"Implementations of methods of computational intelligence"

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Comparison of various methods of computational intelligence are presented and illustrated with examples. These methods include neural networks, fuzzy systems, and evolutionary computation. The presentation is focused on neural networks, fuzzy systems and neuro-fuzzy architectures. Various leaning method of neural networks including supervised and unsupervised methods are presented and illustrated with examples. General learning rule as a function of the incoming signals is discussed. Other learning rules such as Hebbian learning, perceptron learning, LMS - Least Mean Square learning, delta learning, WTA – Winner Take All learning, and PCA - Principal Component Analysis are presented as a derivation of the general learning rule. Architecture specific learning algorithms for cascade correlation networks, Sarajedini and Hecht-Nielsen networks, functional link networks, polynomial networks, counterpropagation networks, RBF-Radial Basis Function networks are described. Dedicated learning algorithms for on chip neural network training are also evaluated. The tutorial focuses on various practical methods such as Quickprop, RPROP, Back Percolation, Delta-bar-Delta and others. Main reasons of convergence difficulties such as local minima or flat spot problems are analyzed. More advance gradient-based methods including pseudo inversion learning, conjugate gradient, Newton and LM - Levenberg-Marquardt Algorithm are illustrated with examples.

Advantages and disadvantages of fuzzy systems will be presented. Detailed comparison of Mamdani and Takagi-Sugeno approaches will be given. Various neuro-fuzzy architectures will be discussed. In the conclusion advantages and disadvantages of neural and fuzzy approaches will be discussed with a reference to their hardware implementation.