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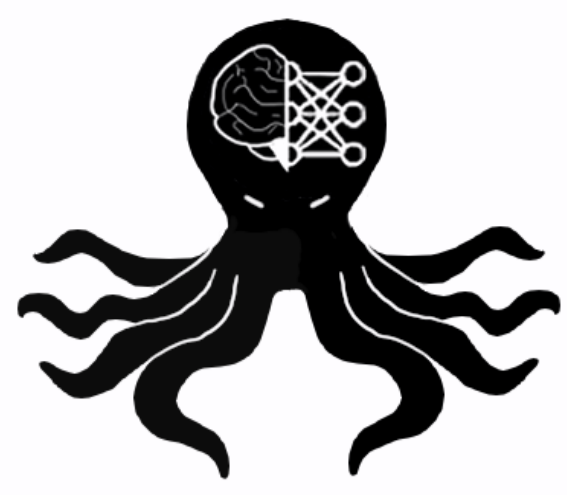
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# ClinicaDL: an open-source deep learning software for reproducible neuroimaging processing



ARAMIS  
LAB  
BRAIN DATA SCIENCE

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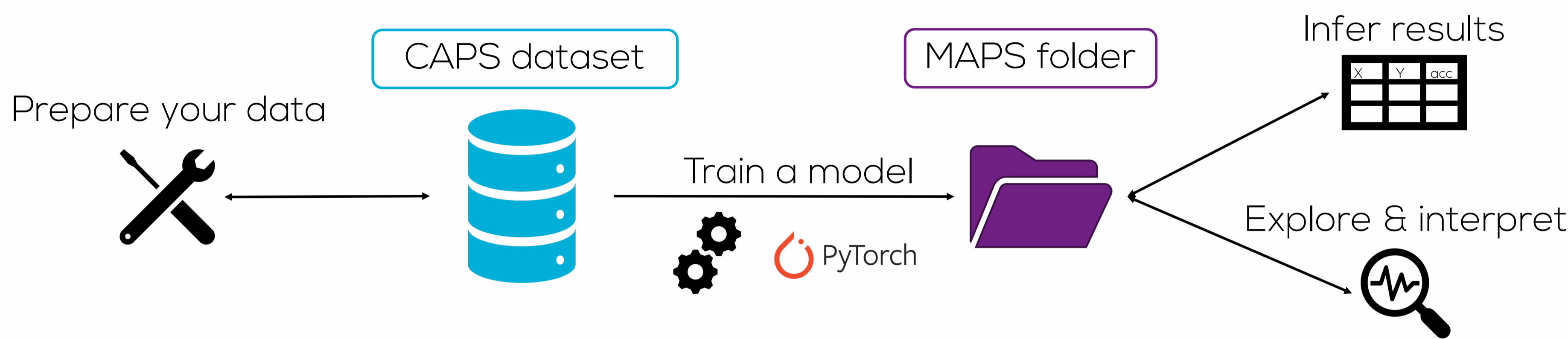
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Deep learning has become one of the most used data analysis technique for medical image analysis. Unfortunately, this recent massive use of deep learning has also been associated with **methodological flaws** in many studies which results are contaminated by data leakage.

Moreover, the whole deep learning community faces a **reproducibility crisis** that discredits its results. Hence there is an urgent need in publishing open-source software, data sets and scripts that allow reproducing the methodologies described in deep learning studies.

Finally, deep learning users who are not neuroimaging specialists have difficulty in accessing **properly formatted and pre-processed data sets**. This issue has been partly tackled by a data set format established by the community: the Brain Imaging Data Structure (BIDS).

