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Fast methods for nonsmooth nonconvex problems using variable projection

Classic inverse problems are formulated using smooth penalties and regularizations. However, nonsmooth and nonconvex penalties/regularizers have proved to be extremely useful in underdetermined and noisy settings. Problems with these features also arise naturally when modeling complex physical and chemical phenomena; including PDE-constrained optimization, phase retrieval, and structural resolution of bio-molecular models.

We propose a new technique for solving a broad range of nonsmooth, nonconvex problems. The technique is based on a relaxed reformulation, and can be implemented on a range of problems in a simple and scalable way. In particular, we typically need only solve least squares problems, as well as implement custom separable operators. We discuss the problem class, reformulation and algorithms, and give numerous examples of very promising numerical results in different applications.

Biography:

Aleksandr Aravkin joined the University of Washington in 2015 as a Washington Research Foundation Data Science Assistant Professor in Applied Mathematics. He is a Fellow at the UW eSciences Institute, and an adjunct professor in the Mathematics and Statistics Departments. Dr. Aravkin received his PhD in Mathematics (Optimization) from the University of Washington in 2010. From 2010-2012, he was a postdoctoral fellow in Computer Science and Earth and Ocean Sciences at UBC, working on robust approaches for seismic inverse problems. From 2012-2015, Dr. Aravkin was a Research Staff Member at the IBM TJ Watson Research center, and an adjunct professor at Columbia University in Computer Science and IEOR departments. Dr. Aravkin works on a wide range of problems in continuous optimization, including machine learning, inversion, and signal processing.