Welcome to the session
AI and Cancer: Unleashing Opportunities, Overcoming Challenges

Clustering event powered by INCISIVE and the AI4HI cluster

INCISIVE

Success stories of cancer medical imaging in advancing cancer research and patient care

13:00 - 13:40

EUCAIM | AI4Health Imaging

Success stories of cancer medical imaging in advancing cancer research and patient care

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Project manager at Visaris
INCISIVE project

Mr. Javier Sánchez
Clinical Science Lead South Europe at Philips

Mr. Mario Aznar
CEO of Matical Innovation
PRIMAGE and CHAIMELEON projects

Mr. Pau López
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Mr. Javier Miguel Aquerreta
Biomedical Engineer at La Fe Health Research Institute

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INCISIVE project

INCISIVE | EUCAIM

Mr. Vladan Zdravković

Project manager at Visaris

INCISIVE project

INCISIVE. The challenge

Early cancer detection could identify tumors at a time when outcomes are superior, and treatment is less aggressive

But there are number of problems and challenges.
Three main questions are as follows:

- how to convince medical professionals to use AI tools
- how to improve precision
- how to back up results with histopathology data

These projects has received funding from the European Union's Horizon 2020 research and innovation programme

INCISIVE. The impact

AI as assistive technology saving time
In initial tests Visaris proved that with AI software users are saving time for:

- automatic image orientation - experienced radiologist up to a minute and inexperienced up to two minutes per patient
- positioning - experienced radiologist up to two minutes and inexperienced up to five minutes
- enlargement and focus - experienced radiologist up to five minutes and inexperienced up to ten minutes

In initial tests Revive proved that with AI software users are saving for:

- automatic reporting - experienced doctor up to four minutes and inexperienced doctor up to six minutes per patient
- search for symptoms and diagnoses - experienced doctor up to ten minutes and inexperienced doctor up to two hours
- cancer detection (95%) precision (for melanoma and skin cancer) - experienced doctor up to five minutes and inexperienced
- doctor up to ten minutes (inexperienced doctors have precision between 60% and 75% depending on cancer type)

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INCISIVE. The challenge

Three main tasks for the industry:

- Find better – more precise solutions
- Back it with data (histopathology and efficiency tests)
- Educate

At this moment for us is the main task to explain:

- how to choose the right tool for the right purpose
- what are features
- how much users can depend on results

It seems that ai is here to stay but

Focus on Assistive functions

Prove time and money savings

Build cases with histopathology

Work with professionals who clearly understand possibilities

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Mr. Javier Sánchez

Clinical Science Lead South Europe at Philips

"AI for Precision Diagnosis"

PHILIPS

www.philips.com

AI for Precision Diagnosis




Scan Preparation → Acquisition → Image Formation → Diagnosis

- Increase efficiency and efficacy
- Decrease user variability
- Improve outcome

AI CT Reconstruction

Supervised residual learning to remove noise from images (improve SNR)
Advanced low-dose simulation [1] to generate training data

