Differential Evolution

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Abstract

Trying to compute the maximum value of $\sin x1 + \cos x2$ using Differential Evolution

1 Introduction

Differential Evolution is an optimization technique through which the best possible values of decision variables are obtained under the given set of constraints and in accordance to a selected optimization objective function. DE is one of the best genetic type algorithms for solving problems with the real valued variables. Differential Evolution uses mutation as a search mechanism and selection to direct the search toward the prospective regions in the feasible region .

2 Steps used in Optimization

2.1 Define the bounds for decision variables

We have two decision variable $x1$ *and* x2 where $-\pi \leq$x1 , $x2 \leq \pi$.

2.2 Generate Initial Population

The initial population is generated randomly between the bounds of decision variables, in this case within -π and π, for the two decision variables. We have generated 10×2 matrix randomly and choose the first member or Individual 1 of the population as the target vector .

2.3 Noisy Random vector generation

In order to generate the noisy random vector, three individuals Individual 2, Individual 4 and Individual 6 from the population size are selected **randomly** while ignoring Individual 1 (since it is set as the target vector). The weighted difference between Individual 2 and Individual 4 is added to the third randomly chosen vector Individual 6 to generate the noisy random vector. The weighting factor F is chosen as 0.80 and weighted difference vector is obtained.

2.4 Trial vector generation

The noisy random vector does a crossover with the target vector to generate the trial vector . This is carried out as for each of the dimensions, generate random number and if random number $>$ CR, copy the value from the target vector, else copy the value from the noisy random vector into the trial vector. The crossover probability CR is chosen as 0.50 .

2.5 Final setting

The objective function of the trial vector is compared with that of the target vector and the vector with the highest value of the two becomes Individual 1 for the next generation. To evolve Individual 2 for the next generation, the second member of the population is set as target vector and the above process is repeated. This process is repeated till the new population set array is filled which completes one generation (assumed 10 here). Once the value of objective function becomes constant , the algorithm ends.