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Special Issue on Computational Intelligence for Changing Environments

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Aims and Scope:

Over the past decade or so, computational intelligence techniques have been highly successful for solving big data challenges in changing environments. In particular, there has been growing interest in so called biologically inspired learning (BIL), which refers to a wide range of learning techniques, motivated by biology, that try to mimic specific biological functions or behaviors. Examples include the hierarchy of the brain neocortex and neural circuits, which have resulted in biologically-inspired features for encoding, deep neural networks for classification, and spiking neural networks for general modelling.

To ensure that these models are generalizable to unseen data, it is common to assume that the training and test data are independently sampled from an identical distribution, known as the sample i.i.d. assumption. In dynamic and non-stationary environments, the distribution of data changes over time, resulting in the phenomenon of 'concept drift' (also known as population drift or concept shift), which is a generalization of covariance shift in statistics. Over the last five years, transfer learning and multitask learning have been used to tackle this problem. Fundamental analyses using probably approximately correct (PAC) and Rademacher complexity frameworks have explained why appropriate incorporation of context and concept drift can improve generalizability in changing environments.

It is possible to use human-level processing power to tackle concept drift in changing environments. Concept drift is a real-world problem, usually associated with online and concept learning, where the relationships between input data and target variables dynamically change over time. Traditional learning schemes do not adequately address this issue, either because they are offline or because they avoid dynamic learning. However, BIL seems to possess properties that would be helpful for solving concept drift problems in changing environments. Intuitively, the human capacity to deal with concept drift is innate to cognitive processes, and the learning problems susceptible to concept drift seem to share some of the dynamic demands placed on plastic neural areas in the brain. Using improved biological models in neural networks can provide insight into cognitive computational phenomena.

However, a main outstanding issue in using computational intelligence for changing environments and domain adaptation is how to build complex networks, or how networks should be connected to the features, samples, and distribution drifts. Manual design and building of these networks are beyond current human capabilities. Recently, computational intelligence methods has been used to address concept drift in changing environments, with promising results. A Hebbian learning model has been used to handle random, as well as correlated, concept drift. Neural networks have been used for concept drift detection, and the influence of latent variables on concept drift in a neural network has been studied. In another study, a timing-dependent synapse model has been applied to concept drift. These works mainly apply biologically-plausible computational models to concept drift problems. Although these results are still in their infancy, they open up new possibilities to achieve brain-like intelligence for solving concept drift problems in changing environments.

Taking the current state of research in computational intelligence for changing environments into account, the objective of this special issue is to collate this research to help unify the concepts and terminology of computational intelligence in changing environments, and to survey state-of-the-art computational intelligence methodologies and the key techniques investigated to date. Therefore, this special issue invites submissions on the most recent developments in computational intelligence for changing environments algorithms and architectures, theoretical foundations, and representations, & their application to real-world problems. We also welcome timely surveys & review papers.

Topics of Interest include (but are not limited to):

- Computational intelligence methodologies and implementation for changing environments
- Transfer learning, Multitask learning, Domain adaption
- Incremental Learning architectures, Unsupervised and semi-supervised learning architectures
- Incremental Knowledge augmentation, Representation learning and disentangling
- Incremental Adaptive Neuro-fuzzy systems
- Incremental and single-pass data mining
- Incremental Neural Clustering & Regression
- Incremental Adaptive decision systems
- Incremental Feature selection and reduction
- Incremental Constructive Learning
- Novelty detection in Incremental learning

Submission Process

The maximum length for the manuscript is typically 25 pages in single column format with double-spacing, including figures and references. Authors should specify in the first page of their manuscripts the corresponding author's contact and up to 5 keywords. Submission should be made via: https://easychair.org/conferences/?conf=ieee-cim-cice2015

Important Dates (for August 2015 Issue)

15th November, 2014: Submission of Manuscripts
15th January, 2015: Notification of Review Results
15th February, 2015: Submission of Revised Manuscripts
15th March, 2015: Submission of Final Manuscripts

Guest Editors

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