



HAL
open science

3DBrainMiner, a tool to generate brain graphs from MR-images

Antoine Bourlier, Elodie Chaillou, Jean-Yves Ramel

► **To cite this version:**

Antoine Bourlier, Elodie Chaillou, Jean-Yves Ramel. 3DBrainMiner, a tool to generate brain graphs from MR-images. NeuroCompare: Comparative Neuronal Circuits For Adaptive Behaviour, Sep 2023, Bordeaux, France. hal-04228052

HAL Id: hal-04228052

<https://hal.science/hal-04228052v1>

Submitted on 4 Oct 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

3DBrainMiner, A TOOL TO GENERATE BRAIN GRAPHS FROM MR-IMAGES

Antoine Bourlier^{1,2}, Elodie Chaillou², Jean-Yves Ramel¹

1. LIFAT Université de Tours, 2. INRAE Nouzilly

Context :

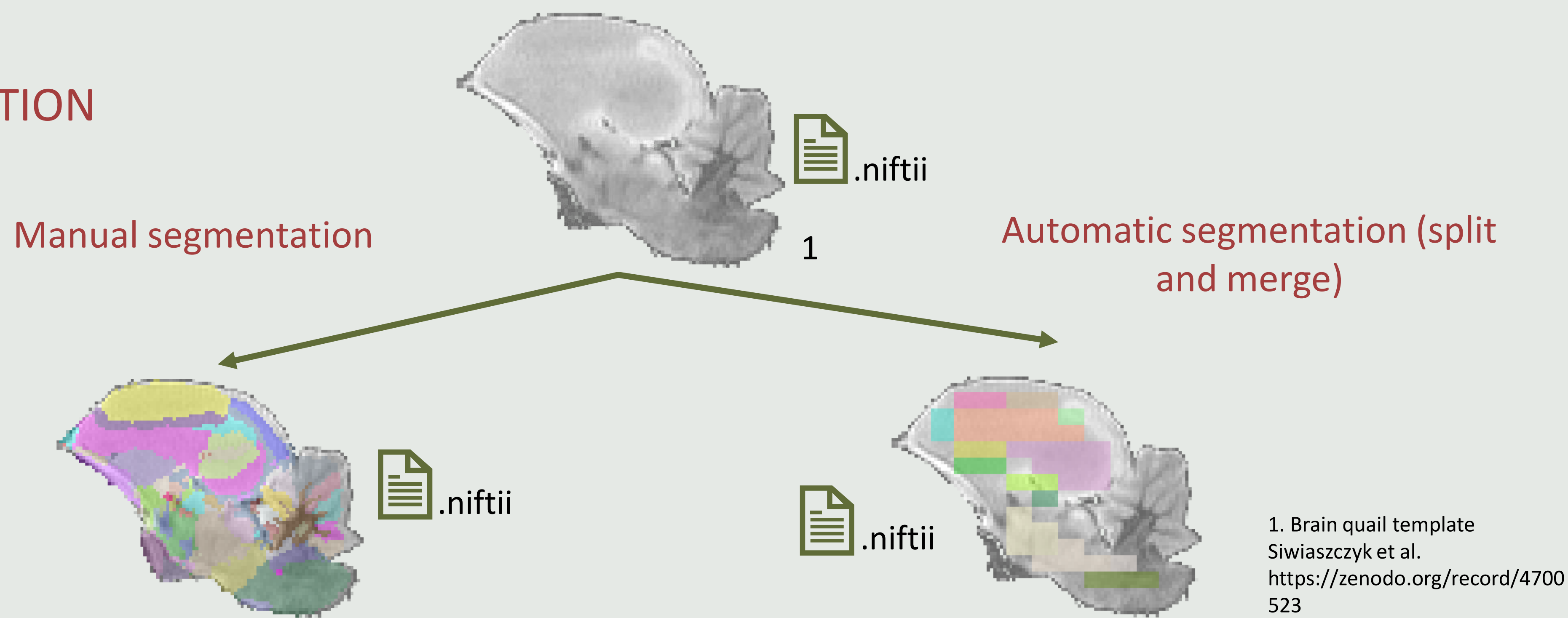
- The rise of brain imaging methods results in a substantial amount of morphological and functional data.
- We are using nonconventional animal models (quail, sheep, wild animals etc.) => less tools and databases
- Objectif 1 : transform anatomic and functional MRI of brains into graphs for better exploration
- Objectif 2 : Use graph matching or machine learning algorithms to analyze graphs

