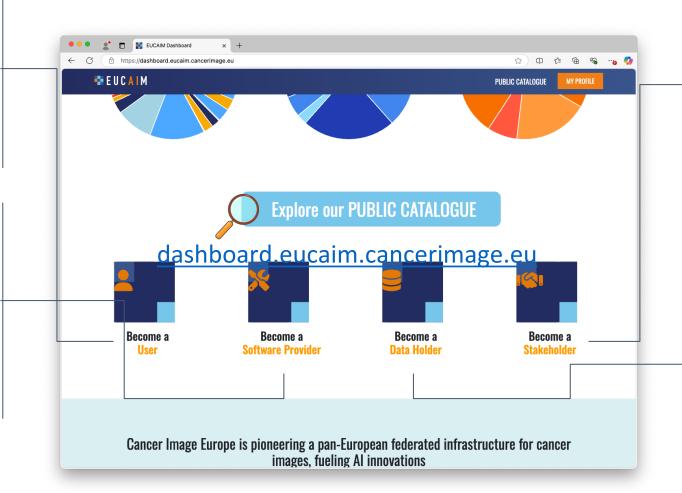


# **Roles targetted by EUCAIM**



Research centers and innovative companies that want to **explore the catalog and request access to the data** 

Researchers and innovators who wish to **contribute** with **processing tools** and **applications** to the EUCAIM catalogue



An entity that wants to join the EUCAIM consortium or that wants to be part of **future collaborations in data collection.** 

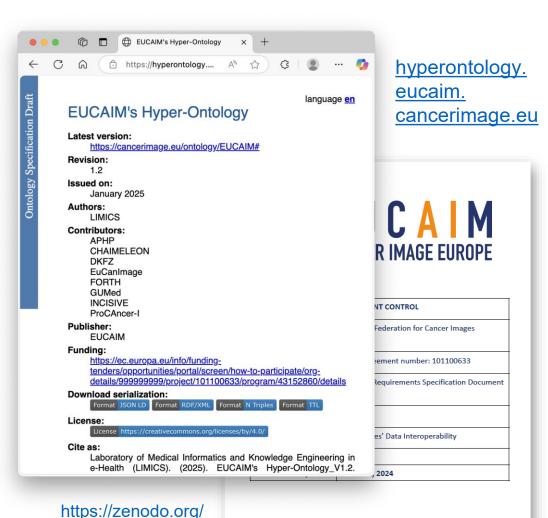
Any natural or legal person, including research organizations in the health or care sector, with the right to **make certain data available** 



# **EUCAIM's Data**



- Current version is 1.3 (release May, 2025)
  - Bottom-up approach mainly based on the clinical and imaging knowledge provided by the AI4HI projects.
- Syntactic mappings are performed to integrate the Hyperontology with OMOP and FHIR standards.
- A total of 64K subjects and 81K studies distributed across 5 providers.
  - Data for training, validation and test.
  - Special datasets for benchmarking.
- Restricted access, access granted on demand.



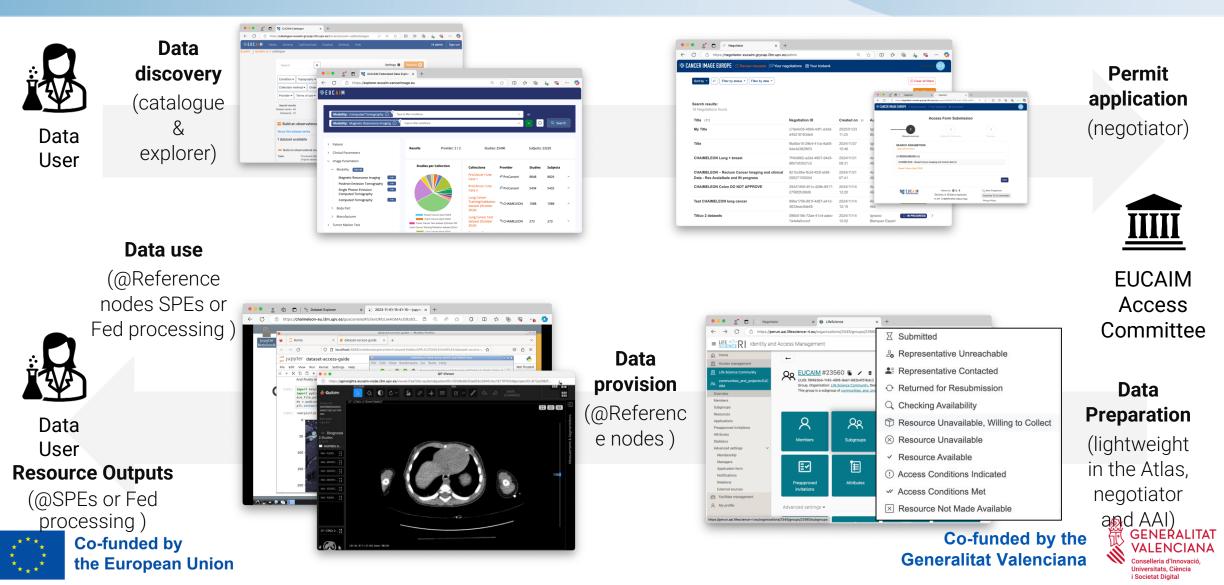
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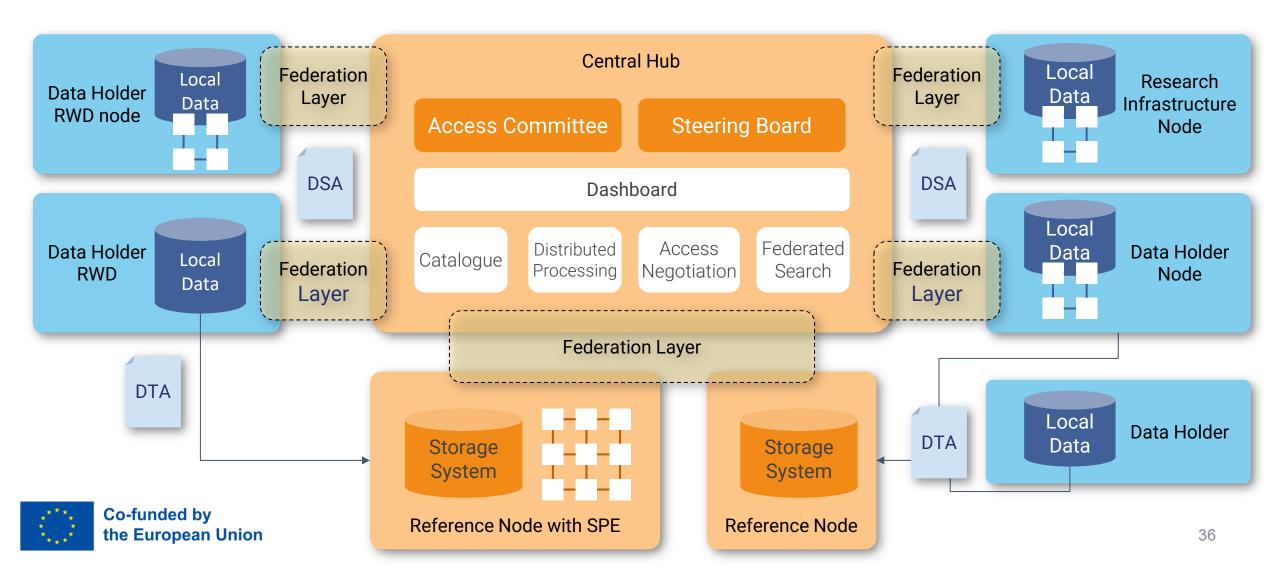
# EHDS Data User Journey for EUCAIM's Atlas of Cancer Images





