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Automatic detection of perfusion abnormalities based on an Arterial Spin Labeling template

ISMRM Scientific Workshop: Perfusion MRI 2012

Camille Maumet, Pierre Maurel, Jean-Christophe Ferré,
Christian Barillot

October 13th, 2012

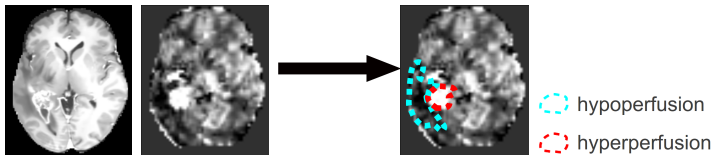


- 1 Context
- 2 Method
- 3 Results

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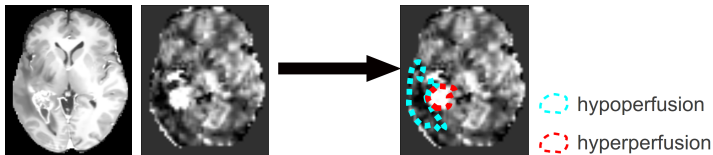
Objective

Quantitative *identification of voxelwise patient-specific perfusion abnormalities.*



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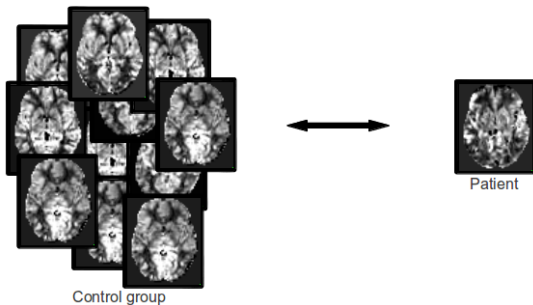


Challenges:

- Low signal-to-noise ratio of the Q2TIPS PASL sequence.
- Presence of artefacts.

- 1 Context
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 - Statistical analysis
 - Ground Truth estimation
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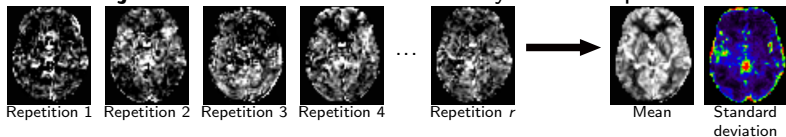
Method

Originality of our approach:

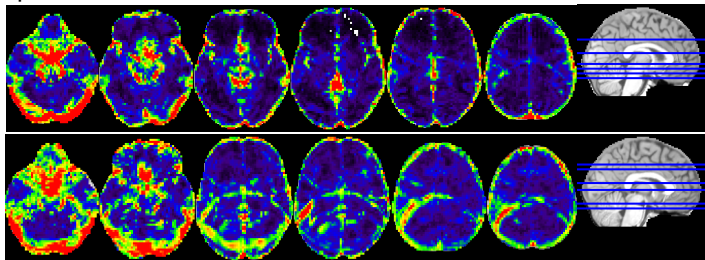
- *Explicit modelling of both **intra-subject** and **inter-subject** variances.*
- ***No pre-smoothing** of the data: a *contrario* approach.*

Intra-subject variance

Intra-subject variance models variability across repetitions

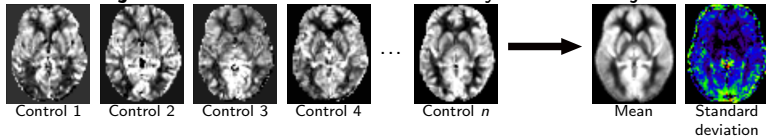


Examples

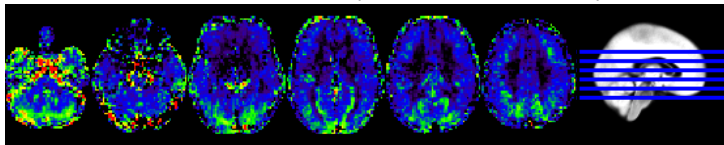


Inter-subject variance

Inter-subject variance models variability across subjects

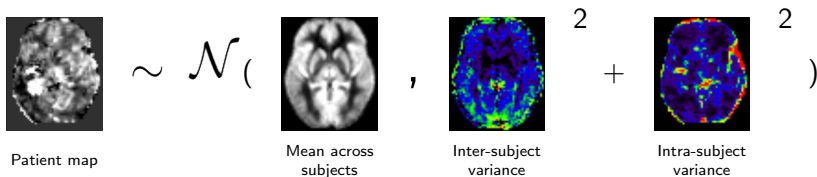


Inter-subject standard deviation (35 healthy subjects)

