Efficient ODE-based methods for unconstrained optimization

ABSTRACT

This paper presents some efficient methods for unconstrained optimization based upon approximating the gradient flow of the objective function. Most ODE-based methods would generate Levenberg-Marquardt-like steps that require the solution of linear systems. On the other hand our proposed methods used some quasi-Newton matrices to approximate the solution of these linear systems, thus avoiding the solution of linear systems repeatedly. Two implementations of the modified ODE-based methods - line search and trust region implementation are proposed. Under some suitable assumptions, the convergence of the proposed methods is then established. Numerical results indicate that the modified methods are more effective and comparable than the standard line search and trust region method using the well-known BFGS formula.