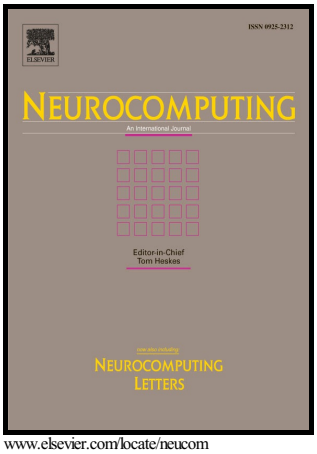

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PII: S0925-2312(16)31067-0
DOI: http://dx.doi.org/10.1016/j.neucom.2016.09.039
Reference: NEUCOM17568

To appear in: *Neurocomputing*

Received date: 28 January 2016
Revised date: 10 August 2016
Accepted date: 20 September 2016

Cite this article as: Changchun Hua, Yuanyuan Wang, Yafeng Li and Huiguang Li, **Decentralized output feedback control of interconnected stochastic nonlinear time-delay systems with dynamic interactions**, *Neurocomputing* http://dx.doi.org/10.1016/j.neucom.2016.09.039

Decentralized output feedback control of interconnected stochastic nonlinear time-delay systems with dynamic interactions

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Abstract. This paper studies the decentralized output feedback control problem for interconnected stochastic nonlinear systems with dynamic input and output interactions containing time delay. Firstly, we design the decentralized filters independent of time delay to estimate the unmeasured state variables. By estimating the norm of unknown parameter vectors instead of themselves, it can avoid the over-estimation problem. Then, using RBF (radial basis function) neural network to approximate the unknown functions, we construct the adaptive neural network output feedback controller with corresponding adaptive laws. Based on Lyapunov stability theorem, we show that the designed controller can render all the signals of the overall closed-loop systems are semi-global bounded in probability with the help of the changing supply functions. Finally, simulation examples are presented to verify the effectiveness of the theoretic results obtained.

Keywords: Neural network control, Time-delay, Stochastic nonlinear system, Decentralized filters

1. Introduction

Interconnected systems can be found in many practical applications such as power networks, manufacturing processes, and communications. The decentralized control for interconnected systems is an efficient and practical technique which can alleviate the computational burden compared with centralized control, and makes the control implementation more feasible, since the designed controller of each subsystem uses its own state variables (see[1,2], and the references therein). In the past decades, research on stochastic systems has received considerable attention due to the existence of stochastic disturbance which may severely degrade the closed-loop system performance, even cause instability in many control systems, see, for instance, [3-6] and the references therein. In [5], the author proposed a totally decentralized adaptive tracking controller for a class of stochastic interconnected systems with both parametric uncertainties and unknown nonlinear interactions. A robust adaptive fuzzy decentralized backstepping output feedback control scheme for a class of uncertain nonlinear stochastic pure-feedback large-scale systems with unknown dead zone based on fuzzy logic system and a K-filters state observer was proposed in [7]. In [8], the problem of decentralized adaptive neural tracking control was considered for a class of multiple input and multiple output uncertain stochastic nonlinear interconnected systems. The finite-time stabilization problem for a class of stochastic nonlinear systems was investigated in [9].

It is well known that time-delay exists in a variety of practical systems, for example, power systems, teleoperation systems, chemical reactor systems, etc. The existence of time-delay is a source of instability for control systems and it also makes the controller design become more difficult and challenging, see [10]-[13]. Two adaptive neural network (NN) decentralized output feedback control approaches were proposed for uncertain nonlinear

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