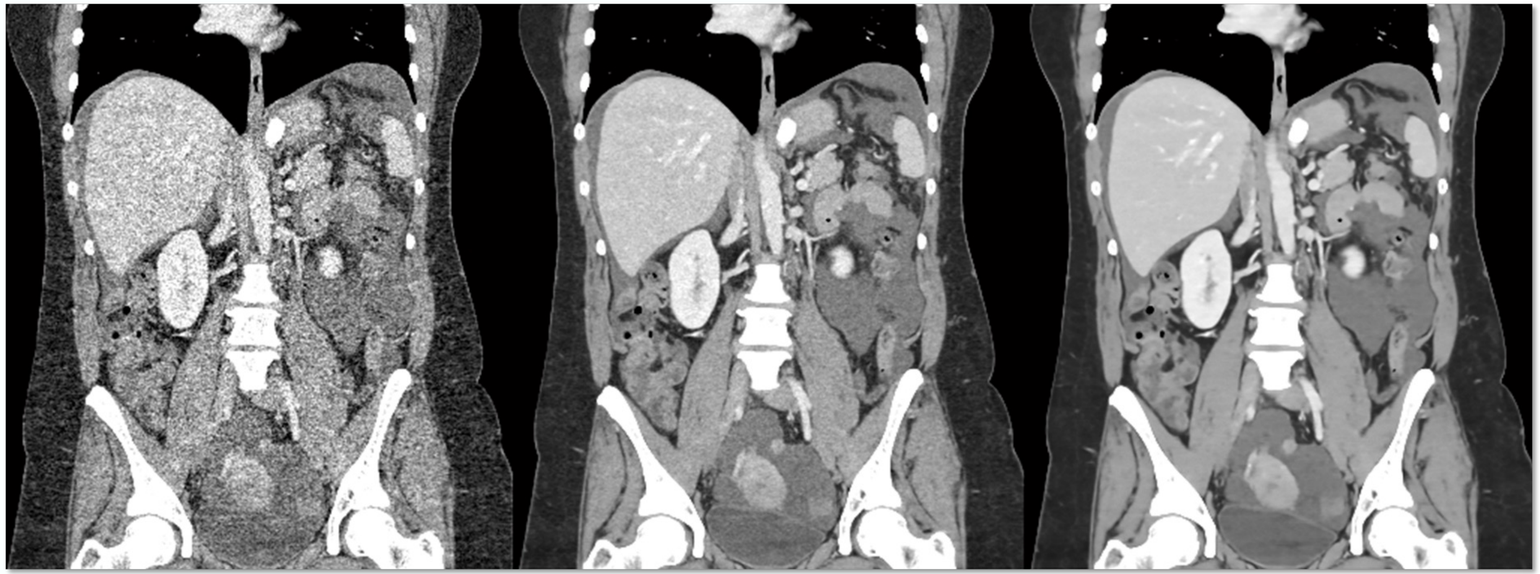
[1] S. Žabić *et al.*, "A low dose simulation tool for CT systems with energy integrating detectors", *Med. Phys.*, 2013

