

Table 1: Performance Results for Sphere $\setminus_2DP$ Problem

Optimizer	Mean Final Value	Std Dev	Best Value	Worst Value	Mean Func Evals	Success Rate (%)	Mean Time (s)
<b>QQN-Backtracking</b>	0.00	0.00	0.00	0.00	12.0	100.0	0.000
QQN-Bisection-2	0.00	0.00	0.00	0.00	14.0	100.0	0.000
QQN-MoreThuente	0.00	0.00	0.00	0.00	13.0	100.0	0.000
L-BFGS	0.00	0.00	0.00	0.00	13.8	100.0	0.000
QQN-CubicQuadraticInterpolation	0.00	0.00	0.00	0.00	13.0	100.0	0.000
QQN-StrongWolfe	0.00	0.00	0.00	0.00	12.0	100.0	0.000
QQN-Bisection-1	0.00	0.00	0.00	0.00	16.0	100.0	0.000
L-BFGS-Aggressive	0.00	0.00	0.00	0.00	12.6	100.0	0.000
QQN-GoldenSection	$3.23 \times 10^{-14}$	$4.77 \times 10^{-15}$	$2.19 \times 10^{-14}$	$4.31 \times 10^{-14}$	47.0	100.0	0.000
GD-WeightDecay	$3.71 \times 10^{-10}$	$1.67 \times 10^{-11}$	$3.44 \times 10^{-10}$	$3.94 \times 10^{-10}$	159.8	100.0	0.005
L-BFGS-Conservative	$7.02 \times 10^{-8}$	$1.36 \times 10^{-7}$	$2.43 \times 10^{-13}$	$5.13 \times 10^{-7}$	549.9	5.0	0.016
GD	$3.01 \times 10^{-6}$	$4.49 \times 10^{-7}$	$2.25 \times 10^{-6}$	$3.94 \times 10^{-6}$	335.0	0.0	0.008
GD-Nesterov	$9.81 \times 10^{-2}$	$1.35 \times 10^{-2}$	$6.31 \times 10^{-2}$	$1.29 \times 10^{-1}$	23.0	0.0	0.001
Adam-Fast	$1.26 \times 10^{-1}$	$5.83 \times 10^{-3}$	$1.10 \times 10^{-1}$	$1.35 \times 10^{-1}$	36.9	0.0	0.001
GD-Momentum	$1.49 \times 10^{-1}$	$2.33 \times 10^{-2}$	$1.18 \times 10^{-1}$	$2.01 \times 10^{-1}$	23.0	0.0	0.001
Adam-WeightDecay	$2.65 \times 10^{-1}$	$7.43 \times 10^{-2}$	$1.37 \times 10^{-1}$	$3.79 \times 10^{-1}$	502.0	0.0	0.011
Adam	1.15	$2.26 \times 10^{-1}$	$7.23 \times 10^{-1}$	1.55	502.0	0.0	0.010
Adam-AMSGrad	1.16	$2.58 \times 10^{-1}$	$6.87 \times 10^{-1}$	1.62	502.0	0.0	0.012
Trust Region-Conservative	3.67	5.21	$2.71 \times 10^{-3}$	$1.80 \times 10^1$	581.6	0.0	0.004
Trust Region-Standard	$7.46 \times 10^2$	$1.21 \times 10^3$	$4.40 \times 10^2$	$6.03 \times 10^3$	28.6	0.0	0.000
Trust Region-Adaptive	$1.16 \times 10^3$	$2.65 \times 10^2$	$3.71 \times 10^{-1}$	$1.22 \times 10^3$	47.1	0.0	0.000