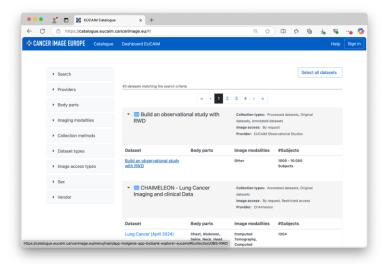
# **EUCAIM Federation**





# Three levels of compliance with the federation

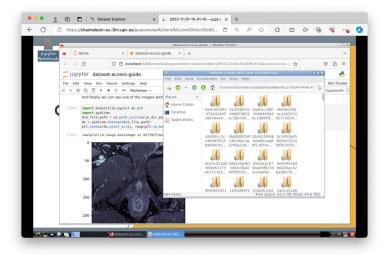




Tier 1: At the Registry level

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Type to filter conditions			×		) Q Sear	rch
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Image Parameters     Tumor Marker Test	Studies per Collectio	n Collections	Provider	Studies	Subjects	
<ul> <li>&gt; Histologic Grade</li> <li>&gt; Cancer stage</li> </ul>		Lung Cancer Training/Validation dataset (October 2024)	* CHAIMELEON	1088	1088	ř
> Tumor		Lung Cancer Test dataset (October 2024)	<sup>™</sup> CHAIMELEON	273	273	ř
	Breast Cancer (April 20 Colon Cancer (April 20 Colon Cancer Test dataset (Oct	al) dataset (October lober 2024) 2024)	* CHAIMELEON	1149	1149	ř
	Colon Cancer Training/Validation datas     Lung Cancer (April 200     Lung Cencer Test dataset (Octi     Lung Cancer Training/Validation datas	N) Prostate Cancer Test aber 2024) dataset (October 2024)	<sup>™</sup> CHAIMELEON	288	288	v
	enChallenge Championship Training Dat enChallenge Championship Training Dat		THAIMELEON	904	904	÷

Tier 2: At the data exploration level



Tier 3: At the Data Processing level



## **EUCAIM's Core Services (I)**



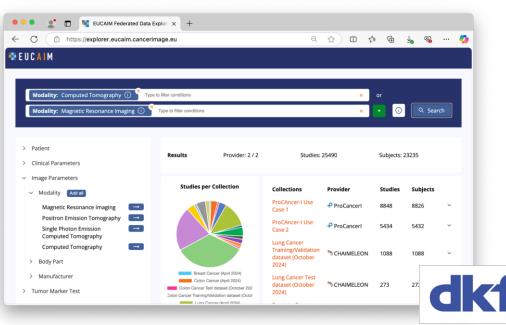
#### Catalogue

- A catalogue with metadata compliant to the HEALTH DCAT-AP schema.
- FAIR Data Points exposing each Dataset.

EUCAIM Catalogue × +	/ excalm-sil / dataset / 822ad/0bd-0201-4932-a8b2-765679c36410 Back to the catalogue / CHAIMELEON - Lung Cancer Imaging and clinical Data / Lung	g Cancer (April 2024) Request.
- C 🗈 https://catalogue-eucaim.grycap.i3m.upv.es/Eu	Dataset Lung Cancer (April 2024)	
• EUCAIM Tables Schema Up/Download Graphe aim / eucaim-ul / catalogue Search × Condition Topography & Body par Collection method * Order of magnitu Provider * Terms of use * Interoper Search results	Lang Control C	He Add Dataset series CHAMELEON - Lung Cancer Imaging and clinical bata mandate of the CHAMELEON constraints Week CHAMELEON-Lung Cancer Imaging and clinical bata (Week CHAMELEON-Lung Cancer (Week CHAMELEON-LUNG CHAMELEON-LUNG CHAMELEON-LUNG CHAMELEON-LUNG (Week CHAMELEON-LUNG CHAMELEON-LUNG (Week CHAMELEON-LUNG CHAMELEON-LUNG (Week CHAMELEON-LUNG CHAMELEON-LUNG (Week CHAMELEON-LUNG CHAMELEON-LUNG (Week CH
Dataset series: 40 Dataset(s): 57 Build an observational study w About this dataset series	Vendor:         Agfa, Canon, Siemens, Toshiba, Philips, General Electric           Image spar range:         2013-2022           Image size (CB):         1500           Gav:         Example	Erasmus MC Universitatir Medisch Centrum Rotterdam
1 dataset available Build an observational study with RWD	5 datasets available	Contin
Type: Processed datasets, Annotated data Original datasets	sets, European Sets, Sets, Number of subjects: 1254	health R

### **Federated Search**

- Provides the list of datasets fulfilling the inclusion criteria and the number of studies.
- 27 searchable items from EUCAIM's CDM.



## **Status of Core Services (II)**



### **Access Request Service**

- Customised BBMRI-ERIC Negotiator. ----
- Full life-cycle of dataset access implemented.
- Access forms customised at dataset -

https://negotiator-eucaim.grycap.i3m.upv.es/	admin	Q	☆ OD 🏠	Ē	<b>⊥</b> ₀ q	6	🧳
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Title	f8a0bb10-29b4-41cb-8a08- 0de4d382f853	2024/11/27 15:46	Ignacio Blanquer Espert	୍ ପ୍ UN	DER REVI	>	
CHAIMELEON Lung + breast	7f40d682-a2dd-4807-94d3- 9857df3527c5	2024/11/21 08:31	Andrei Stefan Alic	( ⊚ co	NCLUDED		
CHAIMELEON – Rectum Cancer Imaging and clinical Data - Res Avaialbale and IN progress	821bc66e-fb3d-453f-afd8- 256271f35204	2024/11/21 07:41	Andrei Stefan Alic	(	NCLUDED		
CHAIMELEON Colon DO NOT APPROVE	29447d59-451c-428b-8517- 2756f2fc99d9	2024/11/14 12:20	Andrei Stefan Alic		PROGRES	s >	
Test CHAIMELEON lung cancer	996e1756-881f-4d87-a41d- 3633eac9de55	2024/11/14 12:15	Andrei Stefa Alic				
Titluo 2 datasets	096b518b-72ae-41c4-aabc- 7a4efa0ccccf	2024/11/14 12:02	Ignacio Blanguer Es	×	• Bl	BN	IRI-

### **Dashboard**

- Entry point for the user.
- Data monitoring and User's Library with the datasets with access granted.



