Nonmonotone Sign-based Algorithms for Neural Networks Learning

George D. Magoulas,
Department of Computer Science and Information Systems
Birkbeck College, University of London, U.K.
gmagoulas@dcs.bbk.ac.uk

Key words: Learning algorithms, nonlinear optimisation, nonlinear Jacobi, Rprop algorithm, neural network architectures.

Nonmonotone learning is in line with theories for cognitive development and is supported by recent advances in optimisation methods, which showed that nonmonotone optimisation algorithms possess useful properties, such as global and superlinear convergence, require fewer numbers of line-searches and function evaluations, and are effective for large-scale unconstrained problems.

In this work, we propose nonmonotone first-order learning methods that apply one-step subminimisation by employing an Resilient Propagation (Rprop)-based heuristic scheme to locate an approximation of the subminimiser along each weight direction operating in a nonmonotone way. This can be considered as a generalisation of the approach proposed by Anastasiadis et al. (2005) and Anastasiadis et al. (2006), which enforced monotone reduction of the learning error. The theoretical foundations of our approach are discussed and experiments are conducted on a variety of datasets using static and dynamic neural networks to empirically evaluate it. The results provide numerical evidence that supports our claims about the benefits of this approach.

References

Anastasiadis, A., Magoulas, G.D., & Vrahatis, M.N. (2005). Sign-based Learning Schemes for Pattern Classification. *Pattern Recognition Letters*, 26, 1926-1936.

Anastasiadis, A., Magoulas, G.D., & Vrahatis, M.N. (2006). Improved sign-based learning algorithm derived by the composite nonlinear Jacobi process. *Journal of Computational and Applied Mathematics*, 191, 166-178.