

Table 1: Performance Results for Trigonometric\_10D Problem

Optimizer	Mean Final Value	Std Dev	Best Value	Worst Value	Mean Func Evals	Success Rate (%)	Mean Time (s)
<b>QQN-CubicQuadraticInterpolation</b>	4.48e-7	2.76e-7	9.99e-9	9.71e-7	329.2	100.0	0.016
QQN-StrongWolfe	2.92e-7	2.02e-7	9.27e-9	7.23e-7	347.3	100.0	0.015
GD-WeightDecay	8.48e-3	2.56e-2	8.63e-7	1.07e-1	134.4	85.0	0.006
QQN-Bisection-1	7.53e-4	2.61e-3	2.91e-8	1.18e-2	858.0	85.0	0.027
QQN-GoldenSection	4.35e-4	1.06e-3	1.12e-7	3.88e-3	1834.2	80.0	0.040
QQN-Bisection-2	3.56e-7	2.58e-7	8.26e-8	9.59e-7	357.8	75.0	0.011
Adam-WeightDecay	4.25e-2	1.14e-1	8.69e-7	5.20e-1	803.8	70.0	0.022
L-BFGS-MoreThuente	1.34e-2	3.73e-2	4.78e-7	1.60e-1	1949.3	60.0	0.050
GD	4.39e-3	1.89e-2	9.77e-7	8.69e-2	958.0	55.0	0.034
Adam	9.70e-2	2.10e-1	9.68e-7	7.20e-1	2080.5	35.0	0.054
L-BFGS-Conservative	9.45e0	4.12e1	7.52e-7	1.89e2	3123.2	25.0	0.043
Adam-Robust	7.13e-2	1.09e-1	9.71e-7	5.20e-1	1825.9	10.0	0.057
Adam-AMSGrad	3.00e-2	3.66e-2	7.20e-6	8.75e-2	2502.0	0.0	0.074
L-BFGS-Limited	7.31e-3	1.99e-2	9.82e-6	8.19e-2	3943.6	0.0	0.058
Adam-Fast	6.24e-2	9.50e-2	2.65e-4	3.60e-1	102.7	0.0	0.003
GD-Momentum	1.17e0	1.48e0	2.40e-3	4.14e0	34.0	0.0	0.001
Trust Region-Conservative	1.22e0	1.60e0	3.82e-3	5.77e0	2651.3	0.0	0.029
Trust Region-Precise	1.07e-1	6.92e-2	2.28e-2	2.53e-1	455.3	0.0	0.005
Trust Region-Adaptive	1.86e-1	1.19e-1	2.37e-2	4.38e-1	118.4	0.0	0.001
GD-AdaptiveMomentum	1.41e-1	7.60e-2	4.06e-2	3.86e-1	48.0	0.0	0.002
GD-Nesterov	1.85e-1	7.94e-2	7.60e-2	4.35e-1	45.1	0.0	0.002
Trust Region-Standard	6.02e-1	2.65e-1	1.37e-1	1.10e0	34.1	0.0	0.000
Trust Region-Aggressive	1.90e0	5.88e-1	9.79e-1	3.67e0	12.2	0.0	0.000
L-BFGS-Aggressive	1.00e1	4.32e0	2.42e0	1.75e1	3852.0	0.0	0.032
L-BFGS	4.76e1	6.11e1	8.87e0	2.11e2	77.5	0.0	0.001