## Software overview



## MAPS

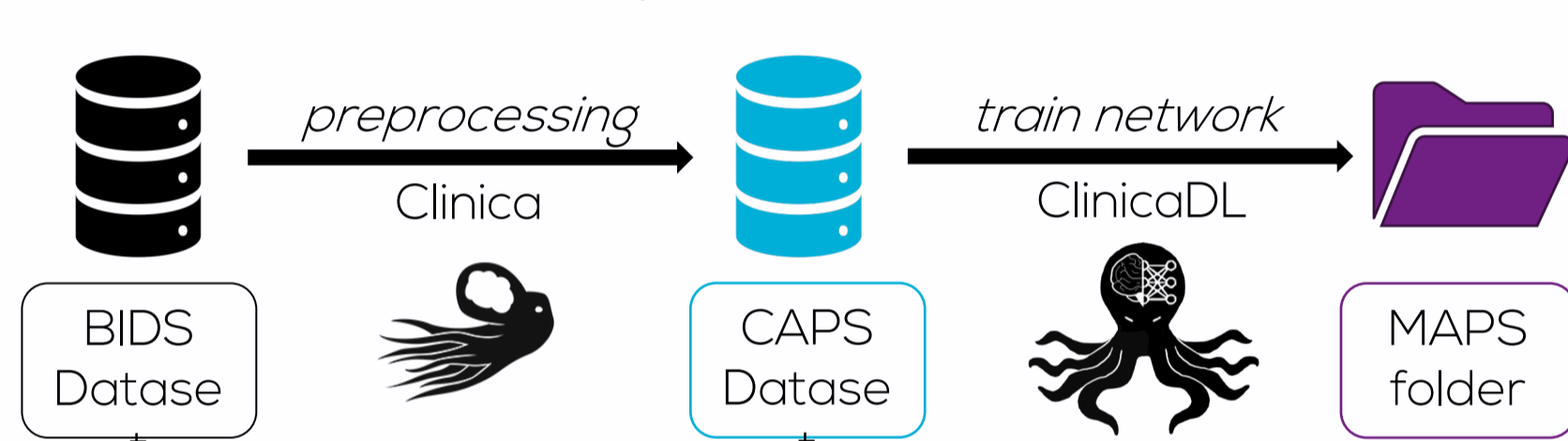
The Model Analysis and Processing Structure (MAPS) contains the results of all operations performed on a model.



## Motivations & Solutions

### Use of neuroimaging

The software ecosystem



#### Problem

Diversity of formats  
- DICOM  
- ANALYZE  
- NIFTI

#### Solution

Use of a standard  
**BIDS**

#### Problem

Complex set of preprocessing tools  
**STK** **FSL** ...

