Crossover-first differential evolution for improved global optimization in non-uniform search landscapes

Abstract

The differential evolution (DE) algorithm is currently one of the most widely used evolutionary-based optimizers for global optimization due to its simplicity, robustness and efficiency. The DE algorithm generates new candidate solutions by first conducting the mutation operation which is then followed by the crossover operation. This order of genetic operation contrasts with other evolutionary algorithms where crossover typically precedes mutation. In this study, we investigate the effects of conducting crossover first and then followed by mutation in DE which we named as crossover-first differential evolution (XDE). In order to test this simple and straightforward modification to the DE algorithm, we compared its performance against the original DE algorithm using the CEC2005 global optimization's set of 25 continuous optimization test problems. The statistical results indicate that the average performance of XDE is better than the original DE and three other well-known global optimizers. This straightforward reversal in the order of the genetic operations in DE can indeed improve its performance, in particular when attempting to solve complex search spaces with highly non-uniform landscapes.