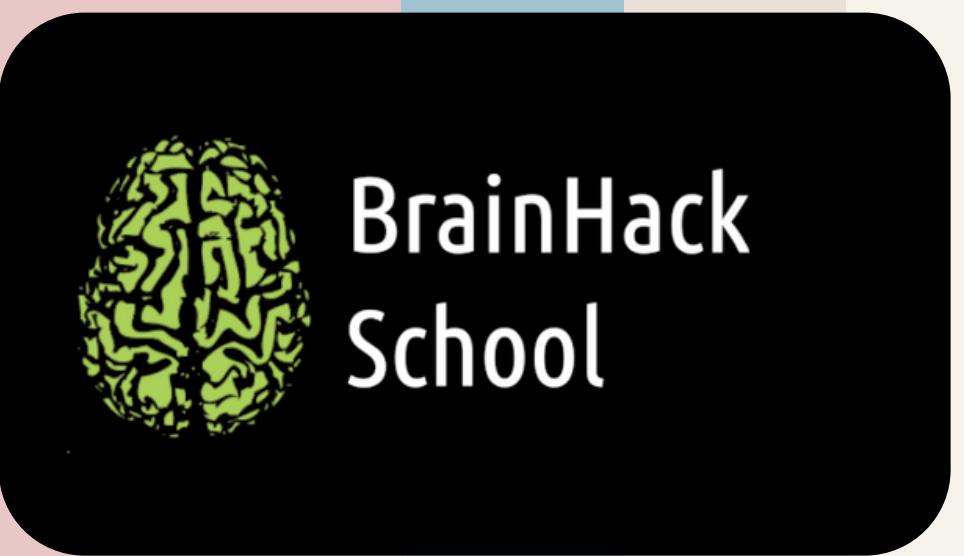


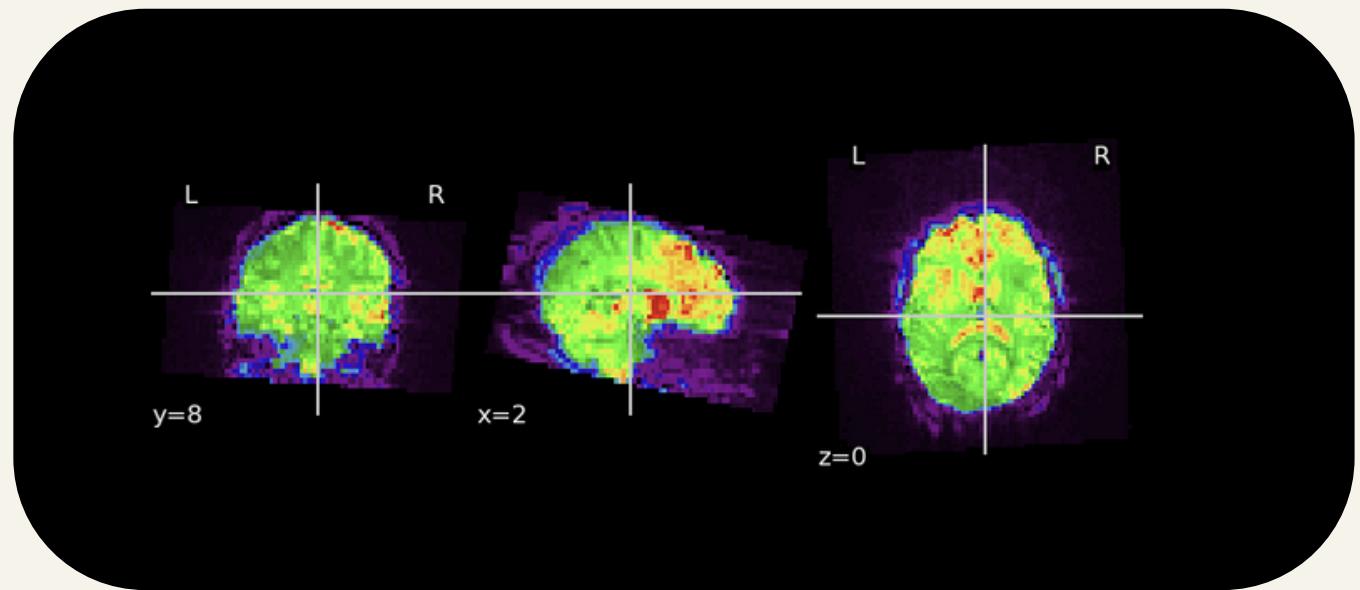
FINAL PRESENTATION

Sleep detection on fMRI images via Machine
learning algorithm

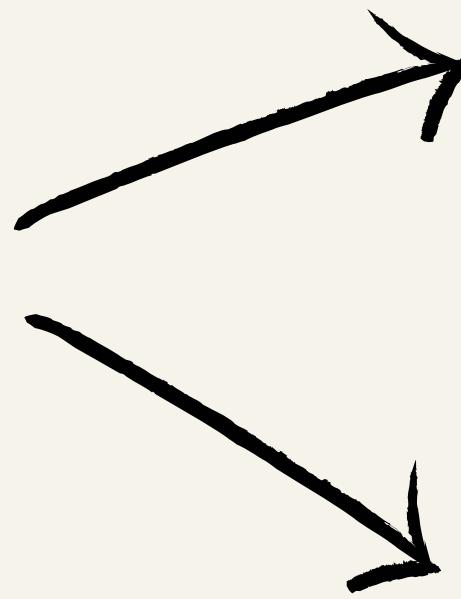
Romain DUCHADEAU (23II547) - Polytechnique Montréal



OBJECTIVES



fMRI image



Sleep

Awakening



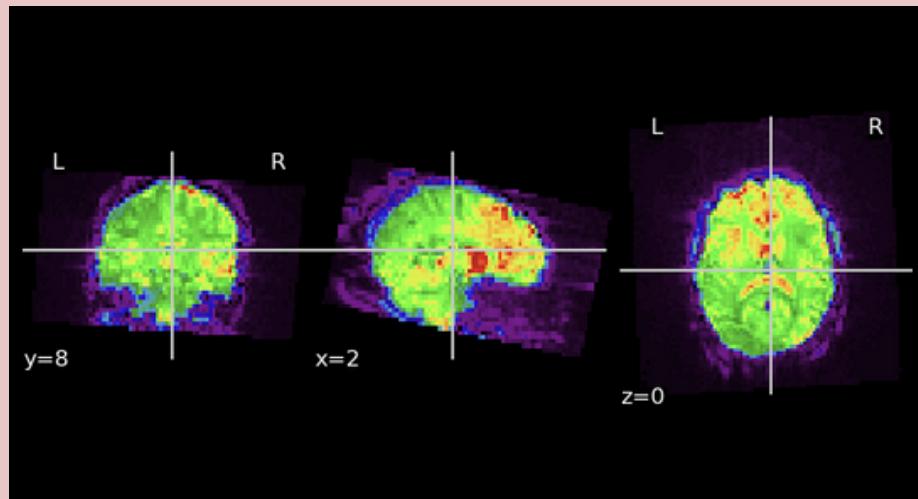
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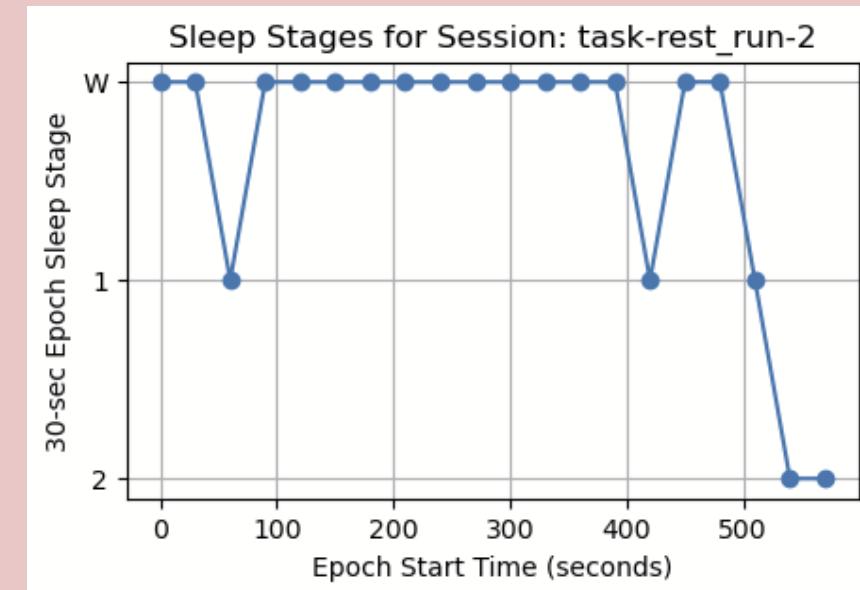


