

Numerical optimization for large scale problems

Constrained optimization

Assignment 2: projected gradient method

Consider the following problem:

$$\begin{array}{ll}\min_{x \in \mathbb{R}^n} & f(x) \\ \text{s.t.} & 0 \leq x_i \leq 5 \quad \forall i\end{array}$$

where

$$f(x) = \sum_{i=1}^n x_i^2 - \sum_{i=1}^{n-1} x_i x_{i+1}$$

Use your own implementation of the projected conjugate gradient method to solve the problem with $n = 10^4$ and $n = 10^6$, both using exact derivatives and using finite differences to approximate the gradient. Compare the behavior of the two implementations, using the following values for the increment h :

$$h = 10^{-k} \hat{x}, \quad k = 2, 4, 6, 8, 10, 12, 14$$

where \hat{x} is the point at which the derivatives have to be approximated. The comparison should be made, for example, in terms of number of iterations and computing time.

Write a report summarizing the results with tables and/or figures, commenting the results obtained.