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From perspective maps to epigraphical projections

The projection onto the epigraph or a level set of a closed, proper, convex function can be done by finding a root of a scalar function that involves the proximal operator as a function of the proximal parameter. To study the variational-analytic properties of this function, we consider general optimization problems that are (partial) infimal projections of the function in question and the perspective map of a kernel. When the latter is the Euclidean norm squared, we recover the proximal map as the solution map, and extract properties such as local Lipschitz continuity, directional differentiability, and semismoothness under suitable assumptions. Based on this, we establish an SC1 optimization framework for computing epigraphical and level set projections, which is competitive with methods tailored specifically to certain instances such as the projection onto the l_1 -unit ball.

This is joint work with Michael P. Friedlander (UBC) and Ariel Goodwin (McGill).