DATASET

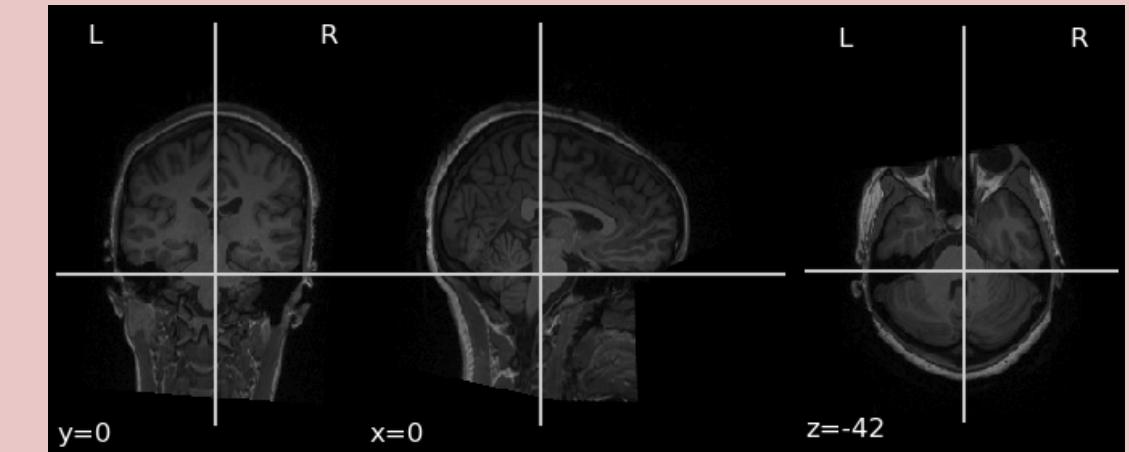
fMRI image



Sleep score every 30s



T1 scan



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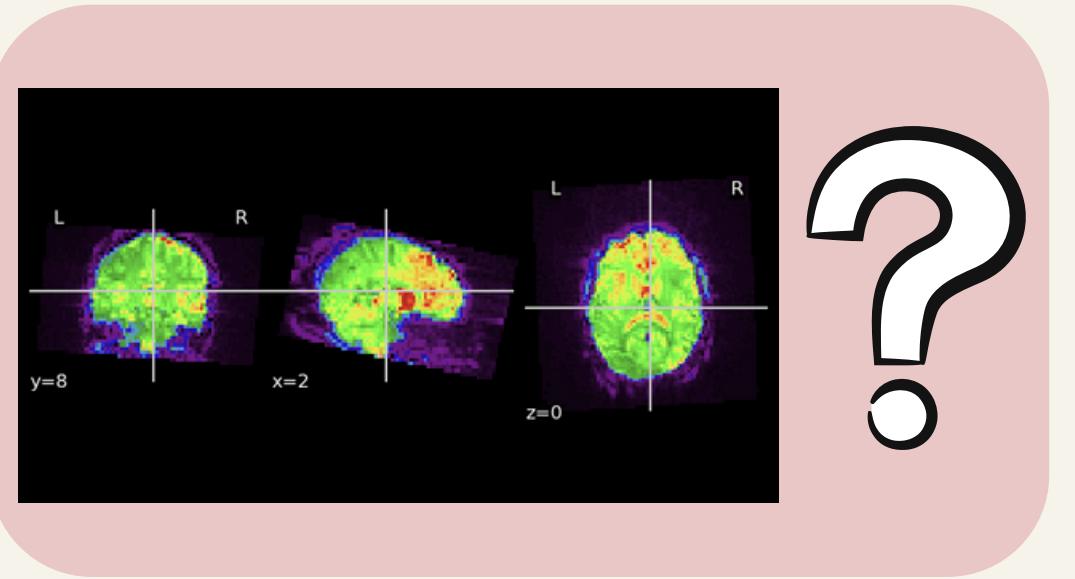
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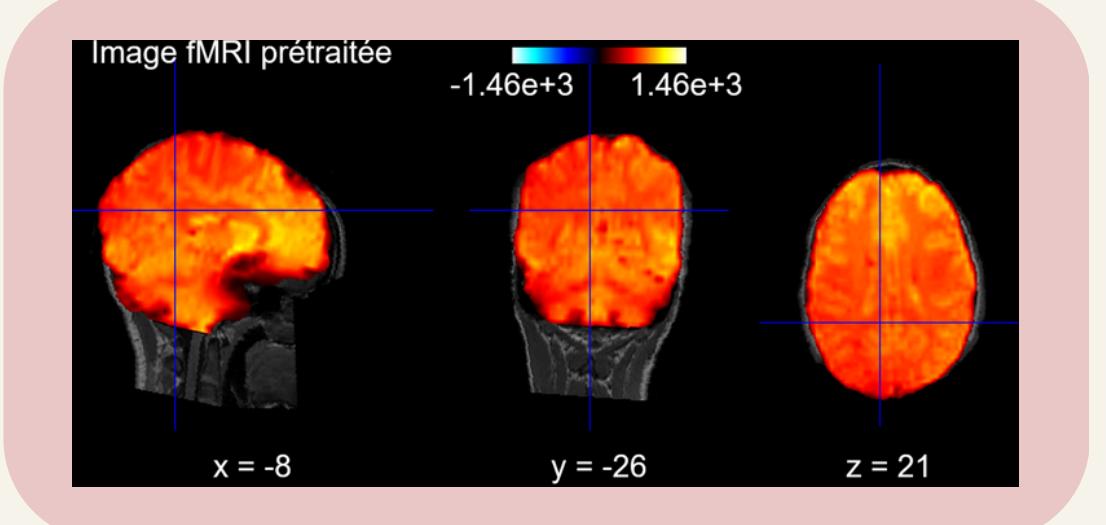
METHODOLOGY

4 Steps :

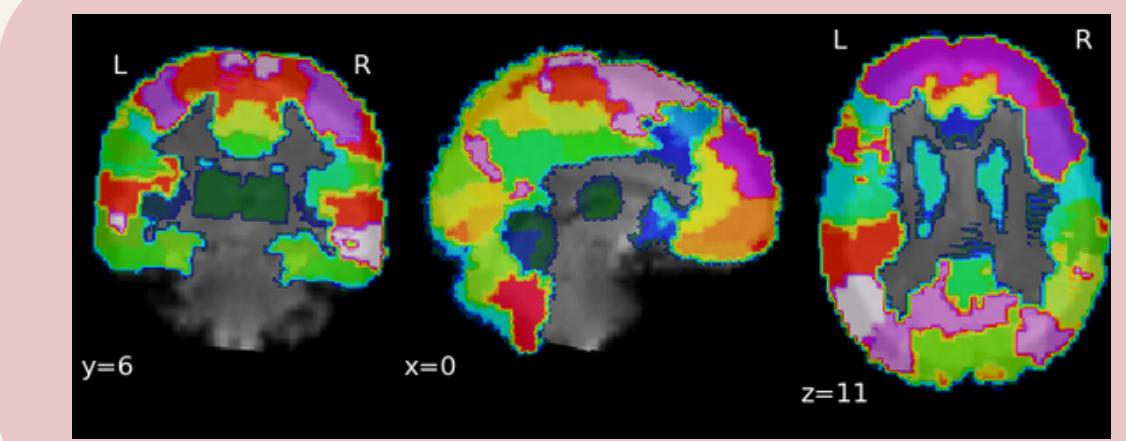
1. Select data



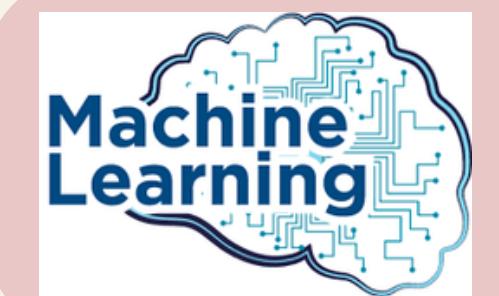
2. Preprocess data



3. Define ROI



4. Train ML algo



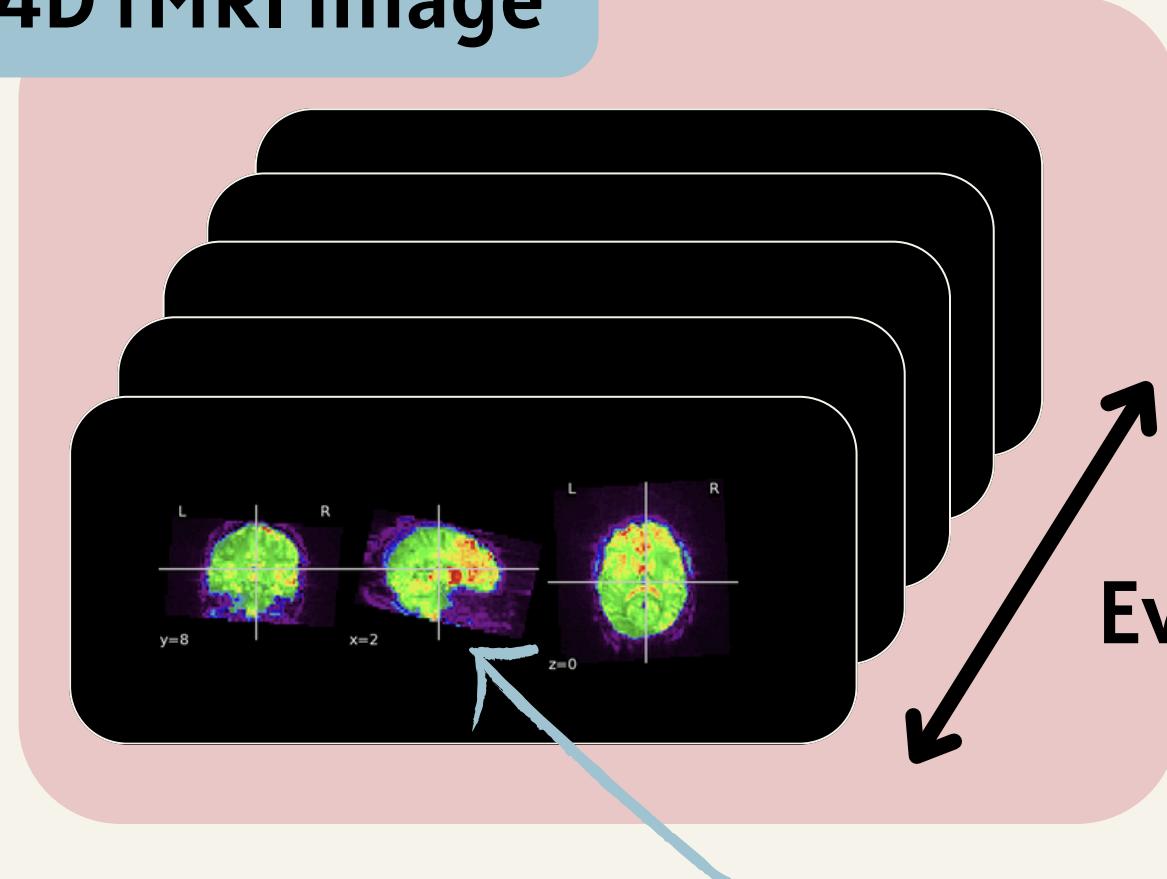
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SELECT DATA

