

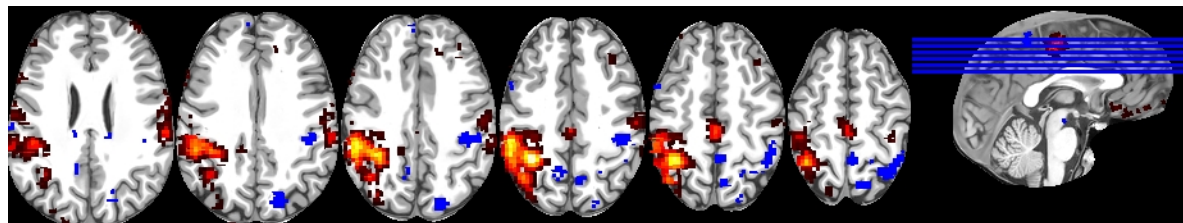
# An a contrario approach for the detection of activated brain areas in fMRI



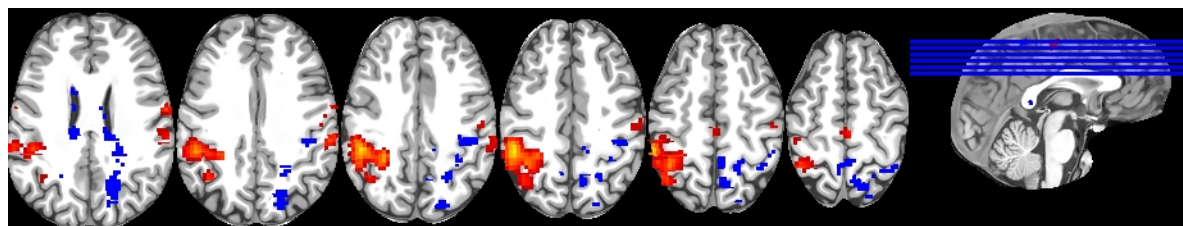
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*Locally multivariate a contrario*



Massively univariate GLM

**Monitor 18**

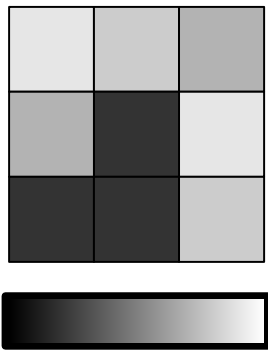




- The main method to detect activation patterns in individuals is the massively univariate General Linear Model.
  - Each voxel is analyzed independently
  - Gaussian smoothing is used as a pre-processing step.
- The *a contrario* approach, from the computer vision community is a locally multivariate procedure.
  - Each voxel is analyzed with its neighborhood
  - No pre-smoothing of the data is required.

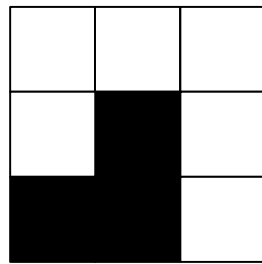


- The *a contrario* approach, a locally multivariate procedure:

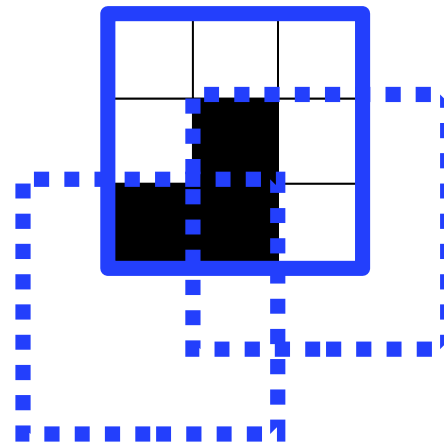


0 1

1. Voxel-based probability

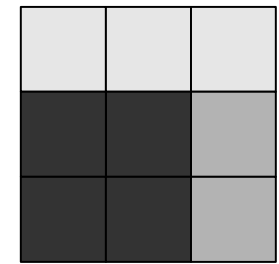


2. Thresholding



3. Rare event count per region

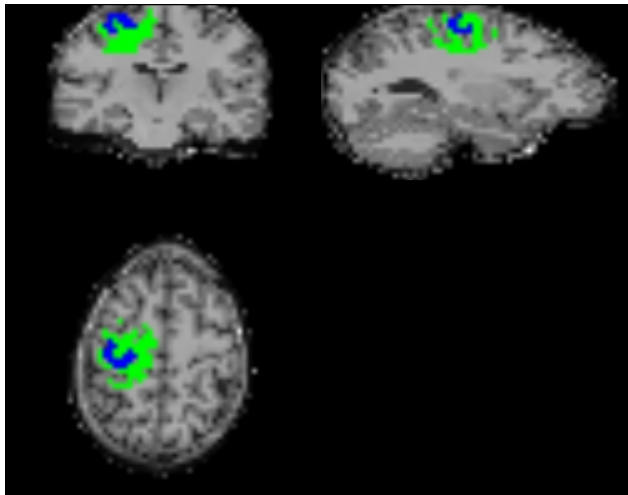
1	1	1
3	3	2
3	3	2



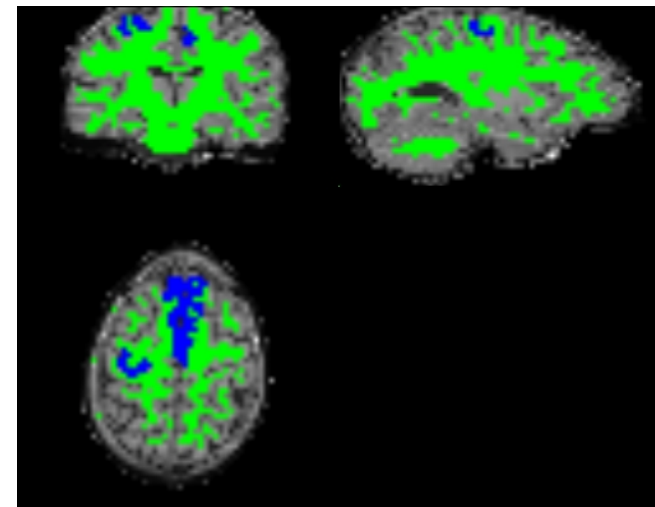
4. Region-based probability



- Data
  - 12 healthy subjects
  - 3 BOLD fMRI sessions of a block motor paradigm
- Computation of 2 ground truths



**Local ground truth**: activation of the hand motor area (grey matter) and no activation of the surrounding white matter