Representation of brains in the form of graphs in the literature :
 NODES = structures, cells, neurons, voxels, recording electrodes, etc.
 EDGES = structural, functional, effective connections, etc.

Quail brains are used to illustrate how 3dBrainMiner works.

3dBrainMiner

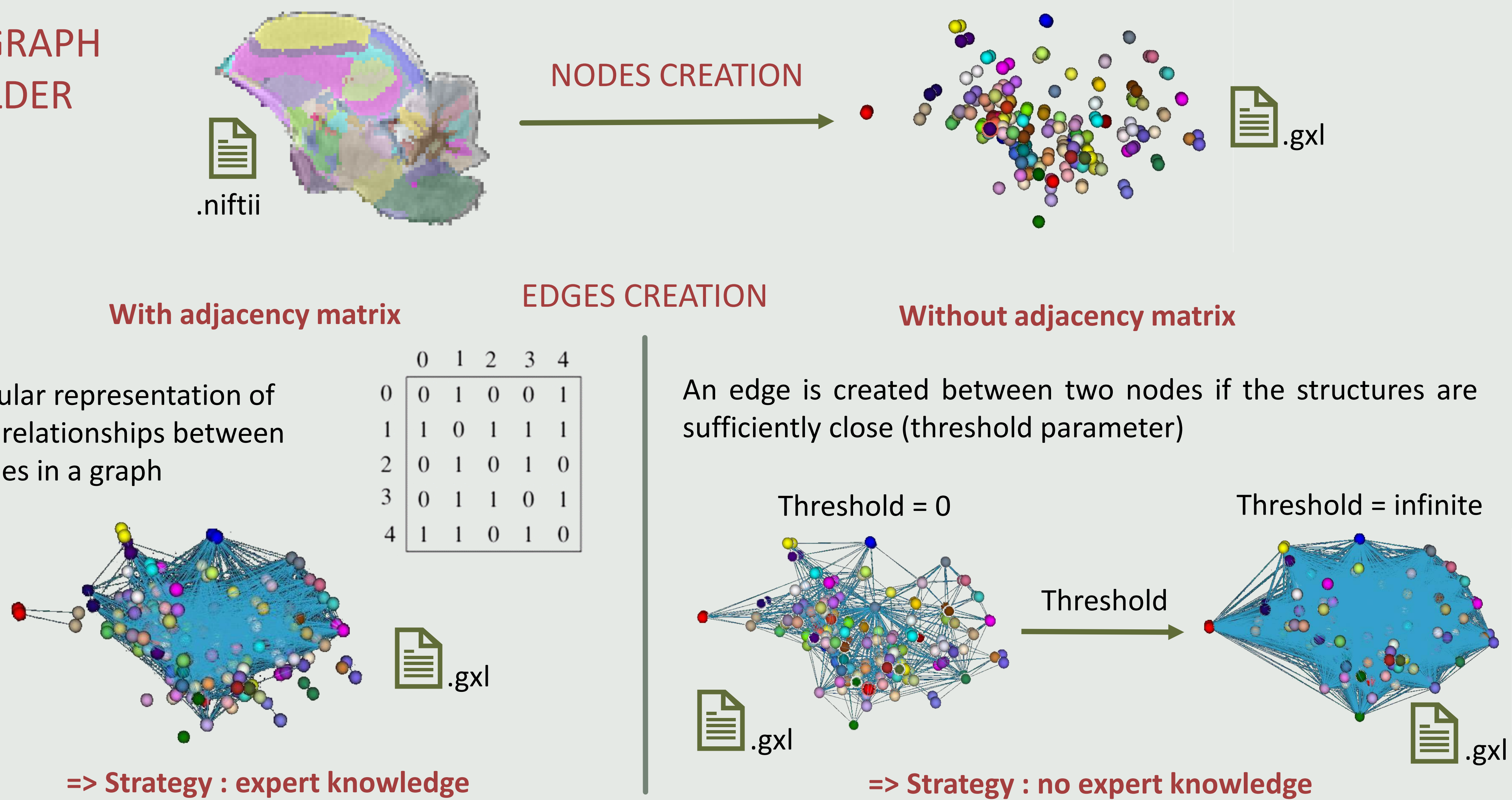
1 – BRAIN SEGMENTATION



2 - FEATURES EXTRACTOR

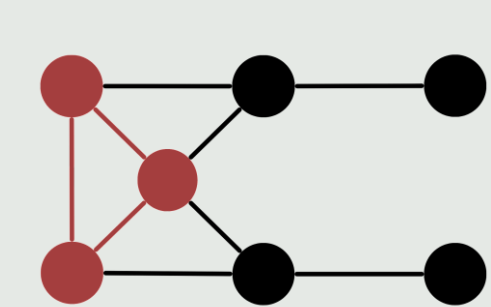
Node features		Edge features
• Mean Intensity	• Volume	• Mean distance
• Intensity variance	• Sphericity	• Min / max distances
	• Surface	• Contact surface
	• Radial profile	
	• Center of gravity	