Philips Research Hamburg

AI CT Reconstruction

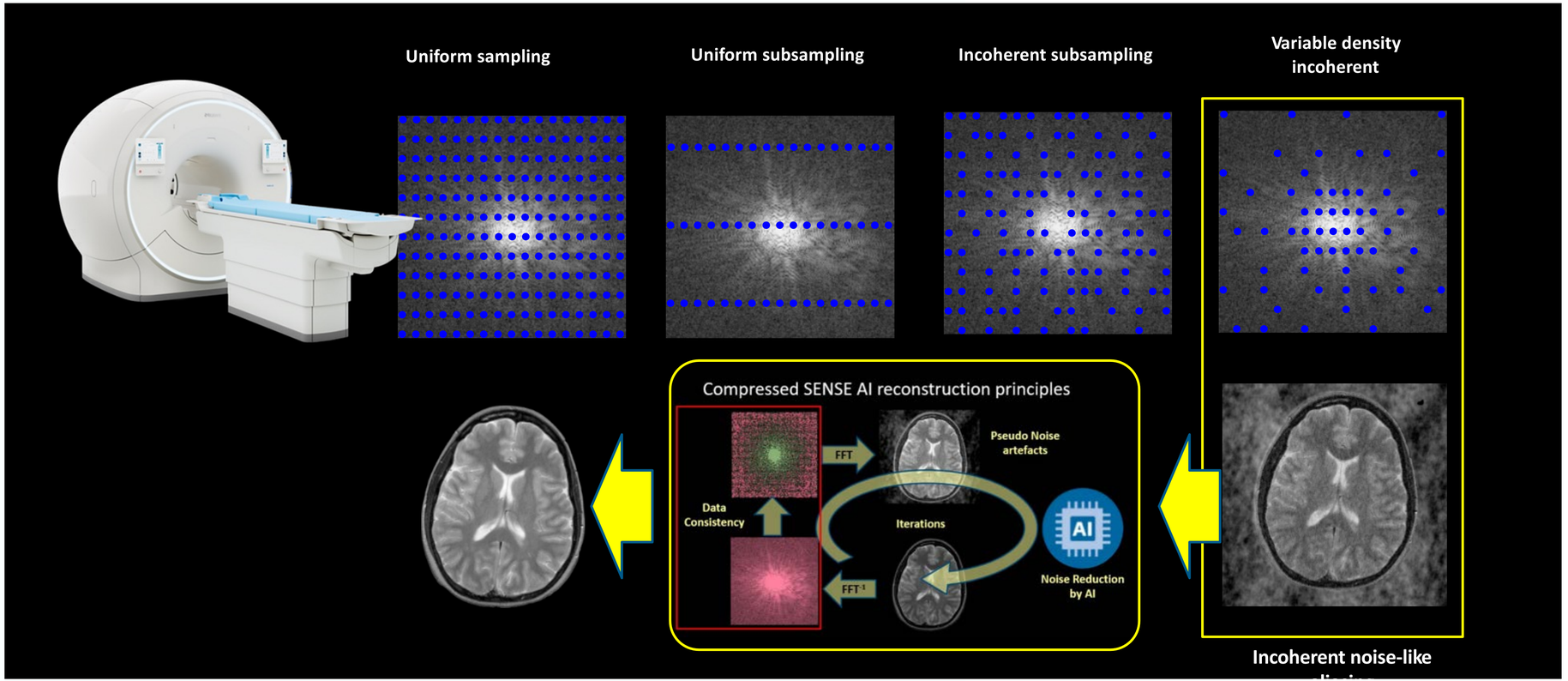
Example: Abdomen

FBP | Philips Precise Image | Philips Precise Image (cleaner)



AI clinical results demonstrate simulated images at 50% less dose and were reviewed by board-certified radiologists.
Results from case studies are not predictive of results in other cases. Results in other cases may vary.

Different k-space sampling



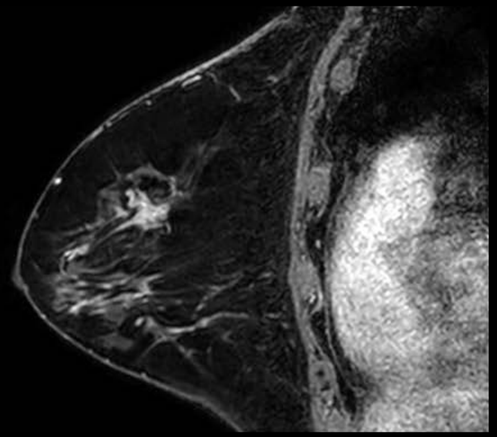
SmartSpeed AI

Delayed HR-3D-mDIXON

Comparison

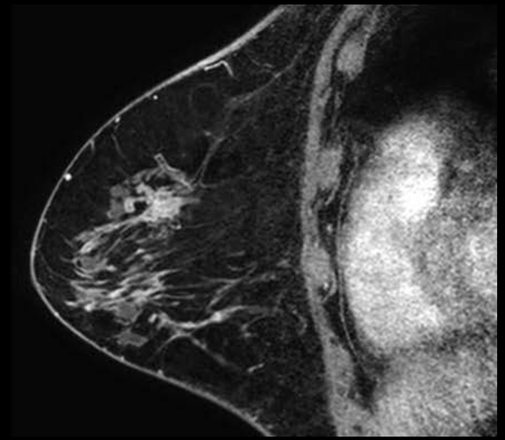
Courtesy : Kumamoto Chuo Hospital, Japan
Ingenia Elition 3.0T X, R11.0

C-SENSE (previous)