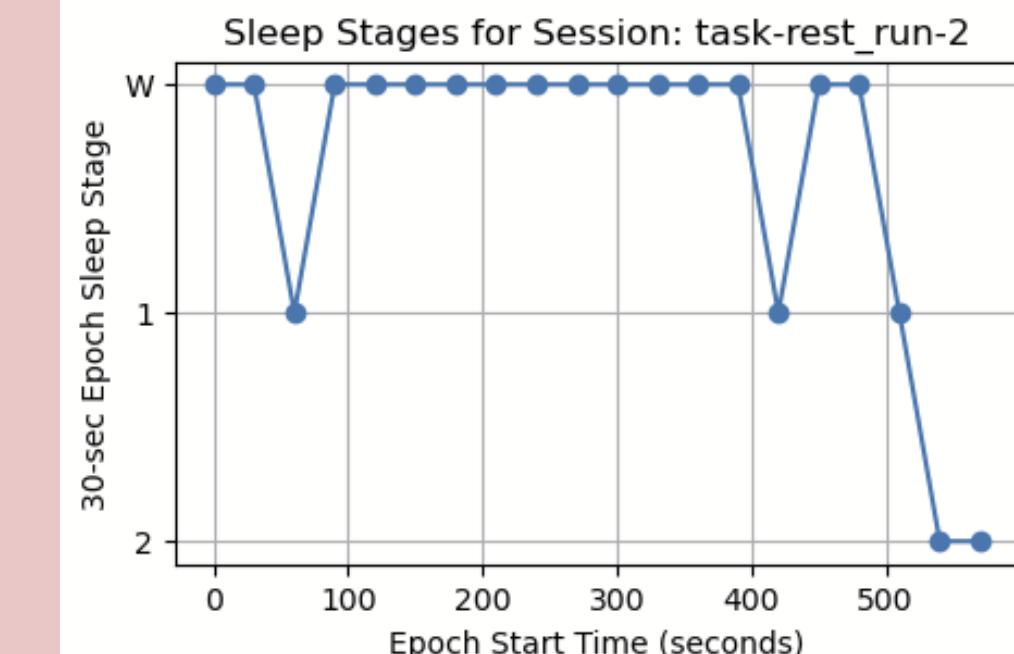
4D fMRI image



3D image

VS

Sleep labels



Every 30 sec

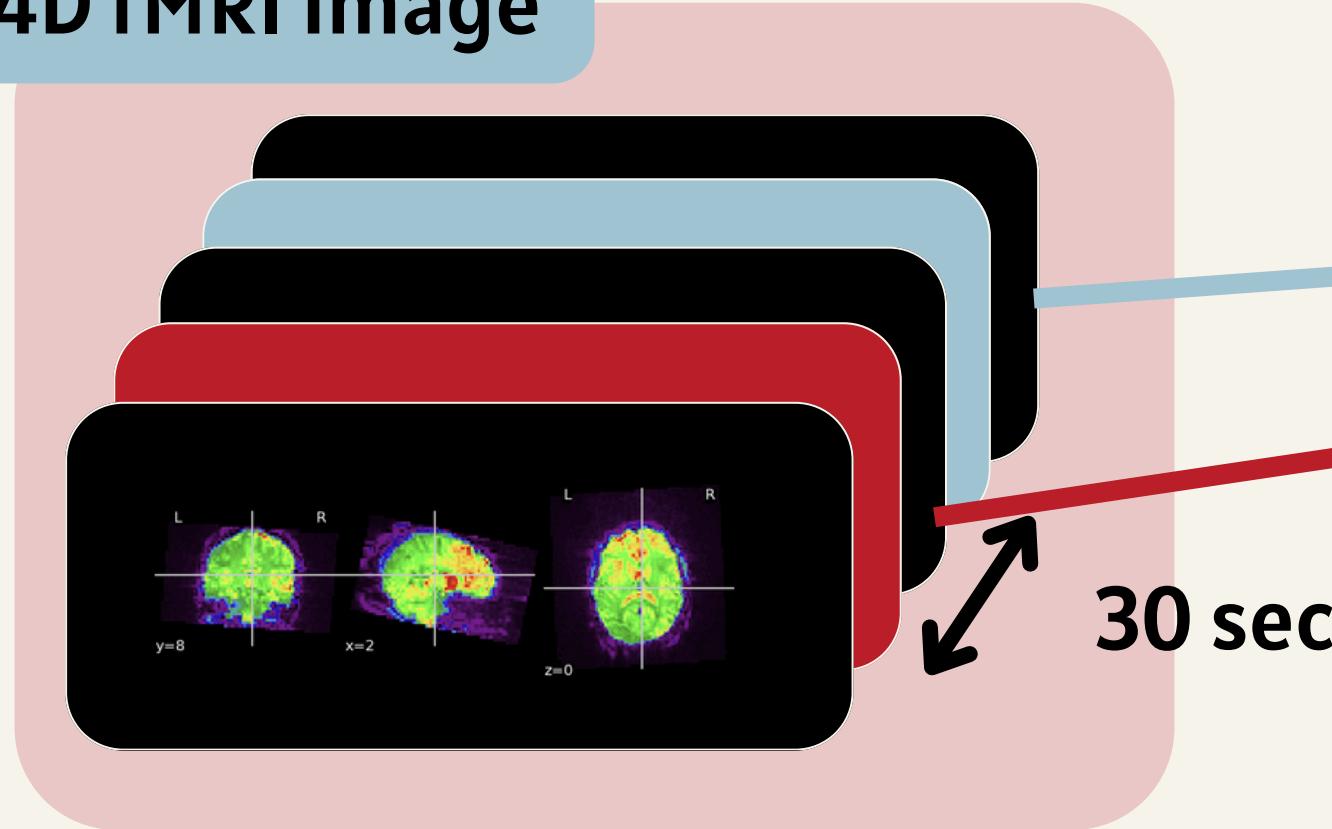
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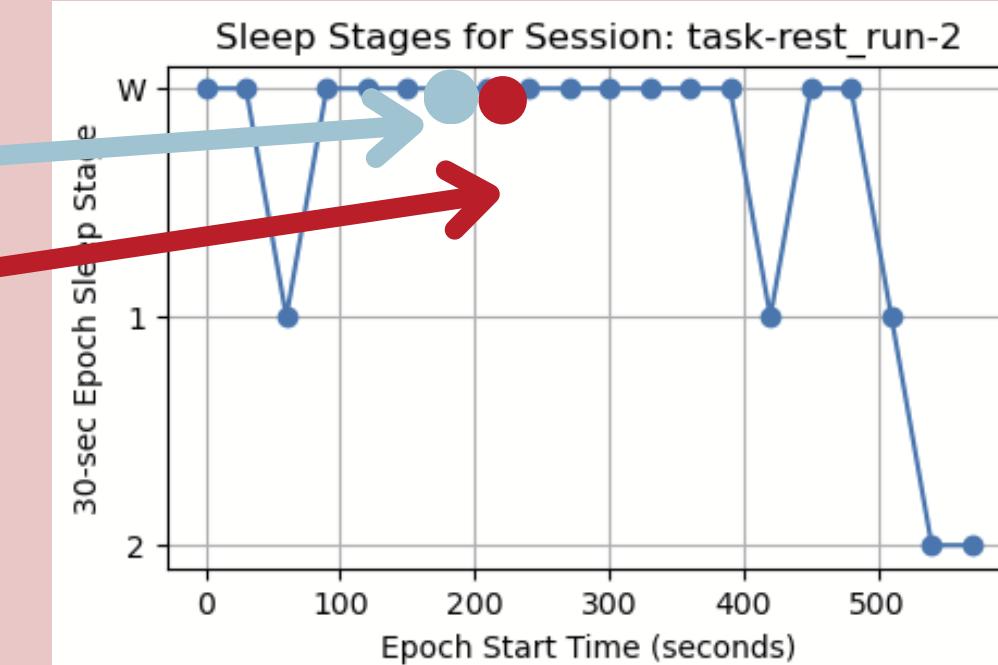


