

Parametric Study to Enhance Genetic Algorithm's Performance when Using Transformation

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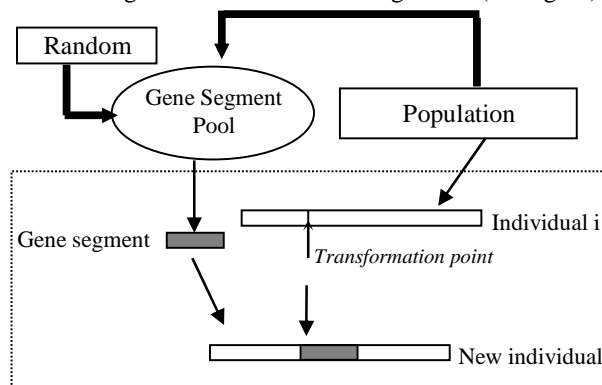
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Extended Abstract

Transformation is a biologically inspired genetic operator that, when incorporated in the standard Genetic Algorithm replacing crossover, can promote diversity in the population (Simões and Costa 2001). The computational mechanism mimics the biological process and consists in the capacity of the individuals to absorb fragments of DNA from the environment. These gene segments are then reintegrated in the individuals' genome (see figure).



We have done an extensive empirical study carried to determine the best parameter setting to use with transformation in order to enhance the GA's performance. These parameters include the gene segment length, the replacement rate (percentage of individuals of the previous population used to update the gene segment pool), and the mutation and transformation rates.

The tests were made in two domains: function optimization (minimization) and combinatorial optimization (maximization). The chosen functions were: Ackley, Griewangk, Rastrigin and Schwefel and the 0/1 Knapsack problem (0/1 KP) for combinatorial optimization.

The tables below show the results obtained with, and without, the best parameters settings, for the case of function optimization and for the 0/1 knapsack.

Parametric Study				Random Choice of Parameters			
Segment length=5 Replacement Rate=90% Transformation Rate= 70% Mutation Rate=0.0%				Segment length=random Replacement Rate=90% Transformation Rate= 70% Mutation Rate=0.1%			
<i>N° evals-></i>	50000	100000	200000	<i>N° evals-></i>	50000	100000	200000
Ackley	2.678	0.044	0.002	Ackley	3.128	0.300	0.002
Griewangk	0.001	0.000	0.000	Griewangk	0.010	0.003	0.001
Rastrigin	8.290	0.821	0.001	Rastrigin	38.401	18.828	6.540
Schwefel	0.147	0.031	0.008	Schwefel	36.212	0.475	0.077

Parametric Study				Random Choice of Parameters			
Segment length=5 Replacement Rate=50% Transf. Rate= 90% Mutation Rate=0.0%				Segment length=random Replacement Rate=90% Transf. Rate= 70% Mutation Rate=0.1%			
<i>Pop size-></i>	50	100		<i>Pop size-></i>	50	100	
50 items	204.60	204.90		50 items	197.30	197.80	
100 items	442.50	444.47		100 items	413.00	408.40	
250 items	955.20	954.60		250 items	838.50	834.87	
500 items	1926.87	1910.00		500 items	1666.20	1669.07	

As we can see, choosing the GA parameters with some criteria, the results obtained were quite better than the results achieved in our initial work.

Acknowledgments

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References

A. Simões, E. Costa (2001). *On Biologically Inspired Genetic Operators: Using Transformation in the Standard Genetic Algorithm*. Proceedings of the Genetic and Evolutionary Computation Conference (GECCO'2001), pp. 584-591, San Francisco, USA, 7-11 July, Morgan Kaufmann Publishers, 2001.