## **Reference nodes**



### **Euro-Biolmaging / Health-RI / EMC**

Medical imaging repository based on XNAT

- SPE supported by data materializer tool or whitelisting
- Integrated with core services (Catalogue, Negotiator).
- Imaging data: DICOM or NIFTI; Clinical data: JSON, CSV.
- Currently Tier 1 functionality.

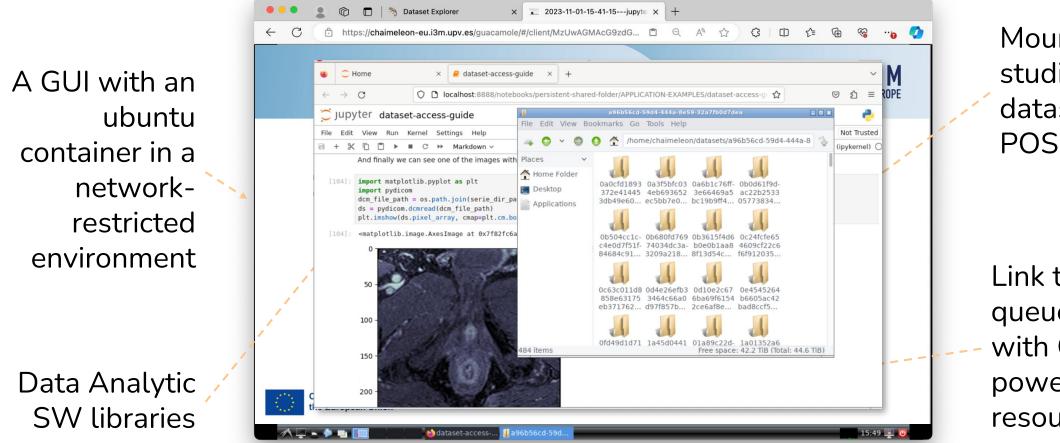
#### UPV

#### Storage with SPE from UPV & QP-Insights (Quibim)

- Integrated with core services (Catalogue, Negotiator, SPE, LS-AAI).
- Imaging data: DICOM (or NIFTI); Clinical data: JSON (or CSV).
- Currently Tier 2 functionality.
- Powered with 10 nodes, 960 cores, 7,5TB RAM and 25 GPU accelerators and an additional server with 300 TB.



### Data use: Virtual Research Environment



Mounts the studies of the datasets as a POSIX volume.

EUCAIM

CANCER IMAGE EUROPE

Link to a batch queue system - with GPUs and powerful resources.

Data cannot be downloaded due to the network policies and the restricted configuration of the access proxy - accesses are traced and preserved.





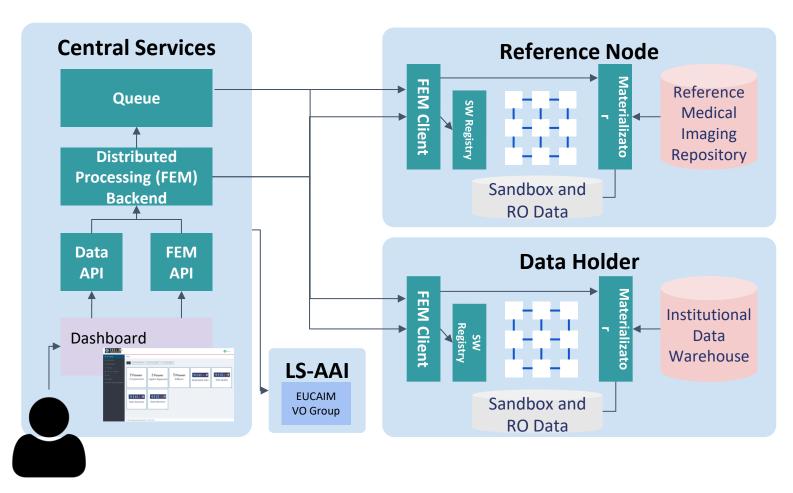
## Data Use: Federated Processing Environment



- Integration with processing environments have been proven through the demonstrators
- Future integration will focus on:
  - GUI in the Dashboard.
  - Permissions through the User's Library.
  - Integration in the SW Catalogue repository (harbor.eucaim.cancerimage.eu).

















# EUCAIM's Broader Contribution to Multimodal AI Research

Leonor Cerdá-Alberich (HULAFE) EUCAIM AI Researcher





Radiology and Nuclear Medicine Imaging Data

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ucaim

Tier-1 Interoperability

CAIM Dashboard	Catalogue Help	
/ <mark>eucaim-ui</mark> / catalogue		
	Search	Request 0
	Condition   Topography  Body part  Geographical coverage	ge 🕶 Collection type 🕶 Collection method 🕶 Order of magnitude 💌
	Sex  Modality 2  Vendor  Image access type  Provid	der ▼ Terms of use ▼ Interoperability tier ▼ Clear all filters
	Dataset serii Dataset serii Dataset Computed Radiography Digital Radiography Digital Radiography Digital Radiography Magnetic Resonance Mammography Nuclear Medicine Nuclear Medicine About tr Other Digital Radiography Digital R	clinical Data         About this dataset series         Because you searched for: Computed Tomography, Magnetic Resonance
	□ Ultrasound ■ Brea Deselect all Number of subjects: 1238 Condition: 126926005 - Neoplasm of breast Sex: Female Male Type: Annotated datasets	More details Prostate Cancer Training/Validation dataset (October 2024) Number of subjects: 1149 Condition: 93974005 - Primary malignant neoplasm of prostate Sex: Male Type: Processed datasets, Annotated datasets Collection Mathed: Cohort Disease specific
	Collection Method: Cohort, Disease specific Because you searched for: Computed Tomography, Magnetic Resonance	Collection Method: Cohort, Disease specific Because you searched for: Computed Tomography, Magnetic Resonance