SELECT DATA

4D fMRI image



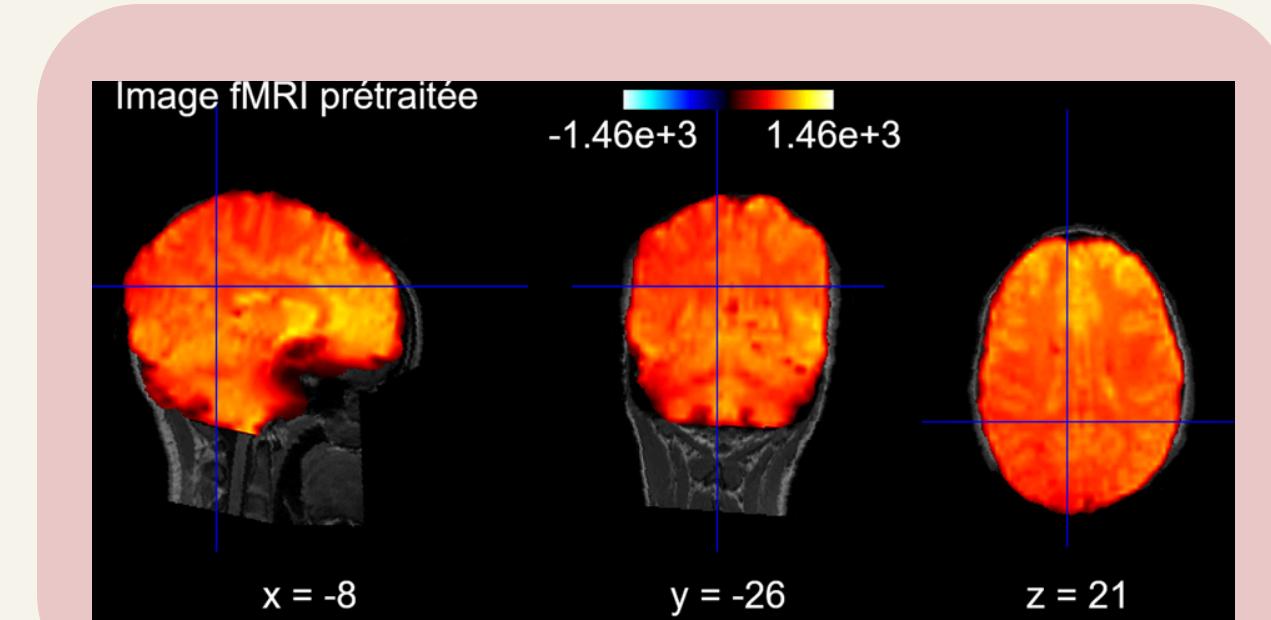
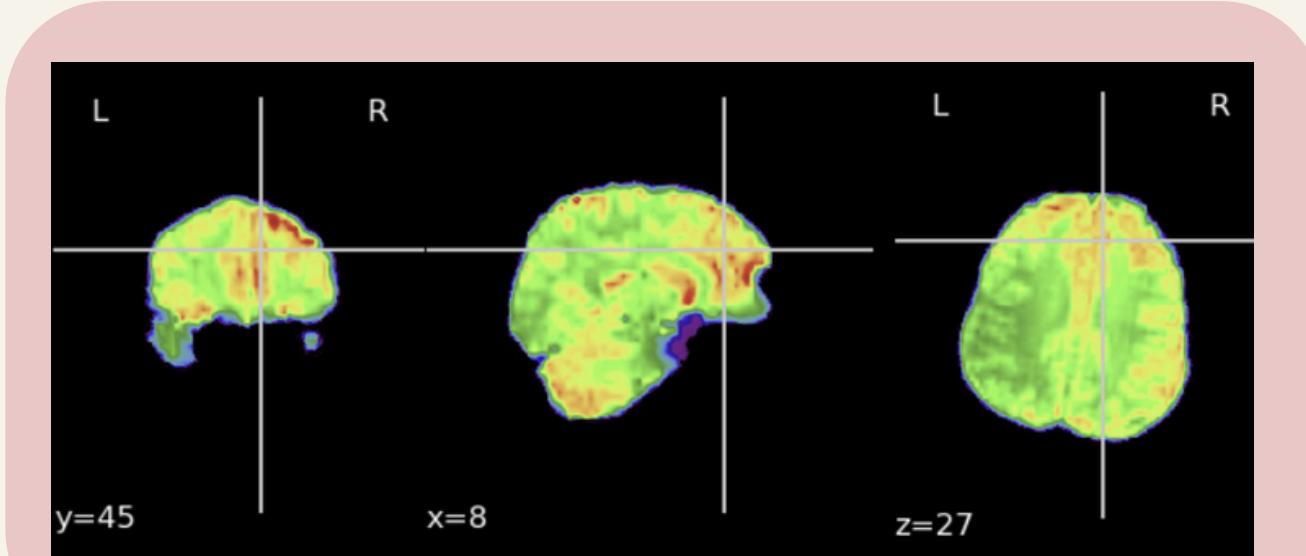
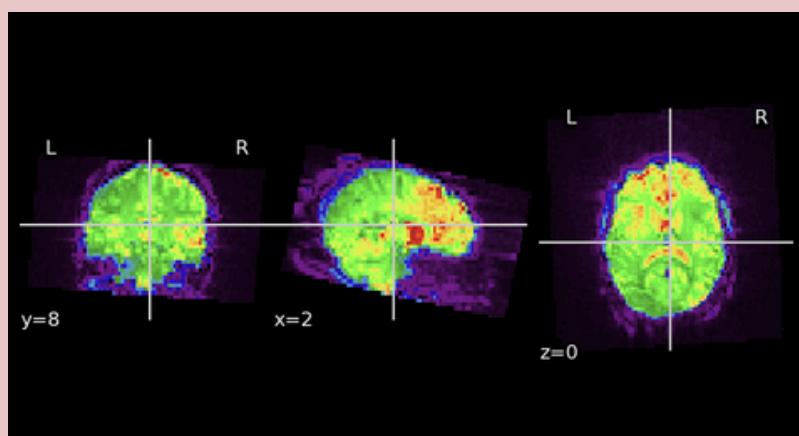
Sleep labels



PREPROCESS DATA

Using FSL / nipype [I]

3 Steps :



1. Load and decompress

2. Brain extraction

3. Align with TI

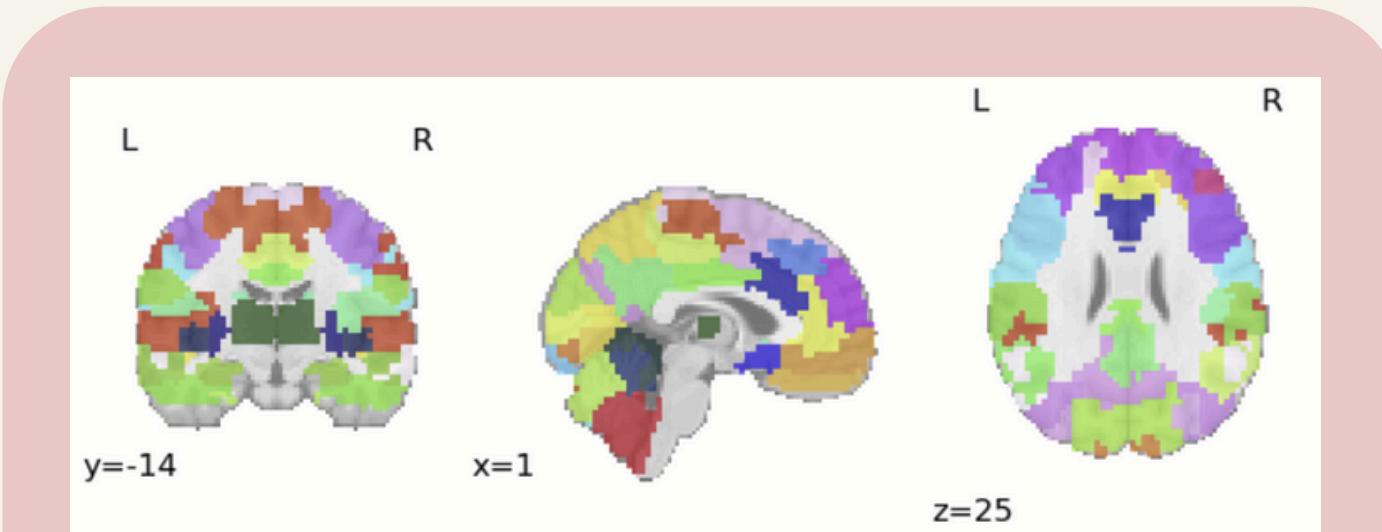
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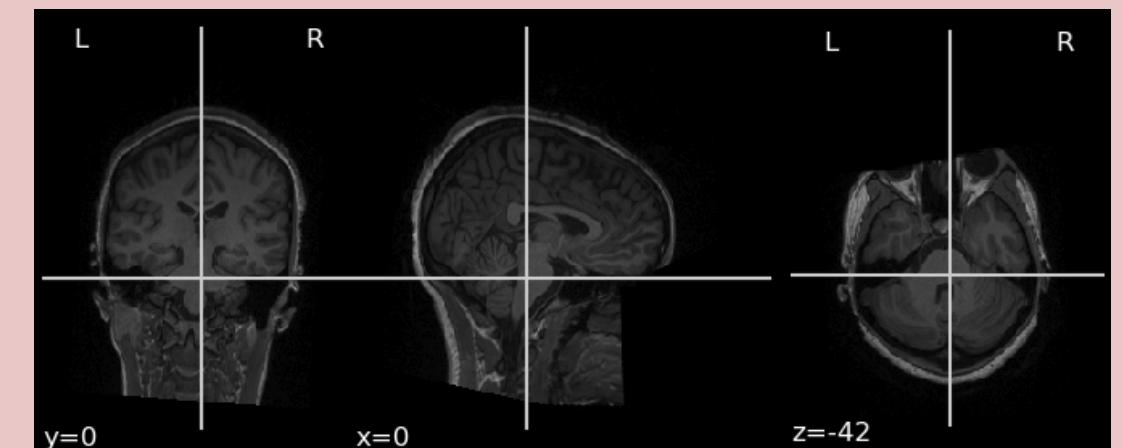
DEFINE ROI

