"Evolutionary Computation"

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Homework 2

Evaluation on the function of ES(1+1) algorithm based on different values of optimal Ps (Probability of success) parameter compared by Hill-climbing algorithm with different values of sigma parameter:

As it can be figured out from the plots below, ES(1+1) has the best performance at optimal Ps values of 0.2 and 0.3, then, the performance gradually decreases at further values like 0.1 and 0.4, then, significantly, the performance drops at values above 0.4 (e.g. 0.5, 0.6, 0.7, 0.8, 0.9, and 1). By performance we mean how fast the algorithm reaches to the global minimum. As we can see below, at values of 0.1, 0.2, 0.3, and 0.4 the algorithm has approximately reached zero cost after 16000 steps as against greater values at which the algorithms haven't reached costs lower than 30000 due to their slow pace.

Also, the Hill-climbing algorithms seems too sensitive to the value of sigma as it shows entirely different behaviors for different sigma values. That is, it has a performance similar to optimal ES(1+1) at sigma values around 0.1 with even greater pace towards global minimum for thousands of first steps. But, at further sigma values (both lower and higher values

from 0.1) the performance of Hill-climbing decreases significantly as we see in the plots below.

To sum up, It seems that Hill-climbing algorithm, at high enough sigma values, moves toward the global minimum with higher speed for only few first steps but the performance suddenly drops due to the inability of adjustment the sigma value as against ES(1+1) algorithm.

ES(1+1) vs Hill-Climbing
c = 0.9, k = 10, Evals = 16000
Genes = 1000, repeat = 20, sigma = 0.1

ES(1+1) vs Hill-Climbing
c = 0.9, k = 10, Evals = 16000
Genes = 1000, repeat = 20, sigma = 0.4

ES(1+1) vs Hill-Climbing
c = 0.9, k = 10, Evals = 16000
Genes = 1000, repeat = 20, sigma = 0.7

Optimal_Ps = 0.1
Optimal_Ps = 0.2
Optimal_Ps = 0.3
Optimal_Ps = 0.4
Optimal_Ps = 0.5
Optimal_Ps = 0.6
Optimal_Ps = 0.7
Optimal_Ps = 0.8
Optimal_Ps = 0.9
Optimal_Ps = 1.0
Hill_Climbing(sigma = 0.7)

ES(1+1) vs Hill-Climbing
c = 0.9, k = 10, Evals = 16000
Genes = 1000, repeat = 20, sigma = 1

Optimal_Ps = 0.1
Optimal_Ps = 0.2
Optimal_Ps = 0.3
Optimal_Ps = 0.4
Optimal_Ps = 0.5
Optimal_Ps = 0.6
Optimal_Ps = 0.7
Optimal_Ps = 0.8
Optimal_Ps = 0.9
Optimal_Ps = 1.0
Hill_Climbing(sigma = 1)