C-SENSE 3.0, 1m46s
0.86/0.86/0.8mm

SmartSpeed AI



AI C-SENSE 7.5, 2m2s
0.7/0.7/0.7mm

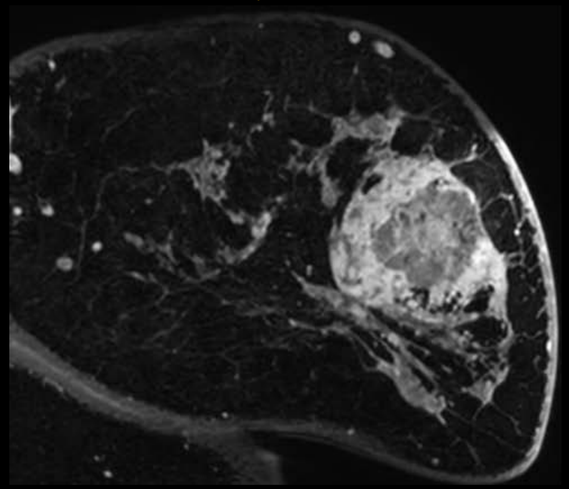
SmartSpeed AI

Delayed HR-3D-mDIXON

Comparison

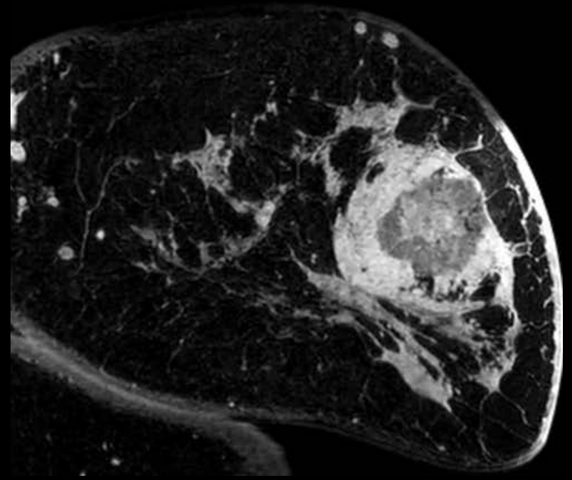
Courtesy : Kumamoto Chuo Hospital, Japan
Ingenia Elition 3.0T X, R11.0

