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## Neuroimaging data sharing with FLI-IAM

Camille Maumet, Michel Dojat

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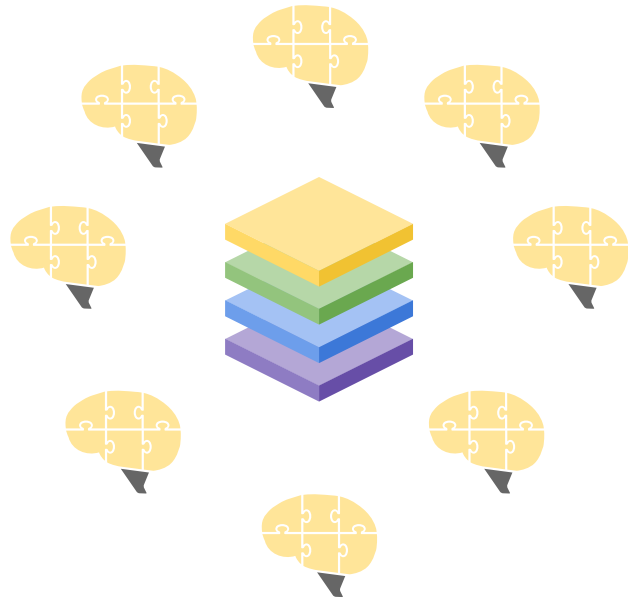
Submitted on 15 Oct 2024

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# Neuroimaging data sharing with FLI-IAM

Camille Maumet<sup>1</sup> and Michel Dojat<sup>2</sup>

1. Inria, Univ Rennes, Inserm, CNRS, IRISA

2. University of Grenoble Alpes, Inserm U1216, Grenoble Institut Neurosciences

# 10 years of brain data sharing...

2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024

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2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024



**Why sharing neuroimaging data?**

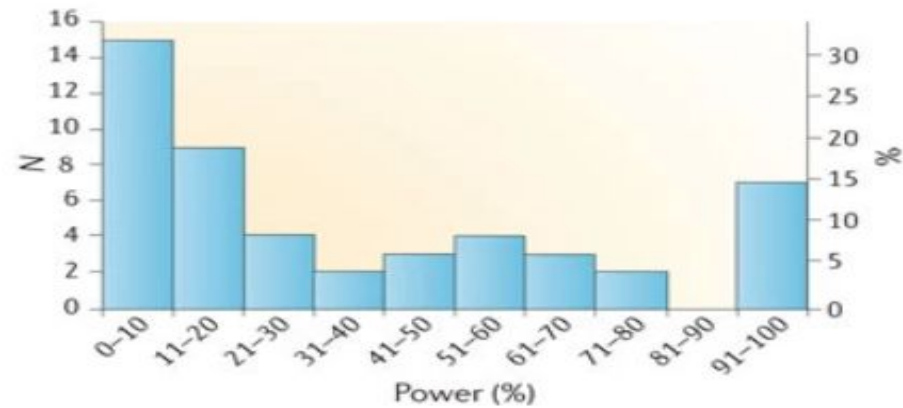
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2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024



## Why sharing neuroimaging data?

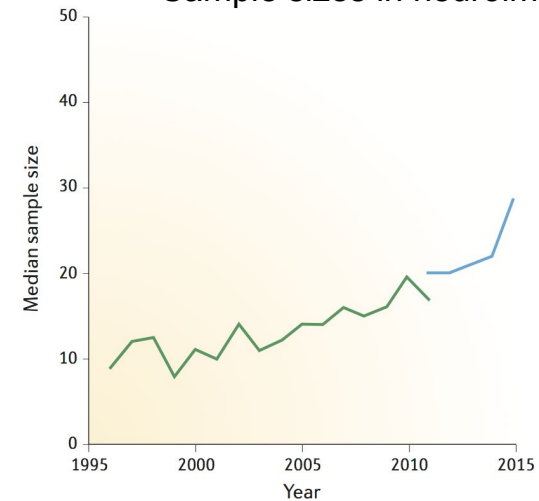
Power of neuroscience studies



(Button et. al, 2013)

## Small samples and low statistical power

Sample sizes in neuroimaging



(Poldrack et. al, 2013)

