

Table 1: Performance Results for Rastrigin 2D Problem

Optimizer	Mean Final Value	Std Dev	Best Value	Worst Value	Mean Func Evals	Success Rate (%)	Mean Time (s)
QQN-CubicQuadraticInterpolation	7.75e0	3.18e0	2.17e0	1.59e1	64.2	80.0	0.002
L-BFGS-Conservative	9.82e0	5.01e0	7.96e0	3.02e1	455.9	75.0	0.006
L-BFGS-Limited	9.13e0	2.25e0	5.86e0	1.29e1	106.5	70.0	0.001
QQN-StrongWolfe	8.32e0	4.20e0	1.36e0	1.69e1	71.4	65.0	0.002
QQN-Bisection-1	8.59e0	4.47e0	1.03e0	1.69e1	125.3	65.0	0.002
QQN-GoldenSection	8.19e0	5.01e0	1.29e-1	1.79e1	156.0	55.0	0.002
L-BFGS-MoreThuente	8.56e0	5.94e0	1.83e0	3.12e1	170.8	55.0	0.003
Adam-AMSGrad	1.02e1	2.48e0	7.96e0	1.29e1	770.2	55.0	0.018
Adam	1.02e1	2.48e0	7.96e0	1.29e1	780.5	55.0	0.016
Adam-WeightDecay	9.71e0	2.38e0	7.96e0	1.30e1	254.7	50.0	0.006
QQN-Bisection-2	8.57e0	4.87e0	2.07e0	1.69e1	23.8	30.0	0.000
Adam-Robust	9.22e0	2.16e0	7.96e0	1.30e1	111.5	15.0	0.003
Trust Region-Adaptive	9.68e0	3.46e0	7.96e0	2.21e1	241.0	15.0	0.002
Trust Region-Precise	9.71e0	2.37e0	7.96e0	1.29e1	915.9	10.0	0.006
GD	1.04e1	2.51e0	7.96e0	1.40e1	13.3	5.0	0.000
GD-Nesterov	1.00e1	2.35e0	7.96e0	1.37e1	20.1	5.0	0.001
GD-WeightDecay	1.01e1	2.27e0	7.96e0	1.34e1	24.3	5.0	0.001
L-BFGS	5.70e1	3.05e1	2.49e0	1.31e2	88.4	5.0	0.001
Trust Region-Standard	9.02e0	1.98e0	7.96e0	1.30e1	63.8	0.0	0.000
GD-AdaptiveMomentum	8.98e0	1.78e0	7.97e0	1.34e1	21.5	0.0	0.001
Trust Region-Aggressive	1.29e1	8.89e0	7.97e0	3.74e1	20.1	0.0	0.000
GD-Momentum	1.04e1	2.44e0	7.98e0	1.57e1	22.7	0.0	0.001
Adam-Fast	9.46e0	2.04e0	8.02e0	1.43e1	36.3	0.0	0.001
Trust Region-Conservative	1.85e1	4.65e0	9.36e0	2.65e1	3002.0	0.0	0.019
L-BFGS-Aggressive	2.81e1	4.88e0	1.91e1	3.73e1	3851.8	0.0	0.024