

Table 1: Performance Results for Griewank_2D Problem

| Optimizer | Mean Final Value | Std Dev | Best Value | Worst Value | Mean Func Evals | Success Rate (%) | Mean Time (s) |
|--|------------------|----------|------------|-------------|-----------------|------------------|---------------|
| QQN-CubicQuadraticInterpolation | 4.80e0 | 4.73e-1 | 2.74e0 | 4.91e0 | 77.3 | 0.0 | 0.002 |
| QQN-StrongWolfe | 4.74e0 | 3.50e-1 | 3.76e0 | 4.91e0 | 347.6 | 0.0 | 0.014 |
| QQN-Bisection-2 | 4.66e0 | 2.21e-1 | 4.25e0 | 4.91e0 | 94.6 | 0.0 | 0.002 |
| QQN-Bisection-1 | 4.91e0 | 1.27e-13 | 4.91e0 | 4.91e0 | 76.3 | 0.0 | 0.002 |
| QQN-GoldenSection | 4.91e0 | 1.03e-13 | 4.91e0 | 4.91e0 | 258.3 | 0.0 | 0.004 |
| L-BFGS-Aggressive | 4.91e0 | 7.72e-3 | 4.91e0 | 4.95e0 | 2427.6 | 0.0 | 0.056 |
| L-BFGS | 4.91e0 | 3.75e-8 | 4.91e0 | 4.91e0 | 295.6 | 0.0 | 0.006 |
| L-BFGS-MoreThuente | 4.91e0 | 1.88e-7 | 4.91e0 | 4.91e0 | 73.0 | 0.0 | 0.001 |
| L-BFGS-Limited | 4.91e0 | 4.49e-8 | 4.91e0 | 4.91e0 | 927.3 | 0.0 | 0.021 |
| L-BFGS-Conservative | 4.91e0 | 3.09e-9 | 4.91e0 | 4.91e0 | 504.6 | 0.0 | 0.012 |
| GD | 4.91e0 | 3.24e-8 | 4.91e0 | 4.91e0 | 1668.0 | 0.0 | 0.042 |
| GD-Nesterov | 4.91e0 | 1.90e-4 | 4.91e0 | 4.91e0 | 125.0 | 0.0 | 0.004 |
| GD-Momentum | 4.91e0 | 4.49e-4 | 4.91e0 | 4.91e0 | 100.2 | 0.0 | 0.003 |
| GD-WeightDecay | 4.91e0 | 1.03e-7 | 4.91e0 | 4.91e0 | 406.6 | 0.0 | 0.013 |
| Trust Region-Conservative | 4.92e0 | 2.48e-3 | 4.91e0 | 4.92e0 | 336.5 | 0.0 | 0.002 |
| Adam-WeightDecay | 4.92e0 | 2.42e-6 | 4.92e0 | 4.92e0 | 2231.2 | 0.0 | 0.047 |
| Adam-Fast | 4.93e0 | 6.09e-3 | 4.92e0 | 4.94e0 | 67.0 | 0.0 | 0.001 |
| Trust Region-Precise | 4.95e0 | 1.38e-2 | 4.93e0 | 4.97e0 | 58.7 | 0.0 | 0.000 |
| GD-AdaptiveMomentum | 4.99e0 | 5.58e-3 | 4.97e0 | 5.00e0 | 32.0 | 0.0 | 0.001 |
| Trust Region-Adaptive | 5.11e0 | 1.18e-1 | 5.00e0 | 5.54e0 | 16.4 | 0.0 | 0.000 |
| Adam | 5.24e0 | 4.43e-2 | 5.16e0 | 5.30e0 | 2502.0 | 0.0 | 0.049 |
| Adam-AMSGrad | 5.24e0 | 4.70e-2 | 5.16e0 | 5.30e0 | 2502.0 | 0.0 | 0.056 |
| Adam-Robust | 5.36e0 | 6.83e-2 | 5.26e0 | 5.48e0 | 2502.0 | 0.0 | 0.055 |
| Trust Region-Aggressive | 6.00e0 | 6.58e-2 | 5.90e0 | 6.12e0 | 5.0 | 0.0 | 0.000 |
| Trust Region-Standard | 5.99e0 | 7.24e-2 | 5.90e0 | 6.16e0 | 5.0 | 0.0 | 0.000 |