Recurrent fuzzy-neural approach for nonlinear control using dynamic structure learning scheme

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Abstract

In this paper, a dynamic recurrent fuzzy neural network (DRFNN) with a structure learning scheme is proposed. The structure learning scheme consists of two learning phases: the node-constructing phase and the node-pruning phase, which enables the DRFNN to determine the nodes dynamically to achieve optimal network structure. Then, a self-structuring recurrent fuzzy neural network control (SRFNNC) system via the DRFNN approach is developed. The SRFNNC system is composed of a neural controller and a compensation controller. The neural controller using a DRFNN to mimic an ideal controller is the main controller, and the compensation controller is designed to compensate the difference between the neural controller and the ideal controller. In the SRFNNC system, all the parameters are evolved based on the Lyapunov function to ensure the system stability. Finally, to investigate the effectiveness of the proposed SRFNNC system, it is applied to control a second-order chaotic nonlinear system. A comparison between a fixed-structuring recurrent fuzzy neural network control and the proposed SRFNNC is made. Through the simulation results, the advantages of the proposed SRFNNC method can be observed.

Keyword：recurrent fuzzy neural network, nonlinear control, dynamic node construction