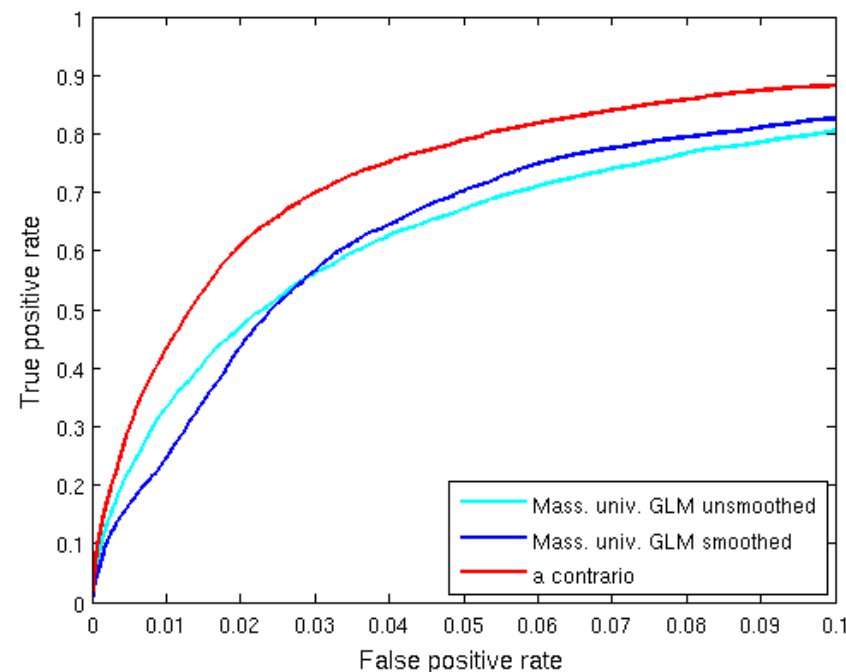
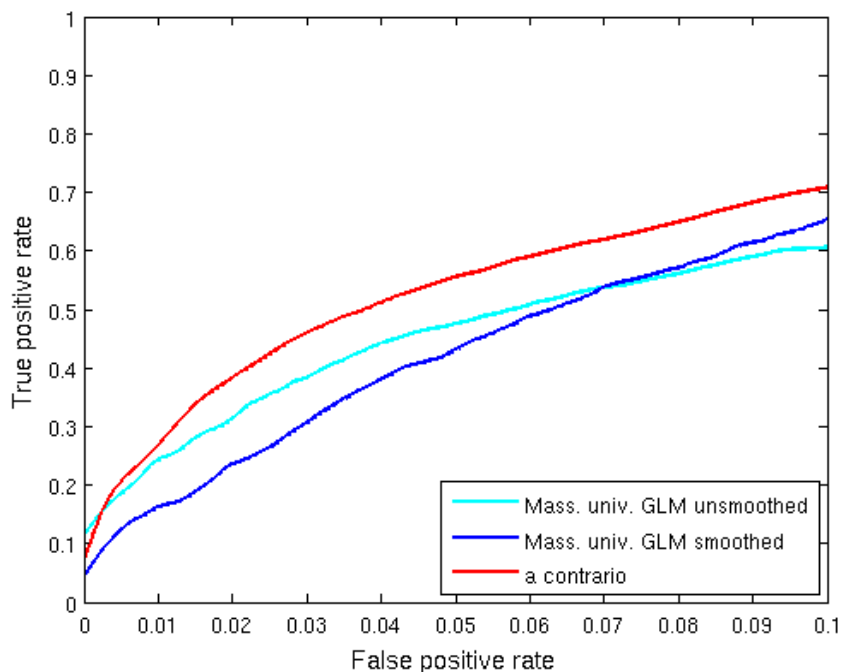


**Global ground truth**: activation of the hand motor area and supplementary motor area (grey matter) and no activation of the white matter

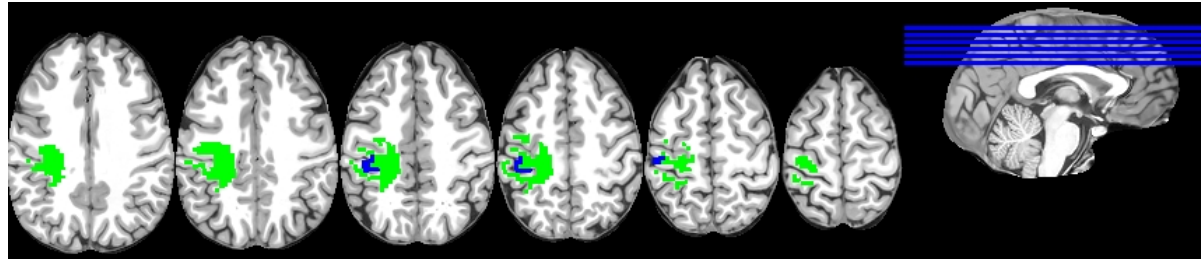
- Receiver-Operating-Characteristics curves

**Local ground truth:** activation of the hand motor area (grey matter) and no activation of the surrounding white matter

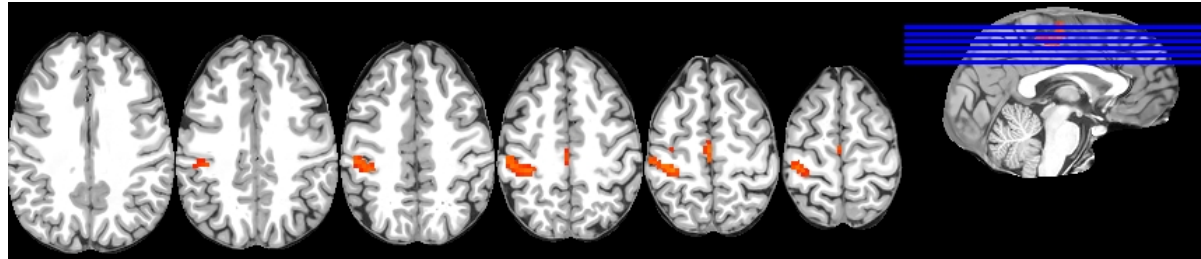
**Global ground truth:** activation of the hand motor area and supplementary motor area (grey matter) and no activation of the white matter



