Optimization and Evolutionary Search: Related Issues

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Evolutionary algorithms (EA) have been long accepted as efficient global optimizers. Given a search space S and an objective function g defined on it, the problem is to find the global maximum (or minimum) of g in S. To apply EA's heuristic search, the coding function or representation ρ is created, that partially maps S to the finite chromosome space C. The genetic operators are used to create new solutions such that $C^n \rightarrow C^m$.
However, as the evolutionary search progresses, it is important to avoid reaching a state where the genetic operators can no longer produce superior offspring, prematurely. This is likely to occur when the search space reaches a homogeneous or near-homogeneous configuration converging to a local optimal solution. Maintaining a certain degree of population diversity is widely believed to help curb this problem. This paper discusses the problem of premature convergence related to EA based optimization. A novel technique is presented, that uses informed genetic operations to reach promising, but un/under-explored areas of the search space, while discouraging local convergence, to curb premature convergence. Elitism is used at a different level aiming at convergence. The proposed technique's improved performance in terms solution precision and convergence characteristics is observed on a number of benchmark test functions with a genetic algorithm (GA) implementation.