

## Complex dynamics in a collaborative evolutionary search model

CAMELIA CHIRA, ANCA GOG, DANIELA ZAHARIE AND DAN DUMITRESCU

### ABSTRACT.

The distributed collaborative evolutionary model analyzed in this paper is characterized by structuring the population using a fitness guided topology and by assigning the individuals to three societies characterized by different mating strategies. The membership of offsprings to societies is decided in a probabilistic manner using a dominance probability. The influence of this dominance probability on the dynamics of societies sizes is analyzed both empirically and theoretically. Consequently, values of the dominance probability leading to particular distributions of the population elements in societies are identified. Numerical experiments indicate a good performance of the proposed model.

### REFERENCES

- [1] Alba, E. and Tomassini, M., *Parallelism and Evolutionary Algorithms*. *IEEE Transactions on Evolutionary Computation*, 6(5), pp. 443-462, 2002
- [2] Bui, L. T., Shan, Y., Qi, F. and Abbass, H. A., *Comparing Two Versions of Differential Evolution in Real Parameter Optimization*, Technical Report, 4/2005, The Artificial Life and Adaptive Robotics Laboratory, University of New South Wales, TR-ALAR-200504009, 2005
- [3] Chira, C., Gog, A. and Dumitrescu, D., *Exploring Population Geometry and Multi-Agent Systems: A New Approach to Developing Evolutionary Techniques*, In Proceedings of GECCO 2008, pp. 1953-1960, 2008
- [4] Garcia-Martinez, C. and Lozano, M., *Hybrid Real-Coded Genetic Algorithms with Female and Male Differentiation*, Congress on Evolutionary Computation, 896-903, 2005
- [5] Golden, B.L. and Assad, A.A., *A decision-theoretic framework for comparing heuristics*, *European J. of Oper. Res.*, 18, 167-171, 1984
- [6] Posik, P., *Real Parameter Optimisation Using Mutation Step Co-evolution*, Congress on Evolutionary Computation, 2005
- [7] Qin, A. K. and Suganthan, P. N., *Self-adaptive differential evolution algorithm for numerical optimization*, Congress on Evolutionary Computation, 1785-1791, 2005
- [8] Suganthan, P. N., Hansen, N., Liang, J. J., Deb, K., Chen, Y.-P., Auger A. and Tiwari, S., *Problem Definitions and Evaluation Criteria for the CEC 2005 Special Session on Real-Parameter Optimization*, Technical Report, Nanyang Technological University, Singapore and KanGAL Report 2005005, IIT Kanpur, India, 2005
- [9] Tang, K., Yao, X., Suganthan, P.N., MacNish, C., Chen, Y.P., Chen, C.M. and Yang, Z., *Benchmark Functions for the CEC'2008 Special Session and Competition on Large Scale Global Optimization*, Technical Report, Nature Inspired Computation and Applications Laboratory, USTC, 2007
- [10] Wooldrige, M., *An Introduction to Multiagent Systems*, Wiley & Sons, 2002
- [11] Yuan, B. and Gallagher, M., *Experimental results for the special session on real-parameter optimization at CEC 2005: a simple, continuous EDA*, pp. 1792-1799, 2005

BABES-BOLYAI UNIVERSITY  
DEPARTMENT OF COMPUTER SCIENCE  
KOGALNICEANU 1  
400084 CLUJ-NAPOCA, ROMANIA  
E-mail address: cchira@cs.ubbcluj.ro  
E-mail address: anca@cs.ubbcluj.ro  
E-mail address: ddumitr@cs.ubbcluj.ro

WEST UNIVERSITY TIMIȘOARA  
300223 TIMIȘOARA, ROMANIA  
E-mail address: dzaharie@info.uvt.ro

Received: 02.11.2008; In revised form: 05.05.2009; Accepted: 11.05.2009.

2000 *Mathematics Subject Classification*. 68T20, 68Q25.

Key words and phrases. *Collaborative evolutionary algorithms, population topology, asynchronous search.*