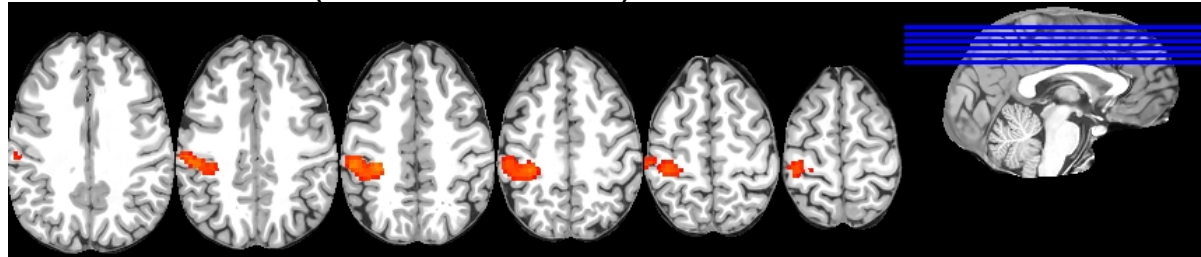
Local ground truth



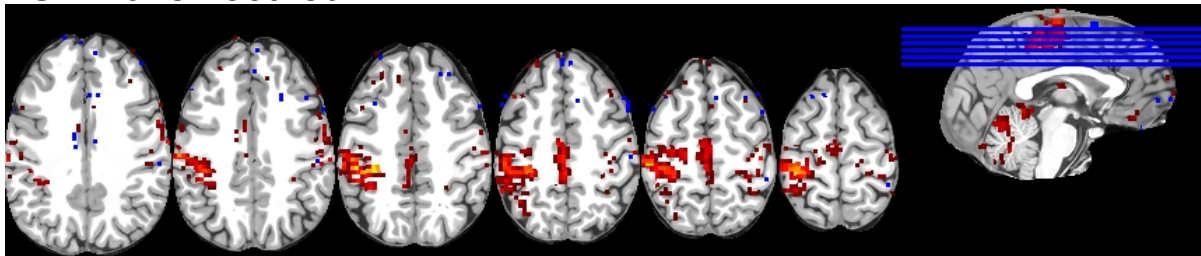
*A contrario*



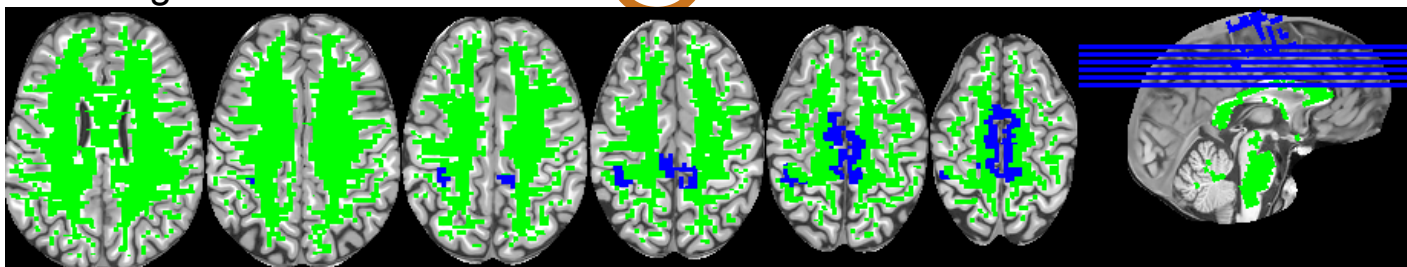
GLM smoothed ( FWHM = 6 mm<sup>3</sup>)