High rate of **false positives** in the literature

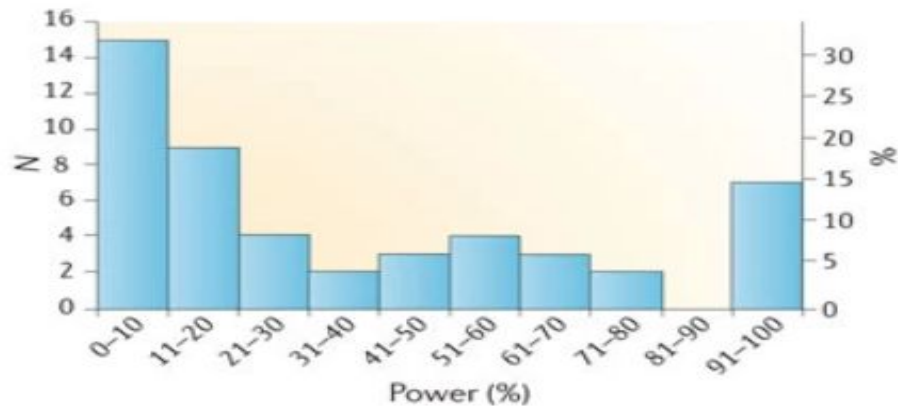
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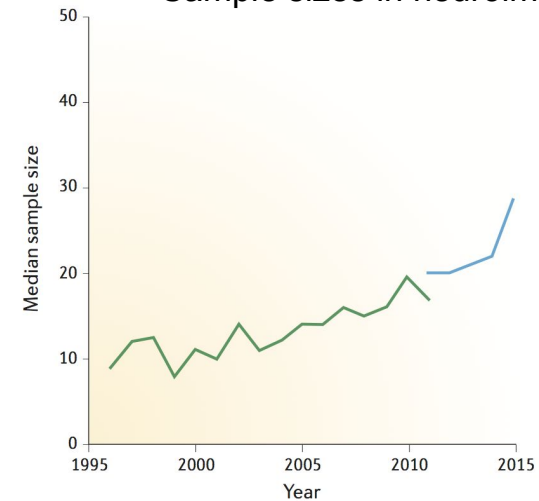
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## Small samples and low statistical power

Sample sizes in neuroimaging



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High rate of **false positives** in the literature



**Solution: Data sharing to get to larger samples**

# Neuroimaging data sharing

Single study  
30 sub.



OpenNEURO



NEUROVAULT

NITRC

OSF



# Neuroimaging data sharing

Single study  
30 sub.



Consortium  
1000 sub.



1000 Functional  
Connectomes Project





# Neuroimaging data sharing

**Single study**  
30 sub.



**Consortium**  
1000 sub.



1000 Functional  
Connectomes Project



**Cohort**  
100 000 sub.



# 10 years of brain data sharing...

2014

2015

2016

2017

2018

2019

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2021

2022

2023

2024

Why sharing neuroimaging data?



# 10 years of brain data sharing...

2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024

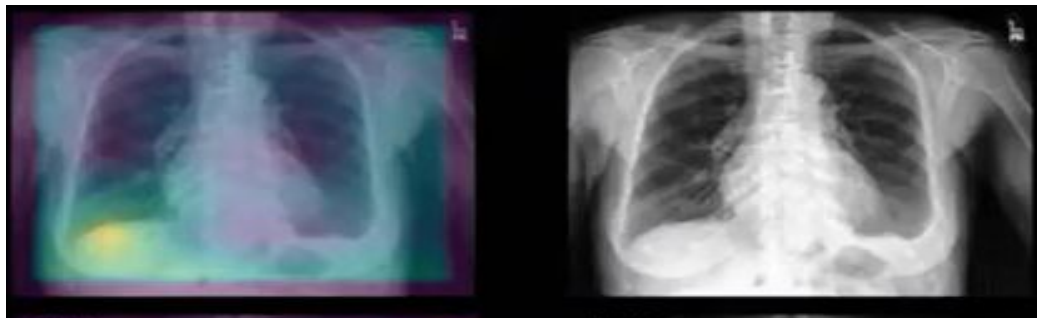
Why sharing neuroimaging data?



## Generalizability and fairness

### **X-ray: Lung opacity detection**

*Model trained on male images, tested on female images*



(Larrazabal et. al, 2020)

Biased models

# 10 years of brain data sharing...

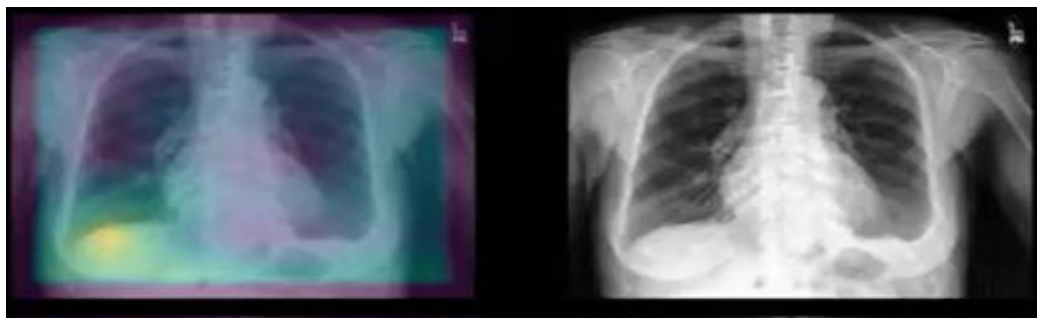
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Why sharing neuroimaging data?



## Generalizability and fairness

**X-ray: Lung opacity detection**  
*Model trained on male images, tested on female images*



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Biased models



**Solution:** Decentralized data sharing to get **more diverse samples**

# 10 years of brain data sharing...

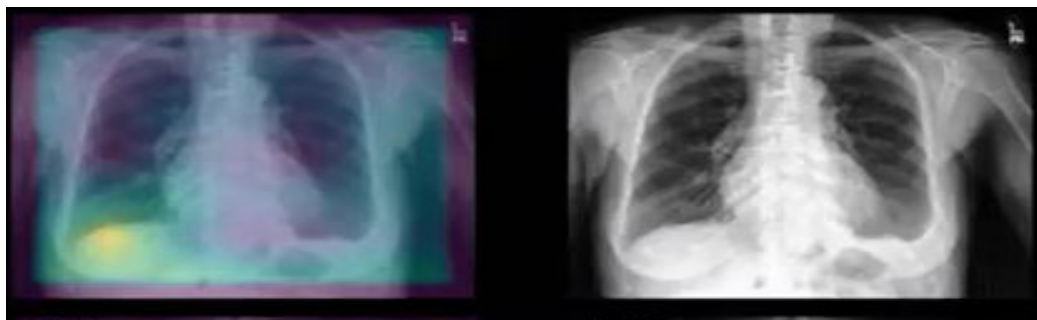
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Why sharing neuroimaging data?