3 - GRAPH BUILDER

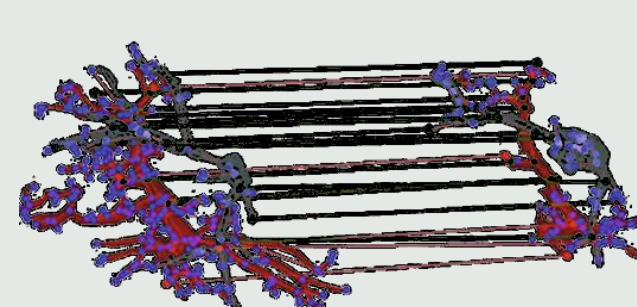


4 - GRAPH MINER

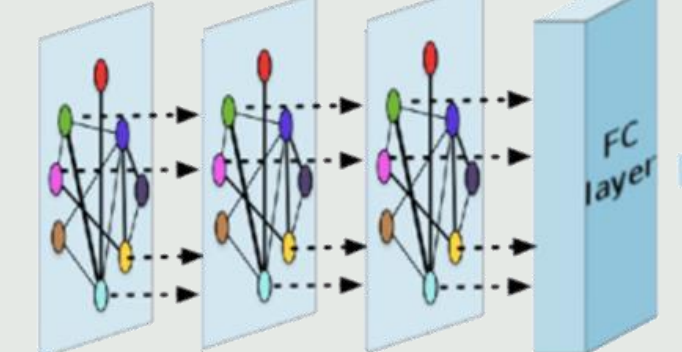
Graph Mining



Graph matching