SmartSpeed AI



AI C-SENSE 7.0, 2m14s
0.75/0.75/0.75mm

SmartSpeed AI



AI C-SENSE 7.0, 3m34s
0.6/0.6/0.6mm

AI for Precision Diagnosis



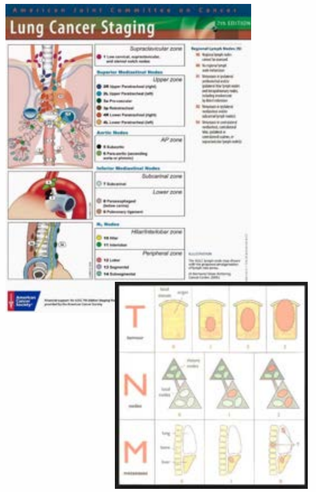

Scan Preparation → Acquisition → Image Formation → Diagnosis

- Increase efficiency and efficacy
- Decrease user variability
- Improve outcome

AI-Based Lymph Node Assessment

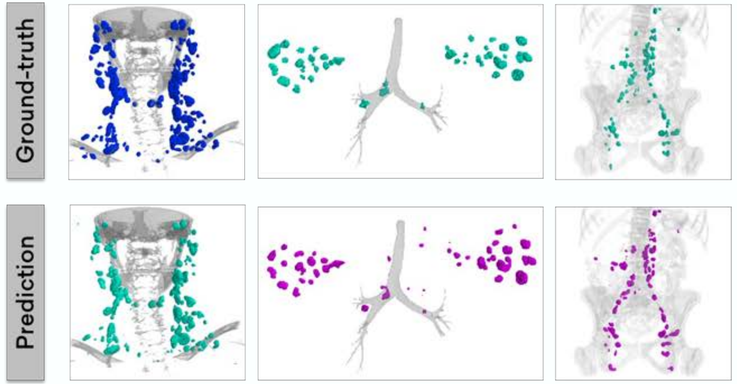
Reading Augmentation in Oncology

- Lymph nodes important for T**N**M staging and follow-up analysis
- Malignant if short axis diameter > 10 mm (RECIST)
- Lymph nodes are numerous, vary in size and shape, have low contrast
- Manual assessment often limited to selected LNs
- Opportunity: Automated detection, segmentation & labelling could significantly improve daily oncological reading

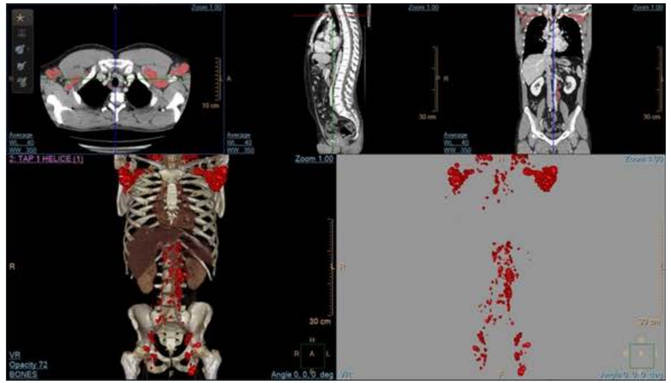


AI-Based Lymph Node Assessment

Results



	head / neck	thorax	abdomen
Localization rate	81.1 %	79 %	80.1 %



[4] *A.-I. Iuga et al.,* "Automated detection and segmentation of thoracic lymph nodes from CT using 3D foveal fully convolutional neural networks", *BMC Medical Imaging,* 2021

[5] *A.-I. Iuga et al.,* "Automated mapping and N-Staging of thoracic lymph nodes in contrast-enhanced CT scans of the chest using a fully convolutional neural network", *European Journal of Radiology,* 2021

[6] *M. Rinneburger et al.,* "Automated Detection and Segmentation of Cervical Lymph Nodes in CT using 3D Foveal Fully Convolutional Neural Networks", *European Radiology Experimental,* submitted

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Mr. Mario Aznar

CEO of Matical Innovation

PRIMAGE and CHAIMELEON projects

The challenge

PRIMAGE
Medical imaging
Artificial intelligence
Childhood cancer research

PRedictive In-silico Multiscale Analytics to support cancer personalized diaGnosis and prognosis, Empowered by imaging biomarkers

Area of application: Neuroblastoma & Diffuse Intrinsic Pontine Glioma

NB: most frequent solid cancer of early childhood (7% childhood malignancies). Staging and diagnosys is made using Cross-sectional imaging (CT or MRI), MIBG imaging agent scan, and bone marrow biopsy to deliver a pre-surgical risk stratification. Progress to enable earlier detection of neuroblastoma in high risk patients is very much needed, as the age at diagnosis has proven to be a crucial factor in the NB prognosis

DIPG: is the leading cause of brain tumour-related death in children.Due to the position of DIPGs deep in the brain and close to vital structures DIPG, biopsy is not an available option. DIPG is diagnosed using MRI or CT scan.

Imaging plays a very important role in the diagnosis, staging, treatment planning, response evaluation and in follow-up of these diseases, as well other related data. In-silico technologies could help provide better diagnosis and prediction of treatment response. I.e: avoiding invasive techniques (Virtual biopsy); simulating tomour growth and predicting biomarkers progression for better clinical decisions making.