## Generalizability and fairness

**X-ray: Lung opacity detection**  
Model trained on male images, tested on female images



(Larrazabal et. al, 2020)

Biased models



**Solution:** Decentralized data sharing to get more diverse samples



Web-based application for **medical imaging storage** and

- Share data with a **Data user agreement**
- **Open source** software
- **Shared governance**

# On GDPR compliance...

## Are neuroimages anonymous?



Cyril Pernet  
Copenhagen Uni Hosp  
(Denmark)



Stephan Heunis  
Resrch Ctr Jülich  
(Germany)

(Open Brain Consent, HBM 2021)

# On GDPR compliance...

## Are neuroimages anonymous?



  
Digital Imaging and Communications in Medicine

Name: Depont  
First : Nathalie  
Birth date : 10/11/1995  
...



Cyril Pernet  
Copenhagen Uni Hosp  
(Denmark)

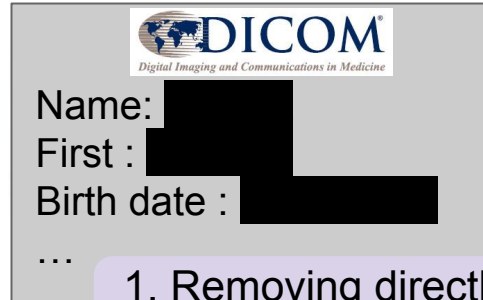


Stephan Heunis  
Rsrch Ctr Jülich  
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(Open Brain Consent, HBM 2021)

# On GDPR compliance...

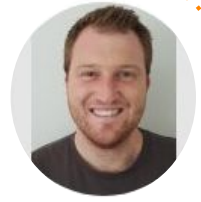
## Are neuroimages anonymous?



1. Removing directly identifiable information



Cyril Pernet  
Copenhagen Uni Hosp  
(Denmark)



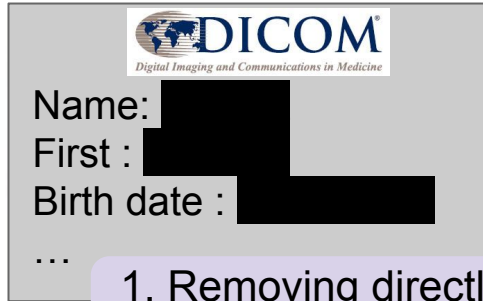
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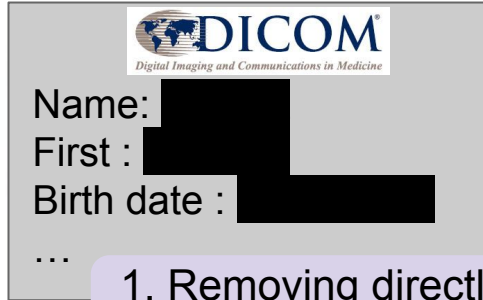


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(Open Brain Consent, HBM 2021)

# On GDPR compliance...

## Are neuroimages anonymous?



1. Removing directly identifiable information



2. Defacing



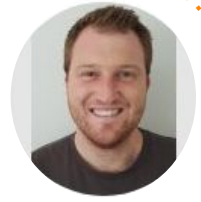
Cyril Pernet  
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(Open Brain Consent, HBM 2021)

# On GDPR compliance...



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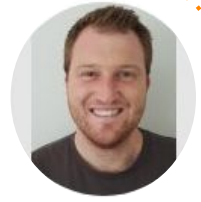
2. Defacing



Anonymous (USA)

(Open Brain Consent, HBM 2021)

# On GDPR compliance...



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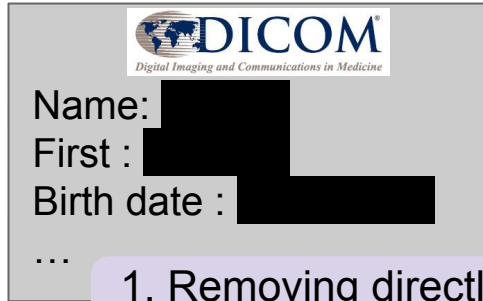
Not anonymous (EU)

**General Data Protection Regulation (GDPR)** → Individualisation

(Open Brain Consent, HBM 2021)

# On GDPR compliance...

## Are neuroimages anonymous?



1. Removing directly identifiable information



2. Defacing



Anonymous (USA)

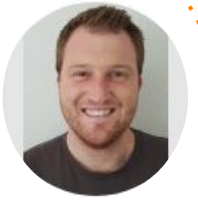


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**General Data Protection Regulation (GDPR)** → Individualisation



Cyril Pernet  
Copenhagen Uni Hosp  
(Denmark)



Stephan Heunis  
Resrch Ctr Jülich  
(Germany)

## Open Brain Consent GDPR edition

### Consent form

Signed by participants

"[...] data might also be used for other future research projects in the field of medical and cognitive neuroscience."