1. Load Atlas
(with nilearn [2])

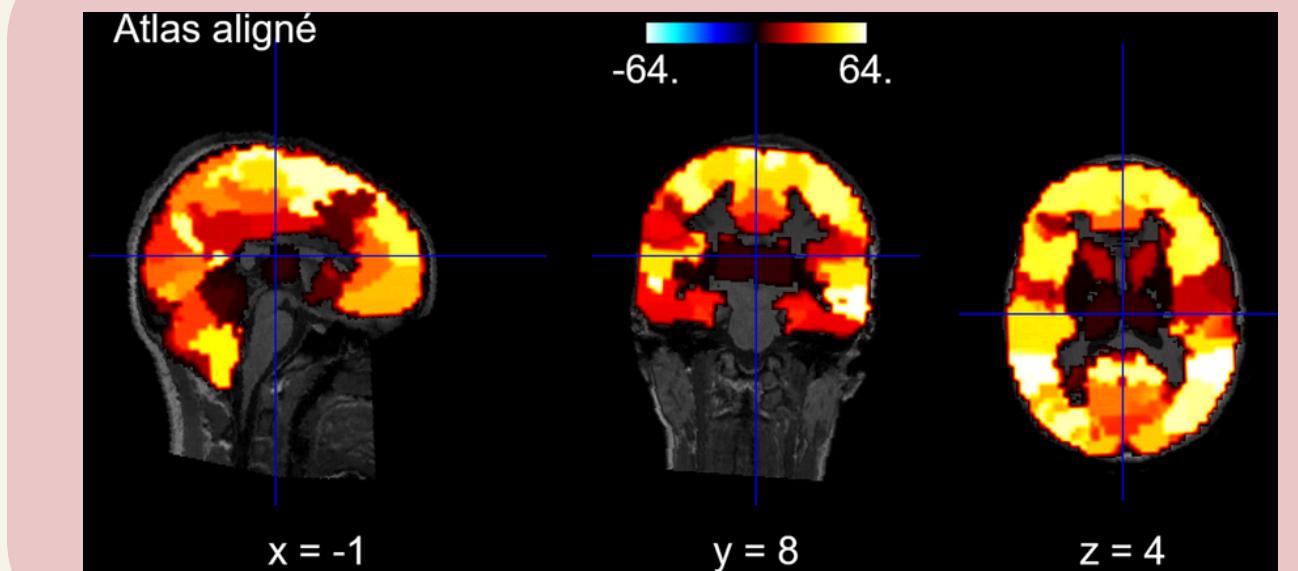


T1 scan

2. Align



Result :



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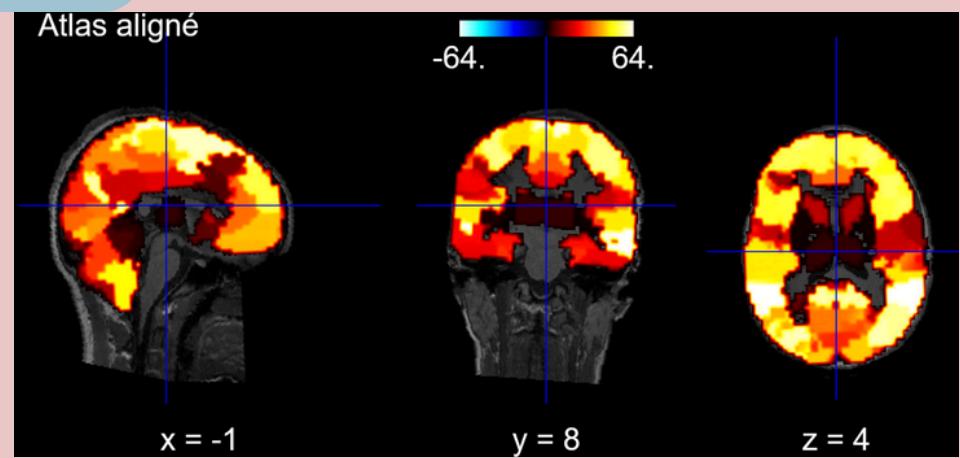
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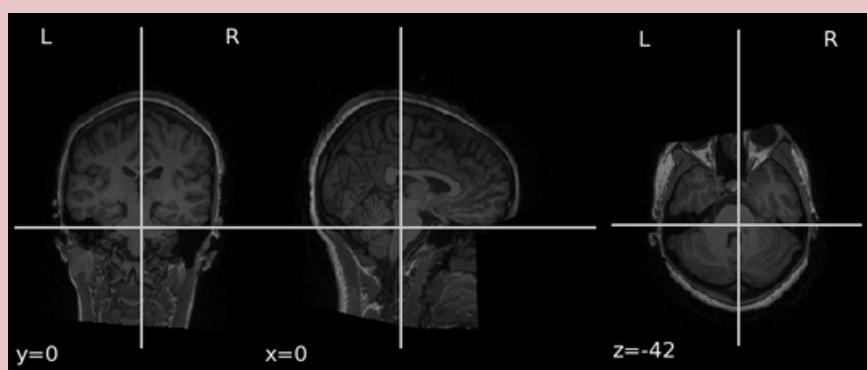


DEFINE ROI

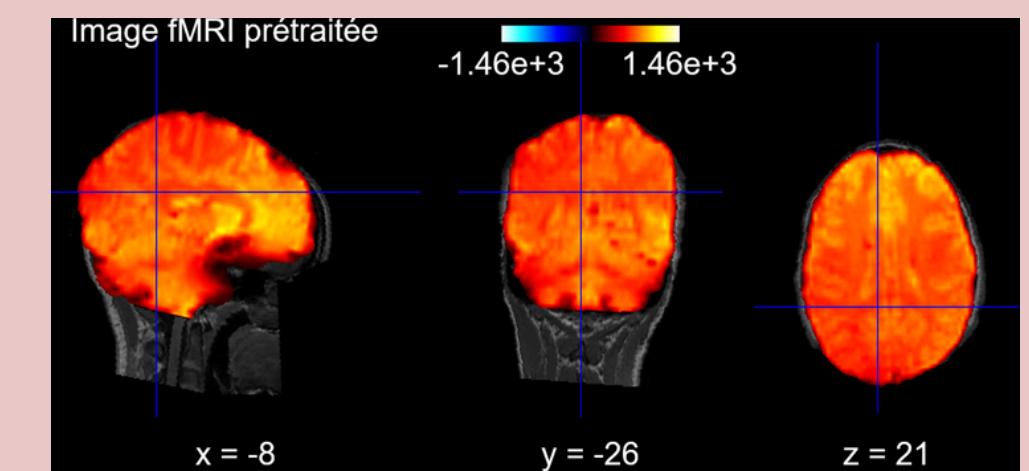
Atlas



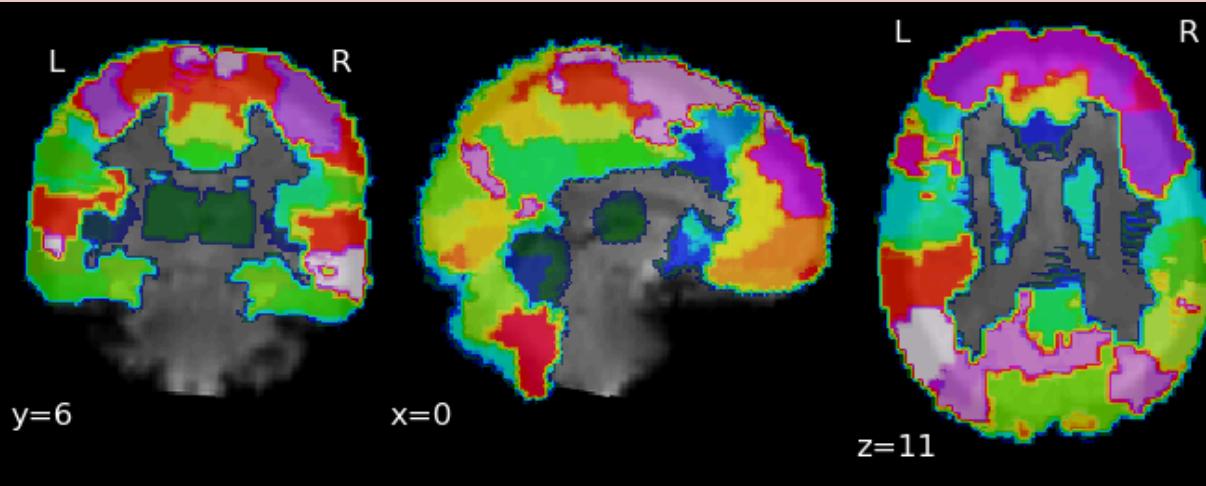
T1 scan



fMRI



Result :



