Methodology

This section describes the implementation methodology and experimental setup used in the optimization project.

Algorithm Implementation

Gradient Descent Algorithm

The core algorithm implements the following iterative procedure for unconstrained optimization:

Input: Initial point $x_0 \in \mathbb{R}^d$, step size $\alpha > 0$, tolerance $\epsilon > 0$, maximum iterations $N_{\max} \in \mathbb{N}$

Output: Approximate solution $x^* \approx \arg\min f(x)$

Algorithm 1: Gradient Descent

```
Initialize: k ← 0, x_0   ^d
While k < N_max do:
    Compute gradient:  f(x_k)
    Check convergence: if || f(x_k)||_2 <   then
        Return x_k as approximate solution
    Update: x_{k+1} ← x_k -   f(x_k)
    Increment: k ← k + 1
```