**EUCAIM Catalogue** 





Radiology and Nuclear Medicine Imaging Data

**Tier-2** Interoperability

#### EUCAIM Federated Search

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Modality: Magnetic Resonance Imaging ①	Type to filter conditions Results	Provider: 4 / 4	Studies: 1	× 8977	+ () Subjects: 1		:h
Clinical Parameters     Image Parameters							
<ul> <li>Modality Add all</li> </ul>	Studies p	er Collection	Collections	Provider	Studies	Subjects	
Magnetic Resonance Imaging			PRIMAGE - Neuroblastoma	UPV-NODE	302	190	~
Positron Emission Tomography Single Photon Emission Computed Tomography		¥ \	PRIMAGE - DIPG ProCAncer-I Use	UPV-NODE	122	65	~
Computed Tomography	No.		Case 1	+ ProCancerl	8848	8826	~
> Body Part			ProCAncer-I Use Case 2	ProCancerl	5434	5432	~
Manufacturer     Tumor Marker Test		Breast Cancer NCISIVE Breast CISIVE Colorectal	Prostate Cancer Training/Validation dataset	S CHAIMELEON	1145	1145	~
> Histologic Grade	Challenge Champion	INCISIVE Lung ICISIVE Prostate ship Training Dataset for Pr	Prostate Cancer Test dataset	CHAIMELEON	286	286	~
> Cancer stage		ship Training Dataset for Re RIMAGE - DIPG	Rectum Cancer		537	360	~
> Tumor	PRIMA	AGE - Neuroblastoma	OpenChallenge Championship Training Dataset for	SCHAIMELEON	231	231	~





#### BBMRI-ERIC Catalogue

Filter: With/ Data	Without Rad. Img.		Filter: W Data	ith/Withou	ıt Path.	lmg.		
Name F	Rad. Img. data		Name	Path.	lmg.	data		
Collection Collection			Collection Collection					
	<b>Collection p</b> Name: Collection 2 Description: XXXX Link to EUCAIM ca	X -				Name: C Descripti	ollection p ollection > on: XXXX BBMRI-EF	<

Co-funded by the European Union

Tier-1 Interoperability

**EUCAIM** Catalogue



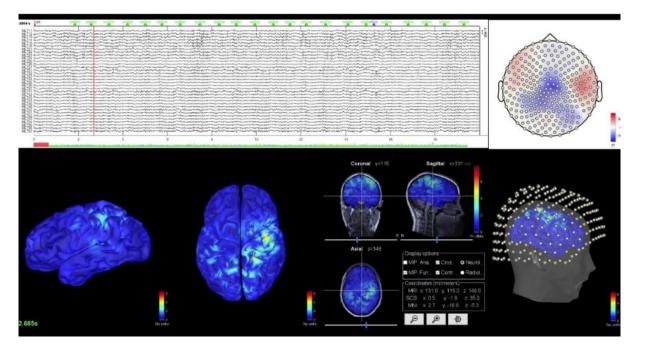
#### **BBMRI-ERIC** Federated Search

🕒 🌑 👘 🗖 😽 BBMRI-ERIC Locator	× +		• • • © EUCAIM Federated Data Explore x +		
C 😡 🔄 https://locator.bbmr	-eric.eu/search/	९ 🔂 ३ 🖆 🤏 🛢 😘 🥠	← C ि C https://explorer.eucaim.cancerimage.eu		
Search for hun	BBMRI-ERIC	C Locator across European biobanks	EUCAIM Diagnosis: Breast Cancer ① Yype to filter	conditions	HOMEBURI G. GMALOGURIA B × + (j) Q Search
Diagnosis ICD-10: C50 U 🗙	Type to filter conditions	× + (j) Q Search	Patient     Clinical Parameters	<b>Results</b> Provide	er: 4 / 4 Studies: 1918 Subjects: 1649
✓ Full Parameter Search ()			<ul> <li>Diagnosis</li> <li>Type to filter conditions</li> <li>Breast Cancer </li> <li>Year of Diagnosis</li> </ul>	Studies per Collection	Collections Provider Studies Subject OpenChallenge Championship Training CHAIMELEON 411 411 Dataset for Breast Cancer
Results ① Sites: 22 / 22	Patients: 212	0 Specimens: 17320	<ul> <li>&gt; Image Parameters</li> <li>&gt; Tumor Marker Test</li> <li>&gt; Histologic Grade</li> <li>&gt; Clease and the state for mellocation</li> </ul>		Breast Cancer CHAIMELEON 1507 1238 BBRMI- ERIC (Pat. Images)
□ Sites ▲	Patients	Specimens			X
Berlin	0	0	*		
Brno-MMCI	0	0			
Brno-RECETOX	0	0			
EUCAIM (Rad. Images)	) 1649	1918			Tier-2 Interoperabi

#### **EUCAIM Federated Search**



#### Radiology and Sensor Data



#### 📲 E U C A I M (i) Q Search HER2 [Presence] in Breast cancer specimen by Immune stain: 1+ 🛈 Type to filter conditions Breast cancer specimen by Immune stain Results Provider: 3 / 3 Studies: 3855 Subjects: 3050 > Progesterone receptor Ag [Presence] in Breast cancer specimen by Immune stain **Studies per Collection** Collections Provider Studies Subjects > Prostate specific Ag [Mass/Volume] in Serum or Plasma **INCISIVE** Colorectal Incisive 209 72 HER2 [Presence] in Breast cancer **INCISIVE Breast** Incisive 111 43 specimen by Immune stain **INCISIVE Lung** Incisive 3296 2831 Add all 0 → INCISIVE Prostate Incisive 239 104 1+ 2+ → 3+ → > Cells.Ki-67 nuclear Ag/100 cells in Breast cancer specimen by Immune stain INCISIVE Breas INCISIVE Colorects > Histologic Grade INCISIVE Lung INCISIVE Prostat Cancer stage

