The swarm intelligence based (SIB) method and its application in statistics

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Abstract

Natural heuristic methods, like the particle swarm optimization and many others, enjoy fast convergence towards optimal solution via a series of inter-particle communication. Such methods are common for the optimization problem in engineering, but few in statistics problem. It is especially difficult to implement in some fields of statistics as the search spaces are mostly discrete, while most natural heuristic methods require continuous search domains. This talk introduces a new method called the Swarm Intelligence Based (SIB) method for optimization in statistics problems, featuring the searches within discrete space. Such fields include experimental designs, community detection, change-point analysis, variable selection, etc. The SIB method is a natural heuristic method that includes the MIX and MOVE operations, which combines target units and selects the best units respectively. This method is advantageous over the traditional particle swarm optimization and many other heuristic approaches in the sense that it is ready for the search of both continuous and discrete domains, and its global best particle is guaranteed to monotonically move towards the optimum. The SIB method is demonstrated in several examples.