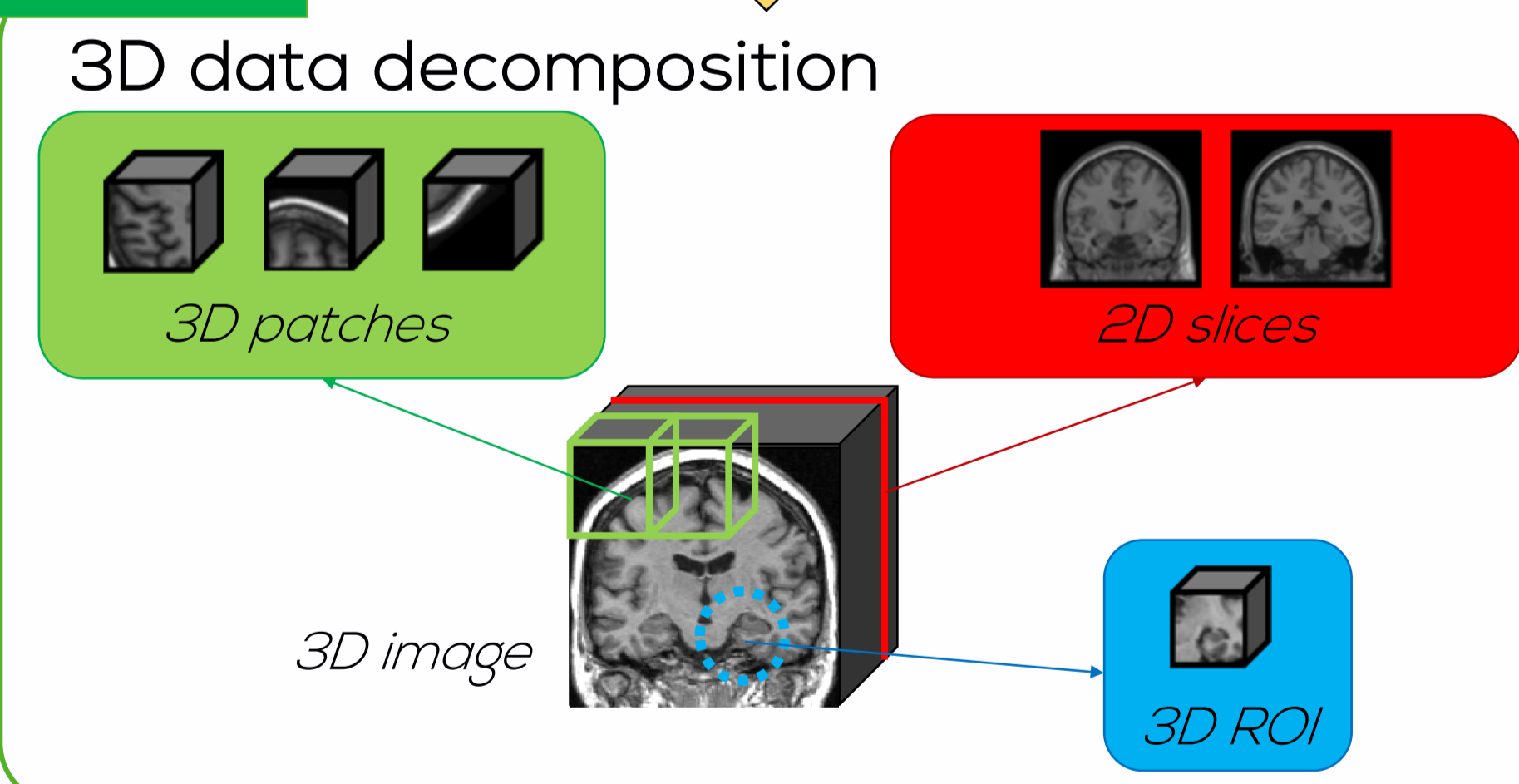
#### Solution

Unique library  
**Clinica**

#### Problem

High dimensional data

#### Solution

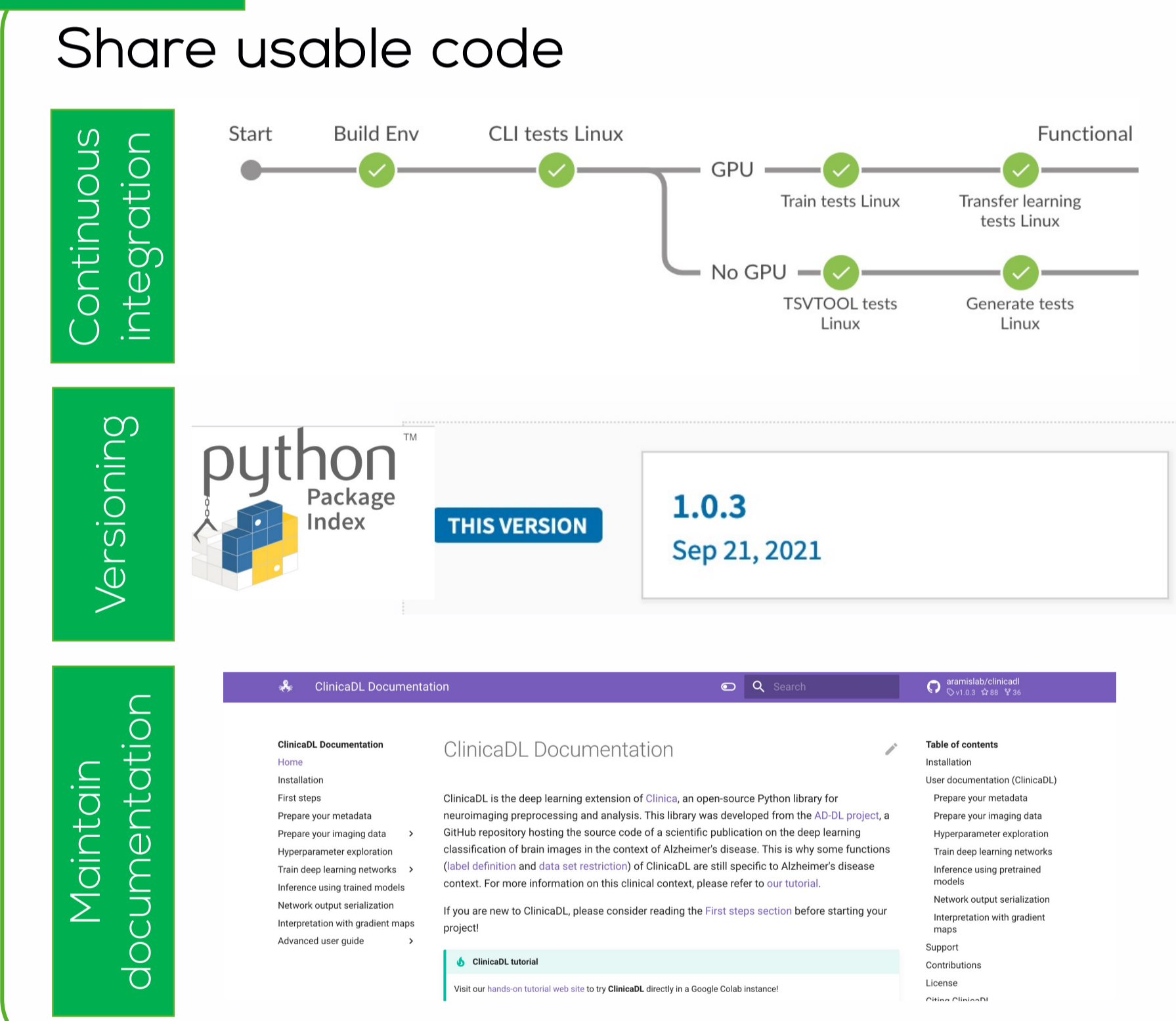


### Reproducibility

#### Problem

Achieve transparency

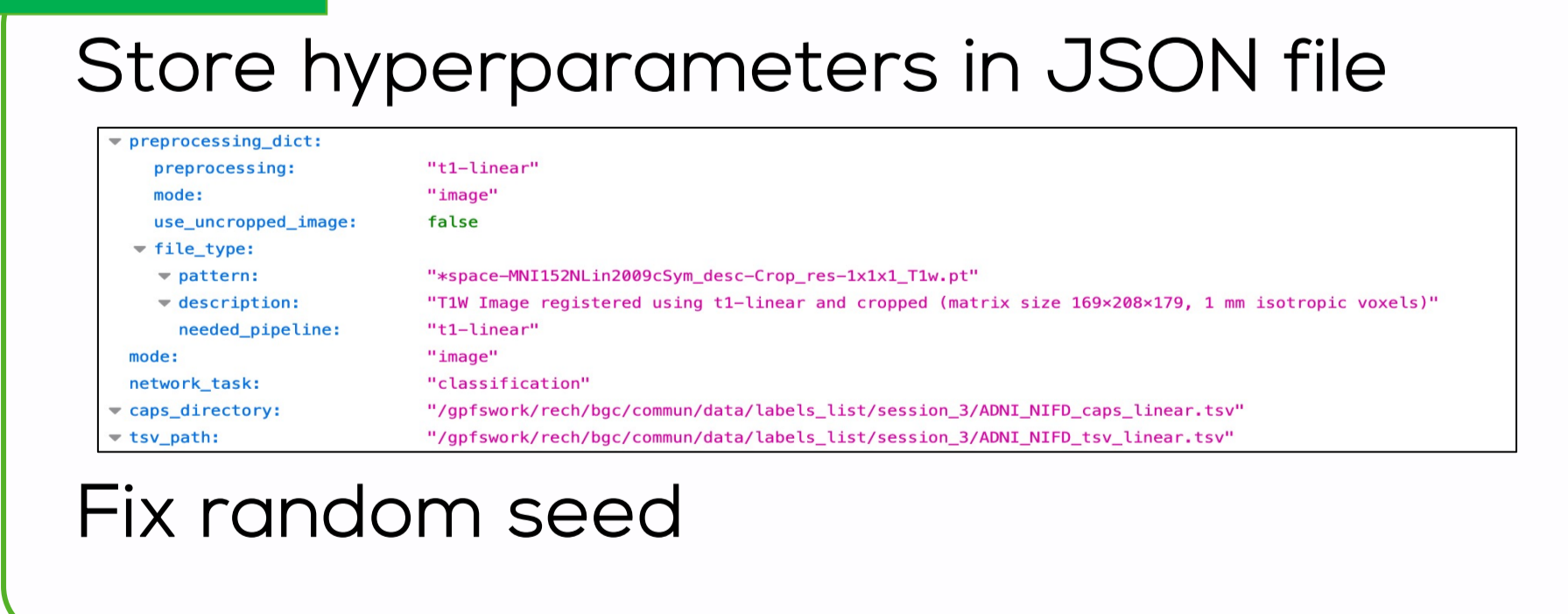
