Liu Bie Ju Centre for Mathematical Sciences
City University of Hong Kong

Mathematical Analysis and its Applications Colloquium

Organized by Prof. Ya Yan LU and Prof. Wei Wei SUN

Learning with Delay: the Nonlinear Dynamics Foundation of Subspace Clustering

by

Professor Jianhong Wu
York University, Canada

Date : March 08, 2012 (Thursday)
Time : 4:30 pm to 5:30 pm
Venue : Room B5-118 (near Lift. 8)
Blue Zone, Level 5, Academic 1 (AC1)
City University of Hong Kong

ABSTRACT:

We describe a new approach for patter recognition, viewed as an inverse process of pattern formation. With Yongqiang Cao (Boston), we developed neural network architecture to detect low dimensional patterns in a high dimensional data set. The developed projective adaptive resonance theory (PART) has been applied for gene filtering and cancer diagnosis, neural spiking trains clustering, ontology construction, text mining and stock associations detection. The key feature of the PART network is a hidden layer which incorporates a selective output signal mechanism (SOS) that calculates the similarity between the output of a given input neuron with the corresponding component of the template of a candidate cluster neuron and allows the signal to be transmitted to the cluster neuron only when the similarity measure is sufficiently large. In a recent study with Hossein Zivari-Piran (Toronto) and John Hunter and John Milton (Claremont), we refined this clustering architecture to incorporate adaptive transmission delays and signal transmission information loss (PART-D). The resultant selective SOS is based on the assumption that the signal transmission velocity between input processing neurons and clustering neurons is proportional to the similarity between the input pattern and the feature vector of the clustering neuron. The mathematical model governing the evolution of the signal transmission delay, the short-term memory traces and the long-term memory traces represents a new class of delay differential equations where the evolution of the delay is described by a nonlinear differential equation involving the similarity measure aforementioned. This talk will describe PART-D architecture and the associated delay differential systems, and it will discuss future directions how state-dependent delay differential equations can be used to design algorithms for clustering in skewed subspaces or sub-manifolds of the data space.

Light refreshments will be provided near Room B5-118 before the colloquium from 4:00 pm to 4:30 pm. Please come and join us!

** **All interested are welcome** **

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