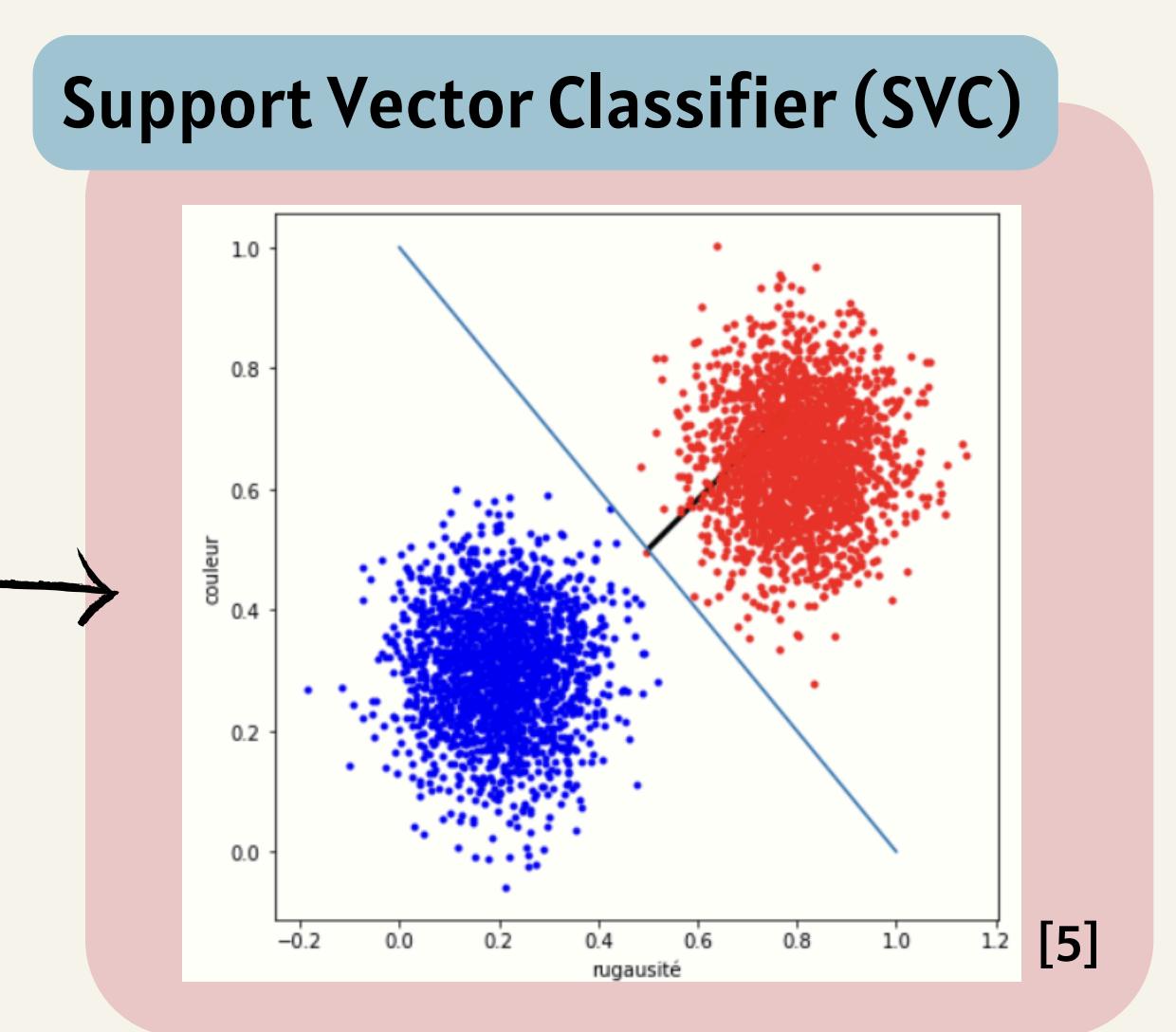
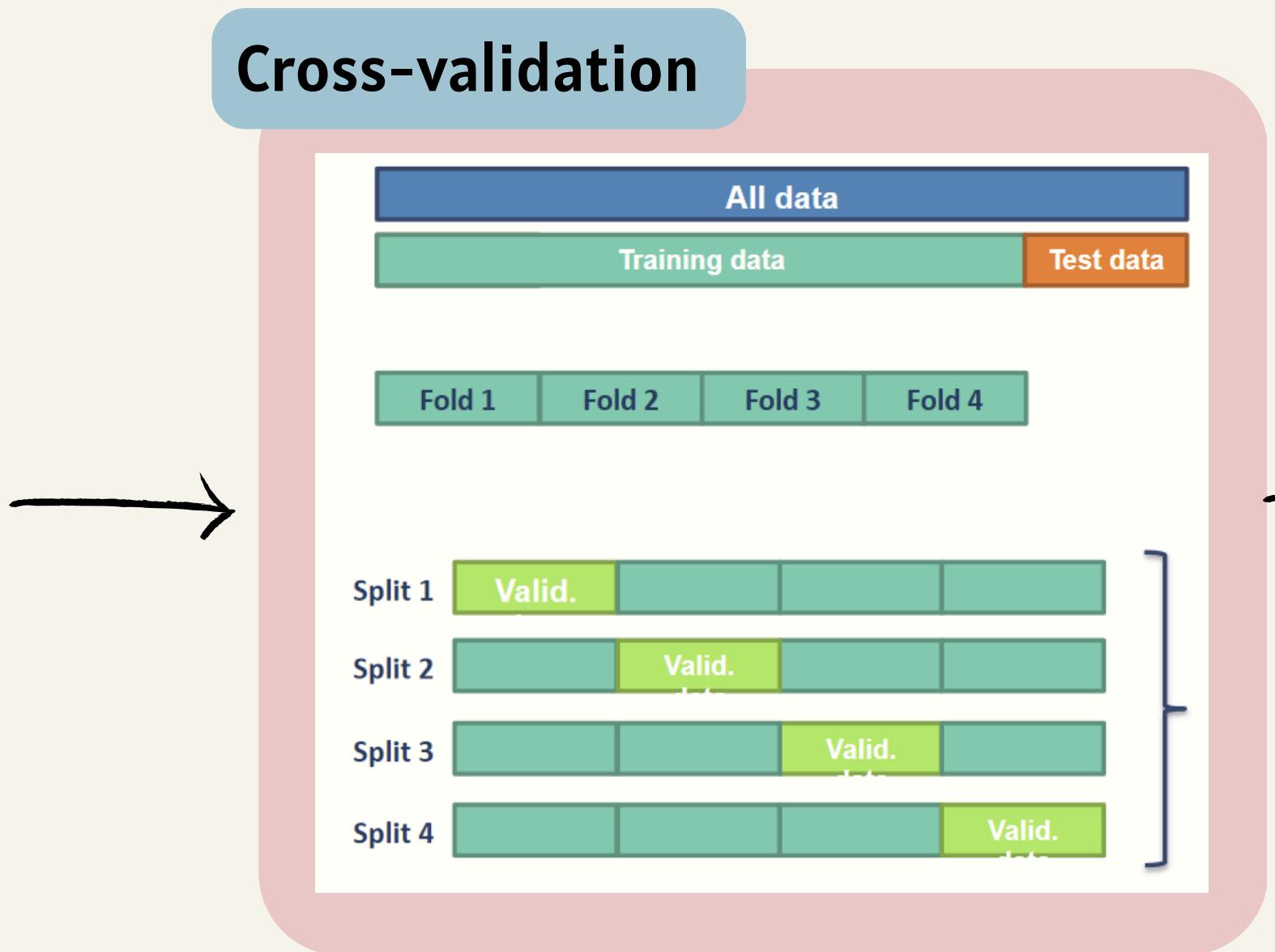
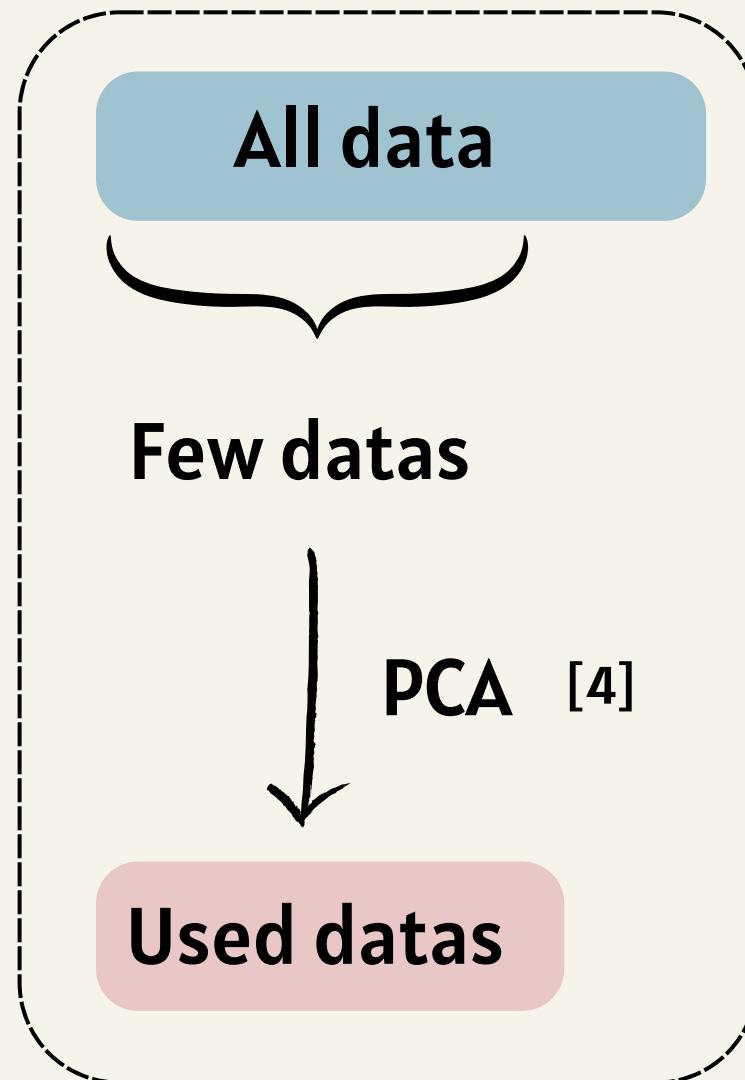
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MACHINE LEARNING