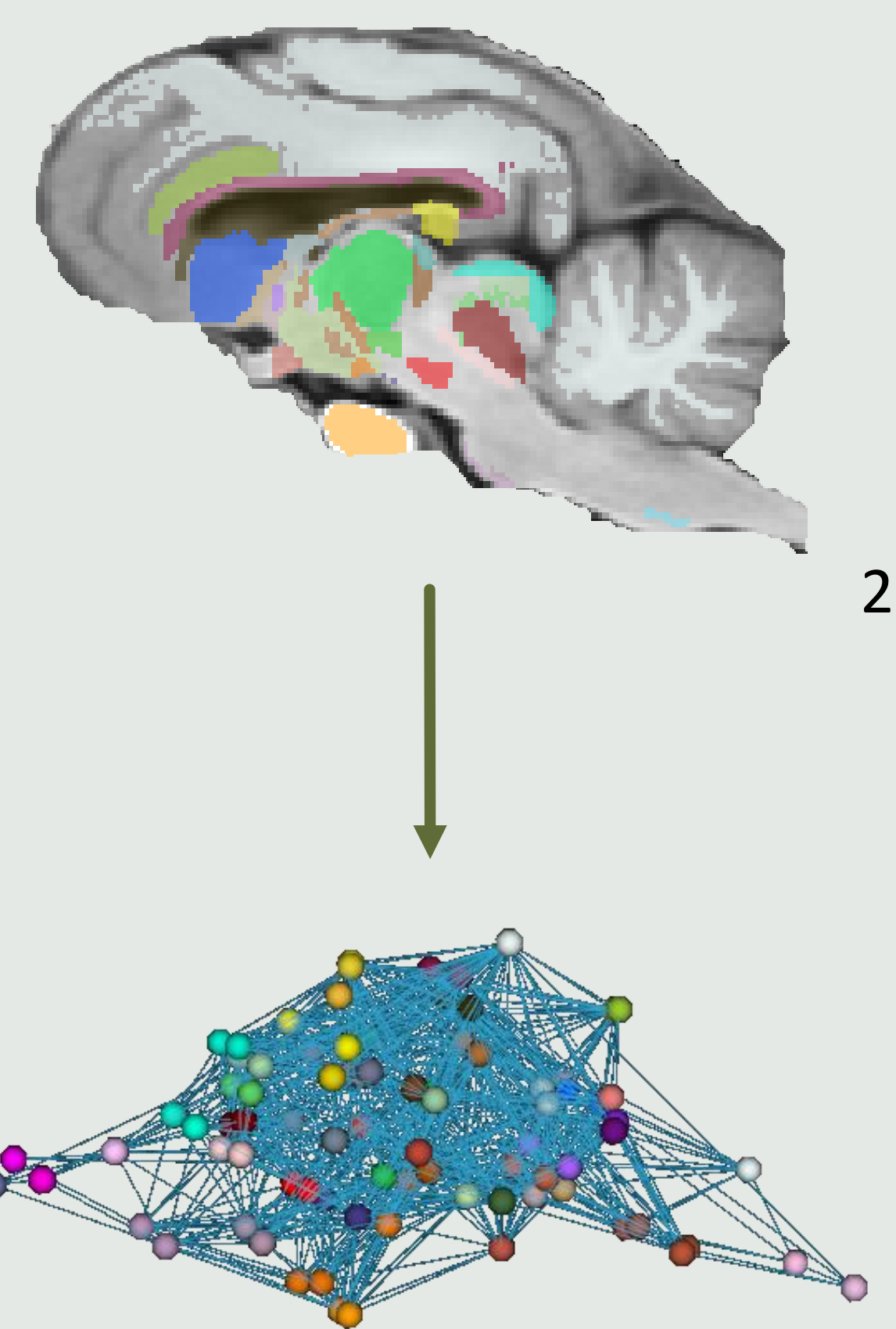
GNN



- Language : python
- Conda environment -> easy to install and use
- Github link : <https://scm.univ-tours.fr/projetspublics/lifat/3dbrainminer>

