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High-dimensional sampling algorithms comparison for particle and astrophysics applications

High energy physics analyses often encounter optimization problems in high-dimensional parameter space, and finding an optimal algorithm represents an important initial step in each analysis, where typically an optimum of a very complicated function needs to be found. We performed an optimization algorithm comparison using a number of test functions, for increasing dimensionality, and compared them to a random sampling algorithm. Additionally we made a performance comparison for a realistic high dimensional example, derived from a recent global fit of weak-scale Supersymmetry. We find that for different test functions different algorithms show to be optimal, and we present comparison of performance for random sampling, Differential Evolution, Particle Swarm Optimization, the Covariance Matrix Adaptation Evolution Strategy, Bayesian Optimization, Grey Wolf Optimization, and the PyGMO Artificial Bee Colony, Gaussian Particle Filter and Adaptive Memory Programming for Global Optimization algorithms in [1].

[1] https://arxiv.org/abs/2101.04525

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