

AI311 – Nature Inspired Computing and Optimization

Practical 1: Lab Sheet

Title:

Implementation of Brute Force and Greedy Hill-Climbing Techniques for Function Minimization

Aim:

To implement and compare brute force and greedy hill-climbing algorithms for solving a basic mathematical optimization problem.

Problem Statement:

You are required to implement and compare two basic optimization techniques — Brute Force Search and Greedy Hill Climbing — for finding the minimum value of a given mathematical function within a specified range.

The objective function is:

$$f(x) = x^2 - 4x + 4$$

Perform the following tasks:

1. Brute Force Method:

- Evaluate $f(x)$ for each integer value of x in the range $[-10, 10]$.
- Identify the value of x for which $f(x)$ is minimum.

2. Greedy Hill Climbing:

- Start from a random integer $x_0 = -10$
- At each iteration, move to the neighboring value (either $x_0 - 1$ or $x_0 + 1$) if it improves the function value.
- Repeat until no improvement is found.

3. Visualization:

- Plot the function $f(x)$
- Highlight the search path taken by the greedy algorithm.
- Mark the global minimum found by the brute force method.

4. Does starting from different point having impact in the optimization problem?

Expected Output:

- Final optimized value of x and $f(x)$ using both methods.
- A graph showing the function and the search path.
- A short comparison paragraph between brute force and greedy outcomes.

Submission Requirements:

- Python source code (.py or .ipynb)
- Plot showing $f(x)$ and optimization steps
- A one-page report with:
 - Method explanation
 - Final values and observations
 - Challenges or limitations noticed