DIFFERENTIAL EVOLUTION WITH ENSEMBLES AND TOPOLOGIES

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Differential Evolution (DE) is one of the most powerful stochastic real-parameter optimization algorithms of current interest. DE operates through similar computational steps as employed by a standard Evolutionary Algorithm (EA). However, unlike traditional EAs, the DE-variants perturb the current-generation population members with the scaled differences of distinct population members, also known as the self-referential mutation. Therefore, no separate probability distribution has to be used for generating the offspring. Since its inception in 1995, DE has drawn the attention of many researchers all over the world resulting in a lot of variants of the basic algorithm with improved performance. This tutorial will begin with a brief overview of the basic concepts related to DE, its algorithmic components and control parameters. It will subsequently discuss some of the significant algorithmic variants of DE for bound constrained single-objective optimization. Recent modifications of the DE family of algorithms for multi-objective, constrained, large-scale, niching and dynamic optimization problems will also be included. The talk will discuss the effects of incorporating ensemble learning in DE – a novel concept that can be applied to swarm and evolutionary algorithms to solve various kinds of optimization problems. The talk will also discuss neighborhood topologies based DE to improve the performance of DE on multi-modal landscapes. The talk will finally highlight a few problems that pose challenge to the state-of-the-art DE algorithms and demand strong research effort from the DE-community in the future.