

Bacterial Memetic Algorithms. Introduction and Applications.

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Evolutionary algorithms play a significant role as search techniques for handling complex problems in many fields such as artificial intelligence and engineering.

The advantage of evolutionary algorithms is their ability to solve and quasi-optimize problems with non-linear, high-dimensional, multi-modal, and discontinuous character. These algorithms have the ability to explore large spaces, without demanding the use of derivatives of the objective functions, such as by gradient-based training methods. Their principles are based on the search for a population of solutions, where tuning is done using mechanisms similar to biological recombination.

Over the last decade, there has been increasingly interest in applying bacterial evolutionary algorithms [1] for solving optimization problems. The bacterial evolutionary algorithm incorporates two operators based on microbial evolution phenomenon. The bacterial mutation optimizes the bacteria individually, whilst the gene transfer allows the bacteria to directly transfer information to other bacteria in the population.

Evolutionary techniques explore the whole objective function, because of their characteristic, so they find the global optimum, but they approach to it slowly. Memetic algorithms [2] combine an evolutionary algorithm with a local search procedure in order to speed up the evolutionary process making it more efficient and find a better, more accurate solution. In this presentation these ideas are combined and the bacterial memetic algorithm [3] is introduced. This technique applies the bacterial approach incorporating a local search procedure.

The bacterial memetic algorithm can be applied for the optimization of fuzzy rule bases. In this task the most effective local search methods are based on gradient calculation. One of the bests gradient-based technique, the Levenberg-Marquardt algorithm is suggested as local search procedure within the bacterial memetic algorithm. Another application of the bacterial memetic algorithm is the approximate solution of the Traveling Salesman Problem and its modified version in which the requirements and features of practical application in road transportation and supply chains are taken into consideration [4].

References

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Short bio: János Botzheim’s degrees earned: Budapest University of Technology and Economics: M.Sc. in Technical Informatics (2001), Ph.D. (2008). Visiting positions: long-term and short-term visits and scholarships as Ph.D. student at the following Universities: Czech Technical University, Prague, Czech Republic (2002, 1 month); Johannes Kepler University, Linz, Austria (4 months in 2003, 2 months in 2004, 4 months in 2005); Cracow University of Technology, Cracow, Poland (2003, 1 month); The Australian National University, Department of Computer Science, Canberra, Australia (8 months, 2005-2006). Research interests: computational intelligence, automatic identification of fuzzy rule based models and some neural networks models, bacterial evolutionary algorithm, memetic algorithms. Membership in scientific societies: John von Neumann Computer Society, Hungarian Fuzzy Association.