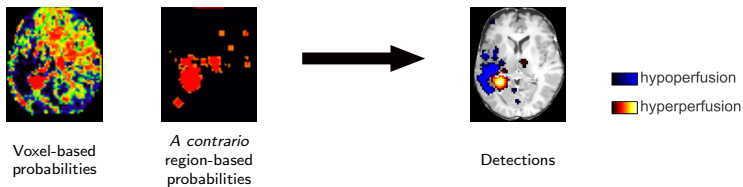


Detection of perfusion abnormalities

Model of normal perfusion:



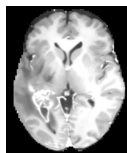
Detection of hypoperfusions and hyperperfusions:



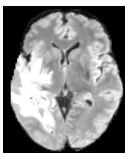
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Ground Truth estimation

Step 1 – Segmentation of the tumor:



T1 Gadolinium



T2 FLAIR

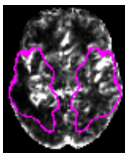


Tumor and
edema
segmentation

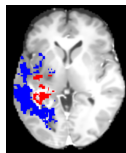
Step 2 – Combination with T2 perfusion information:



Tumor segment.



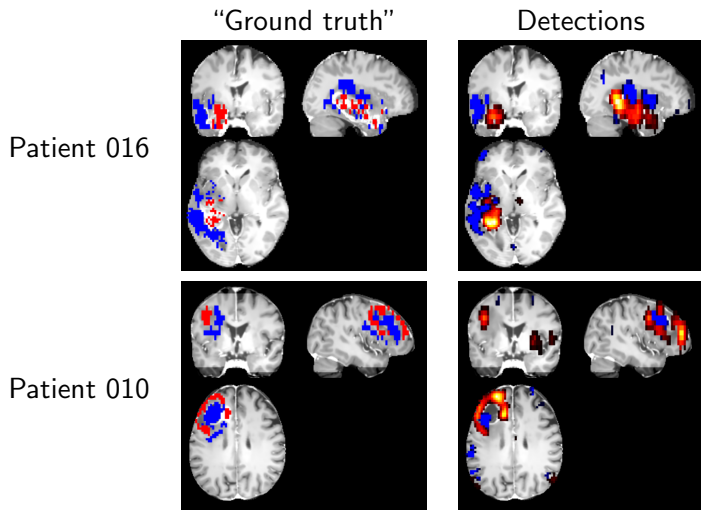
DSC CBF

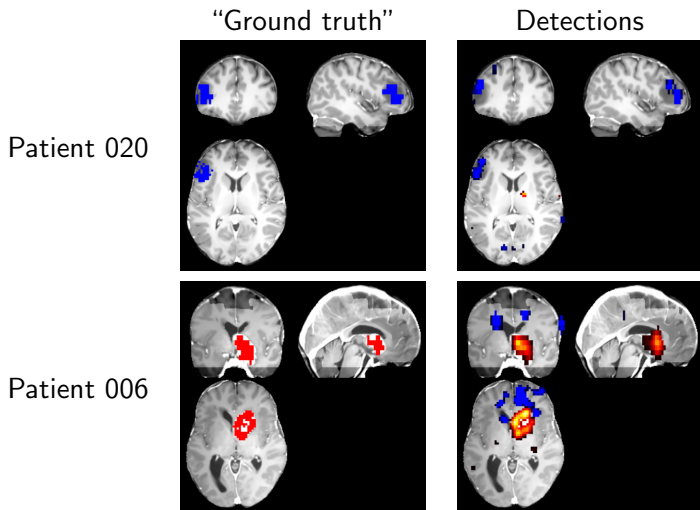


"Ground truth"

Step 3 – Visual assesment and manual corrections by a clinician

- 1 Context
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Quantitative results on a dataset including 22 patients and 35 controls:

Specificity (controls)	0.99
Specificity (patients)	0.93
Sensitivity (hyper)	0.82

Conclusions:

- Importance of intra-subject variance in the detection of patient-specific perfusion abnormalities.
- Good sensitivity and specificity of the proposed approach.

Future work:

- Relationship between the level of CBF in identified abnormalities and the grade of the tumor.
- Application in other pathological contexts.

More details on the *a contrario* approach: C. Maumet, P. Maurel, J.-C. Ferré, and C. Barillot, "A comprehensive framework for the detection of individual brain perfusion abnormalities using arterial spin labeling" MICCAI 2012, pp. 542–549.

Q & A