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Analysis the performances of the multi objective ant colony optimization algorithms

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This contribution is to review the recent multi-objective ant colony optimization algorithms (MOACO) and compare their performance on more than one objective. In addition, a detailed analysis is performed by comparing their performance on several multi-objective instances of the traveling salesman problem (TSP). Seven recent multi objective ant colony optimization algorithms have been proposed for this study by introducing the taxonomy of these MOACO algorithms. The traveling salesman problem has been selected and two, three and four objectives were considered for this study. Hence, six multi-objective TSP instances have been considered: kroab50, kroac50, kroabc50, kroabcd50, kroab100 and kroabc100. The results obtained by each algorithm for six multi-objective TSP instances demonstrated that, ACOMOFS, CPACO, $mACO_4$, MACS and PSACO algorithms are faster than AMPACOA and MCAA algorithms as their completion times are minimal. For bi-objective TSP instances MACS algorithm returns good distribution over the pareto front while other algorithms return solutions in the central part when representing solutions visually. Two different indicators were considered to evaluate the performances of MOACO algorithms; compare solutions with the approximation to the true pareto front and Coverage Performance Indicator. For all TSP instances except Kroab50 instance, MACS algorithm has obtained more than 70% of solutions which are in the pseudo-optimal pareto front while ACOMOFS, CPACO, PSACO and MCAA algorithms obtained less than 30% of solutions. Hence, MACS algorithm is better than all the other algorithms as it obtained solutions close to 100% in all the objectives. In addition, all the MOACO algorithms obtained better performances for three and four objectives as their C indicator value is close to zero. Moreover, ACOMOFS, CPACO, PSACO and MCAA algorithms are competitive with each other in all the objectives. Nevertheless, when considering the central part of the pareto front, ACOMOFS algorithm performs better than the other algorithms. On the other hand, the MACS algorithm performs better than other MOACO algorithms when the whole pareto optimal front is considered.

Keywords: Ant colony optimization, multi objective problem, non-dominated solutions, pareto optimal front, travelling salesman problem

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