

# VOXEL-WISE COMPARISON WITH A-CONTRARIO ANALYSIS FOR AUTOMATED SEGMENTATION OF MULTIPLE SCLEROSIS LESIONS FROM MULTIMODAL MRI

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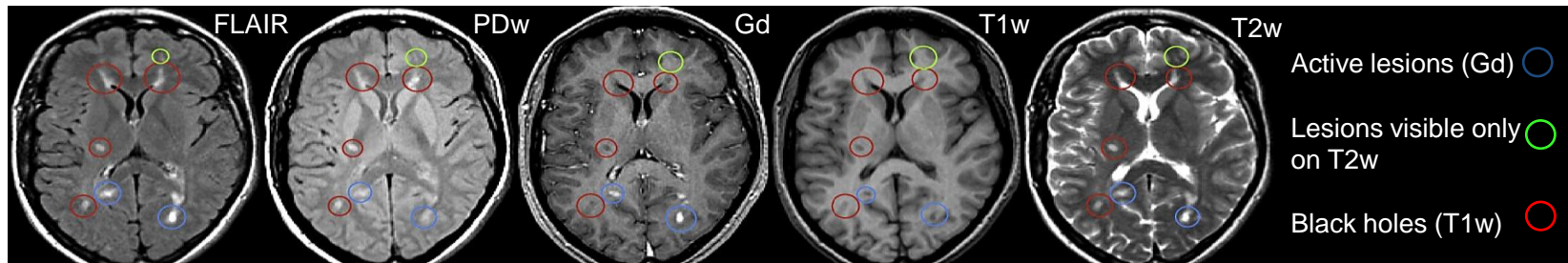
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- Multiple Sclerosis (MS): the most widespread disabling neurological condition of young adults
- Multimodal MRI data: complementary information



[Garcia-Lorenzo et al. Review of automatic segmentation methods of WM lesions on conventional MRI. Medical Image Analysis, 2013]

- MS lesions Automatic segmentation:
  - voxel-wise approaches
    - False Discovery Rate correction for multiple testings

- a-contrario: detection of *unexpected* events, where the term *unexpected* refers to something that deviates from a model\*
  - ▣ spatial context, multiple thresholds

- Steps:

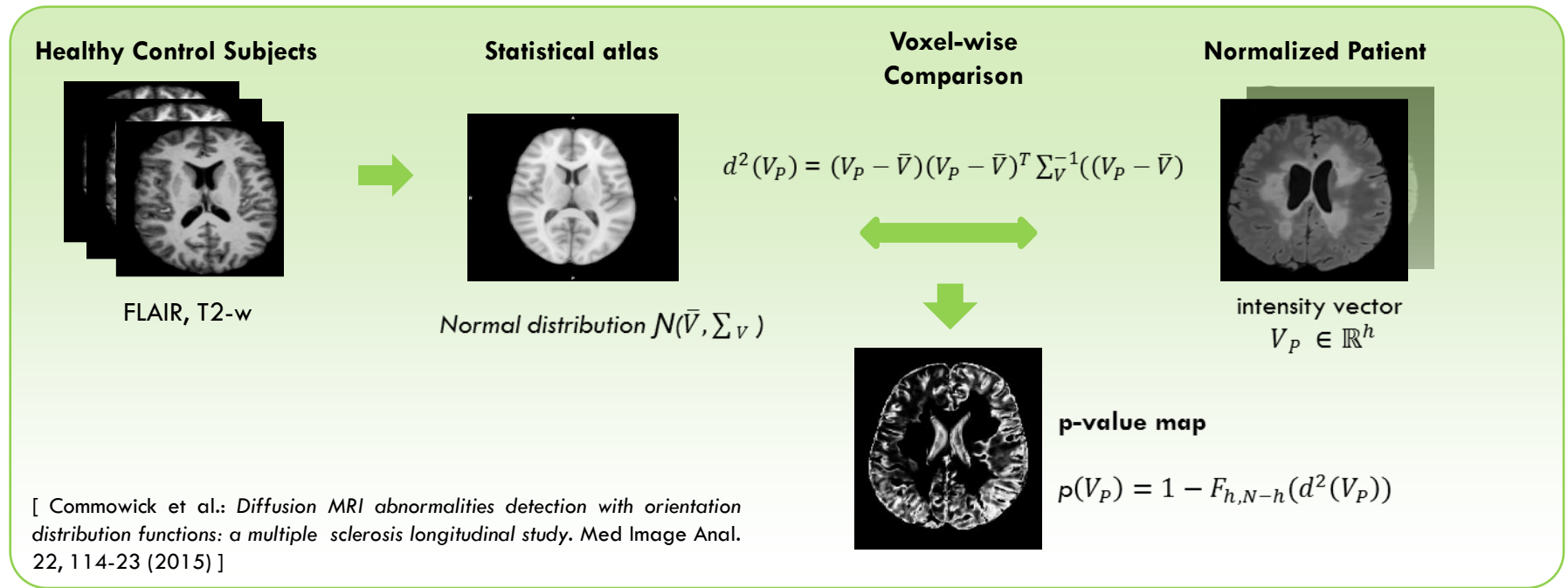
- A voxel-wise probability map is computed
- A region-based probability map is estimated
- Correction for multiple comparisons is performed



