

Assignment 5

1 Line search

Consider a quadratic objective function on \mathbf{R}^2

$$f(x) = \frac{1}{2}(x_1^2 + \gamma x_2^2),$$

where $\gamma > 0$. We would like to apply the gradient descent method with exact line search, starting at the point $\vec{x}^{(0)} = (\gamma, 1)$.

1. Derive the exact line search update.
2. Suppose $\gamma = 10$, what is the value of $\vec{x}^{(2)}$?

2 Constrained simple regression

Consider a simple constrained regression problem of matching a target vector. Let $y \in \mathbb{R}^d$ be a given vector, and C be a constant scalar.

$$\min_{w \in \mathbb{R}^d} \frac{1}{2} \sum_{i=1}^d (w_i - y_i)^2 \quad \text{subject to} \quad \sum_{i=1}^d w_i = C.$$

- (a) Write the Lagrangian $\mathcal{L}(w, \lambda)$.
- (b) Solve for the optimal w^* in closed form (in terms of y and d).