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Limited FOV in group analysis and brain parcelation

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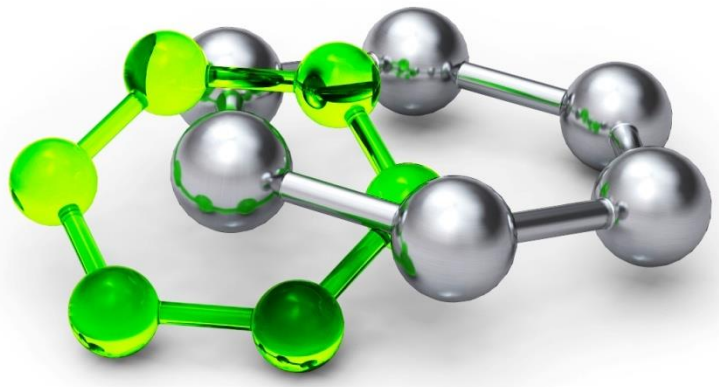

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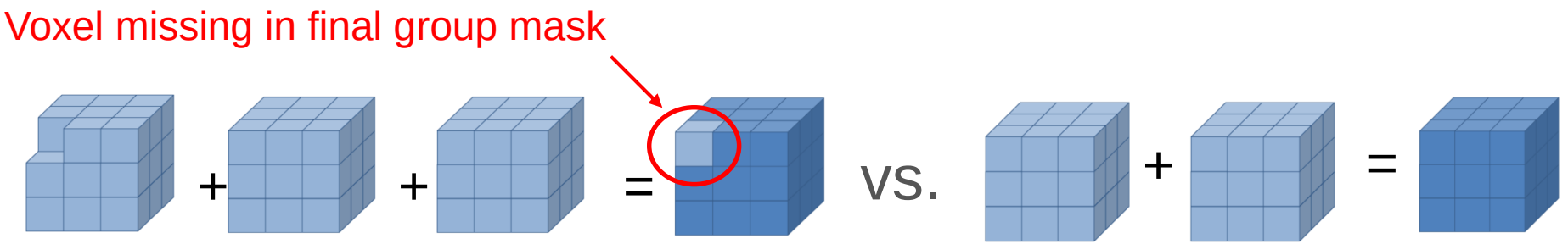
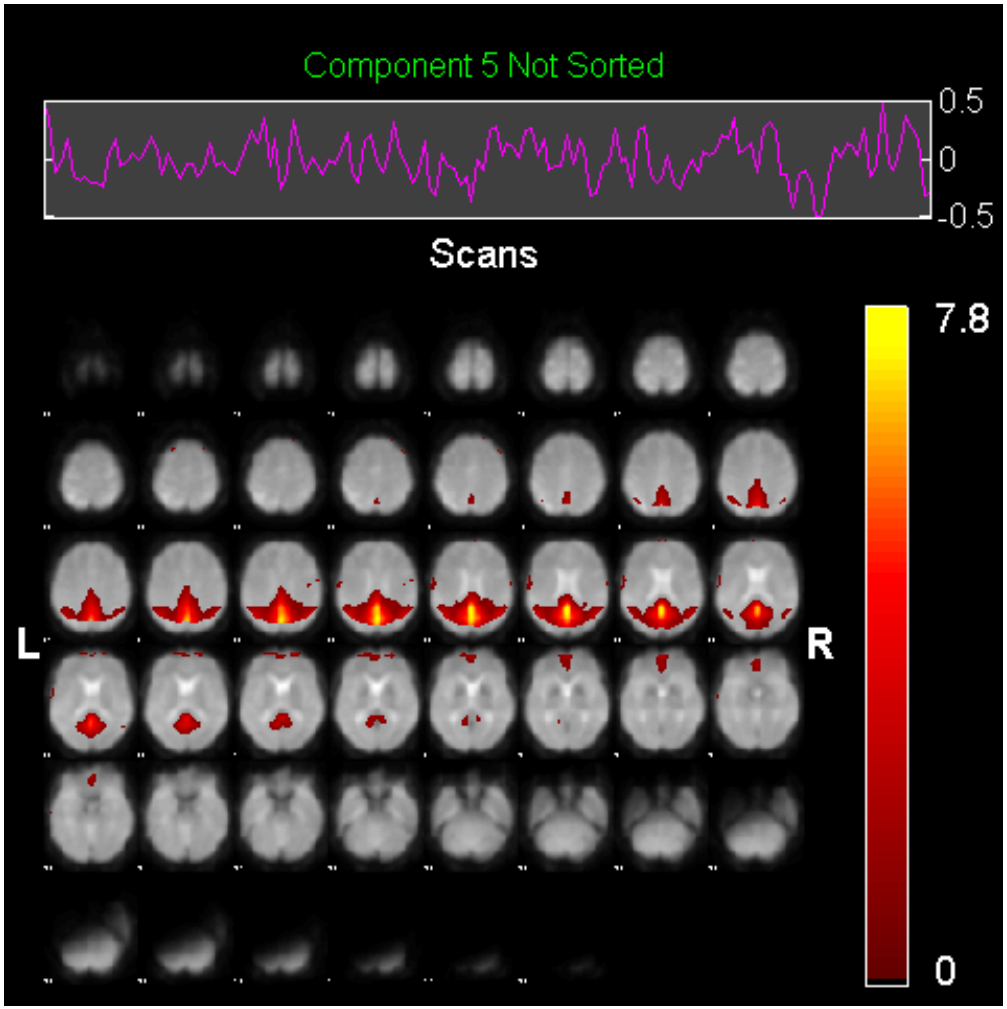
Missing data problems

- Missing data -> missing statistical value -> possibility to accept wrong hypotheses



- Reasons for presence of inconsistent data:
  - Failure in preprocessing
  - Subject with shifted FOV

