

Table 1: Performance Results for Rastrigin_5D Problem

Optimizer	Mean Final Value	Std Dev	Best Value	Worst Value	Mean Func Evals	Success Rate (%)	Mean Time (s)
L-BFGS-Aggressive	7.97e1	9.04e0	5.68e1	9.50e1	3852.0	0.0	0.029
Trust Region-Conservative	6.91e1	7.96e0	5.03e1	8.29e1	3002.0	0.0	0.020
Adam-AMSGrad	2.38e1	3.35e0	2.04e1	2.99e1	719.2	40.0	0.017
Trust Region-Precise	2.39e1	3.48e0	2.03e1	2.99e1	2558.8	35.0	0.017
Adam	2.42e1	3.17e0	2.03e1	2.99e1	745.3	30.0	0.016
L-BFGS-Conservative	2.34e1	3.92e0	1.99e1	3.61e1	881.9	40.0	0.009
Adam-WeightDecay	2.27e1	3.13e0	2.02e1	2.99e1	246.9	55.0	0.006
Trust Region-Adaptive	2.34e1	5.02e0	2.02e1	4.05e1	646.1	60.0	0.004
QQN-GoldenSection	2.31e1	9.30e0	7.97e0	4.97e1	266.0	35.0	0.004
QQN-Bisection-1	2.48e1	4.08e0	1.80e1	3.38e1	186.6	25.0	0.004
QQN-CubicQuadraticInterpolation	2.30e1	8.41e0	4.91e0	4.28e1	106.2	50.0	0.003
L-BFGS-MoreThuente	2.77e1	2.23e1	7.71e0	9.40e1	165.1	50.0	0.003
QQN-StrongWolfe	2.36e1	5.65e0	1.16e1	4.08e1	100.2	40.0	0.003
Adam-Robust	2.24e1	3.09e0	1.99e1	2.99e1	103.5	55.0	0.003
GD-AdaptiveMomentum	2.14e1	2.74e0	1.83e1	2.99e1	52.4	65.0	0.002
L-BFGS-Limited	2.84e1	1.49e1	1.70e1	6.88e1	115.2	35.0	0.002
L-BFGS	1.02e2	2.33e1	5.89e1	1.42e2	98.2	0.0	0.001
GD-Nesterov	2.37e1	4.00e0	1.99e1	3.05e1	41.2	45.0	0.001
GD-WeightDecay	2.25e1	2.90e0	1.89e1	2.99e1	37.8	50.0	0.001
Trust Region-Standard	2.31e1	3.22e0	1.95e1	2.99e1	168.5	45.0	0.001
Adam-Fast	2.33e1	3.56e0	1.92e1	3.17e1	48.9	40.0	0.001
GD-Momentum	3.03e1	6.57e0	2.04e1	4.94e1	28.9	5.0	0.001
QQN-Bisection-2	3.08e1	1.62e1	1.10e1	6.07e1	36.6	15.0	0.001
GD	2.44e1	3.48e0	1.99e1	3.05e1	15.7	30.0	0.000
Trust Region-Aggressive	2.33e1	5.41e0	1.82e1	4.25e1	45.7	50.0	0.000