Computational Intelligence Overview and Example for Complex Optimizations

Nature inspired algorithms – especially population based such as swarms and colonies – are metaphors able to deal fairly well with complex optimization problems. Moreover, they tackle nicely large dimensional search spaces of highly non-monotonic nature; hence, they are normally good to search parameters in problems of high cardinality at relative low computational cost.

In 2008, Bastos Filho and Lima Neto proposed a new metaheuristic in the fast growing family of swarm intelligence techniques, namely, Fish School Search (FSS) [1]. In FSS, the school collectively "swims"(searches) for "food"(candidate solutions) in the "aquarium"(search space). Similarly to PSO (Particle Swarm Optimization) or GA (Genetic Algorithms), the search guidance in FSS is driven by the merit of individual members of the population and the weight of each fish acts as a factual-memory of its individual success. In contrast with PSO, the weight can obviate the need to keep a log of best positions visited as well as any other topological information. As opposed to GA, the actual location of each fish directly substitutes the need of a chromosome. As for the social reasoning, the barycenter of the whole school can guide expansion and contraction of the school, automatically evoking exploration and exploitation when necessary [2]. In other words, the quality of the search can be inferred from regions where larger ensembles of fish are located (and vice-versa).

In the talk, after a brief review on the rationale of Computational Intelligence and motivations, an overview on FSS will be given. This, focusing on main aspects, operators and applications. Our main goal is to make it clear why FSS (as well as other CI techniques) maybe good alternatives for hard optimization tasks. Moreover explain why FSS affords computational features such as: (i) self-adaptable individual guidance towards sought solutions, (ii) on-the-'swim' collective selection between exploration and exploitation, and (iii) non-monotonic and high-dimensional search abilities (that can solve multi-modal optimization problems) [3].