#### Solution



#### Problem

Reproduce experiments

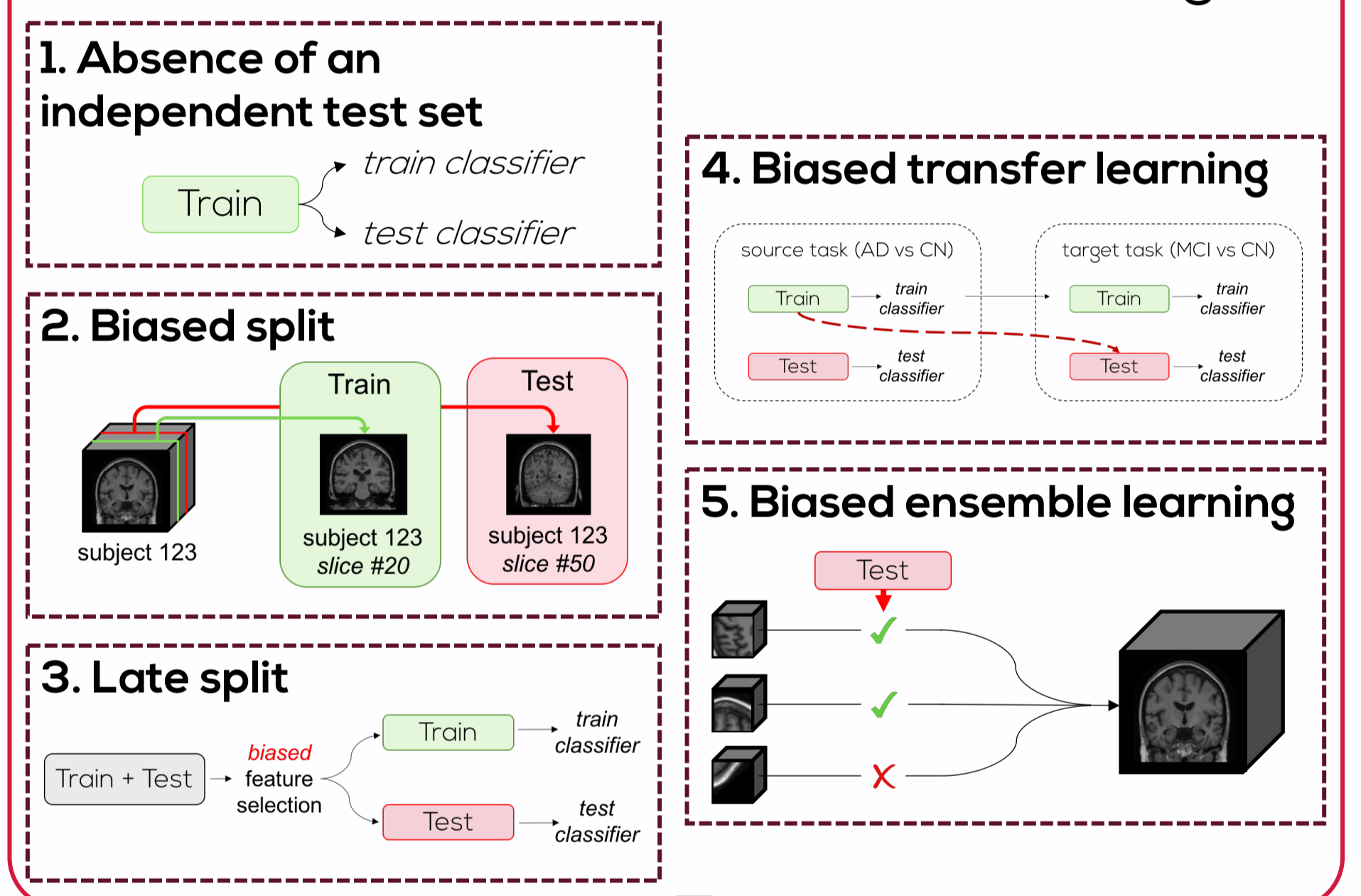
#### Solution



### Rigorous validation

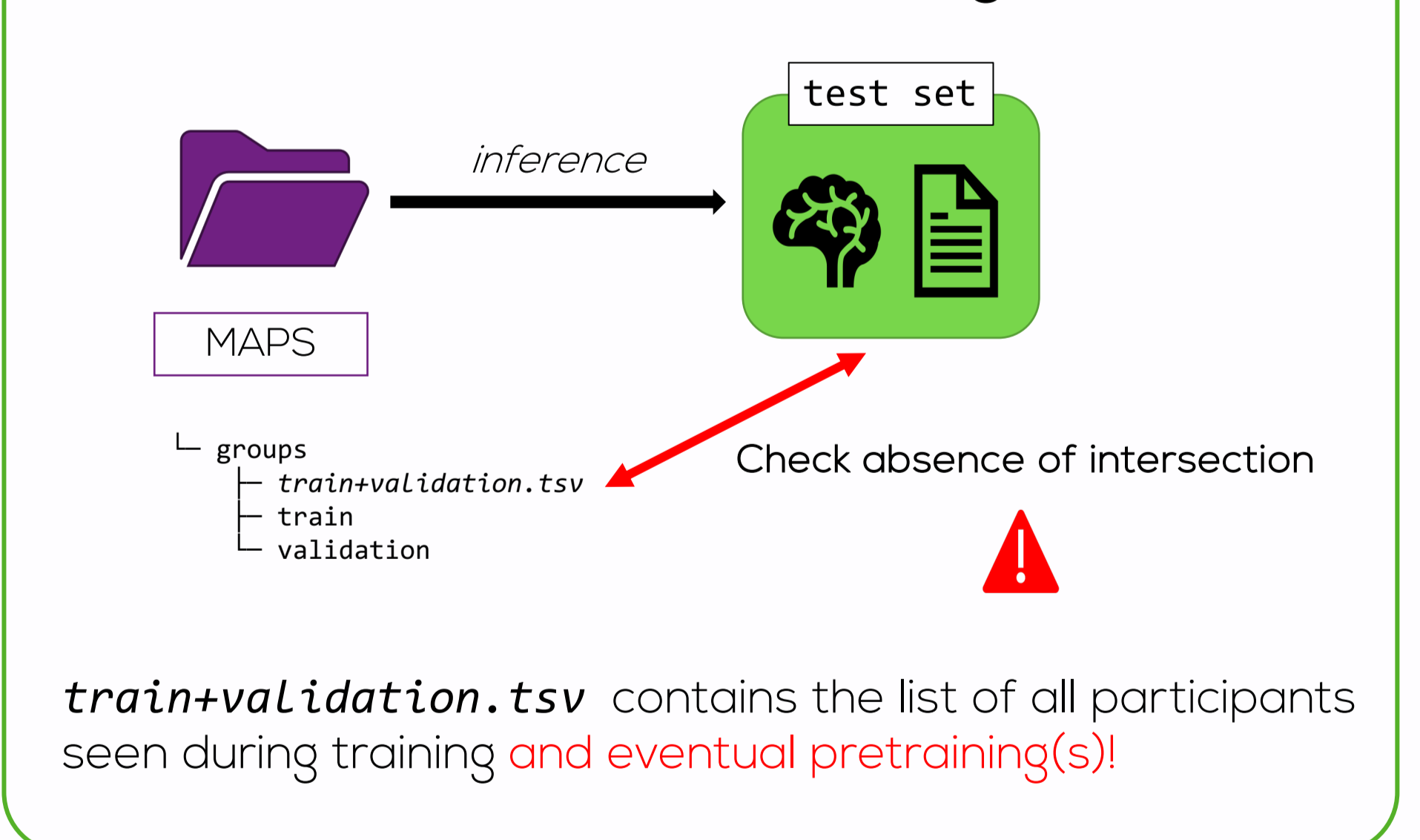
#### Problem

Many possible scenarios of data leakage



#### Example of solution

Check intersection with training data