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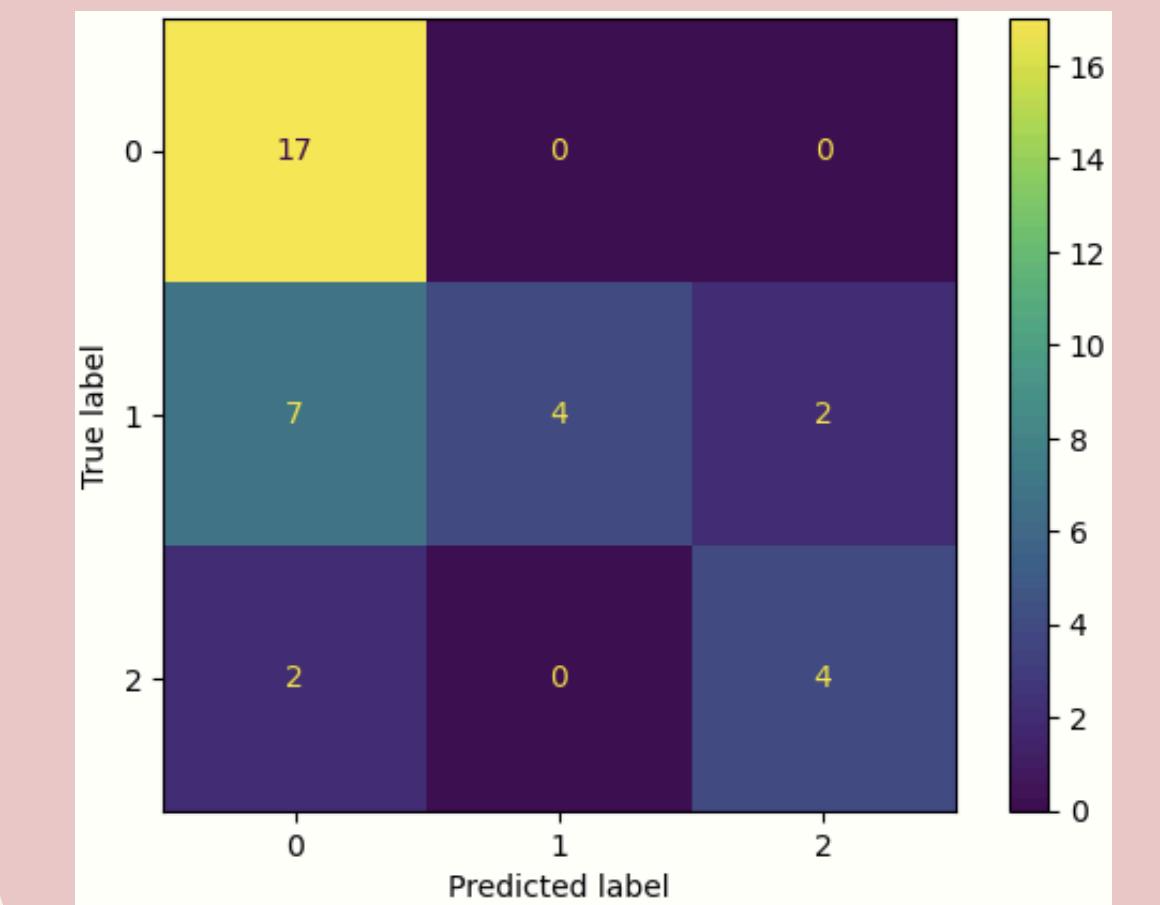
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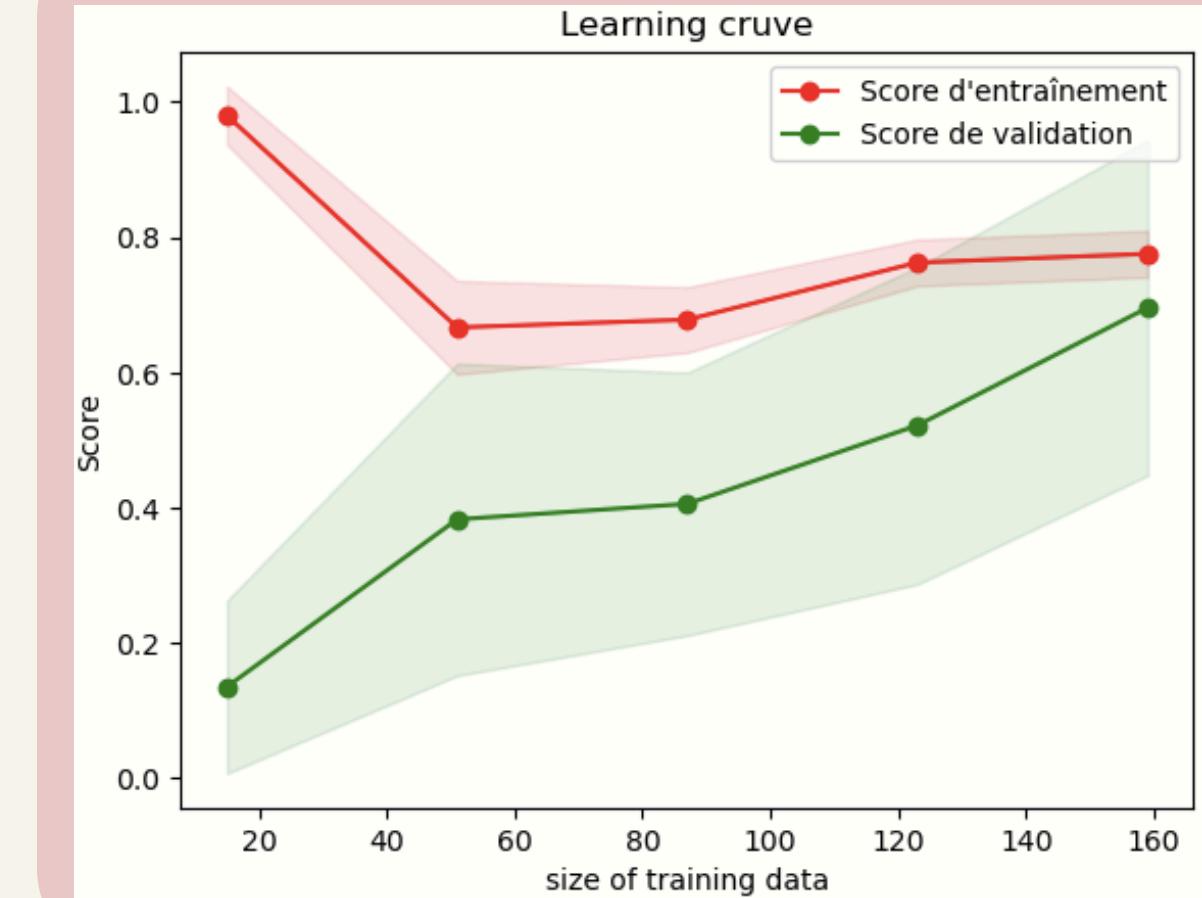
RESULTS

