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Non-convex optimisation in the imaging sciences

iPiano: Inertial Proximal Algorithm for Nonconvex Optimization

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Abstract: We study an algorithm for solving a minimization problem composed of a differentiable (possibly nonconvex) and a simple (possibly nondifferentiable and nonconvex) function. The algorithm iPiano combines forward–backward splitting with an inertial force. It can be seen as a nonsmooth split version of the Heavy-ball method from Polyak. A rigorous analysis of the algorithm for the proposed class of problems yields global convergence of the function values and the arguments. This makes the algorithm robust for usage on nonconvex problems. The convergence result is obtained based on the Kurdyka–Lojasiewicz inequality. This is a very weak restriction, which was used to prove convergence for several other gradient methods. First, an abstract convergence theorem for a generic algorithm is proved, and then iPiano is shown to satisfy the requirements of this theorem. We demonstrate iPiano on computer vision problems.