### Data User Agreement

Signed by researchers

"[...] I will not attempt to [...] retrieve the identity of the study participants."

(Open Brain Consent, HBM 2021)

French



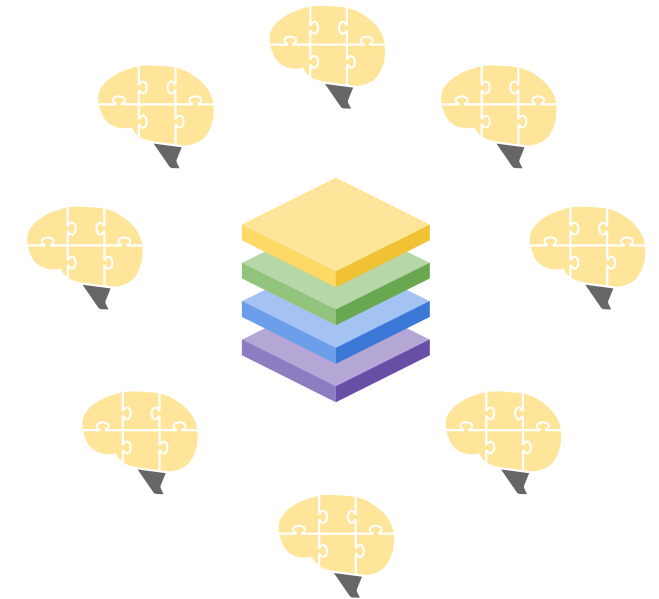
Anne Hespel  
CHU Rennes



Elise Bannier  
CHU Rennes

**13 languages:** Bosnian, Czech, German, Greek, Spanish, Finnish, French, Italian, Dutch, Norwegian, Portuguese, Turkish

# Towards federated European neuroimaging data sharing?



# France Life Imaging

National Infrastructure for medical imaging in  
biology and health



Manager: Régine Trébossen



[regine.trebossen@cea.fr](mailto:regine.trebossen@cea.fr)



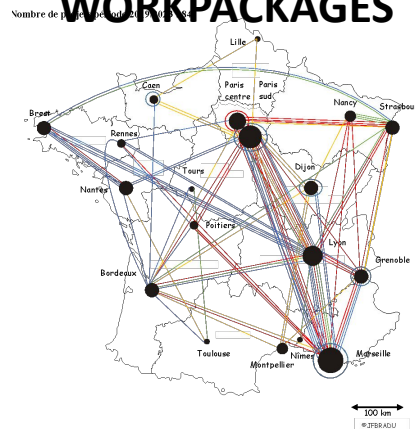
[www.francelifeimaging.fr](http://www.francelifeimaging.fr)

Network of 9 regional HUBS covering the main platforms (160 imaging equipments)



4 networks of expertise in scientific domains + 1 education:

## WORKPACKAGES



- 1 : Molecular imaging agents
  - 2 : Instrumentation & innovative technologies
  - 3 : Interventionnal imaging
  - 4 : Image processing
- Training network

A distributed HUB in data processing: IAM (Information Analysis & Management)



Scientific managers



Technical manager

Sharing

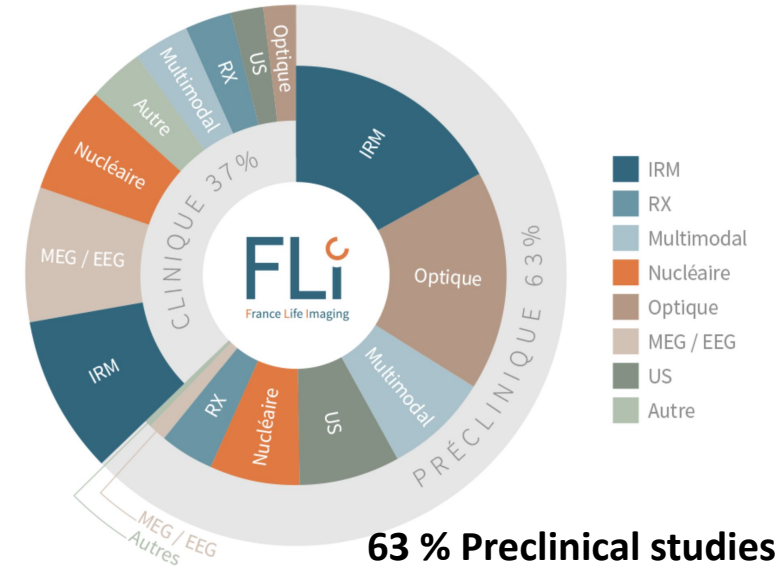




# FLI-IAM: A dedicated infrastructure for ...

- Storage for produced imaging data
  - Raw data
  - Processed data
  - Analysis results
 + Physiological data, eye-tracking, neuropsychology test ...
- Image processing pipelines
  - to compose & execute
- Valorisation : to Expose & Share
- Reinforced needs
  - tracing
  - machine learning
  - open data

