**Post-doctoral position 2016**

**Early medullar MRI markers and late physical handicap in multiple sclerosis patients – Exploitation of a multimodal and multi-centric project database**

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**Location:** VisAGEs research team, IRISA, Campus de Beaulieu, 35042 Rennes Cedex, France  
[http://www.irisa.fr/visages](http://www.irisa.fr/visages)

**Duration:** One year, renewable, starting from September 2016. **Salary:** around 2100 €/month

**Context**

VisAGEs U746 is a research team from Rennes 1 University, jointly affiliated with Inserm and Inria. It is also part of the IRISA (UMR CNRS 6074) and is located in Rennes, France on both medical and science campuses. The objective of the team is to work jointly with clinicians, radiologists from the university hospital to propose new advances in medical image processing. Among others, the team is involved in multiple sclerosis (MS) image processing studies, in close collaboration with neurologists and radiologists. MS is a frequent neurological, inflammatory and demyelinating, disease affecting young adults, and is a source of several disabilities, including ambulatory.

An ongoing national longitudinal multicenter study, lead by Rennes, is investigating the link between spinal cord MR imaging and ambulatory disabilities (EMISEP). To date, most of the many MRI studies have focused on brain MRI but interest in spinal cord MRI is growing. Advanced spinal cord MR imaging remains challenging due to the small volume of the cord as well as to respiratory and cardiac motion. Several MRI sequences are acquired each year, as part of the EMISEP imaging protocol, to visualize focal lesions, evaluate spinal cord volume or diffuse lesions using diffusion and magnetization transfer imaging (examples of such acquisitions are displayed in figure 1).

**Figure 1:** example images acquired in the EMISEP study.  
Focal Lesions: T2 TSE (A) and PSIR (B). Diffusion imaging (C)

**Post-doctoral position objectives**

The main goal of this post-doctoral position will be to develop and evaluate new methods for spinal cord MR analysis and derive markers of spinal cord burden related to ambulatory disability. Therefore, the work will encompass several methodological tasks starting with registration between different MR sequences and between different time points in the same subject, and between different subjects at a
given time point. This work will, among others, rely on methods developed in the research team [1,2]. The second challenge will be devoted to the extraction of regions of interest in the spinal cord, whether white matter, gray matter, lesions or spinal cord tracts, using tools available from the literature [3,4] or adapted from similar tasks on brain MRI for this purpose [5,6].

The post-doctorate will further use all these tools to process the EMISEP database in order to evaluate both focal and diffuse burden as well as their evolution in time. The correlation between these markers and clinical scores acquired in parallel will then be investigated.

From a methodological perspective, this work will deal with
• registration between modalities, time points and patients
• segmentation of the spinal cord and MS lesions
• distortion correction
• statistical comparisons between imaging and clinical scores

**Location:** This post-doctoral position will take place at Inria/IRISA, UMR CNRS 6074, in the VisAGeS U746 research team. The work will be conducted in close link with the MRI experimental platform at Neurinfo (http://www.neurinfo.org) and the neurologists and radiologists involved in the project.

**Keywords:** MRI, spinal cord, multiple sclerosis, image registration, segmentation

**Requirements:** This work will require strong knowledge in the fields of applied mathematics (statistics, optimization), and image processing (image segmentation, registration…). A PhD thesis in one of those fields will thus be required. A good knowledge of computer science tools will also be required, especially in object oriented programming (C++), Matlab or python.

**References**