

Nonlinear Principal Component Analysis using Parallel Neural Networks

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Principal component analysis is a statistical multivariate technique, which uncovers the underlying patterns of complex data sets by extracting uncorrelated variables, called principal components, from the original variables. Autoassociative neural network, a special type of neural networks, has been used to develop nonlinear generalization of principal component analysis. There exist two major approaches to nonlinear principal component analysis using autoassociative neural networks: simultaneous and sequential. However, both approaches have several limitations such as high correlation among principal components and error propagations.

To this end, we propose a parallel neural network structure which performs nonlinear principal component analysis. In such a network, each neural network approximates significantly different nonlinear functions to extract a single principal component. Through case studies, we compare the results obtained from three different neural network based nonlinear principal component analysis (simultaneous, sequential and parallel), and illustrate the advantages of the parallel nonlinear principal component analysis method.