

## CONVERGENCE OF DISCRETE-TIME CELLULAR NEURAL NETWORKS WITH TIME-VARYING DELAYS

QIANG ZHANG<sup>1</sup>, XIAOPENG WEI<sup>1</sup> AND JIN XU<sup>2</sup>

<sup>1</sup>Liaoning Key Lab of Intelligent Information Processing  
Dalian University  
Dalian 116622, P. R. China  
zhangq30@yahoo.com; adtcwpx@126.com

<sup>2</sup>Department of Computer Science  
Peking University  
Beijing 100871, P. R. China  
jxu@pku.edu.cn

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**ABSTRACT.** *Convergence of a class of discrete-time cellular neural networks with time-varying delays is considered. By utilizing a difference inequality and the properties of M-matrix, a new global exponential stability result is presented. The result does not impose the other restrictions on the delay except the boundedness. An example is provided to show the effectiveness of the global exponential stability result given here.*

**Keywords:** Discrete-time cellular neural networks, Time-varying delays, Difference inequality, Global exponential stability

1. **Introduction.** Stability of continuous-time cellular neural networks (CNNs) and delayed cellular neural networks (DCNNs) has attracted increasing attention due to its key role in the practical applications. So far, a great number of sufficient conditions for global asymptotic stability or global exponential stability of continuous-time CNNs and DCNNs have been presented in the literature, see, for example, [1]-[8] and references therein. However, when implementing the continuous-time neural networks for computer simulation or computational purposes, it is necessary to formulate a discrete-time version which is an analogue of the continuous-time neural networks. In fact, discrete-time neural networks have already been applied in many important fields, such as image processing, system identification, quadratic optimization solver, and time series processing, [9]-[12]. Ideally, the discrete-time neural networks should have faithfully the dynamical characteristics of the continuous-time system such as the set of equilibria and their stability. However, the discrete-time analogue may not preserve the convergence dynamics of their continuous-time counterparts [13]. For this reason, it is desirable to investigate the stability of discrete-time cellular neural networks. To the best of our knowledge, the stability results for discrete-time cellular neural networks with delays are very few [14]-[16]. In this paper, by using a discrete Halanay inequality, a new global exponential stability result for discrete-time cellular neural networks with time-varying delays is given. The result is less conservative than those given in the previous literature. A numerical simulation is provided to show the efficiency of our result.