Improving robustness of the L-BFGS for Large Scale Nonlinear Optimization.

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Abstract

This paper presents an algorithm for solving large nonlinear unconstrained optimization problems. It consists of an L-BFGS modification such that in certain iterations some pairs of the limited memory matrix are interchanged aiming at adding information of the local curvature. This is only done when some indicators predict a poor behavior of the L-BFGS direction. We present criteria for measuring the quality of the Hessian approximations and deciding about the convenience of adding extra local information arising from the solution of the second order approximation by discrete conjugate gradients. This approach resembles ideas used by other authors, but a crucial difference is we only perform modifications when L-BFGS exhibits either a non-convergent behaviour or a very slow rate of convergence. The added information consists of selected pairs of conjugate directions and the corresponding gradient differences gathered from the inner iterations, modifying the limited memory matrices without requiring extra storage. Numerical results are given showing sensible improvements for many well-known test problems.

Key words: Limited Memory method, global convergence,extra updates.