SCHOOL ON
LARGE SCALE PROBLEMS IN MACHINE LEARNING
and
WORKSHOP ON COMMON CONCEPTS IN
MACHINE LEARNING AND STATISTICAL PHYSICS

20 - 31 August 2012
(ICTP, Miramare, Trieste, Italy)

The Abdus Salam International Centre for Theoretical Physics (ICTP), Trieste, will organize a *School on Large Scale Problems in Machine Learning,* followed by a *Workshop on Common Concepts in Machine Learning and Statistical Physics,* to be held at ICTP, Trieste, Italy, from *20 to 31 August 2012.*   These events are being co-sponsored by *SNN Adaptive Intelligence, Radboud University of Nijmegen*, The Netherlands.

Machine learning is a branch of computer science that addresses the issue of automatically recognizing complex patterns in empirical data and make intelligent decision based on the representation of these patterns. Optimal solutions are the result of the interplay between reproducing empirical observations and providing answers that generalize optimally for yet unobserved data. This interplay is similar to that between energy and entropy in statistical mechanics. Many applications of machine learning deal with large problems with many variables, and empirical data (training set) is limited to a very small fraction of the space of possible inputs. In statistical mechanics jargon, the entropic contribution plays a dominant role.

Concepts and tools in statistical physics have been proved useful in applications to ensembles of problems in computer science, such as constraint satisfaction or error-correcting codes, by revealing the structure of the space of solutions in typical cases, assessing the performance of algorithms and suggesting new efficient heuristics. The School and Workshop aim at investigating the relevance of these concepts and techniques for the broader field of machine learning, exploring opportunities of mutual cross fertilization between the two communities.

The School provides an overview of the key concepts of Machine Learning which are central to large scale applications. Lectures will be delivered by experts in machine learning and target an audience of researchers and graduate students with a background in physics and/or mathematics. It will last for a week and a half, and be followed by a two days Workshop. Both the School and Workshop will have a particular emphasis on applications of machine learning to computational biology.

TOPICS COVERED BY THE SCHOOL:

- **Graphical models**
- **Approximate inference**
- **Control theory and reinforcement learning**
- **Neural networks**
- **Non-Bayesian kernel methods**
- **Algorithms for Bayesian kernel machines on large scale problems**
- **Nonparametric Monte Carlo techniques and Dirichelet processes**
- **Machine learning in systems biology**

Applicants willing to present a poster are invited to submit a short one-page abstract along with their online application form.

PARTICIPATION
Scientists and students from all countries that are members of the United Nations, UNESCO or IAEA may attend the activity. As it will be conducted in English, participants must have an adequate working knowledge of this language. Although the main purpose of the Centre is to help researchers from developing countries through a programme of training activities within a framework of international cooperation, a limited number of students and post-doctoral scientists from developed countries are also welcome to attend.
As a rule, travel and subsistence expenses of the participants are borne by their home institutions. However, limited funds are available for some participants, who are not more than 45 years of age. Preference will be given to participants who are nationals of, and working in, a developing country. Such support is available only to those attending the entire event. Every effort should be made by candidates to secure support for their fare (or at least half-fare). There is no registration fee for attending the activity.

HOW TO APPLY FOR PARTICIPATION
The Application Form can be accessed at the activity website: **http://agenda.ictp.it/smr.php?2361**. Once in the website, comprehensive instructions will guide you step-by-step, on how to fill out and submit the application form. Deadline for receipt of applications: **20 APRIL 2012.**
Activity Secretariat:

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(Trieste, updated May 2012)
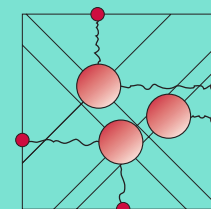
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SPEAKERS include :

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