Radiology and Omics Data

**EUCAIM Federated Search** 

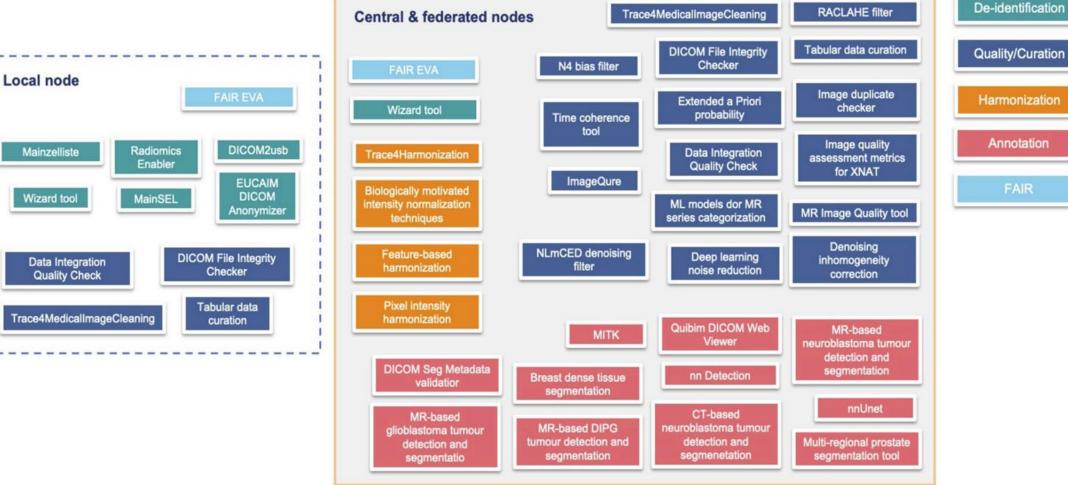
**Tier-2** Interoperability



### **EUCAIM's preprocessing tools**



Preprocessing tools and their location within the EUCAIM infrastructure (local or central/federated nodes).

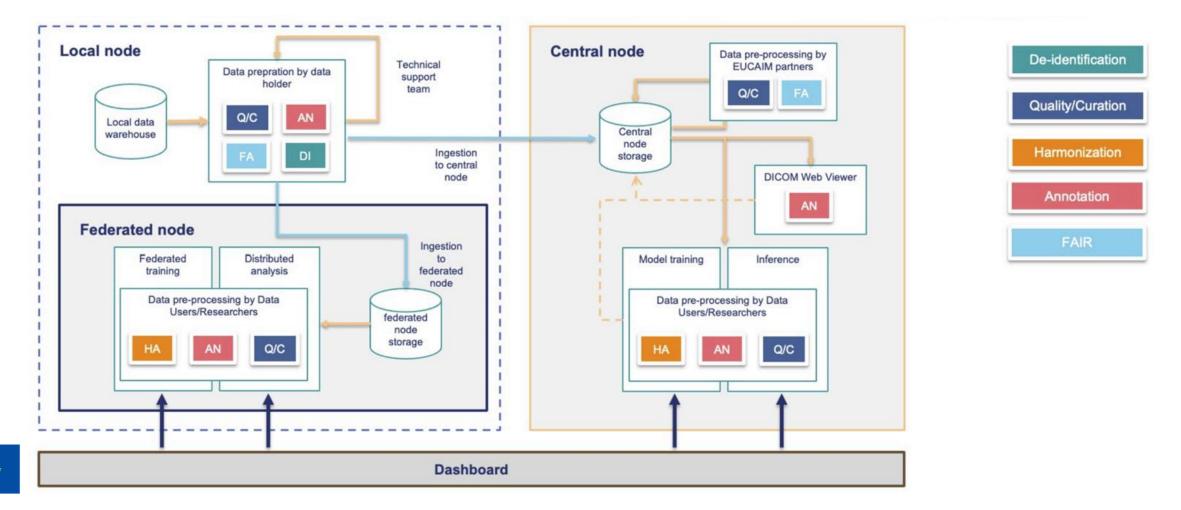




### **Workflow of the preprocessing tools**

Preprocessing tools are distributed across many locations within EUCAIM and cover several critical scenarios, assisting with the data preparation for different tasks and to different EUCAIM Stakeholders

**CANCER IMAGE EUROPE** 



## **Conceptual**, technical and integration validation



#### **Preprocessing tools validation process**

**Goal:** Monitor, anticipate and assess the correct delivery of the tools

	Validation	Goal	Documentation	Demo
	Conceptual	Tool aligns with EUCAIM purpose	Tool description, task, data, input/output formats	Presentation to the Focus Group
	Technical	Tool is technically well-prepared for EUCAIM platform	Methodology description, hardware requirements, traceability/monitoring	Demo/video of the tool running in a local environment
	Integration	Tool is correctly integrated into the EUCAIM infrastructure	Communication channel, common errors, FAQs, tool usage	Demo/video of tool running on the platform
Ĵ₽				
Co-funded by the European Union	Registration in bio.tools		<ul><li>Tool is well documented for:</li><li>Integration into EUCAIM</li><li>Tools users</li></ul>	Allows to: • Give feedback • Spot possible errors



## **Development of AI models**



#### Automated Image Interpretation

Enhancing detection of abnormalities (e.g., nodules in chest X-rays, tumors in MRI scans).

#### Multimodal Learning

Integrating imaging with genomics and clinical data for holistic disease modeling.

#### Synthetic Data Generation

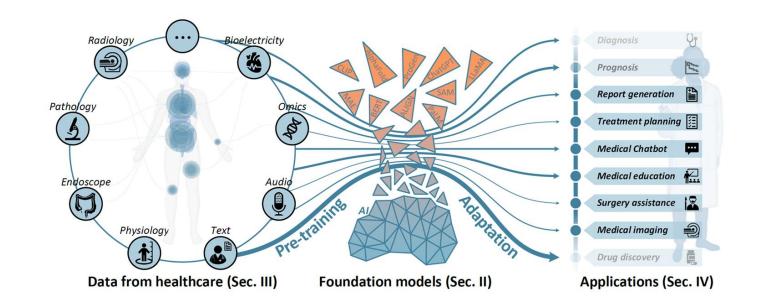
Addressing data scarcity by creating high-fidelity synthetic medical images.

#### **Workflow Optimization**

Al-driven report generation, automated segmentation, and decision support.

**Foundation models** can integrate multimodal data to enhance diagnostic precision and prognostic accuracy across diverse clinical scenarios.





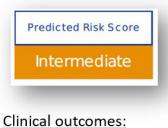
### **Clinical Decision Support Systems**

Phisician Site	Not given	Patient II Birthdate		PSSIRS defined		Predicted Risk
		Birthdate		defined		
Study Date Report Date	13-03-2018 30-08-2023	Age (mont) Sex		9 male		
		- th	10			
—— Patient	t Characteristics	-			ng vari	ables =
Clinical variables			Radiomic	s features		0.45
Age (months)	139		Skewness Maximum 20	diameter		97.00
Sex	Female			ational measure	of correlation	0.63
LDH (U/I)	551.0		GLSZM zone			0.02
MYCN status	Not amplified		GLRLM gray	evel non-uniform	ity	2922.55
Risk group INRG	High					istribution of values abo
INSS	4		mean intensit	y value.		
Bone marrow aspirate	Positive			2D diameter meas	ures the largest	t transversal diameter o
Bone marrow trephine	Positive		tesion		200320020000	
Tumor localization	Abdomen					ber of zones and numbe
Tumor histology type	Neuroblastoma			lesion (fraction of		
Grade of differentiation	Poorty differentiated			are related to mor		ilarity of gray-level inte
Primary tumor automati	ic segmentation, defining the	presentati			cted.	
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Primary tumor automatik	ic segmentation, defining the	·	adiomics feat	tures are extra	cted.	
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#### Explainability

