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To Whom It May Concern:

Dear Sir/Madam,

I am writing this letter to express a strong interest in forming an Associated Team between my research group and the Ariana research group at INRIA. The main area of research will be to develop a *statistical theory of configurations of shapes for analyzing aerial and satellite images*. The tools developed under this research will help detect, recognize, and track objects of interest in scenes using remote sensing data.

I start by describing my interactions with Ariana group. I first met Dr. Josiane Zerubia at the International Conference on Image Processing (ICIP) in Thessaloniki, Greece, in 2001. In June 2002 I was invited to Sophia Antipolis to present a seminar at the Ariana group and to meet other group members. My actual collaborations with Ariana group started during my visit to INRIA, Sophia Antipolis for four months during the summer of 2006. This visit was financially supported by an INRIA fellowship. During this period, I worked closely with several permanent researchers and PhD students of this group. In particular I worked with Ms. Maria Kulikova a Master student in Ariana on her research in classifying trees according to their shapes. She later won a scholarship for pursuing her PhD degree. I was greatly impressed by both the quality and the quantity of the research going on in Ariana. Furthermore, I found a great common interest in our research goals and I believe that a longer-term collaboration between our teams will be very fruitful. While Ariana members have strong expertise in image analysis, stochastic geometry, and MCMC techniques, my group has developed skills in the area of shape analysis, statistics on nonlinear manifolds, and probability models for natural images. By combining our skills and efforts, we can expect a major improvement in our research output in terms of solving problems of common interest.

Our approach will be to extend ideas from classical stochastic geometry where one studies placements and interactions of simple objects as points, lines, and circles. In our approach, the placement of objects can be modeled using spatial point-processes, more specifically area-interaction point processes such as the Strauss process, and the labels (classes) of objects can be modeled using marked versions of these point processes. We are interested in situations where, in addition to having a discrete label such as a tree or a building, we associate more elaborate *features*, such as a shape, an orientation, and a scale, to each object. Further, the model we seek shall allow interaction of these features, in addition to the locations, of neighboring objects. In my opinion, this project will be a realization of an ambitious framework laid out by Prof. Ulf Grenander of Brown University in his development of General Pattern Theory. Grenander's pattern theory suggests analyzing complex systems through configurations of elementary units, called generators, which interact with each other using bonds. The variability associated with configurations is modeled using actions of transformation groups on generators while preserving their bond structure. Statistical models are imposed on the transformation groups and inferences are drawn using sampling algorithms on these groups. The proposed research between Ariana and FSU group is in effect a particularization of these

ideas to the problem of finding objects in aerial and satellite images. The problem of shape analysis has received a major attention in the recent years. Several researchers, including our group at FSU and Prof. David Mumford of Brown University, have independently developed geometric techniques for comparing and quantifying shapes. This proposed project will develop techniques for analyzing collections of shapes, a more practical tool since shapes seldom occur in isolation in nature.

Together our two groups will target several venues for publishing the proposed research. Our recent research results will be submitted to the International Conference on Computer Vision and Pattern Recognition (CVPR) 2007 and the European Signal Processing Conference (EUSIPCO) 2007. For future results, we will seek to present them at similar high-level international conferences. We will also prepare INRIA research reports to document results while the corresponding journal papers are being reviewed. Finally, we will submit results from our joint research for publication in IEEE Transactions on Pattern Analysis and Machine Intelligence and International Journal of Computer Vision.

In terms of funding for the FSU side, I will utilize existing funds to match allocation to Ariana from INRIA. My research is currently supported by grants from the US Army Research Office and the US Air Force Office of Scientific Research. This research also has the benefit of an Innovative Research Grant from the Northrop Grumman Company. I will use funds collectively from these grants to support this collaboration. Additionally, I will seek new venues to support this research by applying to the annual programs of the National Science Foundation (NSF) and the National Geographic Agency (NGA).

In summary, I express my strong interest in collaborating with the Ariana group and wholeheartedly recommend this group for an associated team award from INRIA.

Most Sincerely,

Dated: October 9, 2006



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