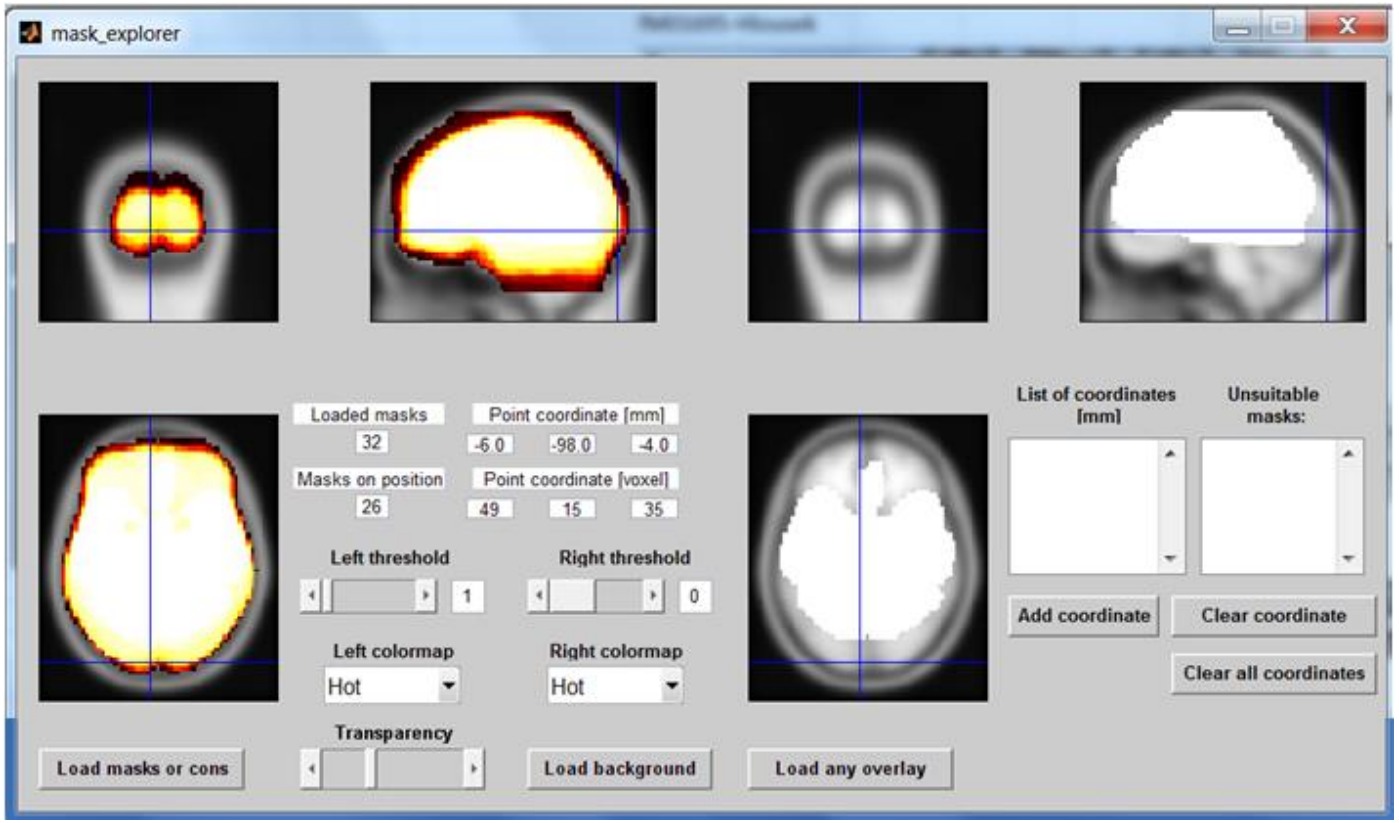
Example 1: PD data and analysis



?

Example 1: PD data and analysis

1.) Identification of failure in preprocessing

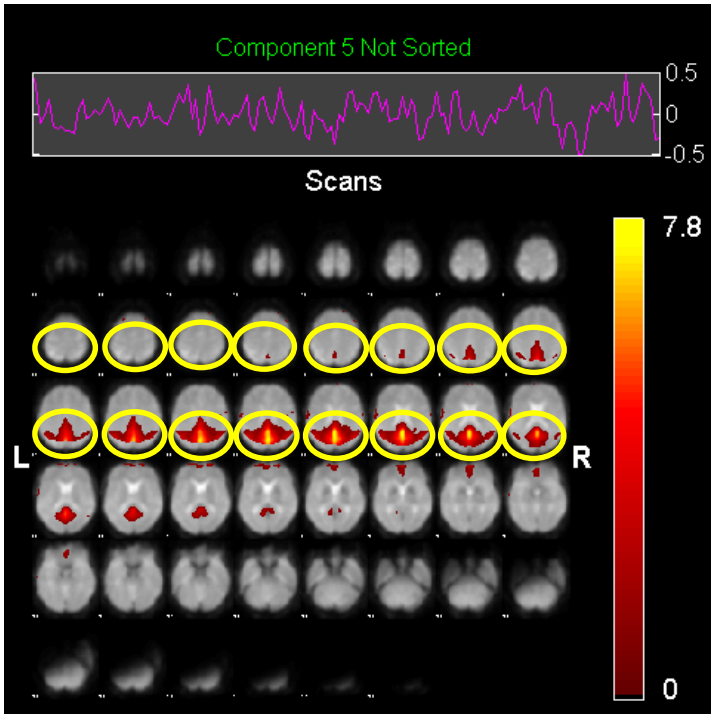


Fix: Spatial normalization to MNI EPI template instead to anatomical scans

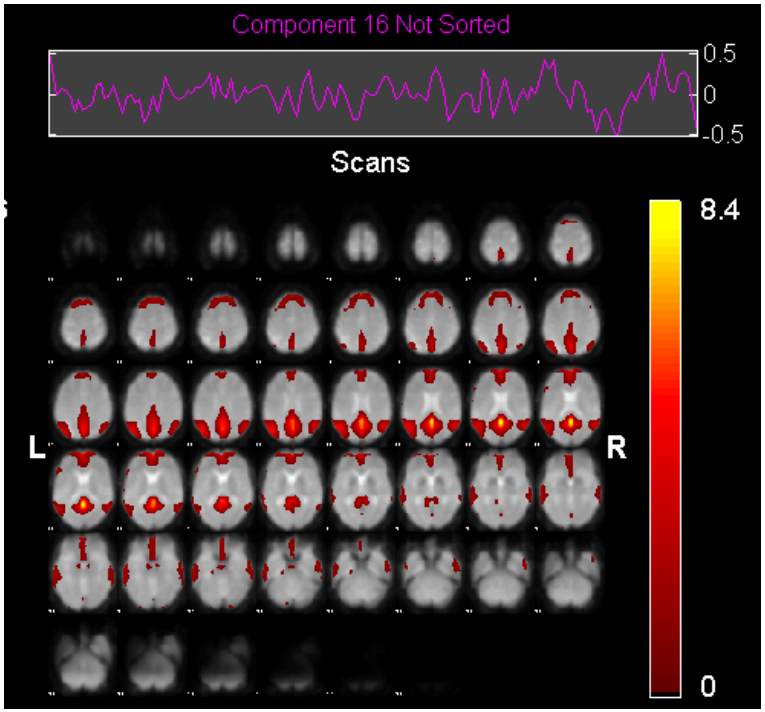
Example 1: PD data and analysis

- ICA – DMN identification using normalization to:

