The Primal-Dual Hybrid Gradient Method for Semiconvex Splittings

Thomas Möllenhoff

Department of Computer Science, Technische Universität München

thomas.moellenhoff@in.tum.de

Abstract: In this work we analyze a recent reformulation of the primal-dual hybrid gradient method which makes it applicable to nonconvex regularizers. In particular, we investigate variational problems for which the energy to be minimized can be written as $G(u) + F(Ku)$, where G is convex, F semiconvex and K a linear operator. We study the method and prove convergence in the case where the nonconvexity of F is compensated by the strong convexity of the G. The convergence proof yields an interesting requirement for the choice of algorithm parameters, which we show to not only be sufficient, but necessary. Additionally, we show boundedness of the iterates under much weaker conditions. Finally, we demonstrate effectiveness and convergence of the algorithm beyond the theoretical guarantees in several numerical experiments.