DATA IS ALL: NO DATA = NO GAME

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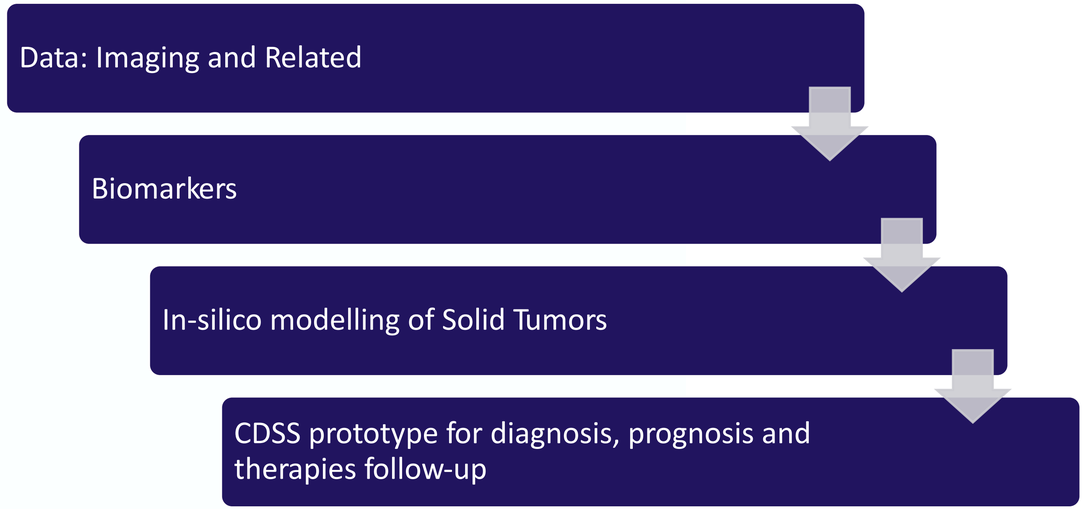
The solution

PRIMAGE
Medical imaging
Artificial intelligence
Childhood cancer research



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The impact

PRIMAGE
Medical imaging
Artificial intelligence
Childhood cancer research

MOST PROMISING RESULTS IDENTIFIED
Computing Platform Specification
Extended Model Execution Environment (MEE)
Computing Platform Specification
Medexprim Suite™ (Radiomics Enabler® solution) for automated image extraction and deidentification tool
Methodology for Clinical data mapping
Image quality control tool
Radiomics models for NB and DIPG
Image registration methodology using rigid and non-rigid approaches for NB and DIPG, including the automatic selection of best registration algorithm with quantitative metrics (SW/tool)
Image enhancement (signal normalization, denoising) methodology for NB and DIPG (SW/tool)
Generation of manual segmentation data set from MRI patient data for NB and DIPG (set of data)
MR automatic segmentation models for NB and DIPG (model/tool)
Deep transfer learning and radiomics feature prediction of survival of patients with NB and DIPG (SW/tool)
A novel methodology of quantitative diffusion: a use-case to classify neuroblastic tumours (SW/tool)
Selection and visualization of features using unsupervised learning (SW/tool)

INNOVATION RADAR

Computational tools for the processing and analysis of imaging data

Market maturity: Tech Ready
Market creation potential: Minor
Project: PRIMAGE
Innovation Topic: Health & Care
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

FUNDACION PARA LA INVESTIGACION DEL HOSPITAL UNIVERSITARIO LA FE DE LA COMUNIDAD VALENCIANA - SPAIN
UNIVERSITA DI PISA - ITALY

Multiscale modelling of tumour growth and progression

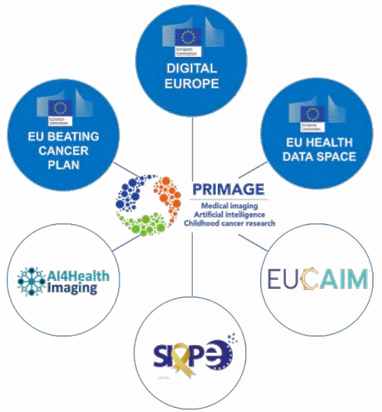
Market maturity: Market Ready
Market creation potential: High
Project: PRIMAGE
Innovation Topic: Health & Care
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