a) Anatomical scans



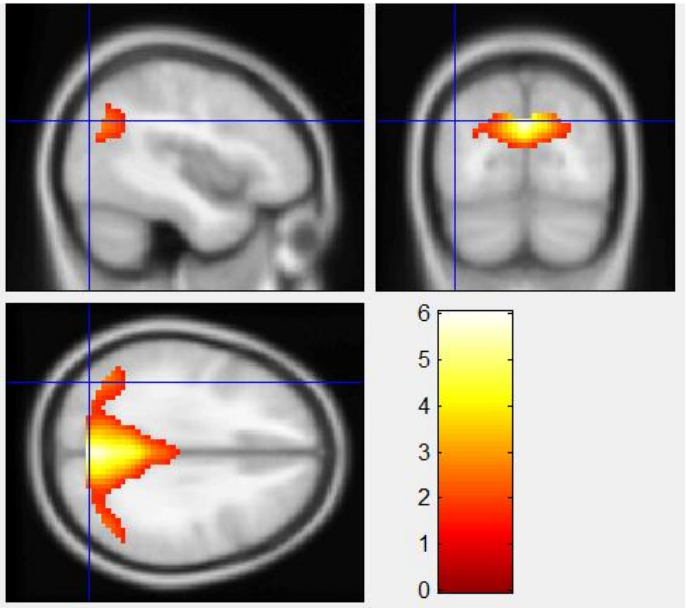
b) MNI EPI template



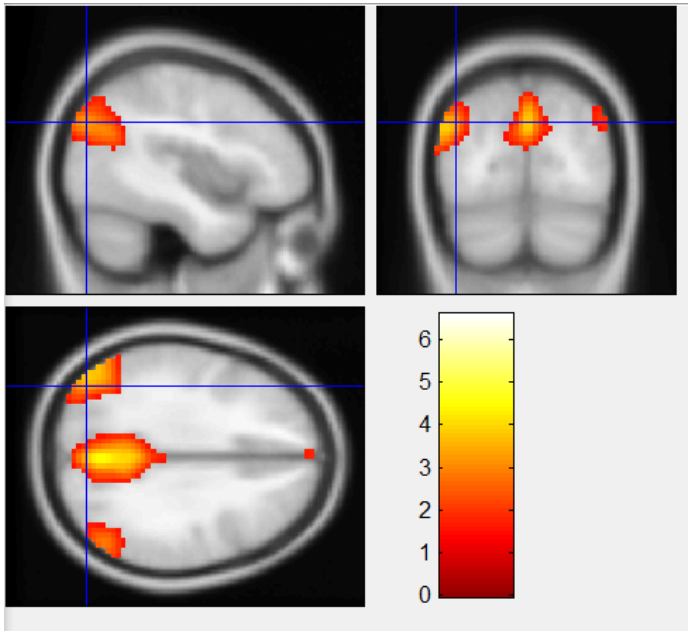
Example 1: PD data and analysis

- ICA – DMN identification using normalization to:

a) Anatomical scans



b) MNI EPI template



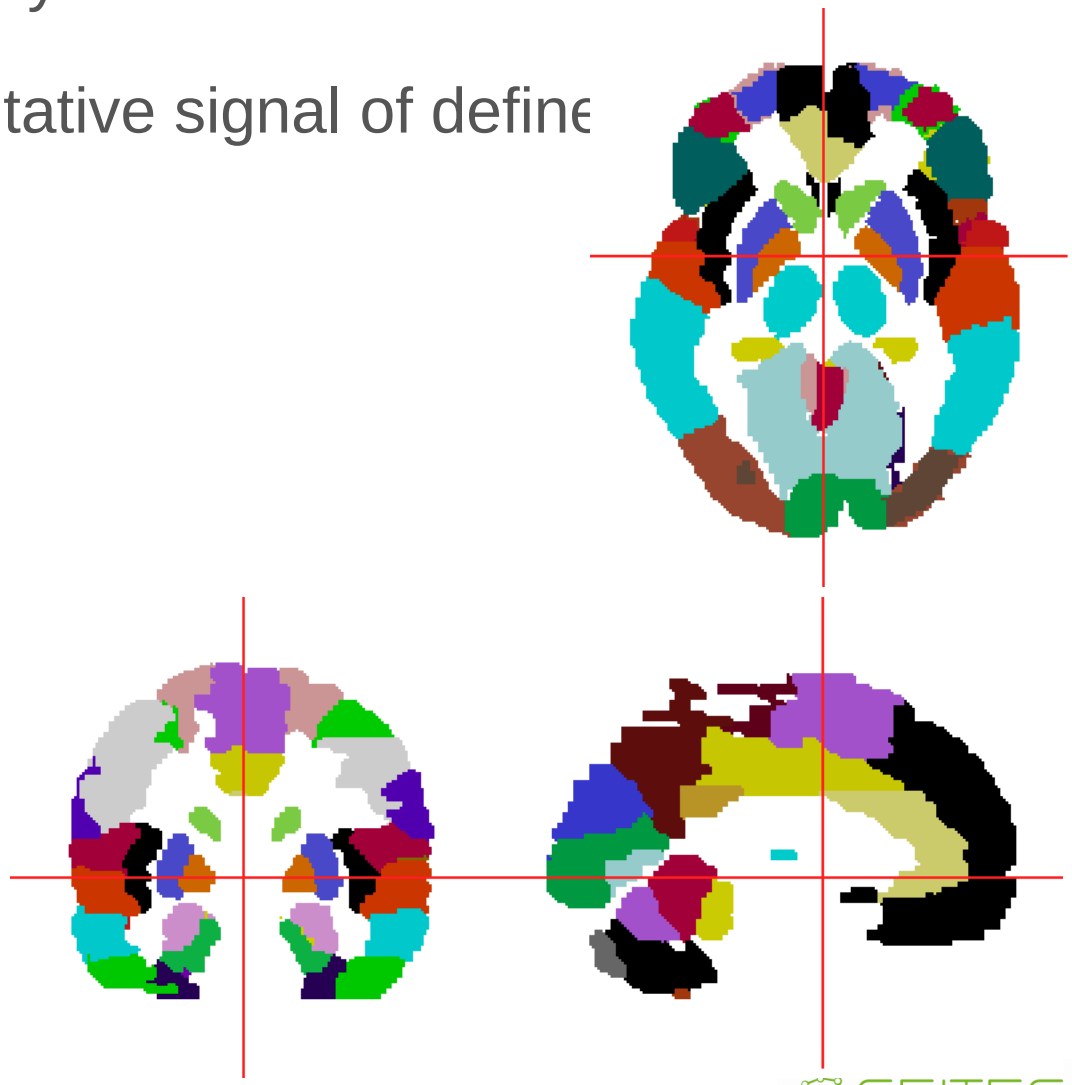
[-42 -77 31] mm; threshold z = 1,5

Example 2: Brain parcelation

- Reduction if dimensionality
- Computation of representative signal of define

  (mean, eigenvector)

