Summer Course on
Numerical and Statistical Methods with Applications to Imaging
University of Bologna - Department of Mathematics
July 4-8, 2005

Organizing Committee
Serena Morigi (University of Bologna)
Fiorella Sgallari (University of Bologna)

This course provides an overview of the basic and most advanced techniques for the solution of inverse problems in image processing, covering statistical and computational aspects. The lectures will be supported by laboratory classes using MATLAB. The course is addressed to graduate students, PhD students, young researchers in scientific disciplines (Mathematics, Statistics, Physics, Engineering, Computer Science, ...).

The course lecturers are:
Patrizia Boccacci (University of Genova) - Daniela Calvetti (Case Western Reserve University)
Luisa D'Amore (University of Naples) - Erkki Somersalo (Helsinki University of Technology)

The following topics will be covered:
1. Statistics: preliminaries
2. Probability distributions. Poisson process, normal distributions
3. Basic problem of statistics: statistical inference
4. Maximum likelihood estimators
5. Basic problem in linear algebra
6. Square, overdetermined and underdetermined linear systems
7. Maximum likelihood and ill-conditioned problems
8. Bayesian statistics
9. Prior information versus regularization
10. Construction of priors: subjective probability, empirical Bayes methods, model based priors
11. Inverse problems viewed as problems of inference
12. Iterative methods and inverse problems
13. Whitening. From statistics to linear algebra
14. Prior information, preconditioning and regularization
15. Priorconditioners: statistically inspired preconditioners
16. Lack of information: ignorance as the first step towards knowledge
17. Unknown conditions at the boundary and beyond
18. Aristotelian priorconditioner
19. Boundary clutter compensation
20. Hierarchical methods
21. Bootstrap priors
22. Image restoration in astronomy
23. Numerical solution of some inverse problems in digital film restoration

Monday, July 4th	9-10.45 D. Calvetti Room Arzela'	10.45-11.15 Coffee break	11.15-13 E. Somersalo Room Arzela'	13-15 Lunch	15-18 Laboratorio Multimediale
Tuesday July 5th	9-12 Laboratorio Multimediale	12-14 Lunch	14-15.45 D. Calvetti Room Enriquez	14.45-15.15 Coffee break	15.15-17 E. Somersalo Room Enriquez
Wednesday July 6th	9-10.45 D. Calvetti Room Seminario I	10.45-11.15 Coffee break	11.15-13 E. Somersalo Room Seminario I	13-15 Lunch	15-18 Laboratorio Multimediale
Thursday July 7th	9-10.45 L. D'Amore Room Seminario II	10.45-11.15 Coffee break	11.15-12 L. D'Amore Room Seminario II	12-14 Lunch	14-16 P. Boccacci Room Enriquez 16-18 Laboratorio Multimediale
Friday July 8th	Discussions				

Those who are interested in updated information on the course can contact the organization via email (sgallari@dm.unibo.it, morigi@dm.unibo.it). There is NO REGISTRATION FEE.
For organizational purposes, participants are kindly requested to send an email before June 30th, 2005.