Accepted Manuscript

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PII: S0377-0427(18)30228-0
DOI: https://doi.org/10.1016/j.cam.2018.03.047
Reference: CAM 11630

To appear in: *Journal of Computational and Applied Mathematics*

Received date : 28 September 2016
Revised date : 7 March 2018

Sampled-data state estimation of Markovian jump static neural networks with interval time-varying delays, [1]

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Abstract: In this paper, we consider the problem of sampled-data state estimation of Markovian jump delayed static neural networks. By constructing a suitable Lyapunov–Krasovskii functional with double and triple integral terms and using Jensen inequality, delay-dependent criteria are presented so that the error system is asymptotically stable. Instead of the continuous measurement, the sampled measurement is employed to estimate the neuron states. It is further demonstrated that the configuration of the gain matrix of state estimator is changed to find a feasible solution of a linear matrix inequalities, which is efficiently facilitated by available algorithms. Finally, two numerical examples are given to illustrate the usefulness and effectiveness of the proposed theoretical results.

Key Words: Lyapunov method, Linear Matrix Inequality, Static neural networks, Sample-data control, Time-varying delays.

1. Introduction

In the past few decades, recurrent neural networks with time-varying delays have been applied successfully in many areas such as pattern recognition, associative memories, signal processing, parallel computation, optimization solvers and so on. Time delays often occur in practical neural networks due to the finite switching speeds of the amplifiers or the finite signal propagation time in biological networks, which may induce the undesirable dynamic behaviours such as oscillation and instability. Therefore, much attention has been paid to the investigation of the stability analysis problem of neural networks with time-varying delays and a large amount of results have been available in the literature [1]–[5].

Neural networks can be classified into two categories, that is, static neural networks and local field networks. In static neural networks, neuron states are chosen as basic variables. While in local field networks, local field states are chosen as basic variables. It has been proved that these two kinds of neural networks are not always equivalent [6]. Compared with rich results for local field networks, results for static neural networks are much more scare. To mention a few, stability of static recurrent neural networks with constant time-delay was investigated in [7]-[9] where new delay-dependent stability criteria were established in the terms of LMI using delay-partitioning approach and Finslers lemma. Delay-independent conditions for static neural networks with time-varying delays were obtained. In addition, new delay-dependent exponential stability criteria for static recurrent neural networks were proposed in [10, 11]. By constructing a new Lyapunov functional and using s-procedure, both delay-dependent and delay-independent stability conditions were developed for static recurrent neural networks with interval time-varying delays in [12]. Stability and dissipativity analysis of static neural networks were investigated in [13].

Up to now, the neuron state estimation problem has been hot research topic that has been drawn considerable attention [14, 15]. In the study of the neuron state estimation only partial information about the neuron states is available in the network outputs of large-scale neural networks. In order to utilize the neural networks, one often needs to estimate the neuron state through available measurement, and then use the estimated neuron state to achieve certain practical performances, such as

[1] *This work was supported by Department of Science and Technology(DST),under research project No. SR/FTP/MS-039/2011.*

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