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Swarm_Intelligence (SI)-State-of-Art (SI-SA) Part 1[#]: Tutorial on Firefly algorithm

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(Dedicated with reverence to Prof G Kateman, core Chemometrician, University of Nijmegan, Netherlands, on his eightieth-birth anniversary)

ABSTRACT

In fireflies of Lampyridae family, bioluminescence with glowing and flashing abdomens is a communication signal for courtship. The photo-chemical processes in these natural fireflies are also to find and absorb preys and protect themselves from predators. Yang et al. put forward (artificial) firefly algorithm, another member of metaheuristic bandwagon. The attractiveness between fireflies is based on light intensity which in turn depends upon the floating point values of object function. The less bright-fireflies flock around and forms a neighbourhood around brighter ones. The algorithm operating in iterative improvement of solutions enables locating simultaneous multiple local and global extrema (minima/maxima) of non-linear non-convex multi-modal mixed-variable and constrained functions with breaks and singularity in the search space. The impetus for movement of fireflies lies in attraction component locating minima and random factor to drive away from trapping in local optima. Firefly algorithm behaves like a scaled random method or part of PSO (particle swarm optimisation) depending upon setting of free parameters. The applications spread their wings into chemistry, medicine, chemical technology, clustering, engineering etc. The loading pattern of fuel assemblies in PWR (pressurised water reactor in atomic energy), phase equilibria, separation of DNA/RNA, medical images in cancer research, truss structures, electrical power generation/distribution are a few of typical conflicting multi-objective hard tasks solved with firefly algorithm. The modifications widening functional capabilities of firefly algorithm include replacing random component by chaotic maps and hybridisation with genetic algorithm (GA), differential evolution (Diff.Evol), mimetic approach, eagle, simulating annealing, ant colony, learning automata and NNs.

Keywords: Glow-worm, Lévy flights, Multi-object-functions, E-man, Nature mimicking, Chemical engineering, cancer diagnosis.