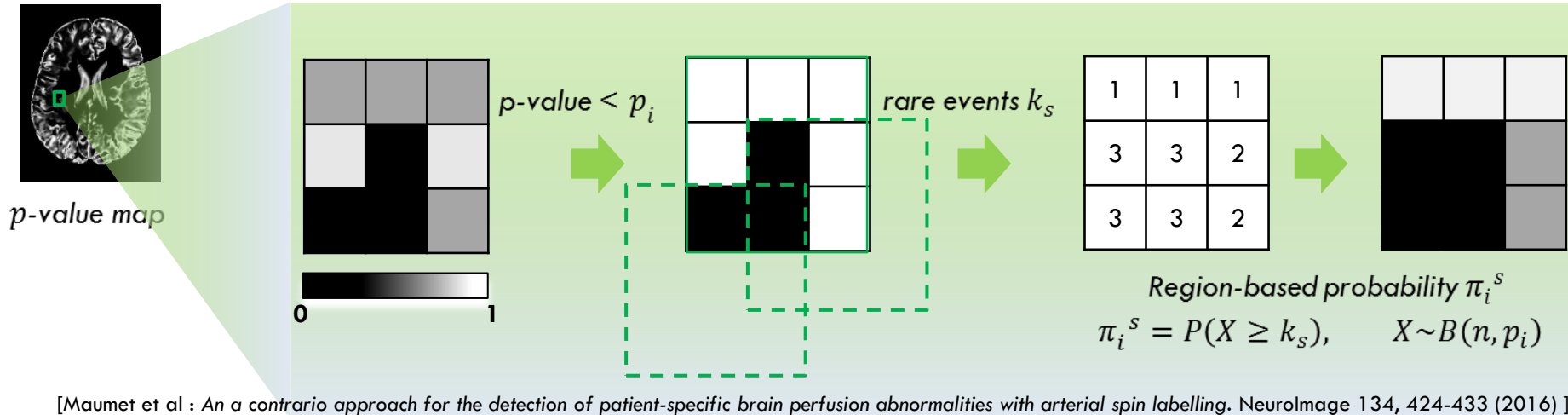
\* [Ammar et al.: AN A-CONTRARIO APPROACH FOR OBJECT DETECTION IN VIDEO SEQUENCE International Journal of Pure and Applied Mathematics Volume 89 No. 2 2013, 173-201 (2013)]

Painting: Kandinsky, from *Approches a contrario en analyse d'images*, Bruno Galerne, Universite Paris Descartes]

- i) A voxel-wise probability map:



- ii) From voxel-based to region-based probability map:



- iii) Number of False Alarms:  $NFA = N T \min(\pi_i^s)$       $N$  thresholds,  $T$  tot voxels

- $NFA < 1$

# Results

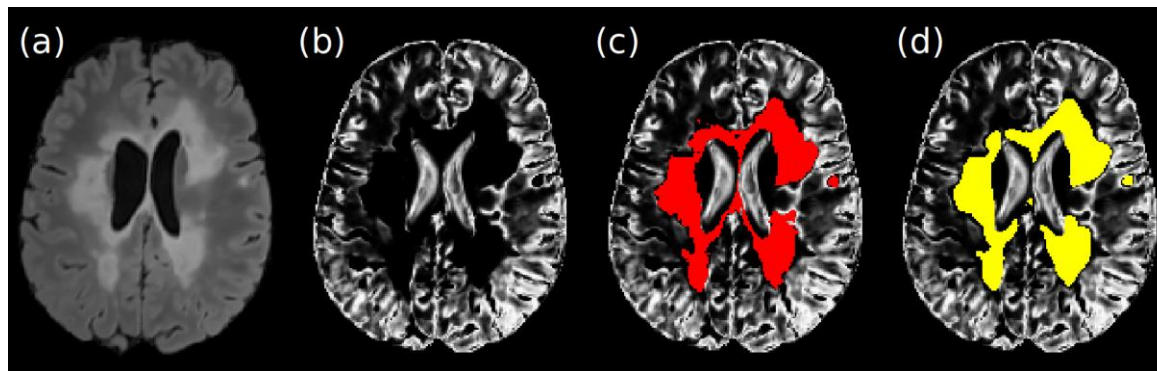
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- Dataset: 53 patients, 4 different sites

