Abstract

Structured-population Genetic Algorithm (GA) usually leads to more superior performance than the panmictic genetic algorithm; since it can control two opposite processes, namely exploration and exploitation in the search space. Several spatially structured-population GAs have been introduced in the literature such as cellular, patchwork, island-model, terrain-based, graph-based, religion-based and social-based GA. All the aforementioned works did not construct the sub-populations based on the genes information of the individuals themselves. The structuring of sub-populations based on this information might help in attaining better performance and more efficient search strategy. In this paper, the structured population is represented as hierarchical hypercube of sub-populations that are dynamically constructed and adapted at search time. Each sub-population represents a sub-division of the real genes space. This structure could help in directing the search towards the promising sub-spaces. Finally, a comparative study with other known structured population GA is provided.

References

- Whitley, D. "Cellular genetic algorithms". In Proceedings of the Fifth
A Structured-Population Genetic-Algorithm based on Hierarchical Hypercube of Genes Expressions

- René Thomsen, Peter Rickers, Thiemo Krink, "A Religion-Based Spatial Model for Evolutionary Algorithms." proceedings of the 6th International Conference on Parallel Problem Solving from Nature (PPSN VI)
- J. C. Costa, R. Tavares, and A. Rosa. An experimental study on dynamic random
  variation of population size. In IEEE International Conference on Systems, Man, and
- A. Piszcz and T. Soule. Genetic programming: Optimal population sizes for varying
  complexity problems. In Generic and Evolutionary Computation Conference, pages 953–954,
  2006.
- V. K. Koumousis and C. P. Katsaras. A saw-tooth genetic algorithm combining the
  effects of variable population size and reinitialization to enhance performance. IEEE
- G. R. Harik and F. G. Lobo. A parameter-less genetic algorithm. In Genetic and
- B. Thomas, A. Eiben, and V. der Vaart. An empirical study on GAs without
- Espinoza, F. , Minsker, B. S. and Goldberg, D. A Self-Adaptive Hybrid Genetic
  Algorithm. Proceedings of the Genetic and Evolutionary Computation Conference, San
- Krink, T. and Ursem, R. K. Parameter Control Using the Agent Based Patchwork
- H. Homayounfar, S. Areibi, F. Wang, &quot;An Advanced Island Based GA For
  Optimization Problems&quot;, DCDIS Conference Guelph, Ontario, Canada, pp: 46-51, May
  2003.
- Shisanu Tongchim, Prabhas Chongstitvatana: Parallel genetic algorithm with parameter
  competing subpopulations. PPSN 3, pages 199-208.
- Cantu-Paz, E., Designing efficient and accurate parallel genetic algorithms, PhD
  thesis, Graduate College of the University of Illinois at Urbana Champaign 1999.
- Malott B. , Averill R. C. , Goodman E. D. , Ding Y. , Punch W. F. , Use of Genetic
  Algorithms for optimal design of laminated composite sandwich panels with bending-twisting
  coupling, presented at AIAA SDM (Structures, Dynamics and Materials), Apr 96, 1996
- Eby D. , Averill R. , Goodman E. , and Punch W. , The Optimization of Flywheels Using
  an Injection Island Genetic Algorithm, in Bentley, P. (ed.), Evolutionary Design by Computers,
- Z. Skolicki and K. D. Jong. Improving evolutionary algorithms with multi-representation
  island models. In Parallel Problem Solving from Nature – PPSN VIII 8th International
- D. Whitley, S. Rana, and R. B. Heckendorn. Island model genetic algorithms and
  linearly separable problems. In Selected Papers from AISB Workshop on Evolutionary
A Structured-Population Genetic-Algorithm based on Hierarchical Hypercube of Genes Expressions


Index Terms

Computer Science

Artificial Intelligence

Keywords
A Structured-Population Genetic-Algorithm based on Hierarchical Hypercube of Genes Expressions

Evolutionary Algorithms  Genetic Algorithms  Structured Population  Gene Expression