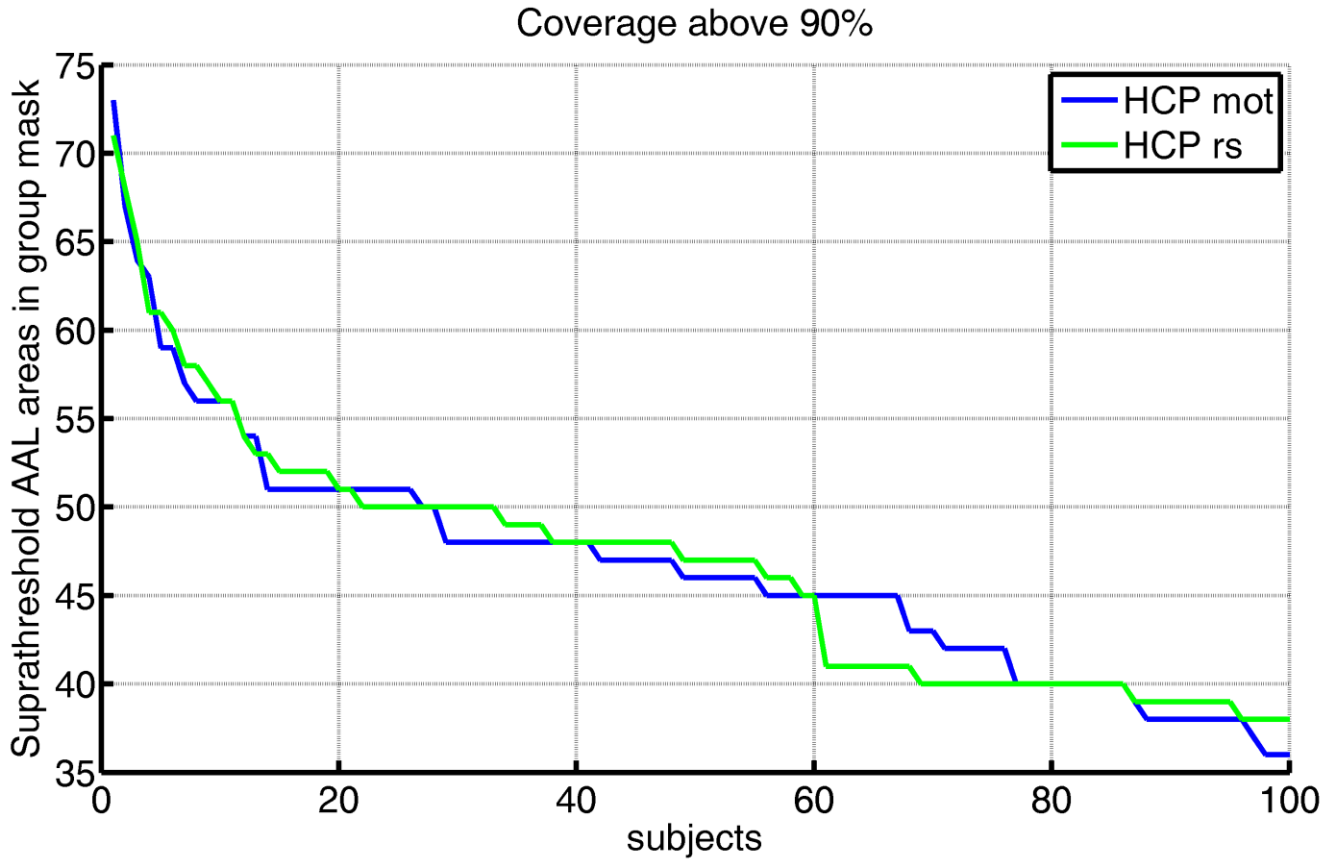
  1. Data driven
  2. Atlas based



Effect of data loss on graph theory metrics

Example 2

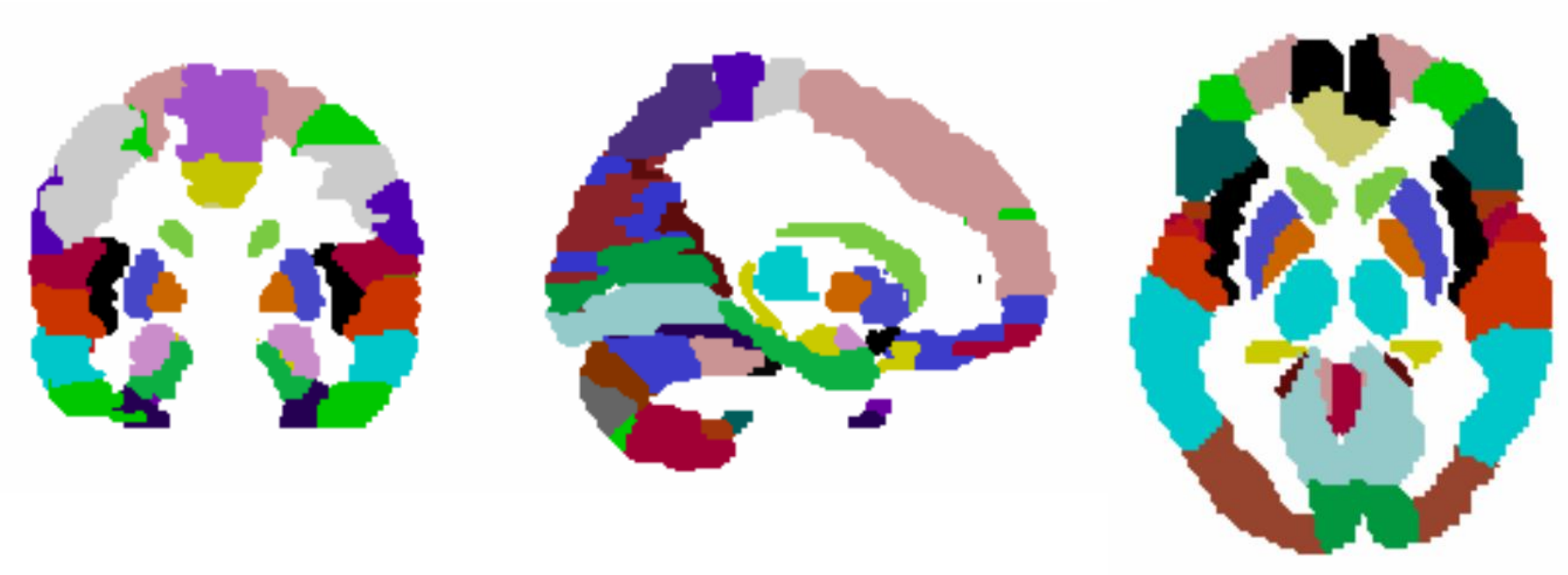
- HCP data, 100 subjects, AAL areas (considering 90 from 116)