Confusion matrix

Accuracy = 0.694



Learning curve



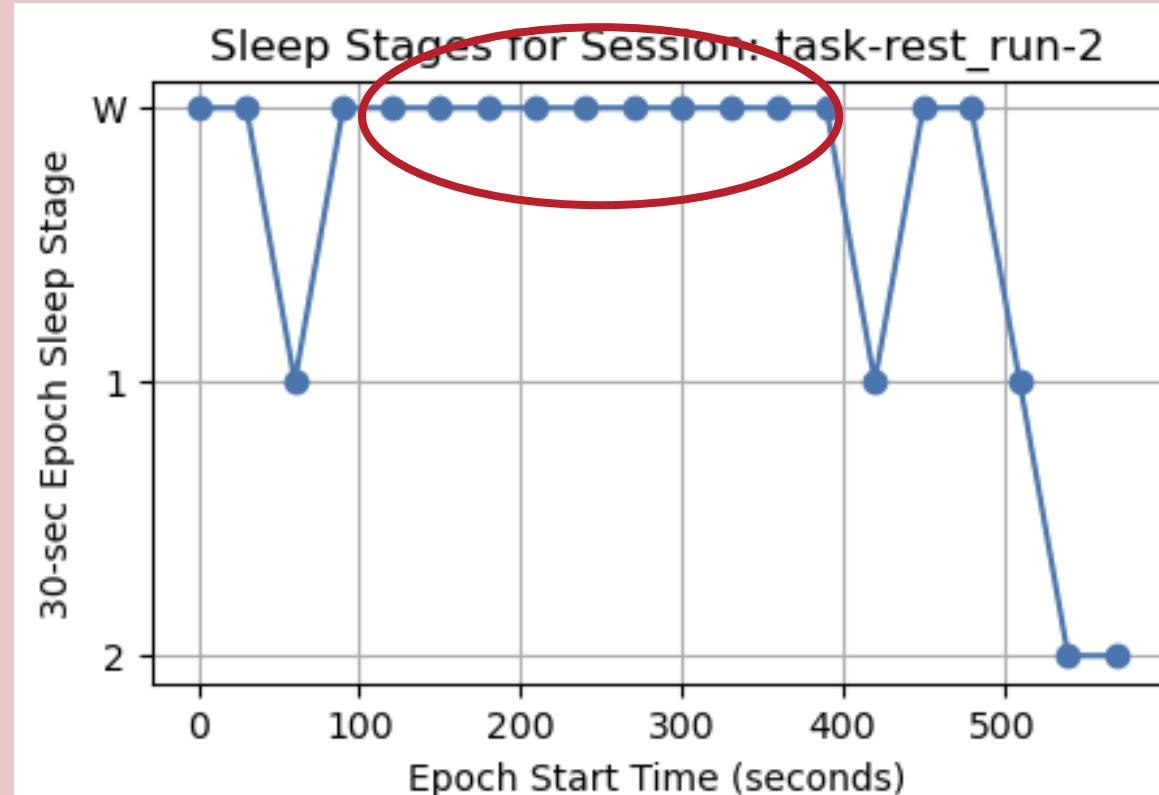
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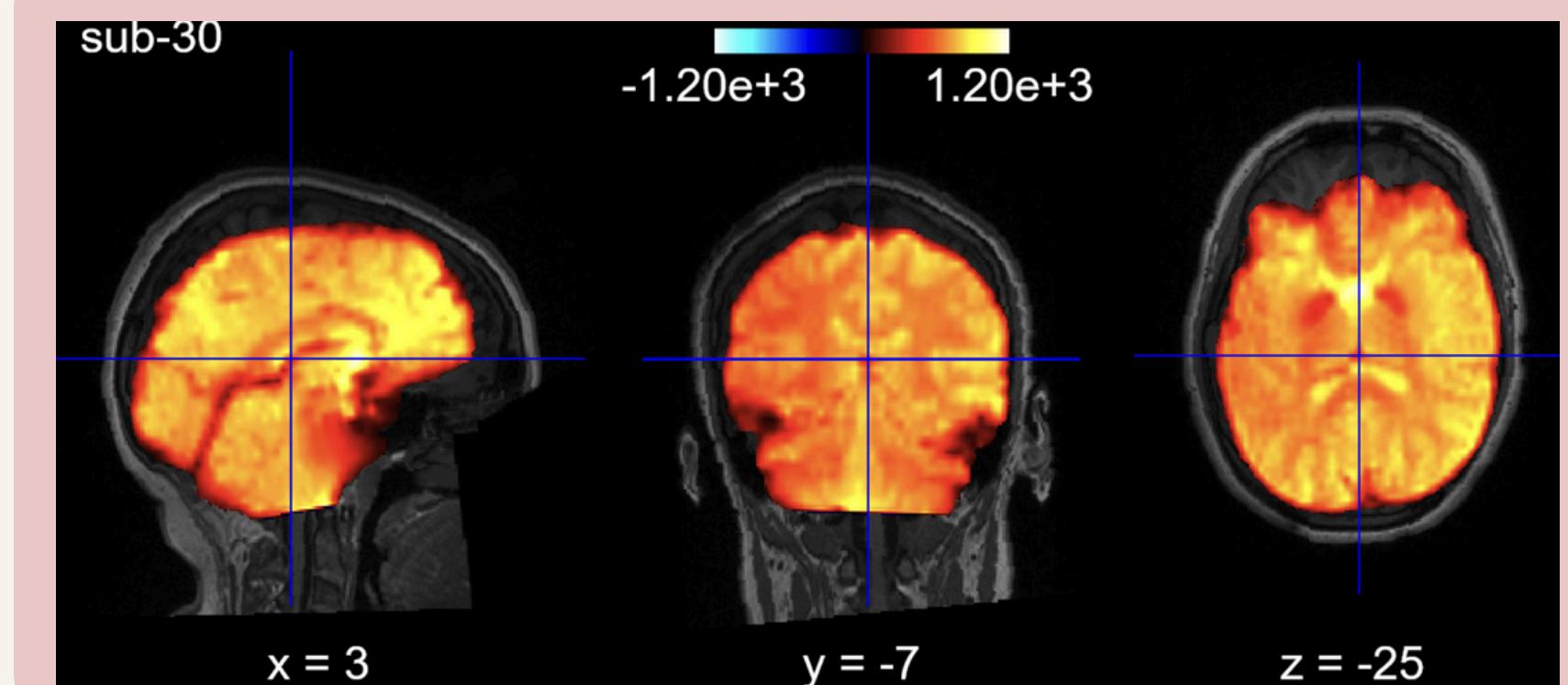


IMPROVEMENTS

- ## • Selected datas

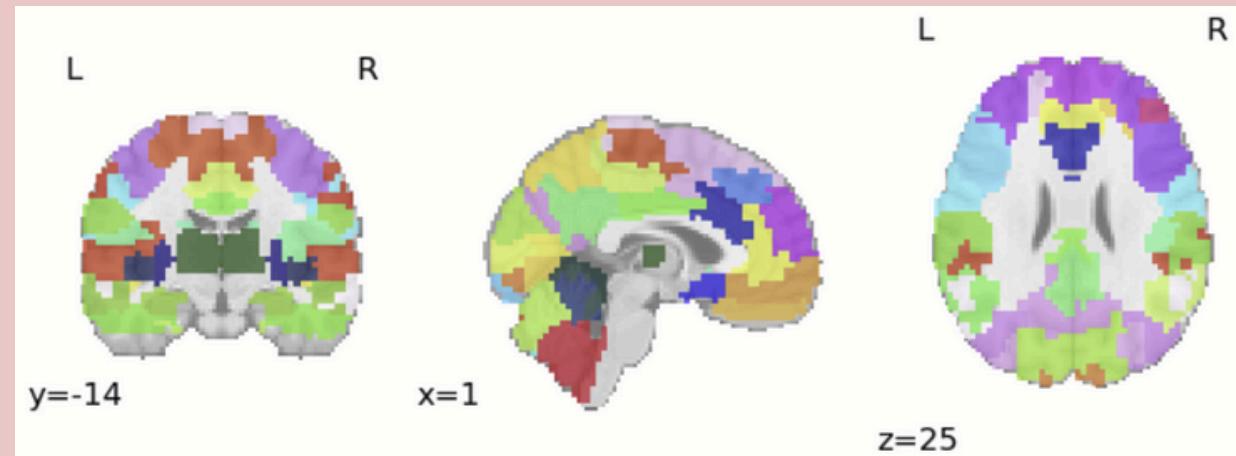


- fine tuned parameters



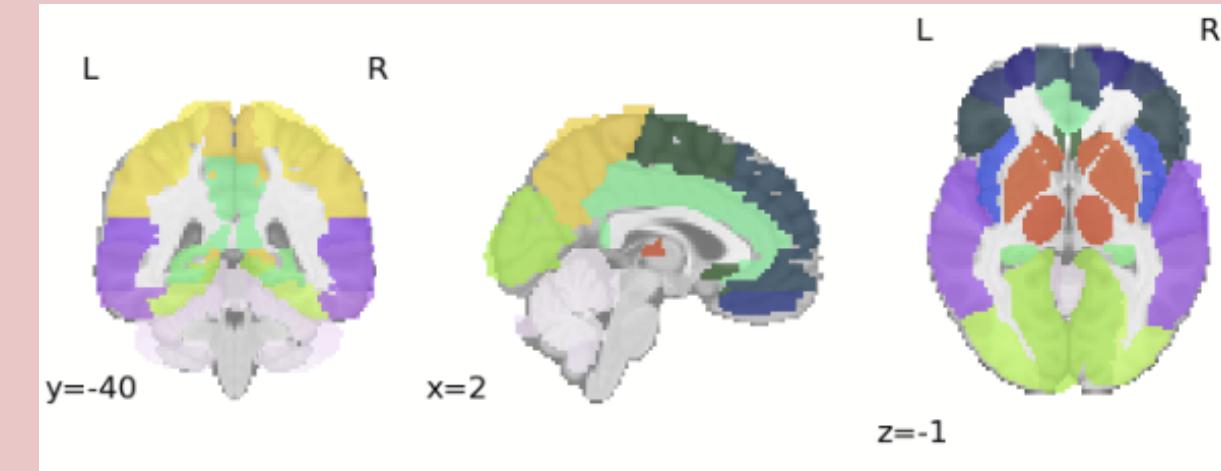
IMPROVEMENTS

- Find better Atlas



MIST atlas (Urchs et al. 2019) [3]

VS



atlas_aal from nilearn [2]

- Use more datas

180 files << $\sim 7\,000$

- Find better algorithm

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DELIVERABLES

- GitHub repository : project code [6]
- Markdown : project description & installation instructions
- Jupyter Notebook : results visualization and step by step reproducible workflow
- Requirements.txt : Specify the Python environment needed to run the notebook
- Presentation of the project

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REFERENCES

- [1] <https://nipype.readthedocs.io/en/latest/>
- [2] <https://nilearn.github.io/stable/index.html>
- [3] <https://mniopenresearch.org/articles/1-3>
- [4] <https://scikit-learn.org/stable/modules/generated/sklearn.decomposition.PCA.html>
- [5] <http://un-est-tout-et-tout-est-un.blogspot.com/2018/12/ia-classification-svc-avec-scikit-learn.html>
- [6] https://github.com/brainhack-school2024/duchadeau_project

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QUESTIONS ?

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