

# ERCIM “Alain Bensoussan” Fellowship Scientific Report

Fellow: Koray Kayabol

Visited Location : PNA2, CWI Amsterdam, Netherlands

Name of Supervisor : Dr. Marie-Colette van Lieshout

Duration of Visit: 01.08.2011 – 30.04.2012

## I - Scientific activity

During my fellowship in the department Probability and Stochastic Networks (PNA2), CWI, I started to work on spatial clustering. I use a finite mixture model for clustering of the spatial data patterns. The model is based on the spatial distances between the data locations in such a way that both the distances of the points to the cluster centers and the distances of a given point to its neighbors within a defined window are involved in the model. Nevertheless, we take into consideration the background noise as well in the model. We resort to Classification Expectation- Maximization (CEM) algorithm for both estimating the parameters and clustering the data points. We test the algorithm on some simulated data sets with different background noise levels and apply it to a real earthquake data recorded in Kashmir in 2005. I have written the technical report in [1] and submitted to a conference.

In [6], we resort to Classification Likelihood in Mixture (CLM) criterion to determine the number of classes for previously developed model during my fellowship in INRIA. We obtained some classification results of water, land and urban areas in both supervised and unsupervised cases on TerraSAR-X data. Using an agglomerative type unsupervised classification method, we get rid of the negative effect of the latent class label initialization. We submitted the paper in [6] to a conference.

Some of the work performed in INRIA appeared in conference proceedings [2], [4]. The paper which covers all work I performed in INRIA is revised and re-submitted to IEEE Trans. on Image Processing.

A short article on SAR image classification [5] is published in ERCIM News.

## IIa- Publication(s) during the fellowship

- [1] K. Kayabol, “A Latent Variable Bayesian Approach to Spatial Clustering with Background Noise,” Tech. Rep. PNA-1106, Netherlands, Dec. 2011. Turkish translation accepted for publication in Proceedings IEE Signal Processing and Communications Applications conference, Turkey, April 2012.
- [2] K. Kayabol, A. Voisin and J. Zerubia (2011) SAR image classification with non-stationary multinomial logistic mixture of amplitude and texture densities. Proceedings of International Conference on Image Processing 2011, pp. 173-176.

- [3] D. Harranz, F. Argueso, E. Salerno, E.E. Kuruoglu and K. Kayabol (2011) Bayesian map detection of extragalactic point sources in microwave astronomical images. Proceedings of International Conference on Image Processing 2011, pp. 1317-1320.
- [4] K. Kayabol, V. Krylov and J. Zerubia (2012) Unsupervised classification of SAR images using hierarchical agglomeration and EM. In: Proceedings of MUSCLE International Workshop on Computational Intelligence for Multimedia Understanding. Lecture Notes in Computer Science 7252, pp. 54-65.
- [5] K. Kayabol (2012) Region-based unsupervised classification of SAR images. ERCIM News 89, p. 45.
- [6] K. Kayabol, “An Hierarchical Approach for Model-based Classification of SAR Images”, (in Turkish) accepted for publication in Proceedings *IEEE Signal Processing and Communications Applications Conf.*, Turkey, April 2012.

Furthermore, the following manuscript

K. Kayabol and J. Zerubia, “Unsupervised amplitude and texture based classification of SAR images with multinomial latent model,”  
has been revised and re-submitted to *IEEE Trans. Image Process.*,

### **III -Attended Seminars, Workshops, and Conferences**

1. IEEE International Conference on Image Processing ICIP'11, Brussels, Belgium, 11-14 September 2011.
2. ERCIM MUSCLE Workshop on Computational Intelligence and Multimedia Understanding, Pisa, Italy, 13-15 December 2011.
3. IEEE 20<sup>th</sup> Signal Processing and Communications Applications Conference, Mugla, Turkey, 18-20 April 2012.