

Field: Mathematics/ Applied Mathematics/ Computer Science

Planning Group Members:

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Session Topic:

Machine Learning and Prediction

Over the past two decades, machine learning has evolved from a field of laboratory demonstrations to a field of significant commercial value. This, in turn, has led to an increase in interest on the academic side – Machine Learning (ML) continues to thrive and grow as a very lively field of research. Principles, methods, models, algorithms and software libraries originating from ML research have spread into such a large number of other fields – and has become an integral part of them – that it is indeed sometimes difficult to draw the line between the “machine learning” part and the other disciplines, e.g. Statistics, Signal and Image Processing, Bioinformatics, Data Mining, Adaptive Process Control.

Machine-learning research has progressed in many directions. Five example directions are (1) the improvement of classification accuracy, (2) methods for scaling up supervised learning algorithms to large data sets, (3) different forms of reinforcement learning, (4) the learning of complex stochastic models, (5) the application of these theoretical fields to such diverse areas as “intelligent” robot systems, computer vision systems for face recognition, battlefield analysis, Spam E-mail analyzers, Brain-Computer-Interfaces etc. Moreover, there has been an increasing area of mutual interest in certain subfields of ML between brain researchers and machine learning researchers. The latter are interested in the mechanisms employed by the human brain for processing the huge amounts of information humans and animals are facing at every instant of their life (and which have to be processed in a highly adaptive way) while brain researchers hope to profit from machine learning research abilities to formalize and simulate learning processes.