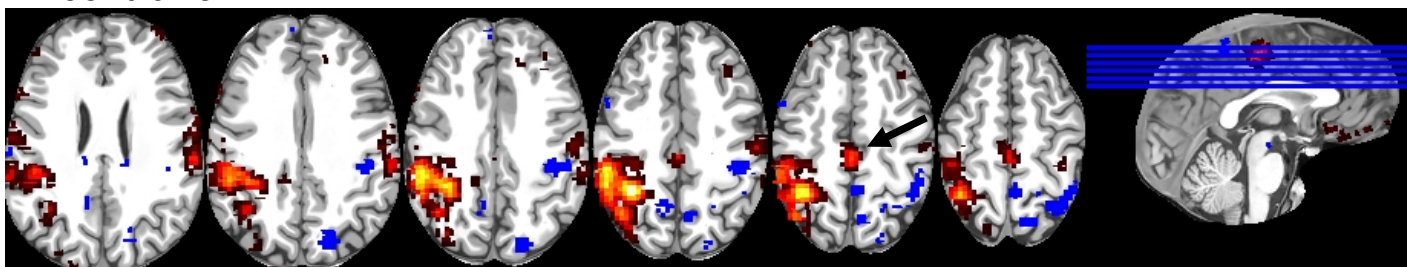
GLM unsmoothed



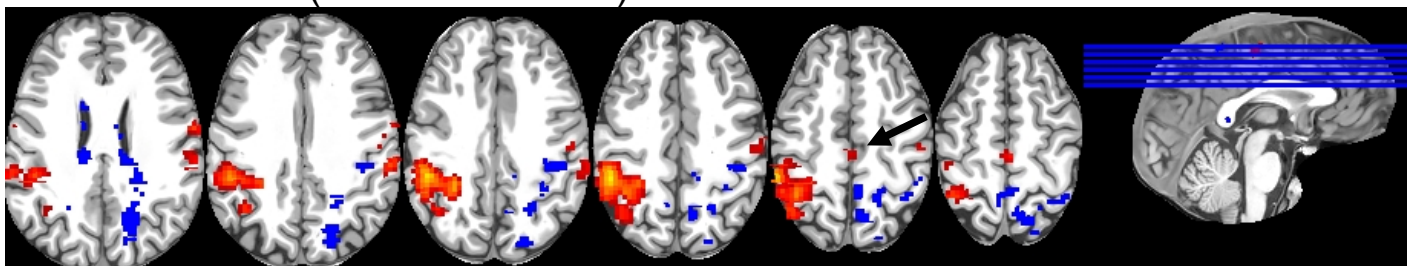
Global ground truth



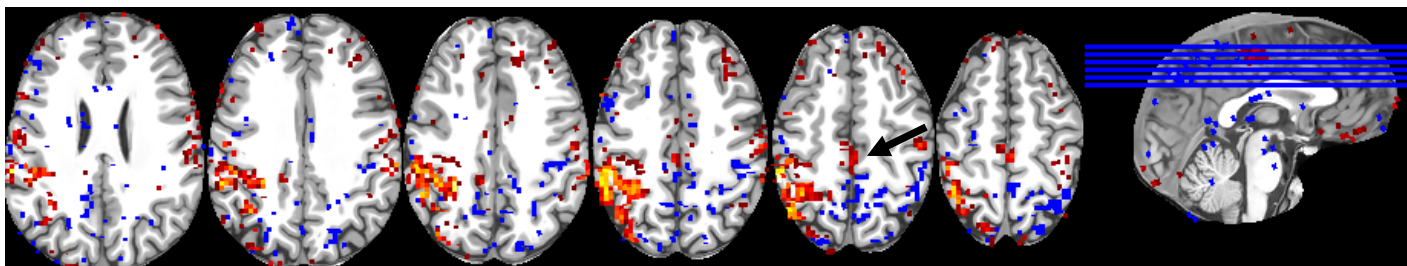
*A contrario*



GLM smoothed ( FWHM = 6 mm<sup>3</sup>)



GLM unsmoothed





- We proposed a new a contrario approach to detect fMRI activations.
- This method displayed better spatially defined activations with a more interesting trade-off between sensitivity and specificity by comparison to the standard massively univariate GLM.