Effect of data loss on graph theory metrics

Example 2

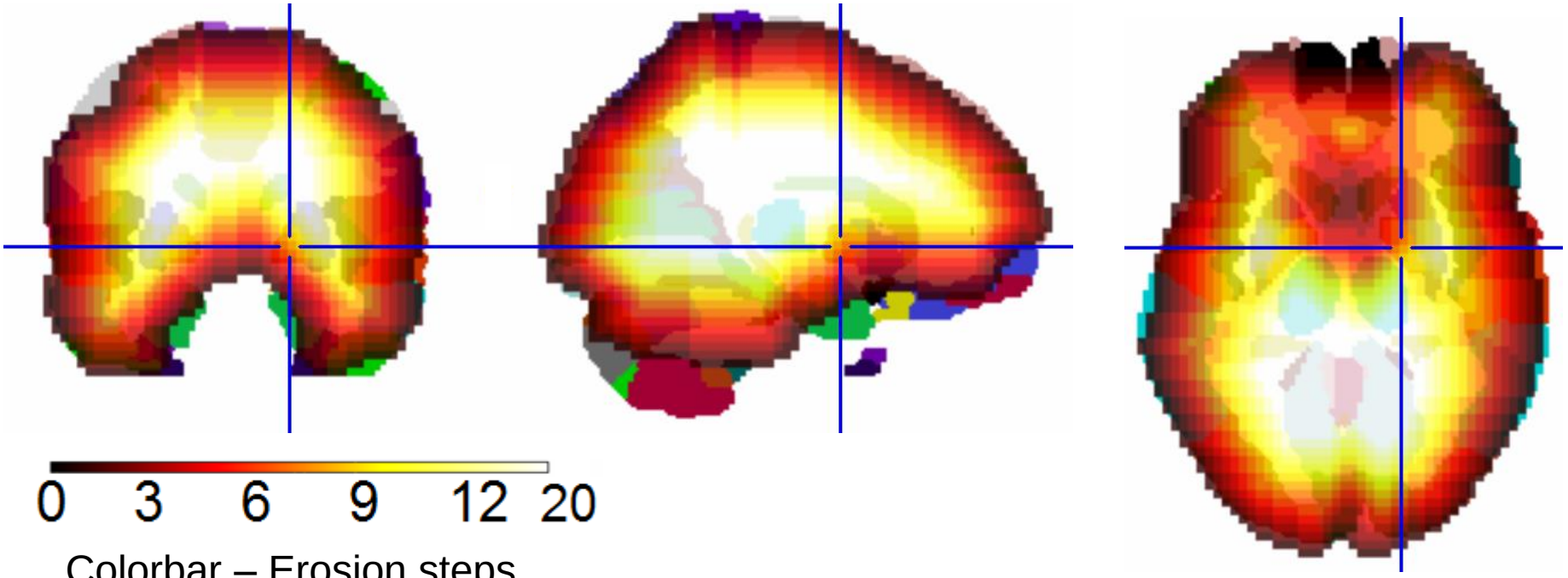
- fMRI data, parcelated according AAL atlas (90 from 116 ROI)
- Vx size [3x3x3]mm



