

Lab 1 Hill Climbing Report

Brute Force Search and Greedy Hill Climbing on $f(x) = x^2 - 4x + 4$

1. 1. Method Explanation

Brute Force

Created a numpy array and stored the $f(x)$ values at each $x \in [-10, 10]$. Found the minimum value of all the values and returned it as the result

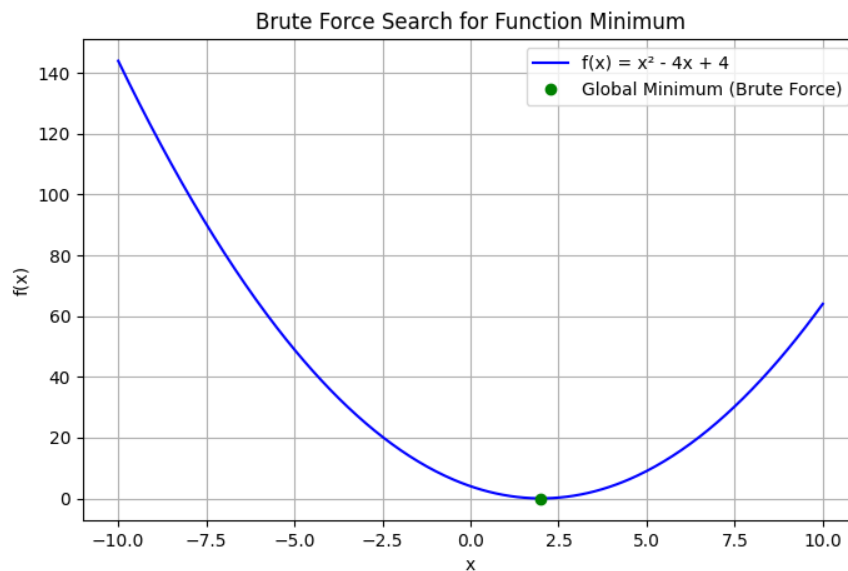


Figure 1: Brute Force Function Plot with Global Minimum

Greedy Hill Climbing

We start from a random point and calculate the $f(x)$ value at neighboring positions. The path follows the position which has the lesser value of $f(x)$ of the two. The algorithm terminates when the current position has lesser value than neighbouring positions.

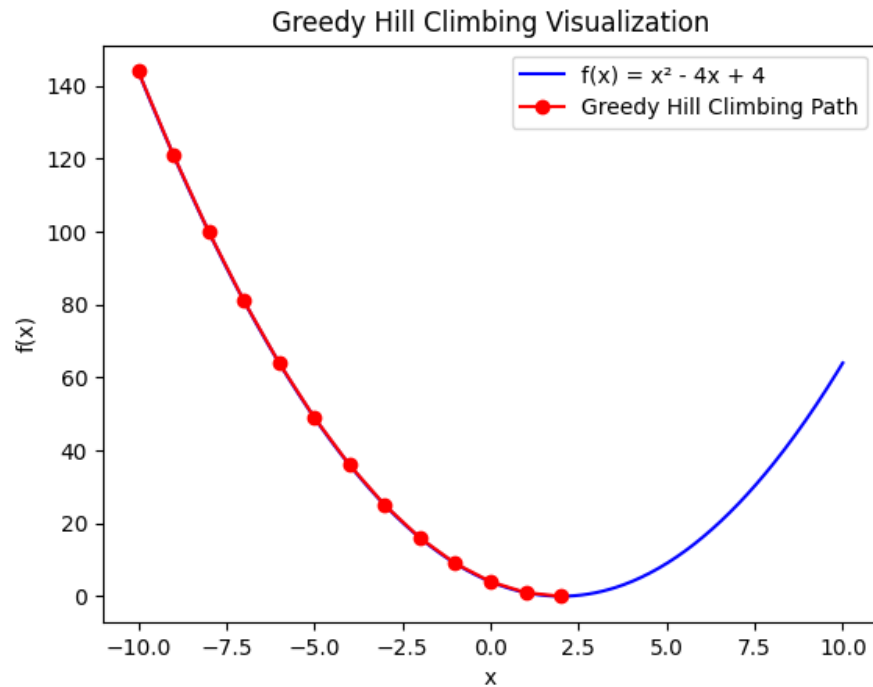


Figure 2: Greedy Hill Climbing Search Path

2. 2. Final Values and Observations

- **Brute Force Result:** $x = 2$, $f(x) = 0$
- **Greedy Hill Climbing Result:** $x = 2$, $f(x) = 0$

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

Not in this case, but in functions where there are multiple local minimas, the greedy algorithm might get stuck at a minima other than the global minima.

3. 3. Challenges or Limitations

In cases where in the given environment 1 might not know the exact function of the hill/(if the hill hasn't been surveyed/) the brute force method will not work. In hills where there are more than 1 local minima the greedy algorithm will never be 100% successful in finding the global minima.

Comparison Between Brute Force and Greedy Hill Climbing:

Brute force is faster than greedy algorithm. Brute force may be more accurate if the intervals are lessened(can use differentiation instead in other functions.)