Three proposed Speeches

Topic1: An Inclusive Learning Algorithm Framework in an increasingly Networked World of Transducers

An inclusive framework for learning algorithms will be presented discussing the "known unknowns" and speculating about "unknown unknowns" in learning algorithm development. A paradigm shift can be observed in wide-ranging application domains such as energy management, image processing, neural engineering, bioinformatics, mechatronics and the broader spectrum of design from architecture to sculpture and paintings which are empowered by rapidly-advancing technologies that can generate large quantities of "imperfect" data for analysis of processes, compounds and organisms. These applications are increasingly demanding transparency thus the need for moving away from completely backbox approaches for learning. These technologies have been spurred by the improvements in processor technology (e.g. GPU), that have allowed practitioners and researchers to overcome the computational limitations of many Neural Networks that depend on fully human curated or labelled data (i.e. Supervised Learning). The following fundamental question then naturally arises: What happens when curated information or labels capture only a subset of critical classes, or the curation process itself is not fault- or error-free? Undoubtedly, the algorithm's perceived reality will distort any subsequent analysis of these data, which may have detrimental downstream effects when new discoveries and critical decisions are made on a basis of these analyses. In such scenarios, learning algorithms that can find models – underlying structures or distinct patterns within data – without relying on labels (i.e. using Unsupervised Learning), have made great progress toward answering these sorts of questions; however, these algorithms only address part of the problem. Unsupervised Learning algorithms do not take into account any available and potentially reliable information or domain knowledge, which could prove useful in developing a robust model of the data. It can be advantageous to consider such information as well as any other available domain knowledge, not as ground truth but as a starting point to build a more complete picture of the problem under investigation. Some of the landmark contributions by the authors research groups at University of Melbourne and Australian National University in areas relevant to IEEE Computational Intelligence Society are also highlighted.

Key journal papers reflecting my own work relevant to Topic 1:

Reducing the number of training samples for fast support vector machine classification
R Koggalage, S Halgamuge
Neural Information Processing-Letters and Reviews 2 (3), 57-65, 2004 Citations: 124

Dynamic self-organizing maps with controlled growth for knowledge discovery
D Alahakoon, SK Halgamuge, B Srinivasan
IEEE Transactions on neural networks 11 (3), 601-614, 2000 Citations: 553

Neural Networks in Designing Fuzzy Systems for Real World Applications
SK Halgamuge, M Glesner
Fuzzy Sets and Systems 65 (1), 1-12, 1994, Citations: 349