Applied Soft Computing

Call for Papers on the Special Issue

Evolving Soft Computing Techniques and Applications

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Scope of the issue

In nowadays industrial systems, the necessity of **on-line learning** becomes more and more an essential aspect, as upcoming new system states, **changing operating conditions and environmental influences** need to be integrated on demand and on-the-fly into the models. Otherwise, the predictive quality of the models may deteriorate significantly due to severe extrapolation cases. Re-training of the models is usually not a feasible option whenever data from streams is continuously arriving as not terminating within a reasonable time-frame. Thus, recently a field of research emerged which is addressing this problem by using methodologies with the ability to train and permanently update models in an incremental, step-wise manner. The models equipped with these capabilities are called **evolving models**.

Practical applications of evolving models are on-line quality control of production items (adapting to different types of, variations in their shape, outlook etc.), supervision and failure analysis of dynamically changing machine states, decision support systems in medicine (including behavioral changes of patients), engine control (adapting to different types of driving conditions), prediction and quantification in very dynamic production processes (e.g. viscose production), welding processes, user profiling in various applications (information filtering/routing, e-commerce, smart homes), forecasting (financial time series), internet (flow of information management), etc.

Evolving methods rely on two concepts: (i) **incrementality of the learning methods** to devise the model and (ii) **self-evolution and -adaptation** of the learned model (parameters and structure). It is needless to stress that incrementality helps to save time-intensive re-training and avoid problems with memory constraints, allowing processing step-wise the incoming data samples (ideally with a minimal usage of past training samples). Generally speaking, dynamic aspects (e.g. new operating conditions, dynamic change of the system's characteristics, dynamic change of the input structure - new feature/variable), states usually extending the feature/variable space should be captured and integrated on demand by evolving structurally the model (system's components) and self-adapting its parameters during the system's deployment. The systematic integration has the advantage of enhancing the system performance over time and guaranteeing **real time processing of data**.

This special issue aims at laying a bridge between incremental learning methodologies, concepts, techniques and aspects which are basically motivated within the field of machine learning and any type of soft computing model architectures, **favoring some sort of interpretability**, **mimicking human brain modeling** and **investigating concepts from evolution theory**.

This special issue intends to draw a picture of the recent advances and challenges in **evolving soft-computing based systems** including **evolving fuzzy systems, evolving neural networks, dynamic evolutionary algorithms and any evolving hybrid systems** (e.g. evolving neuro-fuzzy systems, evolving evolutionary neural networks, dynamic fuzzy evolutionary algorithms, etc.). Particularly, the special issue aims at soliciting contributions dealing with **real-world applications that present dynamic facets requiring on-line learning capabilities.** The connection of evolving soft computing to specific machine learning and data mining concepts such as active learning, dynamic feature weighting/selection, drift analysis in data streams, complexity reduction issues, outlier treatment as well as reliability issues are of high relevance.

Topics

Original contributions are solicited from, but are not limited, the following topics of interest:

- ➢ **Evolving fuzzy systems** (EFS) including:
    - o Evolving fuzzy classifiers
    - o Evolving fuzzy clustering
    - o Evolving fuzzy regression
    - o Evolving Takagi-Sugeno-Kang fuzzy systems
    - o Evolving neuro-fuzzy approaches
    - o Evolving fuzzy controllers
    - o Stability, process-safety and computational related aspects
    - o Complexity reduction and interpretability issues in EFS
    - o Reliability in model predictions and parameters

- ➢ **Evolving neural networks** including:
    - o Online learning paradigm
    - o Sequential radial basis functions networks
    - o Online and incremental support vector machines
    - o Online perceptron-like neural networks
    - o Online probabilistic neural networks
    - o Incremental self-organizing maps
    - o Stability and plasticity issues
    - o Issues regarding forgetting

- ➢ **Dynamic Evolutionary Algorithms** including:
    - o Change detection in the environment
    - o Convergence and computational issues
    - o Adaptive evolutionary computation
    - o Methods and strategies of dynamic optimization
    - o Dynamic multi-objective optimization
    - o Real-world applications of dynamic optimization

- ➢ **Hybrid methodologies**
    - o incremental genetic fuzzy systems
    - o evolving neuro-fuzzy approaches
    - o adaptive neural network training with GAs

- ➢ **Evolving soft computing techniques in connection with**
    - o Active and semi-supervised learning strategies
    - o Techniques to address "Concept Drift"
    - o Online/Incremental Feature Selection
    - o Online tuning via human-machine interaction

- ➢ **Real-World Applications** of evolving soft computing techniques
    - o Online modelling and identification
    - o Online fault detection and decision support systems
    - o Online media classification
    - o Smart systems
    - o Robotics
    - o Applications for mining in huge data bases
    - o Web applications
    - o Adaptive chemometric models
    - o Modeling in dynamic processes
    - o Online time series analysis and stock market forecasting
    - o ....

Important dates

Submission deadline: November 1st, 2012

First author notification: February 1st, 2013
Revised version: April 1st, 2012
Final notification: June 1st, 2013
Publication: 2013

Submission Instructions

Papers will be evaluated based on their originality, presentation as well as relevance and contribution to the field of evolving soft computing techniques, suitability to the special issue, and overall quality. All papers will be rigorously refereed by 3 peer reviewers. Submission of a manuscript to this special issue implies that no similar paper is already accepted or will be submitted to any other journal. Authors should consult the "Guide for Authors", which is available online at http://www.elsevier.com/wps/find/journaldescription.cws_home/621920/authorinstructions, for information about preparation of their manuscripts. Manuscripts should be submitted via the Elsevier Editorial System http://ees.elsevier.com/asoc/. Please choose "**SC: Evolving Techniques**" when specifying the Article Type.