

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-Bisection-1</b>	$4.94 \times 10^{-14}$	$1.30 \times 10^{-13}$	$2.89 \times 10^{-17}$	$5.92 \times 10^{-13}$	136.2	100.0	0.004
QQN-Bisection-2	$7.25 \times 10^{-14}$	$1.60 \times 10^{-13}$	$3.49 \times 10^{-17}$	$6.80 \times 10^{-13}$	120.0	100.0	0.003
QQN-StrongWolfe	$5.77 \times 10^{-13}$	$9.85 \times 10^{-13}$	$2.72 \times 10^{-19}$	$3.18 \times 10^{-12}$	117.9	100.0	0.004
QQN-Backtracking	$2.02 \times 10^{-12}$	$1.41 \times 10^{-12}$	$2.00 \times 10^{-19}$	$3.86 \times 10^{-12}$	218.9	100.0	0.009
QQN-GoldenSection	$1.28 \times 10^{-13}$	$4.84 \times 10^{-13}$	$5.48 \times 10^{-18}$	$3.04 \times 10^{-12}$	404.4	98.3	0.007
QQN-CubicQuadraticInterpolation	$1.04 \times 10^{-13}$	$3.93 \times 10^{-13}$	$1.99 \times 10^{-21}$	$2.49 \times 10^{-12}$	210.2	97.5	0.007
QQN-MoreThuente	$1.50 \times 10^{-13}$	$2.52 \times 10^{-13}$	$2.99 \times 10^{-19}$	$9.97 \times 10^{-13}$	226.4	85.0	0.006
L-BFGS-Aggressive	$2.30 \times 10^{-3}$	$7.65 \times 10^{-3}$	$1.56 \times 10^{-12}$	$4.09 \times 10^{-2}$	673.9	35.0	0.011
L-BFGS	$1.14 \times 10^{-6}$	$3.32 \times 10^{-6}$	$1.29 \times 10^{-12}$	$1.37 \times 10^{-5}$	533.6	25.0	0.013
L-BFGS-Conservative	$2.21 \times 10^{-6}$	$5.37 \times 10^{-6}$	$2.90 \times 10^{-10}$	$2.40 \times 10^{-5}$	559.7	0.0	0.014
GD-WeightDecay	$2.23 \times 10^{-3}$	$3.55 \times 10^{-4}$	$1.67 \times 10^{-3}$	$2.74 \times 10^{-3}$	335.0	0.0	0.011
Trust Region-Conservative	$1.33 \times 10^{-2}$	$2.20 \times 10^{-3}$	$1.05 \times 10^{-2}$	$1.76 \times 10^{-2}$	376.6	0.0	0.003
GD	$1.59 \times 10^{-2}$	$4.56 \times 10^{-3}$	$1.04 \times 10^{-2}$	$2.45 \times 10^{-2}$	335.0	0.0	0.008
Adam-Fast	$7.85 \times 10^{-2}$	$4.22 \times 10^{-3}$	$7.09 \times 10^{-2}$	$8.64 \times 10^{-2}$	36.5	0.0	0.001
GD-Nesterov	$1.18 \times 10^{-1}$	$1.80 \times 10^{-2}$	$8.87 \times 10^{-2}$	$1.65 \times 10^{-1}$	22.2	0.0	0.001
Adam-WeightDecay	$1.60 \times 10^{-1}$	$5.20 \times 10^{-2}$	$9.10 \times 10^{-2}$	$2.51 \times 10^{-1}$	502.0	0.0	0.011
GD-Momentum	$1.65 \times 10^{-1}$	$2.44 \times 10^{-2}$	$1.24 \times 10^{-1}$	$2.21 \times 10^{-1}$	22.4	0.0	0.001
Adam-AMSGrad	$7.60 \times 10^{-1}$	$1.78 \times 10^{-1}$	$5.08 \times 10^{-1}$	1.07	502.0	0.0	0.012
Adam	$7.87 \times 10^{-1}$	$1.82 \times 10^{-1}$	$5.09 \times 10^{-1}$	1.15	502.0	0.0	0.010
Trust Region-Standard	1.50	5.24	$8.01 \times 10^{-4}$	$2.43 \times 10^1$	16.8	0.0	0.000
Trust Region-Adaptive	$1.85 \times 10^1$	$3.93 \times 10^1$	$5.30 \times 10^{-2}$	$1.12 \times 10^2$	27.4	0.0	0.000