<https://portal.i-iam.irisa.fr/msseg-challenge/overview>

- Python, in-house tools

<https://github.com/Inria-Visages/Anima-Public>



*FLAIR*

*p – value map*

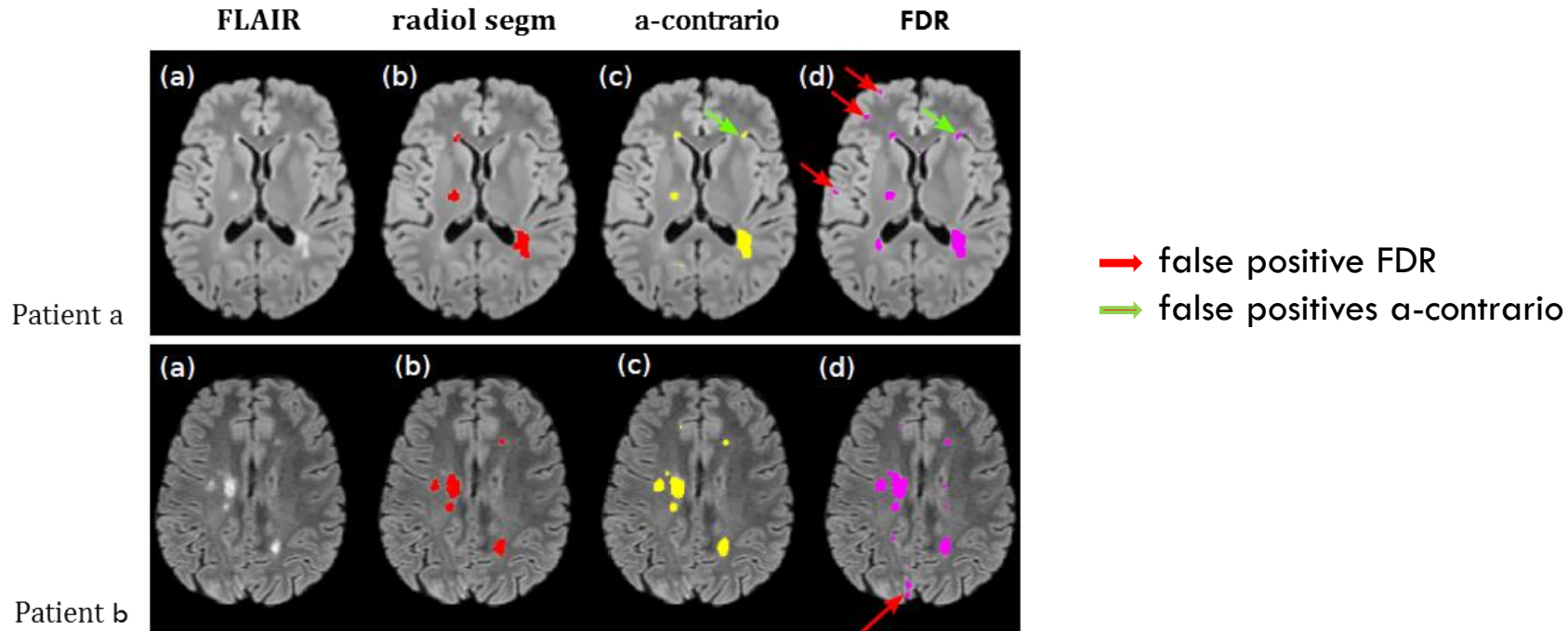
*radiol segm*

*result*

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# Results

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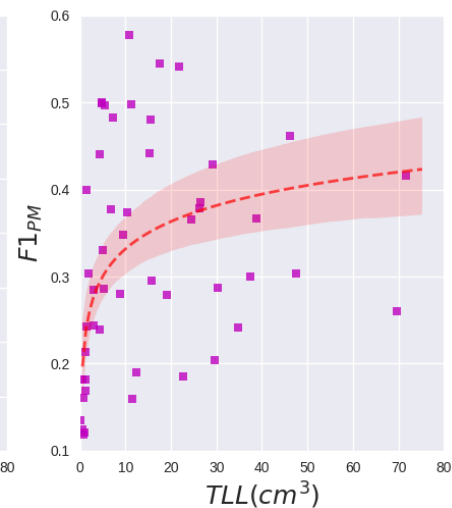
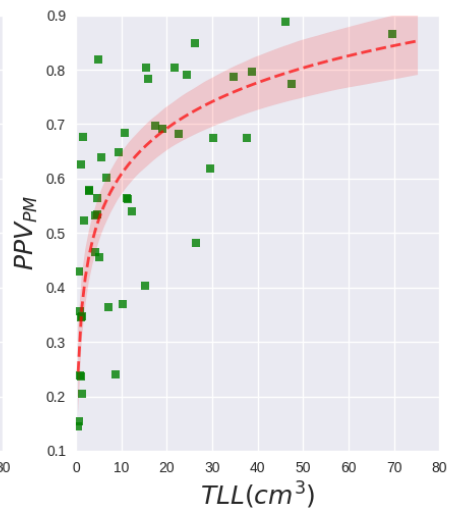
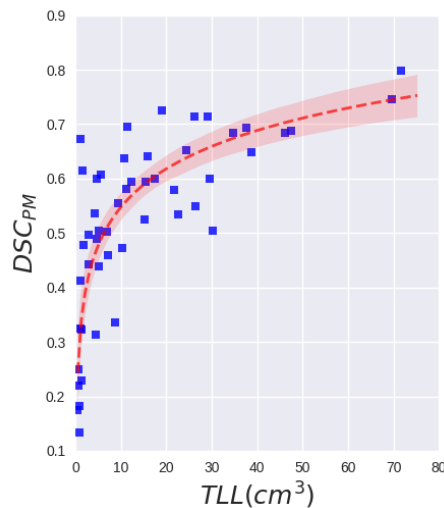


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# Results

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- Dice Similarity Coefficient (DSC)
