Thoughts about PSO

1. The social vs cognitive behaviour follow the analogy personal vs collective interests, the collective interest being presented by a leader (global best). That is simple and efficient model where the balance between the two separates exploratory from exploitation phase. What if there is more than one leader, on the top of the global leader there are local leaders (authorities). A particle will follow cognitive, global social AND local social trends. The local social factor could be defined on a topology and/or proximity criteria. Topology one being just the best among the n closest particles. The proximity one – the best within some sphere of influence (as distance). The big picture would be as we conduct for multi-objective search and on later stage decide to go for single objective. The social analogue would be the way national values are composed from the values of deferent sub-cultures and local interests.
2. The simulation of sexes: create two sub-swarms male and female. First – aggressive (less social) and exploratory and second - more social and with optimized behaviour for local search. Particles could change gender (within some limits) depending of the stage (overall pattern of behaviour) and the social satisfaction from the goals achieved (some function to calculate this). In any case each particle follows the swarm as it is sex-less (democracy), but reacts according its gender (phycology). It is possible (hypothetically) to distinguish how the sexes follow each other, for example: in exploratory phase females follow males and trying to position themselves close to males, but not too close to other females and better performing males attract more – reproduction instinct. From the other hand – after some primary objectives are reached, males become more tamed and the roles of following are reversed. This selective following feature seems to be computation consuming, so its implementation would be more investigatory issue and less improving the optimization efficiency issue.
3. Another segregation approach (apart from sexism) would be elite vs general population (let’s call it crowd). The elite particles are in smaller numbers, seeing the big picture and taking bigger risks exploring. The crowd is generally more short-sighted (seeing local best but less or not at all the global best), more conservative in taking decisions and looking up to (being influenced by) the elite. While an elite particle pays attention mostly to itself, less to other elite particles and the least to the crowd particles. Here again as in gender case, the particles can mutated into alternative type depending of the stage and/or according some conditions.

**Multi-sub-swarm particle swarm optimization algorithm for multimodal function optimization**

This paper presents a novel multi-sub-swarm particle swarm optimization (PSO) algorithm. The proposed algorithm can effectively imitate a natural ecosystem, in which the different sub-populations can compete with each other. After competing, the winner will continue to explore the original district, while the loser will be obliged to explore another district. Four benchmark multimodal functions of varying difficulty are used as test functions. The experimental results show that the proposed method has a stronger adaptive ability and a better performance for complicated multimodal functions with respect to other methods.

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