Effect of data loss on graph theory metrics

Example 2

- Data erosion – simulation of data loss, 20 steps



Colorbar – Erosion steps

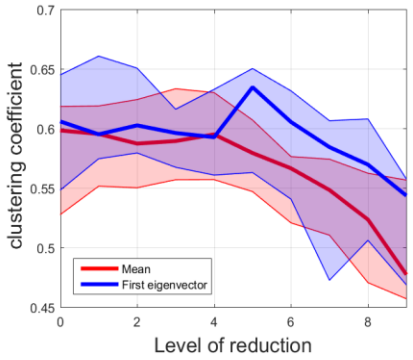
1 subject, overlaid over AAL atlas

Effect of data loss on graph theory metrics

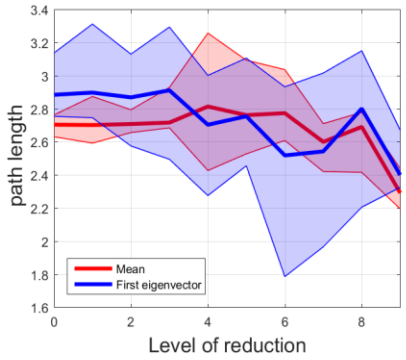
Example 2

- Data erosion – simulation of data loss, 20 steps

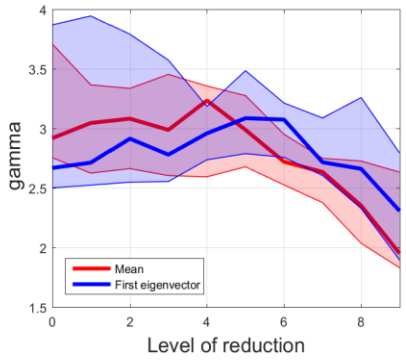
Clustering coefficient



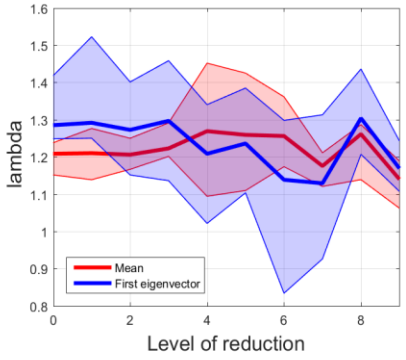
Path length



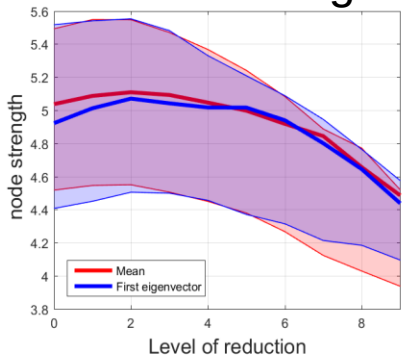
Gamma



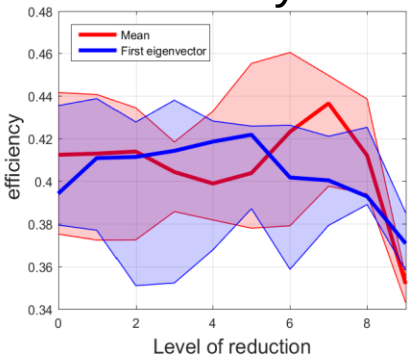
Lambda



