



Final Report on the Faculty Exchange Program at Carnegie Mellon University (CMU)

Petia Georgieva

Signal Processing Lab, IEETA

Department of Electronics Telecommunications and Informatics

University of Aveiro, 3800 - 193 Aveiro, Portugal

petia@ua.pt

Host: 1) Dr. Fernando de la Torre Frade, Robotics Institute
2) Prof. Tom Mitchell, Machine Learning Department, School of Computer Science

Period of visit: 15th of September – 31th of December 2012 (3.5 months)

In this short report I describe the work performed and the experience in CMU. My visit had two main aspects:

I. Teaching activity in collaboration with Prof. Tom Mitchell, Machine Learning Department, School of Computer Science.

I was involved in the course on Machine Learning (10-601) given by Tom Mitchell. I gave recitation sessions for students; Create homeworks and exams; Attended the lectures and teaching assistants meetings. As an outcome of this activity, I have updated my lectures on the module on Machine Learning given to graduate students of the PhD program on Electrical Engineering in the University of Aveiro.

II. Research work in collaboration with Fernando de la Torre Frade from the Computer Vision center in the Robotics Institute.

We have worked on a new approach to discriminate cognitive brain states directly from functional Magnetic Resonance Images (fMRI). We applied Robust Principal Component Analysis (RPCA), a theoretical framework for dimensionality reduction developed a few years ago by Fernando, to construct low dimensional linear-subspace representations from the noisy fMRI images for each subject and then a Gaussian Naïve Bayes (GNB) classification was performed. In previous studies the discrimination of cognitive brain states from fMRI is done by transforming the fMRI into a time sequence of voxels from which the brain states are inferred. RPCA improved the classification rate of a real benchmark fMRI data.

During my stay in CMU I have worked on and written 3 papers:

1. “Robust Principal Component Analysis for improving cognitive brain states discrimination from fMRI”, submitted to the Iberian Conference on Pattern Recognition and Image Analysis (IbPRIA) 2013, Madeira, Portugal, June 5-7 in collaboration with Fernando de la Torre.

2. "Bayesian approach for reconstruction of moving brain dipoles", submitted to the International Conference on Image Analysis and Recognition ICIAR 2013, June 26-28, 2013, Póvoa de Varzim, Portugal.
3. "A particle filter framework for localization of dynamic EEG sources", an extended version of the second paper ready to be submitted to the journal PLoS ONE.

Several conversations with researchers were prompted by the talk I gave on 8th of October 2012, in Robotics Institute (Joint VASC-CBI Seminar), entitled "Particle Filter Framework for Localization of Dynamic EEG Sources" (more details can be found on http://www.ri.cmu.edu/event_detail.html?event_id=701&&menu_id=242&event_type=seminars).

Beyond my teaching and research work, I have attended the week meetings of the research group on intelligent robots of Prof. Manuela Veloso (CORAL) from the Computer Science Department and learned about CoBots - Collaborative Mobile Robots.

I have attended the week meetings of the research group of Prof. Jelena Kovačević in the Center for Bioimage Informatics at CMU.

I also attended PhD thesis proposal presentations, PhD thesis defenses, many seminars and talks given by technological and scientific leaders from all over the world.

In conclusion, this was a very fruitful and successful stay that I am confident will steadily continue at the next stage involving PhD students supervised by me and colleagues from CMU.

Last but not least, I am thankful to the Portuguese Foundation for Science and Technology (FCT), Carnegie Mellon University and the leadership team of the Carnegie Mellon Portugal program for making this possible.

27th of December 2012