Abs distance is abs |final solution – global minimum|. The budget for most functions is 10,000. The budget for F8 and F9 is 40,000. The budget for F4 and F10 is 300,000. The budget for three algorithms is always the same.

Figure sum of abs distance for 20 runs (most functions)

Chart, box and whisker chart

Description automatically generated

Figure sum of abs distance for 20 runs( F8 and F9)

Chart, waterfall chart

Description automatically generated

Figure sum of abs distance for 20 runs (F4 and F10)

Chart, waterfall chart

Description automatically generated

For each function and each parameter combination, we have 20 runs, and this means we have 20 abs distance. Max min distance is calculated as (x-x.min())/(x.max()-x.min()). Each algorithm’s 20 abs distance is normalized by itself. For example, SSGA produces 20 abs distances for each function and each parameter combination, then each box of SSGA is normalized based on 20 abs distances.

Figure max min distance for 20 runs( most functions)

Chart, bar chart

Description automatically generated

Figure max min distance for 20 runs (F4 and F10)

Chart, box and whisker chart

Description automatically generated

Figure max min distance for 20 runs (F8 and F9)

Chart, box and whisker chart

Description automatically generated

Final solutions for 20 runs are generated base on the same budget. The red line is global minimum.

Figure final solutions for 20 runs (F4 and F10)

Chart, waterfall chart

Description automatically generated

Figure final solutions for 20 runs (F8 and F9)

Chart, waterfall chart

Description automatically generated

Figure final solutions for 20 runs (most functions)

Calendar

Description automatically generated