## Conclusion

ClinicaDL is an open-source software for deep learning processing on neuroimaging data. With this software, we solve the three main issues encountered by deep learning users who are not specialist of the neuroimaging domain:

- (1) the data management and preprocessing of neuroimaging data sets,
- (2) the contamination of results by data leakage,
- (3) the lack of reproducibility of deep learning experiments.

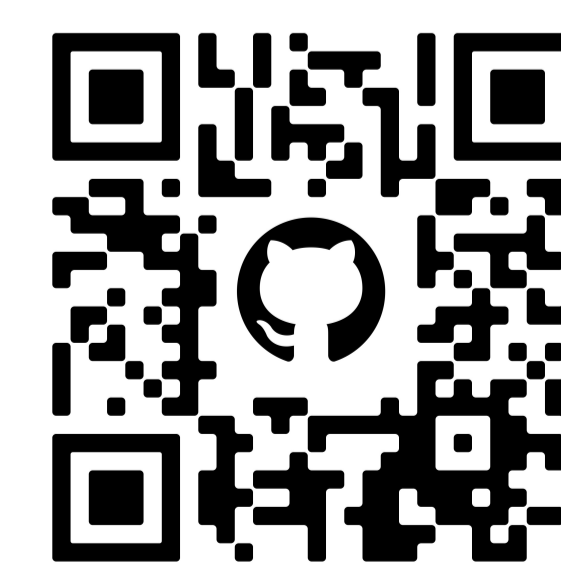
## Useful links

Preprint HAL



hal-03351976

GitHub



aramis-lab/clinicaDL

Documentation



clinicaDL.readthedocs.io