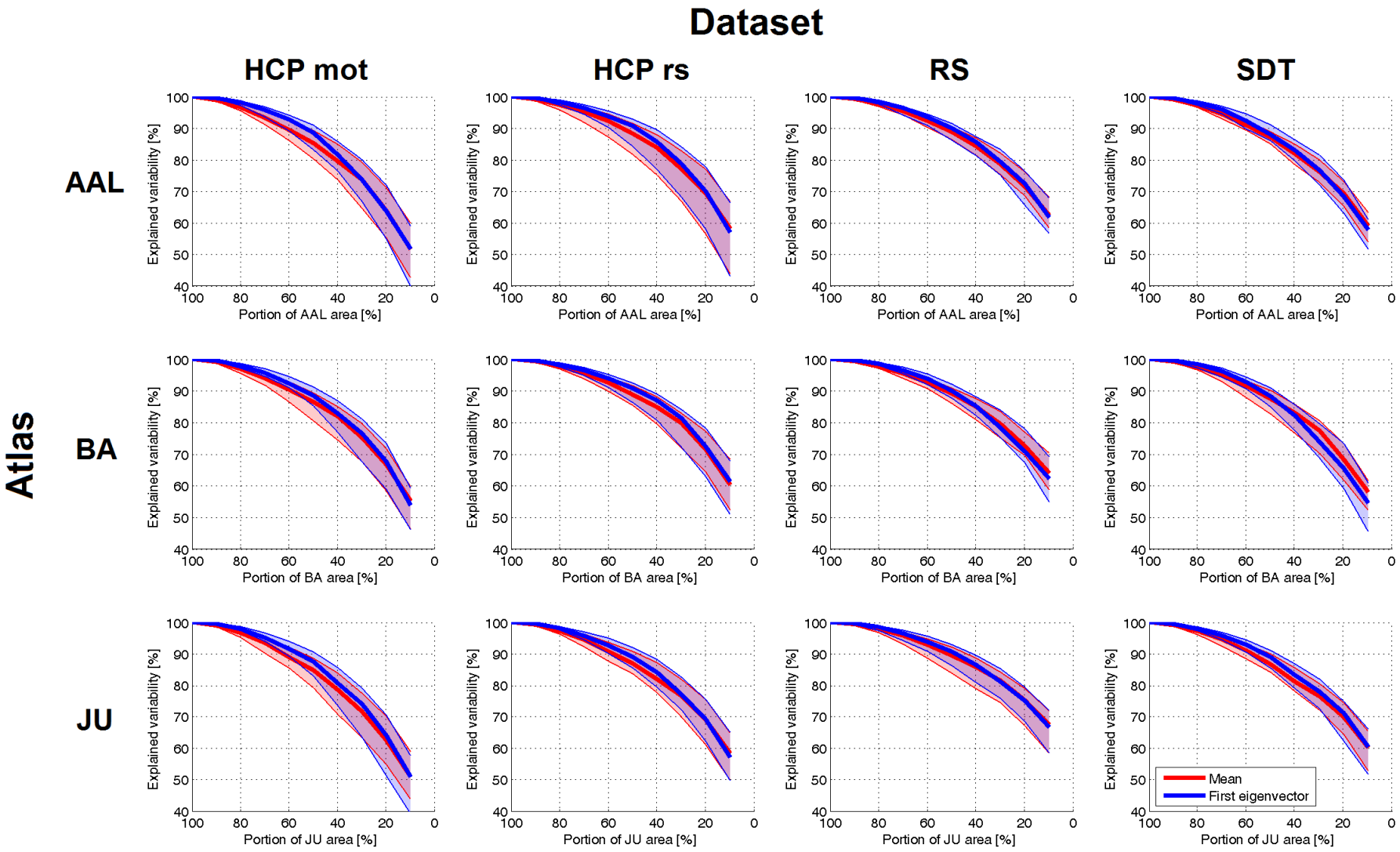
Node strength



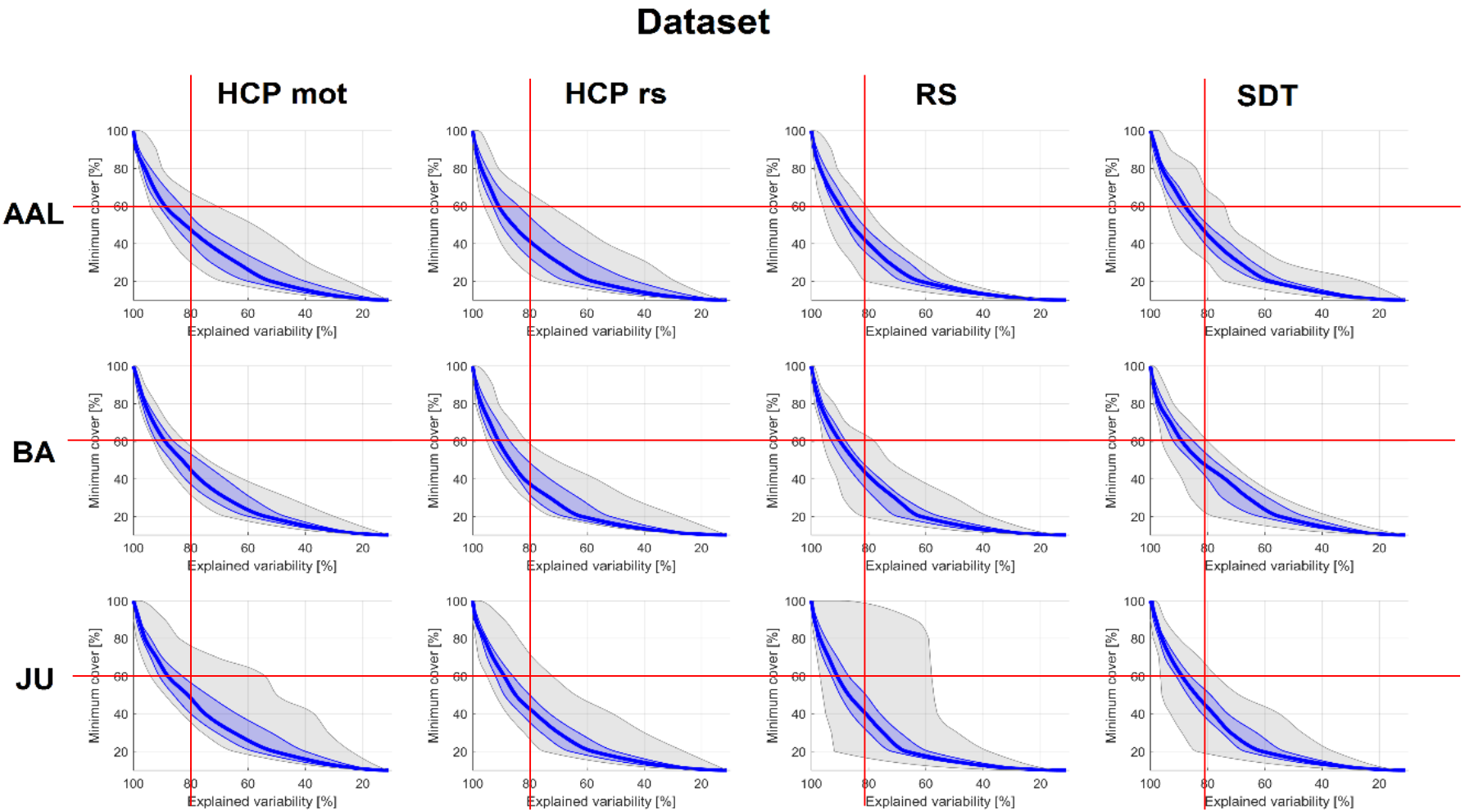
Efficiency



Effect of data loss in particular atlas areas



Effect of data loss in particular atlas areas



- Minimal coverage necessary to reach defined explained variability

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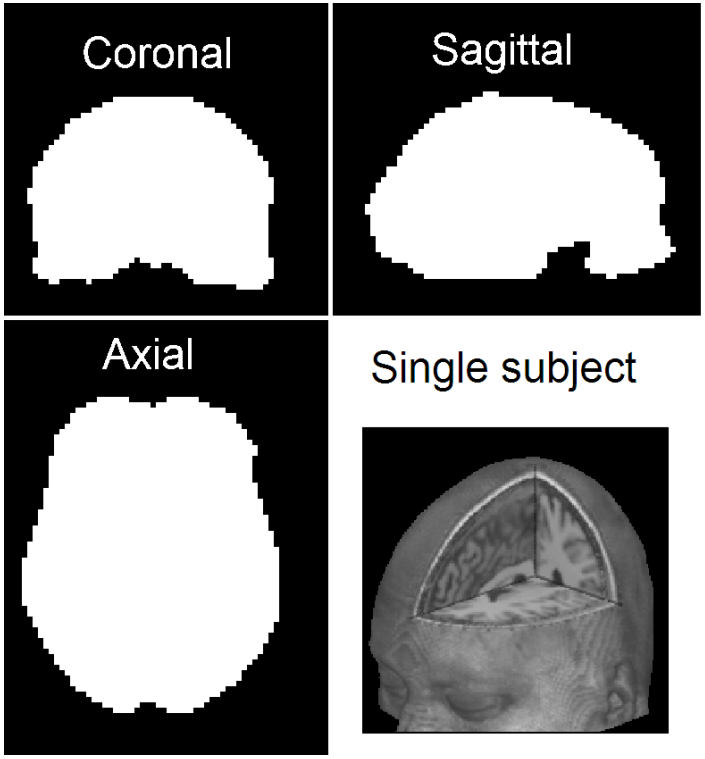
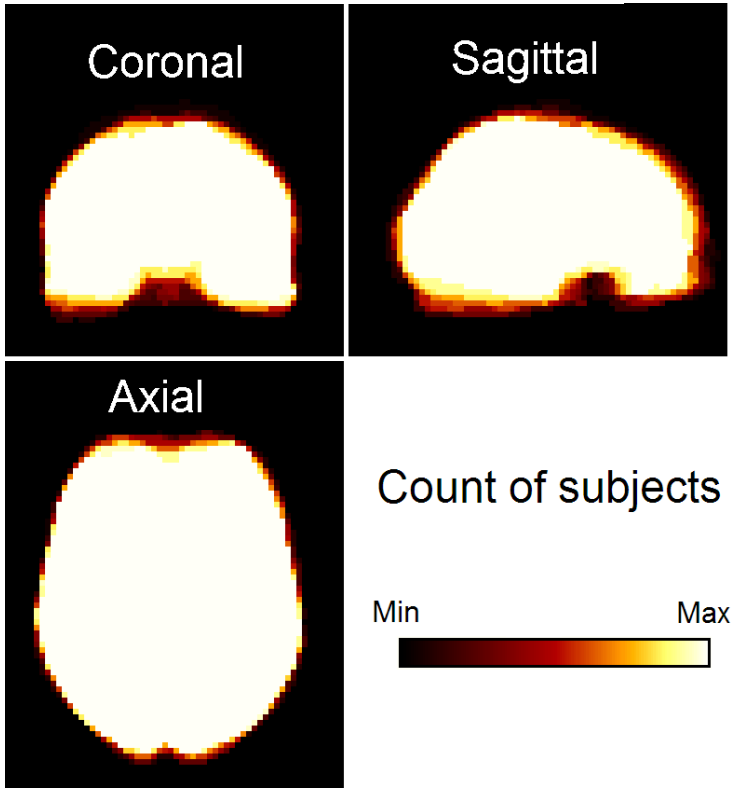
Solution:
Exploration based on masks of subjects

- Helps to find deficient voxel positions
- Mask – binary 3D matrix
- Map of count of subjects
- The tool mask_explorer

