Special Issue on
Adaptive and Learning Systems (ALS)

IEEE Transactions on Systems, Man, and Cybernetics – Part B.

Adaptive and learning systems have drawn considerable attention in the last few decades due to their inherent strength in suitably modeling many real world complex systems, which are, otherwise, difficult to model using the traditional existing tools and systems. Although it is only relatively recently that Learning Automata (LA) and their applications in solving complex problems have become popular, their history dates back to the 1950s and 1960s with reference to the works of Mathematicians and Mathematical Psychologists such as Bush and Mosteller, and Atkinson *et al*., Tsetlin and Varshavskii and Vorontsova, among others. Some of the popular current generation researchers on LA include K. Narendra, M. A. L. Thathachar, B. J. Oommen, S. Lakshmivarahan, M. S. Obaidat, K. Najim, A. S. Poznyak, N. Baba, L. G. Mason, P. S. Sastry, A. S. Pomportsis, G. Papadimitriou, M. R. Meybodi and H. Beigy.

In typical LA systems, a self-operating machine or a mechanism, termed as an *Automaton*, responds to a sequence of instructions in a certain way, so as to achieve a certain goal. The Automaton either responds to a pre-determined set of rules, or adapts to the environmental dynamics in which it operates. The term *learning* has its root in Psychology, and is used to refer to the act of acquiring knowledge and modifying one's behavior based on the experience gained. Thus, in LA, the adaptive automaton adapts to the responses from the environment through a series of interactions with it. It then attempts to learn the best action from a set of possible actions that are offered to it by the random stationary or non-stationary environment in which it operates. The Automaton, thus, acts as a decision maker to arrive at the best action.

Some of the attractive features of LA such as their ability to rapidly and accurately converge and their low computational complexity have made them useful for solving problems involving network call admission control, distributed scheduling, training hidden Markov models, neural network adaptation, graph partitioning, intelligent vehicle control, dynamic shortest path and pattern classification. Their advantages appear prominent in optimizing problems in which an optimal action needs to be determined from a set of actions. Typically, learning is of best help only when there are high levels of *uncertainty* in the system in which the automaton operates.

The proposed Special Issue is intended to attract papers from the focused group of researchers worldwide that are currently working on stochastic learning systems, so that their research results can be disseminated widely for use in solving complex scientific and engineering problems faced by researchers working in different application domains. It is envisaged that the cross-pollination of ideas amongst LA researchers and the researchers working in different application domains will make this Special Issue, indeed "special", in the years to follow. The published papers are expected to include high quality state-of-the-art research papers having both theoretical and application flavours.

Stochastic learning and LA will be of particular interest to us in this Special Issue. However, as AL is not solely concerned about automata learning, we propose to keep our horizons broad enough to attract very good quality papers in all areas of AL. There are different forms of adaptive learning mechanisms that have also gained attention in the last several years. For example, researchers have become fascinated on how naturally occurring organisms such as ants, bees and birds interact with the environment, gain experience from the past actions, and optimize their actions.

Although there are sporadic occurrences of papers in the literature relating to the theory and applications of LA and AL, the proposed Special Issue will help to provide a common firm platform for researchers working in these areas to exhibit their research findings.

Some of the topics of interest include, but are not limited to, both theoretical and application-oriented results in the following:

- Deterministic, Fixed Structure and Variable Structure LA.
- Continuous and Discretized LA.
- Novel learning schemes.
- Estimator and Pursuit class of algorithms.
- Networks of LA and Stochastic Games.
- Novel Linear and Non-linear Learning Approaches for both Stationary and Non-Stationary Environments.
- Optimality, expediency, ergodicity, absorbing and non-absorbing properties.
- Martingales.
- Renewal Theory.
- Invariance and Regularization in Learning.
- Non-Linear Dimension Reduction.
- Event-Based Optimization.
- Fast Algorithms.
- Perturbation Analysis.
- Queuing Systems Applications.
- Stochastic Approximation.
- Dynamical Systems.
- Bayesian Inference and Chaos.
- Continuous-time Nonlinear State-space Models.
- Weight Space Probability Densities in Stochastic Learning.
- Stochastic Co-Operative Multi-Agent Learning Systems.
- Artificial Immune Systems.
- Cooperation in Social Dilemmas.
- Swarm Intelligence-based adaptive learning mechanisms.
- Biological and nature-inspired adaptive learning.
- Other Adaptive Learning mechanisms.
- Autonomous Robot Learning.
- Adaptive and Learning Techniques for Communication Networks
- Adaptive Systems based on Clustering Algorithms
- Adaptive Web Sites
- Learning Mechanisms for Intelligent Tutoring Systems.
- Adaptive Speech Recognition, Pattern Recognition and Image Processing using Learning.
- Adaptive Communication Protocols and Architectures
- Adaptive Clustering
- Adaptive push systems
- Application of learning automata to routing and control in computer networks
- Carrier-sense-assisted adaptive learning MAC protocol for wireless LANs
- Using learning automata for fast graph partitioning
- Control of manufacturing plants using learning automata
- Applications of adaptive learning to active vehicle suspension
- Path planning for manipulators using learning automata

- Applications and Case Studies of Adaptive Learning Mechanisms.

Schedule:
Manuscript submission deadline: December 31, 2008.
First notification to authors: May 15, 2009.
Revised submission: June 30, 2009.
Final notification: September 20, 2009.
Publication date: Fourth Quarter, 2009 (tentative).

Protocol for Paper Acceptance:

- The reports from at least three reviewers will be carefully assessed and papers of high quality will be accepted. The quality criteria that will be considered to judge the papers include: originality, technical depth, significance of results, adequacy of prior works referenced, overall organization, clarity and readability, satisfactory standard of English, clear illustrations, sufficient support for assertions and conclusion, appropriate title, and abstract.
- Both the comments to the Authors and the (confidential) comments to the Editors by the Reviewers will be taken into account when making an acceptance decision.
- The papers that will be accepted will be assessed to see if they align well with the goals of this Special Issue and also with the interests of the audience of the Journal.

- All electronic submissions must be made through the Manuscript Central web site: http://smcb-ieee.manuscriptcentral.com/. Manuscripts should conform to the standard format of the IEEE Transactions on System, Man, Cybernetic - Part B as indicated in the Information for Authors
- **Please also include a note that the paper is intended for the special issue by either entering author comments to the editor during the submission process or putting the information on the first page of your submission**. This is crucial to ensuring that your paper is routed correctly.

- All enquiries on this special issue should be sent to any one of the Guest Editors.

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