Optimization with Artificial Neural Network Systems: A Mapping Principle and a Comparison to Gradient Based Me

Authors:

Harrison Leong

Abstract:

General formulae for mapping optimization problems into systems of ordinary differential equations associated with artificial neural networks are presented. A

comparison is made to optim(cid:173) ization using gradient-search methods. The perfonnance measure is the settling time from an initial state

to a target state. A simple analytical example illustrates a situation where dynamical systems representing artificial neural network methods would

settle faster than those representing gradient(cid:173) search. Settling time was investigated for a more complicated optimization problem using com(cid:173) puter

simulations. The problem was a simplified version of a problem in medical imaging: deter(cid:173) mining loci of cerebral activity from

electromagnetic measurements at the scalp. The simulations showed that gradient based systems typically settled 50 to 100 times faster than

systems based on current neural network optimization methods.