Inexact Proximal Quasi-Newton Methods with Generalized Bregman Distances

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Abstract

In this work, we introduce an Inexact Proximal Quasi-Newton with Bregman Distance (iPGQNC–D) method that extends the quasi-Newton proximal gradient approach. First, the Euclidean proximal term is replaced by a Bregman distance D_ψ generated by convex function ψ, enabling the use of entropic, Kullback–Leibler, and power-type geometries. Second, we relax the assumptions on the concave outer function ϕ, thereby accommodating a wider class of nonconvex regularizers including log-sum, SCAD, and capped-ℓ_1. The proposed method, termed iPGQNC–D, incorporates quasi-Newton curvature (Broyden or L-BFGS) within a non-Euclidean proximal framework. Under relative smoothness and the Kurdyka–Łojasiewicz property, we establish global convergence to a critical point and prove finite Bregman length of the iterates.

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