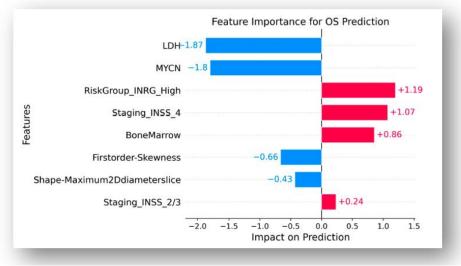
#### Input variables:

- Sex: Female
- Age: 139 months
- LDH (IU/L): 551
- Histology: Neuroblastoma
- Degree of differentiation: Poorly differentiated
- MYCN: Not amplified
- Primary tumor location: Abdomen
- INRG: High
- INSS: 4



**CANCER IMAGE EUROPE** 

- Overall survival:
   1484 days
- Status: Alive





Integration of

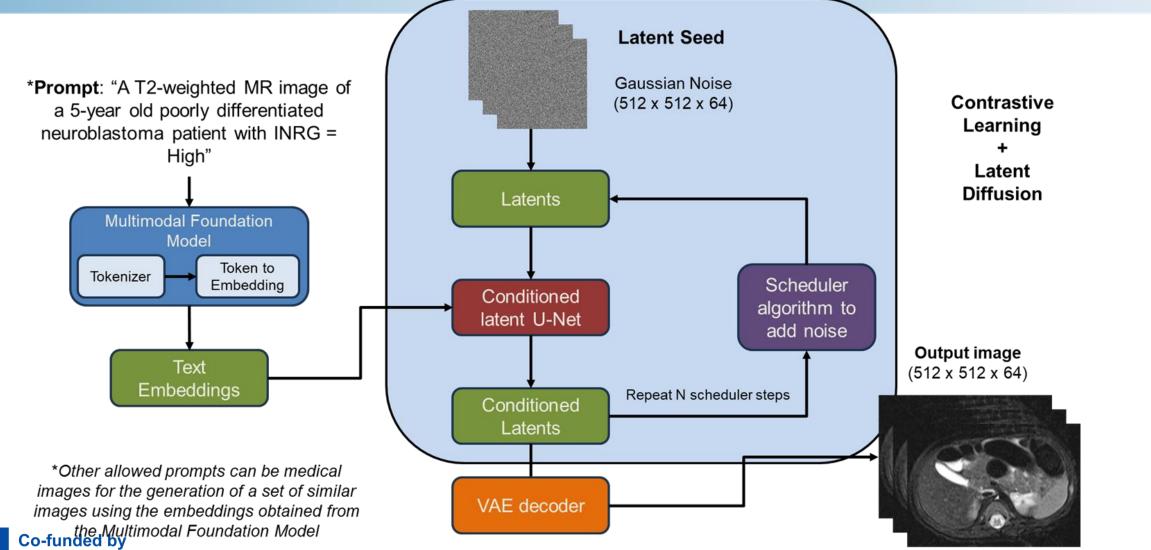
diagnosis

clinical and imaging

data for Al-based

### **Generative Al**





## **Software Benchmarking**

**EUCAIM** CANCER IMAGE EUROPE

Importance of Evaluation: Key to ensuring success in EUCAIM and gaining patients' trust, crucial for adoption in healthcare.

**Evaluation Scope**: Data, tools, AI models and platforms to be assessed on bias and fairness, scientific outcomes, user experience, software quality, performance and clinical outcomes.

**OpenEBench platform**: EUCAIM's benchmarking portal for data visualization, analysis, and evaluation.

Goal: Ensure tools, AI models, and datasets meet high standards of performance, fairness, and reliability.

Metrics Purpose: Define minimum acceptance criteria for inclusion in EUCAIM and showcase strengths of tools, models, and datasets.

#### Efficacy and Performance Metrics

General Metrics: TN, TP, FN, FP, FNR, FPR, OA (Overall Accuracy), Precision.

Fairness Metrics: Statistical Parity (SP), Equal Opportunity (EO), Predictive Equality (PE).

Task-Specific Metrics:

- Segmentation: Dice Similarity Coefficient, Jaccard Index, Hausdorff Distance, etc.
- Detection: Sensitivity, AUC, False Positives Per Image (FPPI), etc.
- Classification: Accuracy, Sensitivity, AUC, Precision, F1-score, Cohen Kappa, etc.

#### Fairness & Bias Metrics:

- Sex/Gender Bias: Metrics like Treatment Equality (TE), Accuracy Difference (AD), Disparate Impact (DI).
- Ethnicity & Race
- Shapley Values / Feature Importance

### \*\*\*\*

#### Co-funded by the European Union

#### **Technical Metrics**

Scientific Outcomes: Impact on research (citations, peer reviews, etc.).

Software Quality: Code quality (e.g., complexity, updates, adherence to standards).

Overall Performance: Speed, accuracy, efficiency in task performance.

#### **Robustness Metrics**

Stress tests

Adversarial attacks

Out-of-distribution detection

Extreme case analysis

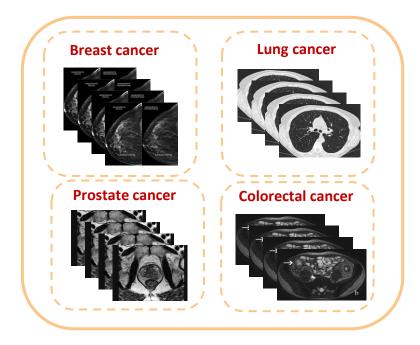
## Software Benchmarking: Dataset



The importance of selecting a multicenter, representative dataset for software benchmarking.

#### **Biases:**

- Undersample: number and diversity of cases
- Image harmonization and robustness
- Data Quality
- Protocols, vendors, releases of images
- Country of origin
- Demographic descriptors (age, sex/gender, ethnicity...)
- Comorbidities and risk factors (smoking, COPD, dense breast...)
- Spectrum of the disease (genotype, phenotype, histology grade...)
- Data leaking: imaging duplicates detection.





