R. Davidi, *Algorithms for Superiorization and their Applications to Image Reconstruction*, Ph.D. dissertation, Department of Computer Science, The City University of New York, NY, USA, **2010**.
http://gradworks.umi.com/34/26/3426727.html.

Abstract

Computational tractability with limited computing resources is a major barrier for the ever increasing problem sizes of constrained optimization models that seek a minimum of an objective function satisfying a set of constraints. On the other hand, there exist efficient and computationally much less demanding iterative methods for finding a feasible solution that only fulfills the constraints. These methods can handle problem sizes beyond which existing optimization algorithms cannot function. To bridge this gap we present a new concept called *superiorization,* envisioned methodologically as lying between optimization and feasibility seeking. It enables us to use efficient iterative methods to steer the iterates toward a point that is feasible and superior, but not necessarily optimal, with respect to the given objective/merit function.

Using efficient iterative methods to do ‘superiorization’ instead of ‘full constrained optimization’ or only ‘feasibility’ is a new tool for handling mathematical models that include constraints and a merit function. The target improvement of the superiorization methodology is to affect the computational treatment of the mathematical models so that we can reach solutions that are desirable from the point of view of the application at hand at a relatively small computational cost. The key to superiorization is our discovery that two principal prototypical algorithmic schemes, string-averaging projections and block-iterative projections, which include many projection methods, are bounded perturbation resilient. While stability of algorithms under perturbations is usually made to cope with all kinds of imperfections in the data, here we have taken a proactive approach designed to extract specific benefits from the kind of stability that we term *perturbation-resilience.* Superiorization uses perturbations proactively to reach feasible points that are superior, according to some criterion, to the ones to which we would get without employing perturbations. In this work, we set forth the fundamental principle of the superiorization methodology, give some mathematical formulations, theorems and results, and show potential benefits in the field of image reconstruction from projections.