G.T. Herman, Superiorization for image analysis, in: *Combinatorial Image Analysis*, Lecture Notes in Computer Science Vol. 8466, Springer, **2014**, pp. 1-7. DOI:10.1007/978-3-319-07148-0_1.

Abstract

Many scientific, engineering and medical applications of image analysis use constrained optimization, with the constraints arising from the desire to produce a solution that is constraints-compatible. It is typically the case that a large number of solutions would be considered good enough from the point of view of being constraints-compatible. In such a case, an optimization criterion is introduced that helps us to distinguish the “better” constraints-compatible solutions. The superiorization methodology is a recently-developed heuristic approach to constrained optimization. The underlying idea is that in many applications there exist computationally-efficient iterative algorithms that produce solutions that are constraints-compatible. Often the algorithm is perturbation resilient in the sense that, even if certain kinds of changes are made at the end of each iterative step, the algorithm still produces a constraints-compatible solution. This property is exploited in superiorization by using such perturbations to steer the algorithm to a solution that is not only constraints-compatible, but is also desirable according to a specified optimization criterion. The approach is very general, it is applicable to many iterative procedures and optimization criteria. Most importantly, superiorization is a totally automatic procedure that turns an iterative algorithm into its superiorized version. This, and its practical consequences in various application areas, have been investigated for a variety of constrained optimization tasks.