Abstract

This paper is devoted to studying both the global and local stability of dynamical neural networks. In particular, it has focused on nonlinear neural networks with perturbation. Properties relating to asymptotic and exponential stability and instability have been detailed. This paper also looks at the robustness of neural networks to perturbations and examines if the related properties have been preserved. Circumstances for global and local exponential stability of nonlinear neural network dynamics have been studied. We mentioned that the local exponential stability of any equilibrium point of dynamical neural networks is equivalent to the stability of the linearized system around that equilibrium point. From this, some well-known and new sufficient conditions for local exponential stability of neural networks have been obtained. The Lyapunov's procedure has been used to analyze the stability property of nonlinear dynamical systems and many outcomes have been combined and generalized. A kind of Lyapunov's stability of the stable points of Hopfield neural network (HNN) have been proven, which means that if the initial state of the network is close enough to a stable point, then the network state will remain in a small neighborhood of the stable point. These stability results indicate the convergence of the memory process of HNN. The theoretical results are illustrated through a few problem cases for a nonlinear dynamical system with perturbation behavior.
Index Terms

Computer Science
Artificial Intelligence

Keywords
Perturbed nonlinear systems  Hopfield neural network  Lyapunov stability  equilibrium state