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Emilie Lindkvist: Solving Time-dependent Multivariate Nonlinear Systems Using Radial Basis Function Networks and Reinforcement Learning

Sammanfattning

This thesis covers the problem of solving time dependent multivariate nonlinear systems using function approximation. The focus is on three different types of functions: a static function; a logistic function; and a logistic function with hysteresis effect. Each one represents a specific natural resource management problem (Clark 1976).

Using an artificial neural network and a learning model, an autonomous agent (an entity with a mental model) is created for finding the optimal solution for each function. The artificial neural network used is a Radial Basis Function network (Poggio & Girosi 1989) and is used for storing the experiences and modeling the function. The learning technique Reinforcement Learning (Sutton & Barto 1998) is added to make prediction possible. Thus the solution architecture consists of an agent implemented in Java using a mental model made up of the RBF-network and reinforcement learning. The agent is successfully used in MATLAB-models for solving dynamic multivariate nonlinear functions, which in this case represent natural resource management problems.

The thesis includes a description of the RBF-Network, reinforcement learning and how they are integrated for solving the problems. Also,the results of the agent's capabilities are presented. The result shows that the agent's behavior and its intelligence is more than sufficient; with the right type of experimentation, the agent can find the optima or maximum sustainable yield of all three functions.