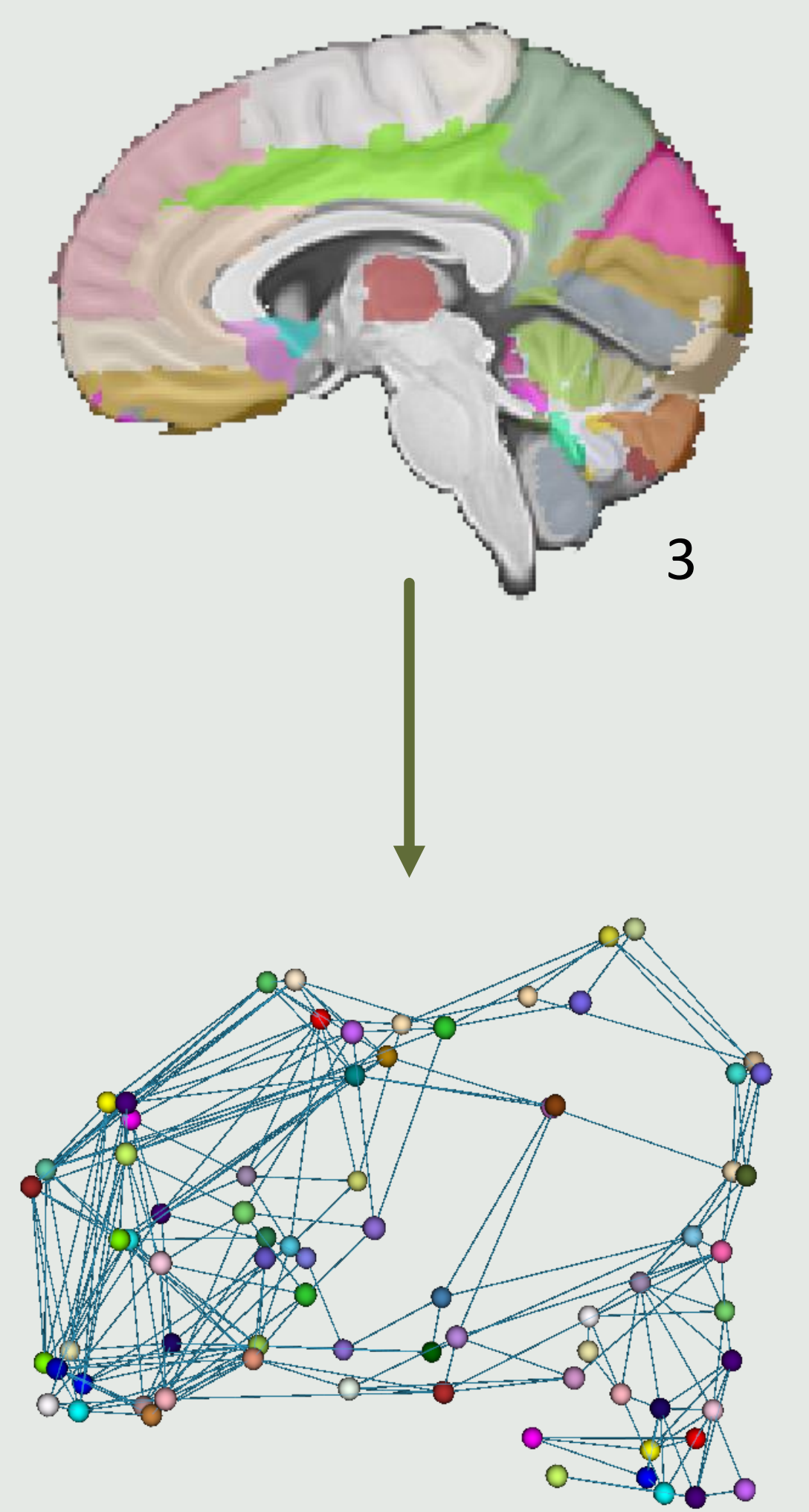
Graphs obtained with 3dBrainMiner :

Sheep brain



2. Musiclamb (Neuro2Co project : <https://hal.inrae.fr/hal-04106607>)

Human brain



3. Yang et al. Neuroimage, 206, 116318.

Original features of 3dBrainMiner:

- A set of interoperable tools (brain segmenter, features extractor, graph builder, graph miner)
- Creation of new features (structure shape, contact surface between structures, radial profile etc.)
- Freedom of adding neuroanatomical knowledge for segmentation, adjacency matrix construction and features creation