MATH130165h: Homework 08

Due Jun 9, 2024

Problem 1. [20 pt] Given an constraint optimization problem,

$$\min_{x\in\Omega} f(x),$$

where $f(x)$ is a convex function and the feasible set Ω is also convex. Show that all local solutions are also global solutions. In addition, the set of global solutions is convex.

Problem 2. [15 pt] Let $v : \mathbb{R}^n \to \mathbb{R}^m$ be a smooth vector function and consider the unconstrained nonsmooth optimization problem,

$$\min_{x\in\mathbb{R}^n} \max_{i=1,2,\dots,m} |v_i(x)| .$$

Reformulate this problem as a smooth constrained optimization problem.

Problem 3. [20 pt] Implement the L-BFGS with a backtracking linesearch.

Problem 4. [15 pt] Apply your L-BFGS implementation to an objective function $f(x) = \frac{1}{2}x^\top Ax - x^\top b$ with SPD A. Try a few different number of columns and plot the convergence curves for various numbers of columns on the same figure.