"Seventeenth Learning and Intelligent Optimization Conference", (LION17 2023), June 4-8, 2023, Nice, France

Abstract

Fast and robust constrained optimization via evolutionary and quadratic programming

Konstantinos I. Chatzilygeroudis and Michael N. Vrahatis

Many efficient and effective approaches have been proposed in the evolutionary computation litera-ture for solving constrained optimization problems. Most of the approaches assume that both the objective function and the constraints are black-box functions, while a few of them can take advan-tage of the gradient information. On the other hand, when the gradient information is available, the most versatile approaches are arguably the ones coming from the numerical optimization lite-rature. Perhaps the most popular methods in this field are sequential quadratic programming and interior point. Despite their success, those methods require accurate gradients and usually require a well-shaped initialization to work as expected. In the paper at hand, a novel hybrid method, named UPSO-QP, is presented that is based on particle swarm optimization and borrows ideas from the numerical optimization literature and sequential quadratic programming approaches. The proposed method is evaluated on numerous constrained optimization tasks from simple low dimen-sional problems to high dimensional realistic trajectory optimization scenarios, and showcase that is able to outperform other evolutionary algorithms both in terms of convergence speed as well as performance, while also being robust to noisy gradients and bad initialization.