

## **Tutorial at WCCI 2014, Beijing: Autonomous Learning**

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### **Background Information - Autonomous Learning**

Autonomous learning is a very broad term and includes many different kinds of learning. Fundamental to all of them is some kind of a learning algorithm. Whatever the kind of learning, we generally have not been able to deploy the learning systems on a very wide scale, although there certainly are exceptions. One of the biggest challenges to wider deployment of existing learning systems comes from algorithmic control. Most of the current learning algorithms require parameters to be set individually for almost every problem to be solved.

The limitations of the current learning systems, compared to biological ones, was pointed out in a 2007 National Science Foundation (USA) report from a workshop co-chaired by Rodney Douglas of E. T. H. and University of Zurich and Terry Sejnowski of Salk Institute and University of California at San Diego (<http://www.cnl.salk.edu/Media/NSFWorkshopReport.v4.pdf>). Here's a part of the summary of that report:

“Biological learners have the ability to learn autonomously, in an ever changing and uncertain world. This property includes the ability to generate their own supervision, select the most informative training samples, produce their own loss function, and evaluate their own performance. More importantly, it appears that biological learners can effectively produce appropriate internal representations for composable percepts -- a kind of organizational scaffold - as part of the learning process. By contrast, virtually all current approaches to machine learning typically require a human supervisor to design the learning architecture, select the training examples, design the form of the representation of the training examples, choose the learning algorithm, set the learning parameters, decide when to stop learning, and choose the way in which the performance of the learning algorithm is evaluated. This strong dependence on human supervision is greatly retarding the development and ubiquitous deployment autonomous artificial learning systems.”

This tutorial will broadly introduce some new ideas about learning and some new types of learning methods developed over the last few years. Participants will learn about a set of principles for designing and constructing autonomous learning algorithms. There will also be a demonstration of these new autonomous learning algorithms on a variety of problems. The topics covered will include class-specific feature selection, incremental learning, hypersphere nets that require no weight training, approximate rule extraction, problem decomposition, generalization and basic principles of design and construction of autonomous systems.