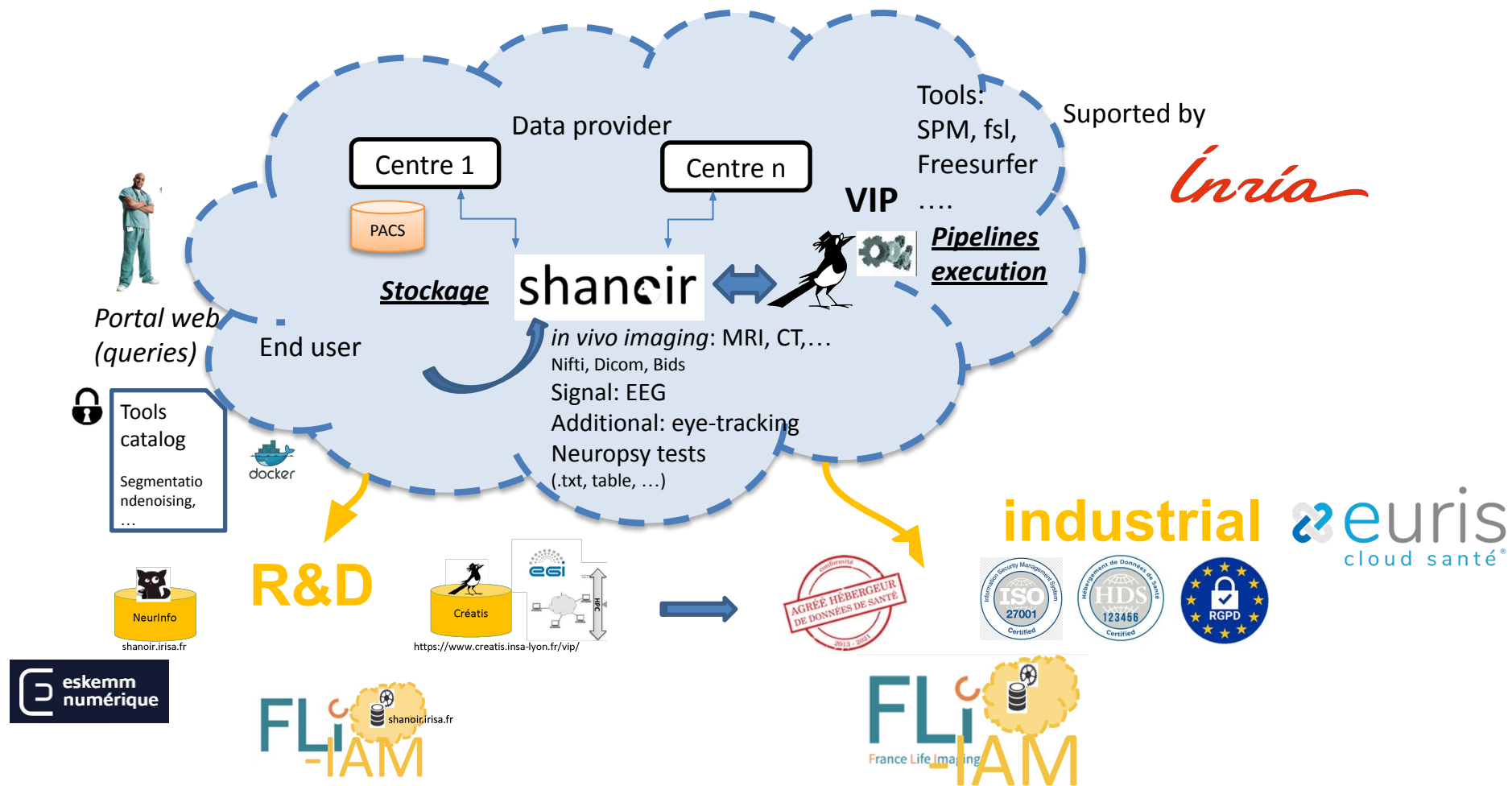
32 % Clinical studies



63 % Preclinical studies



# Cloud-based Architecture

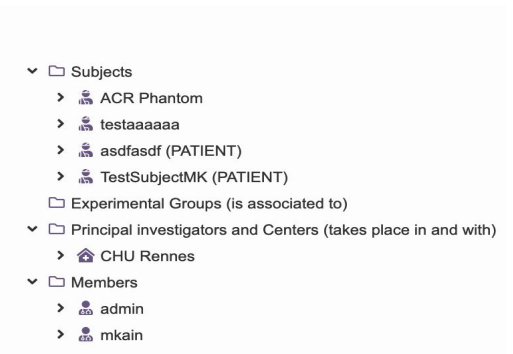
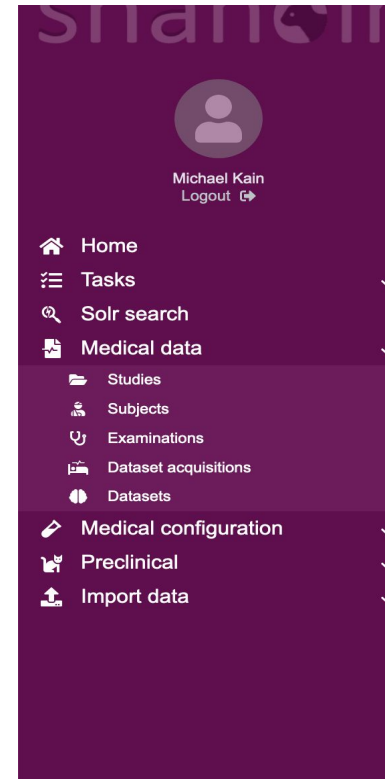
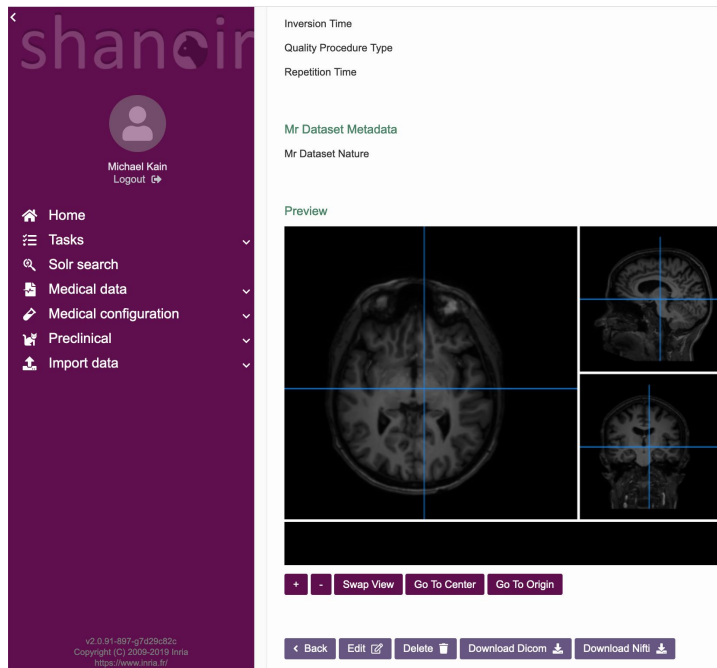


# Two main components: 1/2

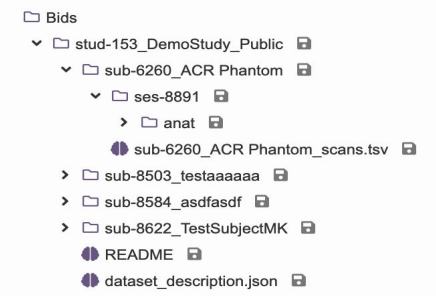
## shanoir

<https://project.inria.fr/shanoir/>

- Developed since 2003
- Store & Share pseudo-anonymized data
- Use an specific ontology (Ontoneurolog)
- DUA associated to each study
- Dicom, nifti, bids
- Used in various large multicentre projects



