Name	Alessandro Crimi
Nationality	Italian
Host Organization	INRIA
Scientific Coordinator	Christian Barillot
Period of the fellowship	01/12/2011- 30/11/2012

I – SCIENTIFIC ACTIVITY DURING YOUR FELLOWSHIP

During the research period that I have spent at INRIA-Atlantique in the Visages Team, under the supervision of Dr.Christian Barillot.
I have worked on a longitudinal study about Multiple Sclerosis.
Multiple sclerosis (MS) is a disease with heterogeneous evolution among the patients. Some classifications have been carried out according to either the clinical course or the immunopathological profiles. Epidemiological data and imaging are showing that MS is a two-phase neurodegenerative inflammatory disease A Clinically Isolated Syndrome (CIS) is a first neurologic episode caused by inflammation/demyelination in the central nervous system which may lead to MS.   Better understanding of the disease at its onset will lead to a better discovery of pathogenic mechanisms, allowing suitable therapies at an early stage.

During my year at INRIA, we developed a new data processing framework
able to provide an early characterization of CIS patients according to lesion patterns, and more specifically according to the nature of the inflammatory patterns of these lesions. The method is based on a two layers classification. Initially, the spatio-temporal lesion patterns are classified using a tensor-like representation. The discovered lesion patterns are then used to identify groups of patients and their correlation to fifteen months follow-up total lesion loads, which is so far the main image-based figure that can potentially correlate to future evolution of the pathology. We expect that the proposed framework can infer new prospective figures from the earliest imaging signs of MS since it can provide a classification of different types of lesions across patients.
Another aspect we investigated was ad hoc segmentation algorithm capable of detecting lesions for two different contrast agent. In this way the cumbersome and time-consuming work entrusted to a radiologist can be drastically reduced.

II – PUBLICATION(S) DURING YOUR FELLOWSHIP

During the 1-year fellowship I have submitted several articles in topics I did not work previously, we have two accepted publications in conferences, one manuscript for a conference and one journal manuscript which are submitted but currently under revision.

Accepted publications:
- ''Multiple Sclerosis Lesions Evolution in Patients with Clinically Isolated Syndrome'', A.Crimi, O.Commowick, J.C. Ferre, A.Maarouf, G.Edan and C.Barillot. Society of Photo-Optical Instrumentation Engineers, Medical Imaging 2013.

- ''Segmentation automatique des lésions de sclérose en plaques marquées avec Gadolinium et USPIO chez patients CIS (Segmentation automatic of

lesions of Multiple Sclerosis enhanced with Gadolinium and USPIO in CIS patients)'', A.Crimi, O.Commowick, JC Ferré, G.Edan, C.Barillot, 2012 Annual meeting of the Foundation pour l'Aide à la Recherce sur la Sclerose en Plaques.

Pending publications:
- ''Semi-automatic classification of lesion patterns in patients with clinically isolated syndrome''. A.Crimi, O.Commowick, JC Ferré, G.Edan, C.Barillot 2013 International Symposium on Biomedical Imaging

- ''Multiple Sclerosis Lesion Patterns in Patients with Clinically Isolated Syndrome'' A. Crimi, O. Commowick, A. Maarouf, J.C. Ferré, The MS USPIO-CIS Initiative, G. Edan and C.Barillot.
  Neuroimage journal, previous 5-Year *Impact Factor*: 6.608**.**

III – ATTENDED SEMINARS, WORKSHOPS, CONFERENCES

- Seminars on Particle filter, January-March 2012, INRIA, Campus de Beaulieu,Rennes, France

- Workshop on Sparse Models and Machine Learning, 15th-16th October 2012, IRISA, Campus de Beaulieu, Rennes, France

- Annual meeting of the Foundation pour l'Aide à la Recherce sur la Sclerose en Plaques. 1st June 2012, Institut des Cordeliers Paris, France.

Upcoming, after end of ERCIM fellowship:
- Society of Photo-Optical Instrumentation Engineers, Medical Imaging February 2013, Orlando, USA.

IV – RESEARCH EXCHANGE PROGRAMME (REP)

1. EPFL (SARIT) – Switzerland – Dr.JeanPhilippe Thiran – 16-21 April 2012

2. VTT– Finland – Dr. Mark van Gils and Dr. Jyrki Lötjönen   – 24th-29th September 2012

During the week spent at EPFL I have encountered many people working in the team led by Prof. JeanPhilippe Thiran; they presented me their last efforts in

Neuroimage in particular about Connectome methodologies, segmentation and pattern recognition. A connectome is a comprehensive map of neural connections in the brain.

Dr. Thiran arranged several meetings also with people from partner institution of EPFL, for example I had the possibility of discussing my project with Dr.Meritxell Bach Cuadra of University of Lausanne, which gave me some useful criticisms.

Moreover, I discussed with Dr.Alessandro Daducci and Alessandra Griffa the possibility of extending the work done at INRIA with some of their developed tools about Connectomes, for evaluating the practical effect of a lesion in the brain, considering which fiber bundle in the brain is destroyed by Multiple sclerosis lesions.

We do believe that this approach could be used in a more general settings including also inflammation effects on fiber bundle and therefore prediction of future disabilities.

During the week at VTT in Tampere, Dr. Mark van Gils and Dr. Jyrki Lötjönen arranged a complete program of informal talks for the entire week. Their group deals with research in the field of Behavior change and medical imaging analysis. Behavior change is a broad range of activities and approaches which focus on the individual, community and environmental influences on behavior.

In particular, their group develops tools - which can be integrated in common mobile phone – monitoring the behavior of elderly people and trying to promote an healthier style of life. Although not directly related to my research topic, it has been useful to learn about these approaches which can be used in conjunction to clinical practices developed in my project.

The other part of the group is instead more focused on medical imaging analysis, in particular on prognosis and diagnosis of Alzheimer disease.

Although Alzheimer disease is not the same pathology of Multiple Sclerosis, its analysis has several converging aspects, and it has been useful to discuss with expert in the field about it. In particular   Dr. Lötjönen has given me some useful insight on the project.

For both groups, we envisioned potential future collaborations.