Chapter 4
Ultra High Frequency Sigmoid and Trigonometric Higher Order Neural Networks for Data Pattern Recognition

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ABSTRACT
This chapter develops a new nonlinear model, Ultra high frequency sigmoid and Trigonometric Higher Order Neural Networks (UGT-HONN), for data pattern recognition. UGT-HONN includes Ultra high frequency sigmoid and Sine function Higher Order Neural Networks (UGS-HONN) and Ultra high frequency sigmoid and Cosine functions Higher Order Neural Networks (UGC-HONN). UGS-HONN and UGC-HONN models are used to recognition data patterns. Results show that UGS-HONN and UGC-HONN models are better than other Polynomial Higher Order Neural Network (PHONN) and Trigonometric Higher Order Neural Network (THONN) models, since UGS-HONN and UGC-HONN models to recognize data pattern with error approaching 0.0000%.

INTRODUCTION
The contributions of this chapter will be:

- Introduce the background of HONNs with the pattern recognition of HONNs.
- Develop a new UGT-HONN model for ultra-high frequency data pattern recognition.
- Provide the UGT-HONN learning algorithm and weight update formulae.
- Applications of UGT-HONN model for data pattern recognition.

This chapter is organized as follows: Section “BACKGROUND” gives the background knowledge of HONNs and pattern recognition applications using HONNs. Section “UGT-HONN MODELS” in-
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Introduces UGT-HONN structure and different modes of the UGT-HONN model. Section LEARNING ALGORITHM OF UGT-HONN MODELS provides the UGT-HONN model update formula, learning algorithms, and convergence theories of HONN. Section “UGT-HONN TESTING” describes UGT-HONN computer software system and testing results for data pattern recognition.

BACKGROUND


Selviah (2009) focuses on high speed optical higher order neural networks for discovering data trends and patterns in very large database. Selviah describes the progress in using optical technology to construct high-speed artificial higher order neural network systems. The chapter reviews how optical technology can speed up searches within large databases in order to identify relationships and dependencies between individual data records, such as financial or business time-series, as well as trends and relationships within them. Two distinct approaches in which optics may be used are reviewed. In the first approach, the chapter reviews current research replacing copper connections in a conventional data storage system, such as a several terabyte RAID array of magnetic hard discs, by optical waveguides to achieve very high data rates with low crosstalk interference. In the second approach, the chapter reviews how high speed optical correlators with feedback can be used to realize artificial higher order neural networks using Fourier Transform free space optics and holographic database storage.

Wang, Liu, and Liu (2009) investigate on complex artificial higher order neural networks for dealing with stochasticity, jumps and delays. This research deals with the analysis problem of the global exponential stability for a general class of stochastic artificial higher order neural networks with multiple mixed time delays and Markovian jumping parameters. The mixed time delays under consideration comprise
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