

Table 1: Performance Results for Levy\_2D Problem

Optimizer	Mean Final Value	Std Dev	Best Value	Worst Value	Mean Func Evals	Success Rate (%)	Mean Time (s)
<b>QQN-StrongWolfe</b>	2.98e-7	3.89e-7	1.89e-10	9.85e-7	79.0	100.0	0.003
QQN-CubicQuadraticInterpolation	8.29e-8	1.84e-7	5.12e-10	8.65e-7	87.6	100.0	0.003
QQN-Bisection-2	1.80e-7	2.24e-7	2.53e-9	8.17e-7	93.0	100.0	0.002
QQN-Bisection-1	1.15e-7	1.44e-7	2.81e-9	5.10e-7	102.2	100.0	0.002
QQN-GoldenSection	1.81e-7	2.48e-7	1.48e-10	8.51e-7	300.9	100.0	0.005
GD-WeightDecay	9.96e-7	1.94e-9	9.93e-7	1.00e-6	1453.5	100.0	0.046
Adam-WeightDecay	9.83e-7	7.75e-9	9.67e-7	9.98e-7	2229.0	100.0	0.048
L-BFGS-MoreThuente	5.43e-6	2.10e-5	7.84e-9	9.69e-5	286.5	95.0	0.006
L-BFGS-Limited	1.05e-6	8.37e-7	1.49e-7	4.54e-6	583.7	95.0	0.013
L-BFGS-Conservative	9.25e-7	1.12e-6	8.80e-8	5.33e-6	626.6	85.0	0.016
L-BFGS	7.38e-3	2.81e-2	1.57e-7	1.29e-1	285.0	80.0	0.007
L-BFGS-Aggressive	6.19e-4	9.61e-4	6.80e-8	2.64e-3	1303.1	70.0	0.017
GD	2.39e-4	2.63e-5	1.85e-4	2.75e-4	1668.0	0.0	0.042
Adam	5.69e-3	3.31e-3	1.60e-3	1.48e-2	2502.0	0.0	0.051
Trust Region-Standard	3.36e0	7.59e0	1.74e-3	2.47e1	18.2	0.0	0.000
Trust Region-Conservative	1.34e-2	2.06e-3	9.88e-3	1.65e-2	385.2	0.0	0.003
Adam-AMSGrad	2.61e-2	1.26e-2	1.24e-2	5.59e-2	2502.0	0.0	0.057
Adam-Robust	4.34e-2	2.28e-2	1.83e-2	9.34e-2	2502.0	0.0	0.058
Trust Region-Precise	6.16e-2	3.23e-2	3.16e-2	1.88e-1	70.6	0.0	0.001
Trust Region-Adaptive	1.01e1	2.44e1	6.77e-2	1.07e2	27.2	0.0	0.000
Adam-Fast	7.87e-2	4.29e-3	7.26e-2	8.98e-2	36.5	0.0	0.001
GD-Nesterov	1.31e-1	2.65e-2	9.69e-2	1.81e-1	22.4	0.0	0.001
GD-Momentum	1.57e-1	2.47e-2	1.15e-1	2.20e-1	22.5	0.0	0.001
GD-AdaptiveMomentum	3.36e-1	5.15e-2	2.35e-1	4.11e-1	16.4	0.0	0.001
Trust Region-Aggressive	1.31e0	2.09e-1	9.21e-1	1.57e0	5.0	0.0	0.000