## **In-Silico Clinical Validation**



#### In collaboration with the CHAIMELEON Project ORTHANC Open Health Imaging Foundation **DICOM VIEWER** FED BY THE PACS AND WITH ACCESS TO CLINICAL DATA AND AI RESULTS PACS INDEXING FROM FILESYSTEM COLON RECTUM BREAST LUNG THE MODES MODES MODES MODES CHAIMELEON DATASETS 123 1 2 3 1 2 3 1 2 3 COLON RECTUM BREAST PROSTATE LUNG POSTGRES EXTENSIONS EXTENSIONS EXTENSIONS EXTENSIONS EXTENSIONS chaimeleen JS DASHBOARD **USER INTERFACE** SAPI I API DATASETS and UPV

 A user-friendly platform developed to improve user experience during clinical validation (timing per case evaluated with/without, potential result biases, feedback and comments through a survey.
 the European Union







chaimele

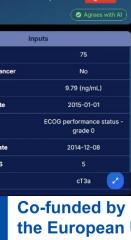
### **In-Silico** Validation





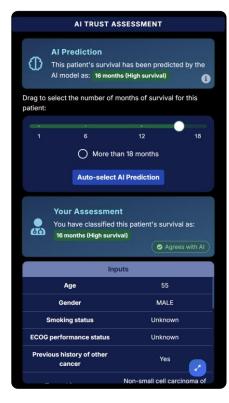
PROSTATE

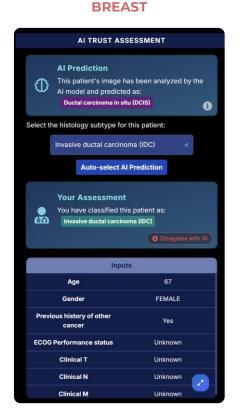
	AI TRUS	TASSESSMENT					
٩		age has been analyzed by the adicted as: High Risk					
Select th	ne risk for this pati	ent:					
	LOW RISK	HIGH RISK					
	Auto-select Al Prediction						
	Your Assessment You have classified this patient as: High Risk						
æ		ied this patient as: High Riak					
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#### LUNG







COLON

AI TRUST ASSESSMENT

		ASSESSMENT
٩		age has been analyzed by the dicted as: T1-T2 N0 M0
Select th	e pTNM for this pa	atient:
T1-T2	■ N0	< M0 <
	View TNM Info	Auto-select Al Prediction
•	T1-T2 N0 M0	ed this patient as:
	_	Inputs
	Age	93
	Gender	FEMALE
Previo	ous history of other cancer	No
ECOG	Performance status	s Unknown
	ECOG Date	Not evaluated
L	ocation Cecum	No
	ocation Cecum on ascending color	
	ocation Cocum	No

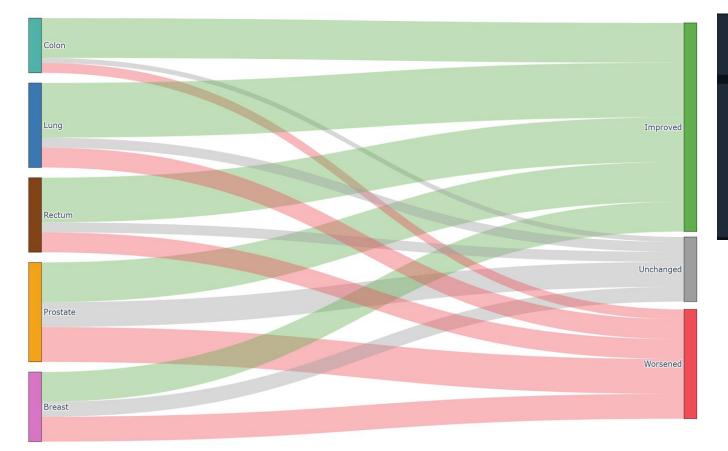


	AI TRUST ASS	SESSMENT				
٩		as been analyzed by the Al S: Vascular Invasion: Yes				
	Vascular Extramural Invasion: No Yes Mesorectal Fascia Invasion: No Yes Auto-select Al Prediction					
•3	Your Assessment You have classified thi Vascular Invasion: Yes	is patient as: Mesorectal Invasion: No C Disagrees with Al				
	Inpu	ts				
	Age	50				
	Gender	MALE				
Previo	ous history of other cancer	No				
ECOG	Performance status	Unknown				
	ECOG Date	Not evaluated				



## **In-Silico Validation**









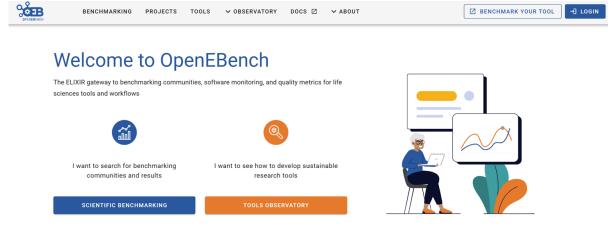


- Cases: 1,553 (5 tumors).
- Observers: 77 (34 radiologist and 43 physicians).
- Different Experience Level (14: <5 year, 7: 5-10 years, 56: >10 years).
- 54% improved, 17% unchanged, 29% worsened.

## **Software Benchmarking**



- Contribution to **multicentric datasets from new hospitals** and clinical centers in Europe.
- Benchmarking of pre- and post-market AI solutions in our platform using our own computational and storage resources.
- Use of our defined guidelines and frameworks for **AI benchmarking** including 1) conceptual, technical and integration validation, 2) dataset validation in terms of bias and fairness; 3) performance validation, and 4) clinical validation.
- Use of EUCAIM's **Trustworthy and Explainable AI** guidelines and metrics.
- Use of EUCAIM's pre-processing tools to perform **stress tests** on the AI solutions.
- **Incoporation of all datasets** into the EUCAIM infrastructure (either centralized or federated) for post-market regulatory compliance.







