A Local-Minima-Free Neural Network Approach to Building A/D Converters and Associative Adders

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Abstract

The theory of neural networks is extended to include discrete neurons called *quantrons* (Q'trons, a shorthand for quantum neurons). Q'trons are featured in their multiple output levels whose number is usually greater than two. In this paper, the dynamics of Q'tron neural network (NN) are studied and the property of the embedded system energy, referred to as *Liapunov energy*, is derived. If a problem can be reformulated as one which minimizes the Liapunov energy, then it can be solved by a suitably constructed Q'tron NN. Two typical examples, namely, A/D converter and associative adder, are realized by using such Q'tron NN's. In order to make this NN approach complete, i.e., it will never provide false solutions, a mechanism which prevents the NN from being stuck at some local minima of the Liapunov energy is incorporated into each Q'tron. To demonstrate the effectiveness of the proposed NN, computer simulations have been performed.

Neural Networks that Learn State Space Trajectories by "Hebbian" Rule

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Abstract *A neural network structure is proposed, which can learn state space trajectories (sequential state transitions) by Hebbian-like rule, but without resort to time-delayed synaptic connections. The main idea is to use two Hopfield networks, each of which stabilizes its own memories while drives the other network into state transition. The dynamics of the network is considered. As an emergent property, the state transitions of all individual neurons are synchronous. The learning rate of the network is estimated.*