PyBP: Python for Brain Parcellation

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PyBP

PyBP: A versatile toolbox to partition the brain into different subunits

1. input: anatomical or functional neuroimaging data
2. process: segment the brain into different based on some criterion.
3. output: ROIs in NII format and object in HDF5

Dependencies

1. Python
2. Pymvpa
3. NIPY
4. Nipype
5. Subversion

ROI Making

1. manually operation
2. Automatic method
3. Semiautomatic method

Learn from Pymvpa

直接把数据提取，然后丢掉了空间近邻信息。但信息保存在map中，所以是否可以采用pymvpa的架构，直接利用matrix和mapper，然后利用后续算法进行操作？

1. Base: base class for all module？
2. Datasets: IO
3. Mapper：preprocessing and transform
4. Measure：distance or similarity
5. Clfs：classifer
6. Algorithms：general algorithms except Clfs?
7. Kernels：Kernels to compute the distance in high dimension.
8. Featsel：feature selection

Principal of PyBP Design

直接基于pymvpa
优势: 框架设计良好，和其它软件接口设计良好。缺点: 是为decoding 专门设计，很多特征不是我们所需的。

Tradeoff
借鉴pymvpa,nipy，把整个过程拆分成不同module，每个module逻辑上相对独立，具有共同基类, module 中其它类均从其继承。增添针对PyBP的特有module: Neighbor,Sparse. 这种才能真正学习设计，让我们进步，我们必须采用这类方法。

Object in PyBP

Input

1. Task fMRI(Label or Volume)
2. Rest fMRI
3. DTI
4. MRI
5. Connectivity matrix

Output

1. Volume ROI
2. Surface ROI

Process or Algorithms

1. Supervised:Generative model(Bayes, Dictionary learning,Hierarchy model)
2. Unsupervised: Watershed, Region Growing,

Platform

1. Format(volume and surface)
2. Software(FSL,SPM,Freesurfer,Caret)

ROI Making

Manually operation

1. Display the map
2. Draw the ROI manually and save ROI

Semiautomatic method

1. Segment contrast probabilistic map to generate group ROI(Ncut,Watershed,K-means).
2. Generate individual subject ROI guiding by group ROI.

Automatic method

1. Generate feature(fMRI, rs-fcMRI, DTI) for labeled voxel.
2. Train the model
3. Predict non-training voxels or subject

Basic function

1. Draw ROI manually(fROI,pyQTGraph,pyQwt)
2. Find peak(peak_nii)
3. Probabilistic map(SPM anatomy toolbox)
4. Combine volume and surface(pyROI)
5. Good Framework (pymvpa)
6. Extract signal of ROI(fROI,marsBar)
7. Automatic method(our features)

GUI coordinate system

Windows vs. viewport

1. 窗口是虚拟，逻辑对象，看不到。窗口使用逻辑坐标，如mm
2. 视口在设备上实现了窗口，实际在设备上看到。视口使用设备坐标，如pixel

Coordinate

1. 逻辑坐标系是指用于指定逻辑坐标的坐标系，视口坐标系是指用于指定设备坐标的坐标系。
2. 窗口和视口原点均为目标窗口和视口左上角，为是同一点，只是以不同的坐标系表示而已，因为后者是前者的物理实现。
3. 设备坐标系分为屏幕坐标系、窗口坐标系和客户区坐标系三种相互独立的坐标系。