# Use Cases & Engagement Opportunities for Innovators

Ángel Alberich (QUIBIM) EUCAIM leading private partner

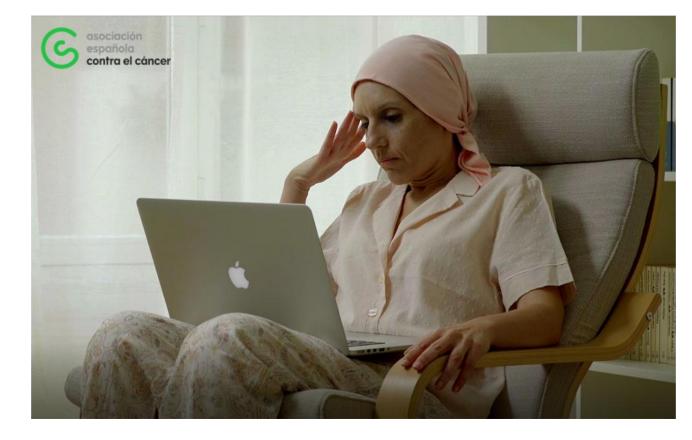




### **Social impact: patients**

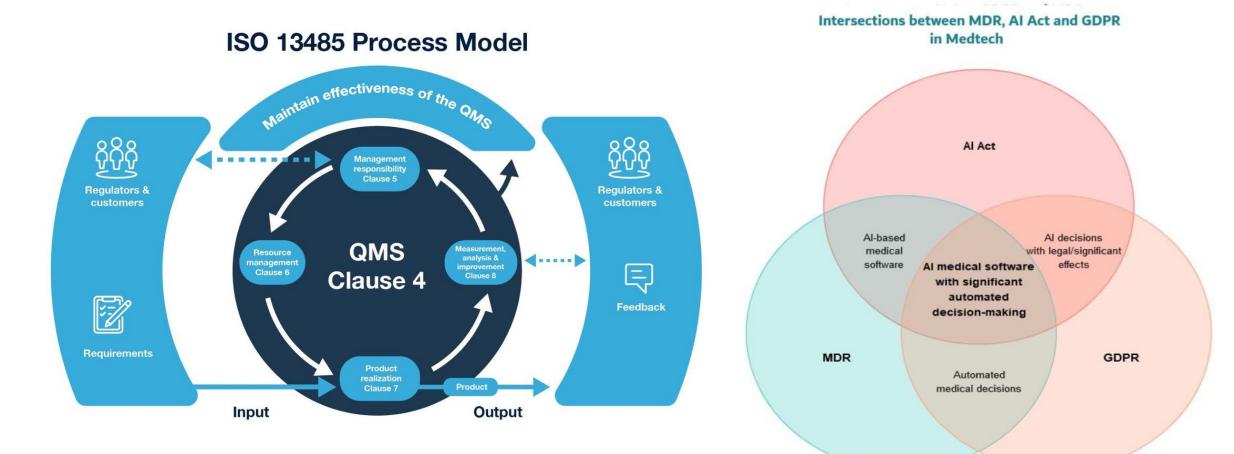
Patients benefit from research results in AI and imaging when these are evolved into products to be used in clinical practice.

### **Medical Devices**















### **Economic impact: Medical Devices industry**

Cancer Image Europe must catalyze and promote the industry of medical devices for cancer and medical imaging in Europe:

- Al and Medical Imaging companies
- Equipment manufacturers
- Providers of PACS and EHR information systems

# KPI: % Growth in Certified AI Medical Imaging Devices in Europe during the post-Cancer Image Europe phase





# Economic impact: Medical Devices industry

To facilitate the access to data and decrease the cost of developing new AI products.

Lower cost, more products, more access.

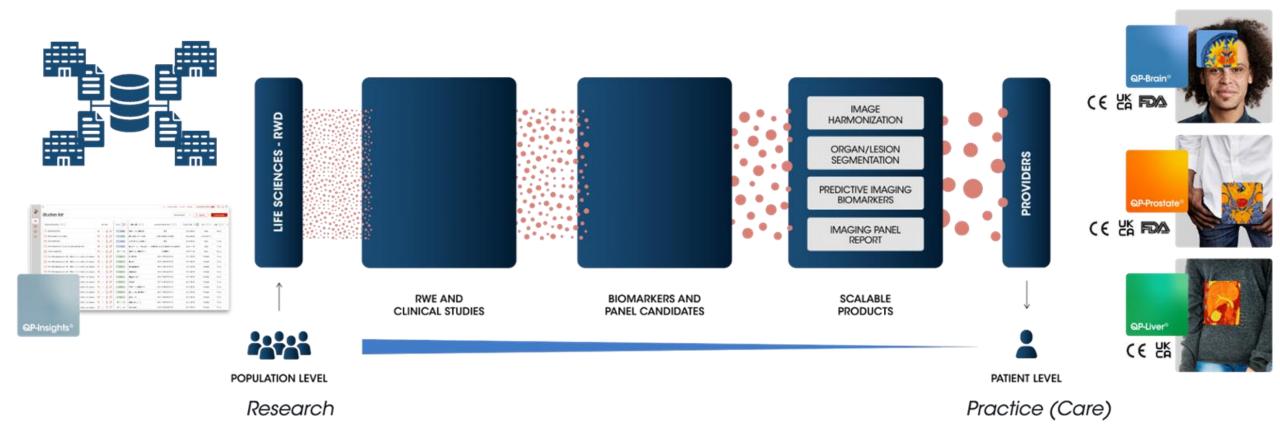


Average \$88m per product!











#### nature research

Quibim: Empowering biopharma to turn images into actionable predictions using artificial intelligence. Nature – Biopharma dealmakers. June 2023





# EUCAIM will transform the development of medical devices in Europe

- What is needed to catalyze the innovation process?
- Highly available, cyber-secure technical infrastructure with strong technical and organizational information security measures.
- Datasets compliant with data interoperability standards.
- Integration with multi-modal clinical data: electronic health records, pathology and molecular biology data, among others.
- Audit trail mechanism.
- For model training: data download under licensing agreements. The manufacturing process requires that manufacturers have access to the data to train AI models on auditable and traceable infrastructures (AI Act compliance).
- For model validation: integration of AI modules as Docker containers on the platform, meeting EUCAIM validation requirements.







### **BEFORE EUCAIM:**

	9-12 months			3-6 months		12 months		30
Proc idea	tion	Data gathering (hospital-by- hospital, data brokers)	Data curation	Manufacturing (training and validation)	Product r regul submi	atory	Cleara	ance
WITH EUCAIM:								
	2-6 months		3-4 mo	nths 12	12 months 22			
Proc idea		Data gathering and curation (EUCAIM access request)	Manufacturing (training and validation)	Product ready for regulatory submission	. (	→ Clearance		
Co-funded by the European Union *F6S lists 100 top medical imaging companies and startups,								69

## **EUCAIM offer to innovators**



#### EUCAIM will transform the development of Al-powered, imagingbased medical devices in Europe

- Access to Large-Scale, Multimodal Cancer Imaging Data: Datasets from across Europe: MRI, CT, PET, mammography, among others. Annotated, harmonized, and linked to clinical data in many cases. Covers diverse patient populations, institutions, and imaging protocols. Enables real-world AI model generalization across different scanners, populations, and clinical workflows.
- **Benchmarking and Validation Tools**: Evaluate AI models on external, standardized datasets. Generate evidence for MDR regulatory submissions. Contribute and test models in a secure and auditable environment. Frameworks and blind-access datasets for the benchmarking and licensing.
- Support for CE Marking / Regulatory Readiness: EUCAIM provides traceability, audit trails, and a compliance-friendly infrastructure (aligned with EU AI Act requirements).
- Secure access via cloud and edge infrastructure, ensuring fine-grain access control to datasets
- Container-based model integration and testing
- Metadata harmonization using HEALTH DCAT-AP schema and datasets following the FAIR principles
- Licensing frameworks and access control for data usage





## Discussion