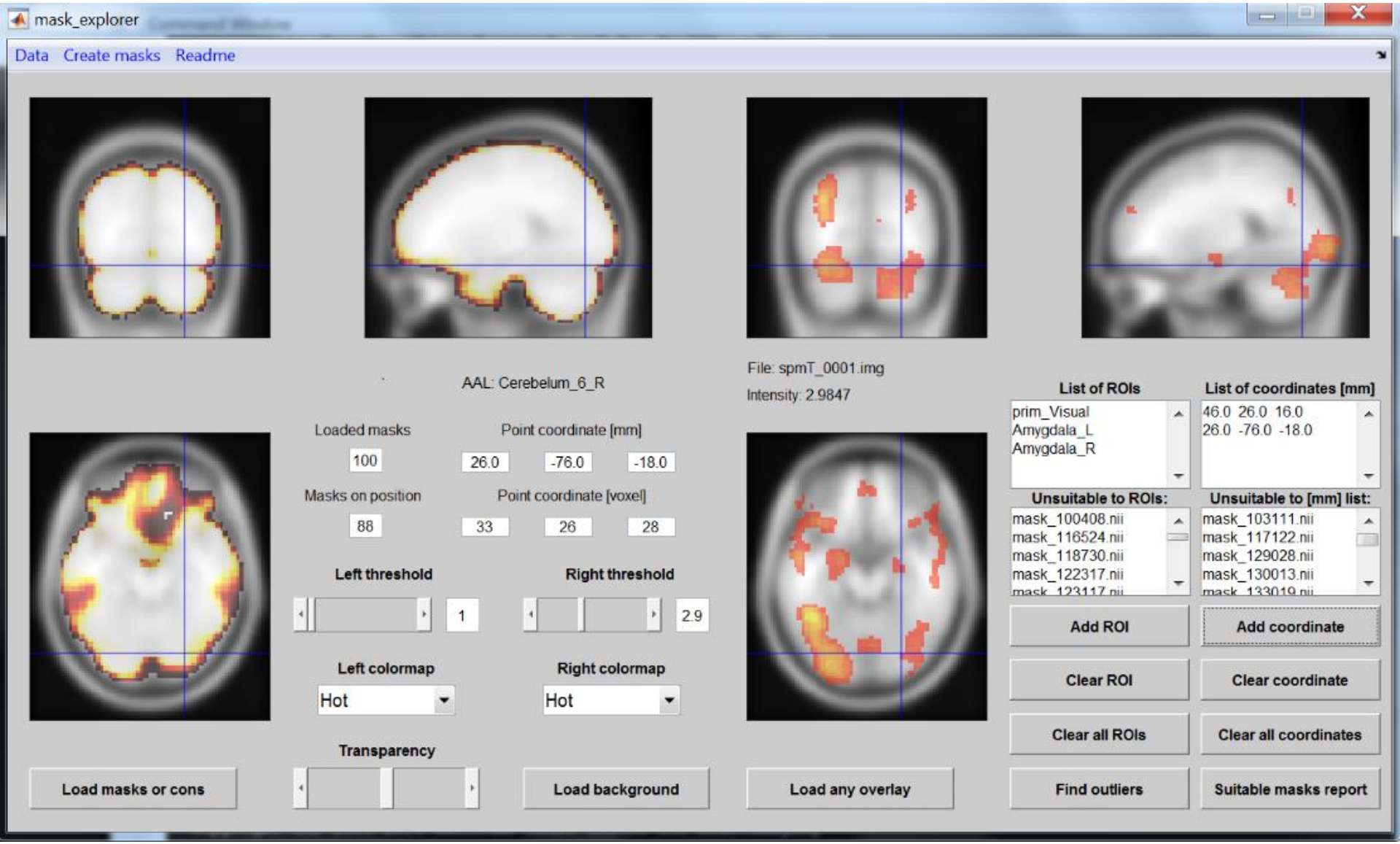


Mask_explorer

- MATLAB + SPM8 or SPM12
- Simplifies fMRI dataset analysis
- Group binary mask
- File of count of subjects
- Available for free on: https://www.nitrc.org/projects/mask_explorer/

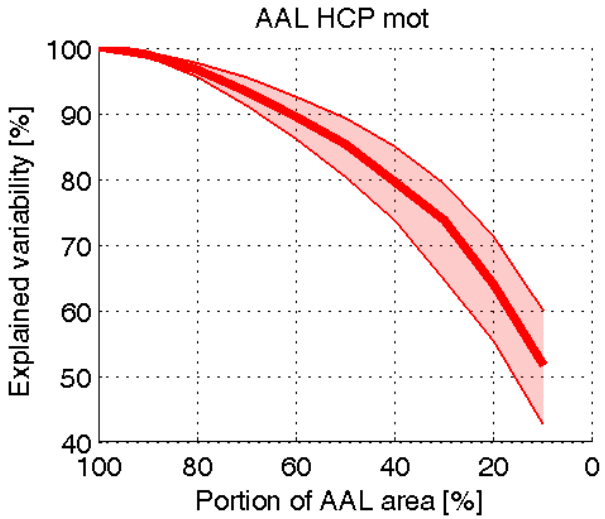


Mask_explorer - interface



Conclusion

- Explore your dataset carefully
- Verify quality of acquired data (FOV, noise, …), preprocessing, and inputs entering your analyses
- We recommend for AAL parcelations to retain areas with coverage at least 60% to ensure 80% of explained variability of original representative signal (-> Pearson r ~ 0,9)



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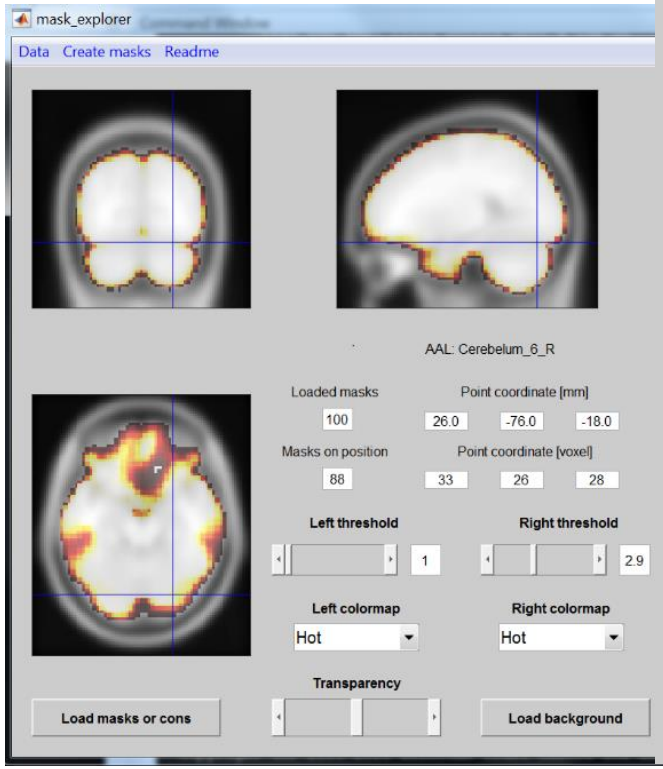
Conclusion

- Atlas coverage can be ispected using the tool Mask_explorer

https://www.nitrc.org/projects/mask_explorer/



Report of suitable masks

ROI coverage info

	Amygdala_L	Cuneus_R	Occipital_Inf_L	Puta
mask_103414.nii	100	99.7893	90.7545	
mask_103818.nii	100	99.5787	94.4740	
mask_105014.nii	100	99.1573	87.0351	9
mask_105115.nii	100	98.7360	92.4548	
mask_106016.nii	100	99.2275	90.7545	9
mask_108828.nii	100	95.7163	59.0861	9
mask_110411.nii	100	99.6489	90.6482	9
mask_111312.nii	100	99.8596	94.0489	9
mask_111716.nii	100	98.9466	95.1116	9
mask_113619.nii	100	98.5253	73.3262	9
mask_113922.nii	100	98.8764	74.1764	
mask_114419.nii	100	99.2275	96.2806	9
mask_115320.nii	100	99.2275	80.5526	
mask_116524.nii	100	98.6657	88.5228	
mask_117122.nii	100	99.8596	91.6047	9
mask_118528.nii	100	99.1573	82.9968	
mask_118730.nii	99.0909	98.8764	94.0489	
mask_118932.nii	100	99.4382	91.8172	
mask_120111.nii	100	99.9298	90.3294	
mask_122317.nii	100	99.9298	85.1222	9
mask_122620.nii	100	99.9298	96.4931	9
mask_123117.nii	100	99.6489	96.0680	
mask_123925.nii	100	98.9466	74.2827	9
mask_124422.nii	100	99.0169	87.3539	9
mask_125525.nii	100	100	94.6865	9
mask_126325.nii	100	99.4382	93.5175	
mask_127630.nii	100	100	90.7545	
mask_127933.nii	100	100	87.9915	9

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