ALMA MATER STUDIORUM - UNIVERSITA DI BOLOGNA - ITALY
CHEMOTARGETS S.L. - SPAIN
UNIVERSIDAD DE ZARAGOZA - SPAIN

Platform for the collection, exploration and analysis of clinical data

Market maturity: Market Ready
Market creation potential: High
Project: PRIMAGE
Innovation Topic: Health & Care
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

FUNDACION PARA LA INVESTIGACION DEL HOSPITAL UNIVERSITARIO LA FE DE LA COMUNIDAD VALENCIANA - SPAIN
QUIBIM SOCIEDAD LIMITADA - SPAIN
MEDEXPRIM - FRANCE



European Society for Paediatric Oncology (SIOPE) uptaking PRIMAGE Platform as their Imaging Management Tool

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Mr. Pau López

Head of the Informations Systems Technical Office of the Catalan Institute of Health (ICS)

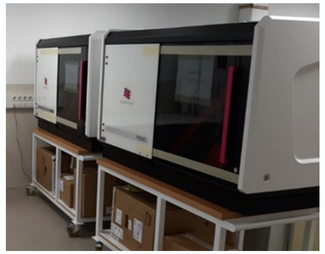
The challenge

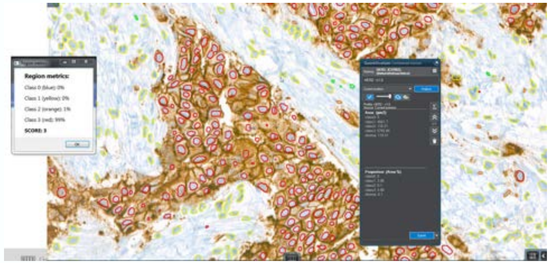
DigiPatICS project

Incorporate Digital Pathology and Artificial Intelligence in Pathology Departments, with an organizational change that modifies work dynamics, responds to current and future challenges, and improves quality, efficiency, effectiveness, equity, speed, systematicity, and reproducibility of diagnoses, affecting other disciplines and increasing patient safety

The solution

- Deployment of 24 scanners
- Redesign pathologist process
- Create a new LIS
- Incorporation of UPC University to develop IA algorithms
- Creation of an IA platform and a visualization framework
- Involve ICS pathologies to define their algorithms
- Deploy new IT services and infrastructures
- Development of a new platform to storage the slides -> PAT-SIMDCAT





The impact

- Networking between the 8 ICS hospital centers (168 pathologist) with telediagnosis, case sharing and teaching, increasing patient safety, reproducibility, and fairness in diagnosis
- Standardized DICOM integration of images in SIMDCAT with more than 1,5 Millions images digitalized in SIMDCAT (1,5 PB), Since November 2021
- 4 algorithms of breast cancer developed and deployed in the slide viewer (Ki67, Her2, RP, RE)
- Developing new algorithms in lung cancer and cancer detection in HE
- Preparing new IA developments