- Positive Predictive Value (PPV)
- F1-score (F1)



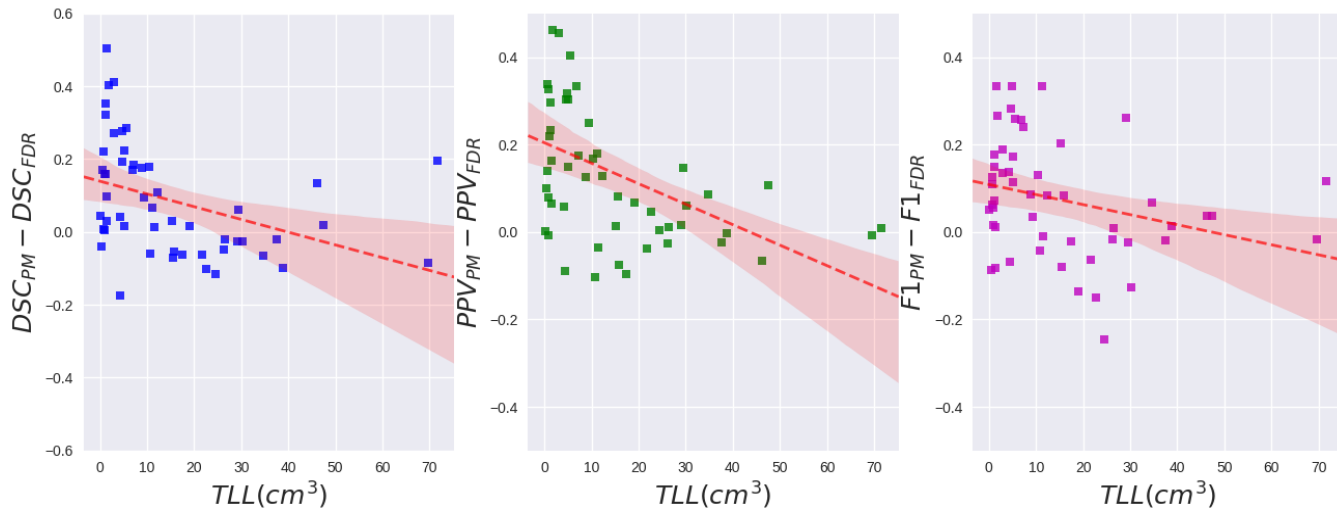
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# Conclusions:

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- ❑ Experiments have shown that **the method outperforms the classical FDR-correction** approach
- ❑ **Improvements increase with decreasing total lesion load**, indicating that the proposed method is more specific and sensitive for patients with low lesion loads
- ❑ **The performance of the method relies on parameters**, i.e. size of a region and set of thresholds, that must be accurately tuned on a set of cases

Thank you!