### Bids



For clinical and preclinical imaging data

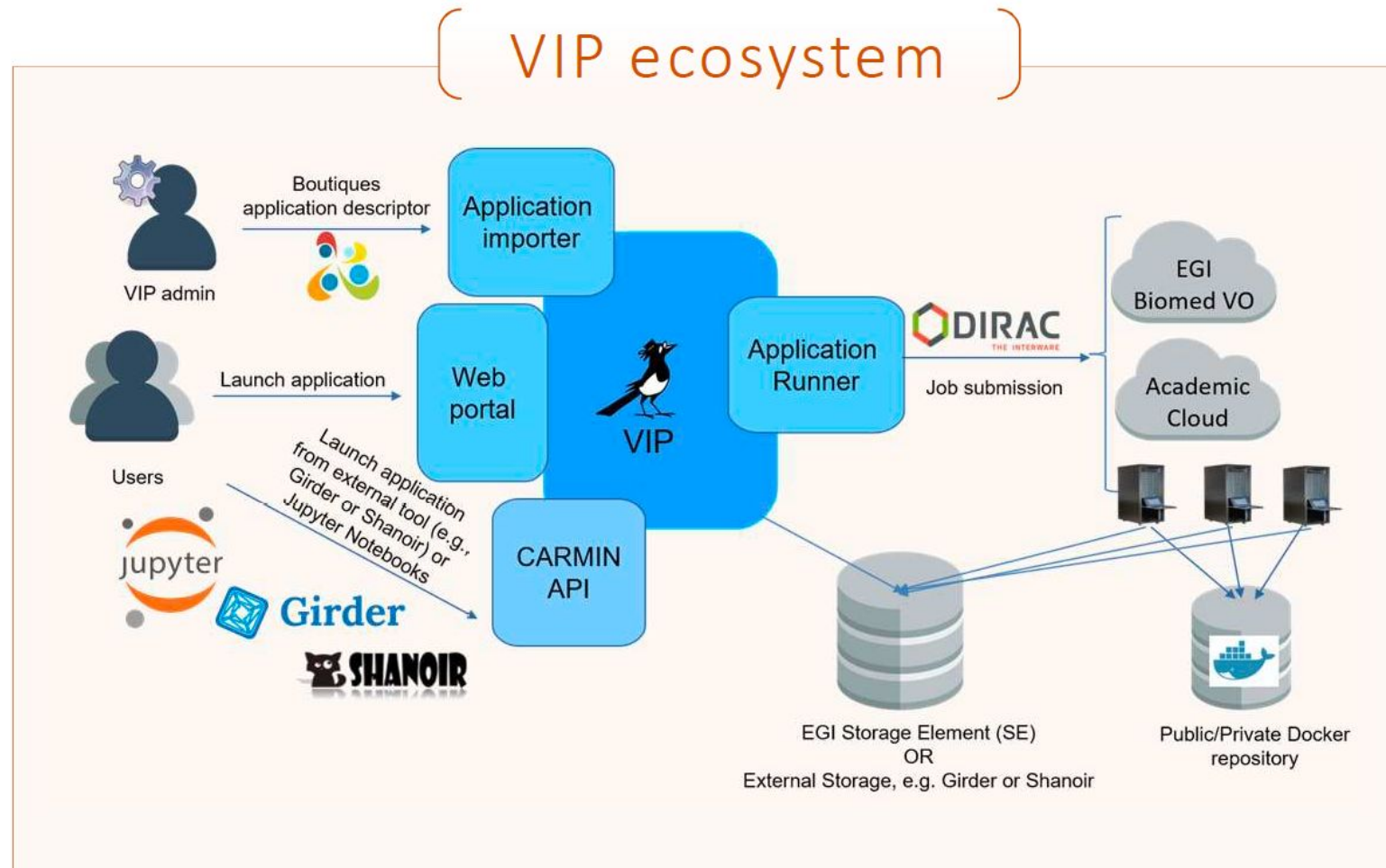
# Two main components: 2/2

## Virtual Imaging Platform (VIP)

<https://vip.creatis.insa-lyon.fr>



Sorina Pop



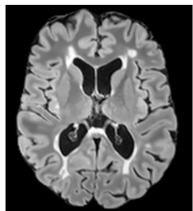
# OBJECTIVES-I

- *Visibility*
  - to Provide a web portal to **FIND and ACCESS** data & processing tools
- *Diffusion*
  - to Facilitate compliance to ethical & law rules for data **REUSE & SHARING** (“as open as possible, as restricted as necessary” )
  - to Provide a data management plan (ISO)
  - to Renforce databases **INTER-OPERABILITY** (FBI, genetics, ...)
- *Valorisation*
  - Referencing data and imaging processing tools (DOI)
- *Scientific motivations*
  - Challenges organisation (validation, performances, ...)
  - Multicenter studies (Statistical robustness, reproducibility, ...)
  - 3R policy (Reduce, Raffine, Replace)

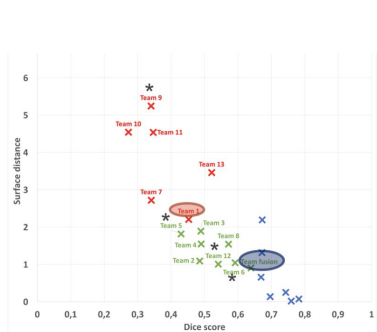


# OBJECTIVES-II

- To be a national and european actor for the management of *digital commons*:  
imaging *in vivo* (FAIR) data



Commowick, O. et al. Nature Scientific Reports, 2018



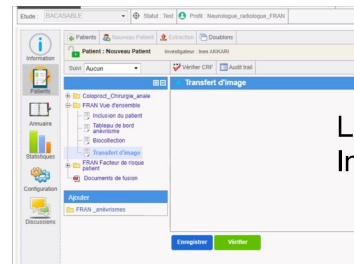
## Challenges organisation

## Integrated to clinical digital environnement

French national medical registers

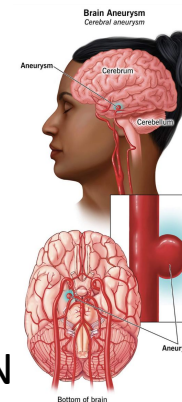


Stratégie nationale pour l'intelligence artificielle



Link to Imagerie *in vivo*

FRAN (H. Desal CHU Nantes)



ECAN

## Clinical research partner



## Shared data

**shanoir**  
SHaring IN vivo Imaging Resources

3 public studies

**MSSEG-2** | MS new lesions segmentation challenge of MICCAI 2021  
START DATE : 2021-03-01 | END DATE : 2025-02-28  
ID : 208 | STATUS : In Progress  
EXAMINATIONS : 0 | SUBJECTS : 0  
100 subjects | MRI brain images | NIFTI | Multiple sclerosis  
[Request an Access](#)

**MSSEG 2016** | MS lesions segmentation challenge of MICCAI 2016  
START DATE : 2021-03-01 | END DATE : 2025-02-28  
ID : 209 | STATUS : In Progress  
EXAMINATIONS : 0 | SUBJECTS : 0  
60 subjects | MRI brain images | NIFTI | Multiple sclerosis  
[Request an Access](#)

**MS-Multi-Spine** | MS lesion segmentation challenge on spinal cord  
ID : 259 | STATUS : In Progress  
EXAMINATIONS : 0 | SUBJECTS : 0  
Spinal cord | Multiple sclerosis (MS) | Lesion segmentation | 200 subjects  
[Request an Access](#)

### Data User Agreement

Signed by researchers

"[...] I will **not** attempt to [...] retrieve the identity of the study participants."