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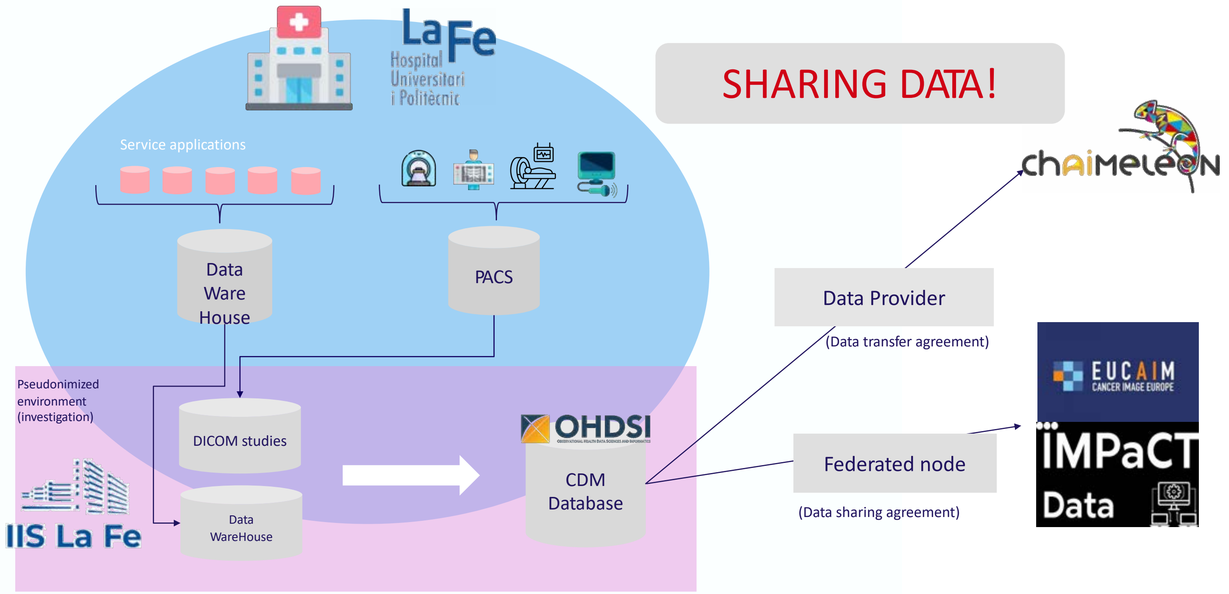
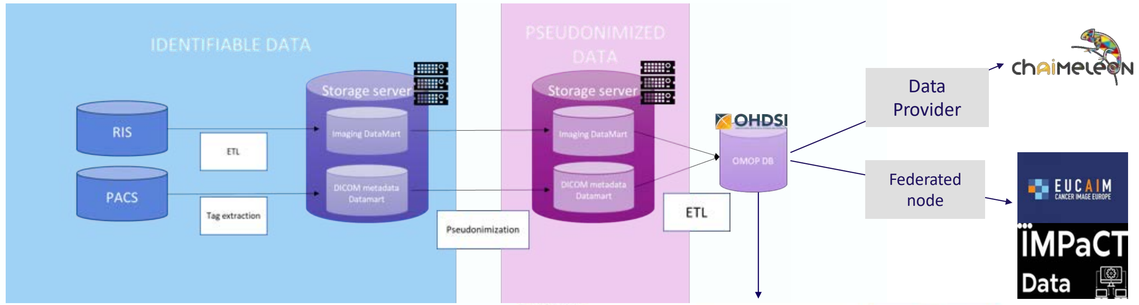
Mr. Javier Miguel Aquerreta
Biomedical Engineer at La Fe Health Research Institute

The challenge

Interoperability between centres: Building a DataWarehouse with a CDM.

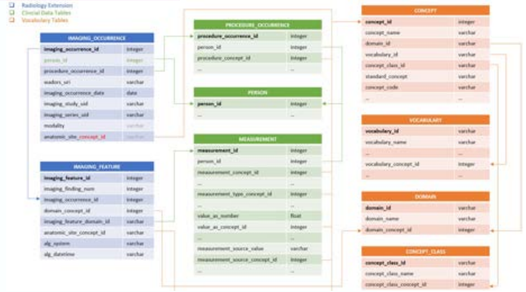


The solution



Radiology extension for OMOP

- 2 new tables
  - Imaging_occurrence
  - Imaging_feature
- Custom vocabulary and concepts
- Relations between procedure occurence and the new tables



The impact

- Integration between clinical data and imaging data.

- Allow more complex data analysis

- Use of CDM: easier interoperability between centres