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Cooperative intelligent search using adaptive memory techniques.

Voss, Stefan (ed.) et al., Meta-heuristics. Advances and trends in local search paradigms for optimization. 2nd Meta-Heuristics international conference (MIC-97), Sophia-Antipolis, France, July 21-24, 1997. Dordrecht: Kluwer Academic Publishers. 297-312 (1999).

Summary: Ant colony methods have recently attracted attention for their application to several types of optimization problems, especially those with a “graph related formulation”. Like other heuristics the ant system was also inspired by the adaptation of biological processes. However, first results have not been very promising for further research on that specific branch of a much broader field of science, that we will draw attention to in this paper, the intelligent agent systems. Besides the experience with ant systems intelligent agent systems may provide a useful paradigm for search processes designed to solve complex problems. These systems are particularly relevant for parallel processing applications and also offer useful strategies for sequential heuristic search. Respective methods can be interpreted as a set of specific formulas (to monitor “ant traces”) that embody components of strategic principles being fundamental to Adaptive Memory Programming (AMP) processes, as notably represented by tabu search. From a conceptual view we show that the more general framework of intelligent agents, which does not restrict its operation to the limited perspectives embodied in ant colony methods, may provide improved efficiency. Specifically, we examine the use of agents that are more heterogeneous characterized by mechanisms of communication between the agents which are more variable and dynamic. Furthermore, these intelligent agents make fully use of adaptive memory ideas from AMP. The conceptual idea of our AMP system model is exemplified on a classical combinatorial optimization problem, the traveling salesman problem.

Keywords: intelligent agent systems; search; combinatorial optimization; traveling salesman problem