**MSSEG-2**

Access to OFSEP MRI used for the MICCAI 2021 challenge

March 2021

I request access to the data collected in the digital repository of the OFSEP cohort provided in the context of the MICCAI 2021 challenge.

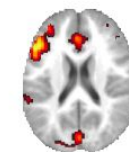
By accessing this agreement, I become the data controller (as defined under the European GDPR) of the data that I have access to, and I am responsible that I access these data under the GDPR obligations and the specific following terms:

- I will comply with all relevant risks and regulations imposed by my institution and my government. This agreement never has precedence over existing general data protection regulations that are applicable in my country.
- I will not attempt to establish or retrieve the identity of the study participants. I will not link these data to any other database in a way that could provide identifying information. I will not request the pseudonymization key that would link these data to an individual's personal information, nor will I accept any additional information about individual participants under this Data Use Agreement.
- I will not redistribute these data or share access to these data with others, unless they have independently acquired and been granted access to these data, i.e., signed this Data Use Agreement. This includes individuals in my institution.
- When sharing secondary or derivative data (e.g. group statistical maps, lesion masks or templates), I will only do so if they are on a group level, and information from individual participants cannot be deduced.
- I will reference the specific source of the accessed data when publicly presenting my results or algorithms that benefited from their use. (All Papers, book chapters, books, posters, and presentations) and all public presentations of results, including from my own institution.

[Download the dsa file DUA-OFSEP\\_MRI\\_Data\\_Access\\_Agreement\\_MICCAI\\_2021.pdf](#)

I have read the data user agreement contract for the study MSSEG-2 and I fully accept it.

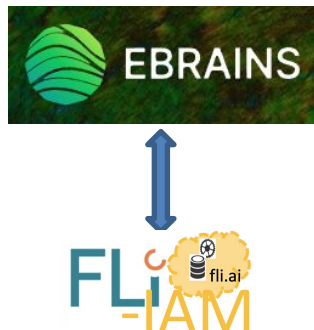
[Accept](#)



3- Access the data

## 2- Sign the Data User Agreement

A research infrastructure service for brain research?



## Destination INFRA-SERV: Research infrastructures services to support health research, accelerate the green transition and the digital transformation, and advance frontier knowledge

### Objective:

- To provide access to broad portfolios of installations and scientific services relevant for a large research domain or in support of societal challenge and EU priorities

### Expected impact:

- Effective access of European researchers to the best research infrastructure services from national and pan-European research infrastructures
- Improved research infrastructure services to address evolving scientific and societal challenges
- Further opening of national research infrastructures and strengthened access programmes of pan-European research infrastructures in the longer term
- Improved transnational access to new users

Topic ID	Topic title	Type of Action	Expected number of GAs	Expected EU contribution per GA M€	Budget M€
HORIZON-INFRA-2025-01-SERV-01	Research infrastructure services to enable R&I addressing main challenges and EU priorities related to the <b>health</b> domain	RIA	4	5-12	37.0



## Destination INFRASERV: Proposed topics (1)

### Research infrastructure services to enable R&I addressing main challenges and EU priorities related to the health domain

1. Support research and development of medical countermeasures for epidemic response;
2. Improve clinical research in the paediatric area;
3. Enable research linking environmental factors to human health;
4. Access to novel radionuclides and facilities

### Research infrastructure services to enable R&I addressing main challenges and EU priorities

1. For advanced biotechnology and biomanufacturing;
2. To improve the understanding and prediction of future climate changes and their impact.

Note: (both challenge-driven topics) less limited about improving & developing new services, including, when duly justified, if they cannot be offered by the end of the action.

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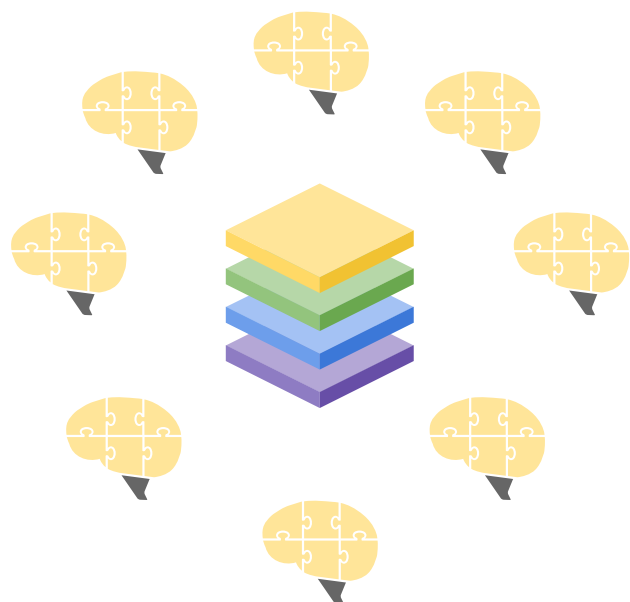
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Note: (both challenge-driven topics) less limited about improving & developing new services, including, when duly justified, if they cannot be offered by the end of the action.

To add: Improve clinical research in the neurodegenerative and psychiatric areas

**EBRAINS France workshop**  
October 15, 2024



# Neuroimaging data sharing with FLI-IAM

**Camille Maumet and Michel Dojat**

Shanoir core development is supported by: **Shanoir Consortium**  
(InriaSoft) and **FLI-IAM**

