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CS471 Project1

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1 INTRODUCTION

This report contains the results of running 30 iterations of a Blind Algorithm on 10 different fitness functions. The description of the benchmark functions are listed in Section 2. Condensed Results and statistical analysis are in Section 3.

2 BENCHMARK FUNCTION DESCRIPTION AND FULL RESULTS

Each of the following functions were evaluated 30 times using a Blind Algorithm which generates a random vector within the domain. The Experiment specifications can be found in Table 1. The results can be seen in Section 3.

2.1 BENCHMARKING FUNCTIONS

1. Schwefel's function

$$f_1(x) = 418.9829 * n - \sum_{i=1}^{n} -x_i \cdot sin\left(\sqrt{|x_i|}\right) \tag{2.1}$$

2. 1st De Jong's function:

$$f_2(x) = \sum_{i=1}^{n} x_i^2 \tag{2.2}$$

3. Rosenbrock:

$$f_3(x) = \sum_{i=1}^{n-1} 100(x_i^2 - x_{i+1})^2 \tag{2.3}$$

4. Rastrigin:

$$f_4 = 10 * n \sum_{i=1}^{n} (x_i^2 - 10 \cdot cos(2\pi \cdot x_i)) \tag{2.4}$$

5. Griewangk:

$$f_5 = 1 + \sum_{i=1}^{n} \frac{x_i^2}{4000} - \prod_{i=1}^{n} \cos\left(\frac{x_i}{\sqrt{i}}\right) \tag{2.5}$$

6. Sine Envelope Sine Wave:

$$f_6 = -\sum_{i=1}^{n-1} 0.5 + \frac{sin\left(x_i^2 + x_{i+1}^2 - 0.5\right)}{\left(1 + 0.001\left(x_i^2 + x_{i+1}^2\right)\right)^2} \tag{2.6}$$

7. Stretched V Sine Wave:

$$f_7 = \sum_{i=1}^{n-1} \left(\sqrt[4]{x_i^2 + x_{i+1}^2} \cdot sin\left(50\ \sqrt[10]{x_i^2 + x_{i+1}^2}\right)^2 + 1\right) \tag{2.7}$$

8. Ackley's One:

$$f_8 = \sum_{i=1}^{n-1} \frac{1}{e^{0.2}} \sqrt{x_i^2 + x_{i+1}^2} + (cos(2x_i) + sin(2x_{i+1})) \tag{2.8}$$

9. Ackley's Two:

$$f_9 = \sum_{i=1}^{n-1} 20 + e - \frac{20}{e^{0.2\sqrt{\frac{x_i^2 + x_{i+1}^2}{2}}}} - e^{0.5(cos(2\pi \cdot x_i) + cos(2\pi \cdot x_{i+1}))} \tag{2.9}$$

10. Egg Holder:

$$f_{10} = \sum_{i=1}^{n-1} -x_i \cdot sin\left(\sqrt{|x_i - x_i + 1 - 47|}\right) - (x_{i+1} + 47) \cdot sin\left(\sqrt{\left|x_{i+1} + 46\frac{x_i}{2}\right|}\right) \tag{2.10}$$

Table 2.1: Experiment Specifications

	Name	Dimensions	Range
f_1	Schwefel	30	$[-512,512]^n$
f_2	De Jong 1	30	$[-100,100]^n$
f_3	Rosenbrock's Saddle	30	$[-100,100]^n$
f_4	Rastrigin	30	$[-30,30]^n$
f_5	Griewangk	30	$[-500,500]^n$
f_6	Sine Envelope Sine Wave	30	$[-30,30]^n$
f_7	Stretch V Sine Wave	30	$[-30,30]^n$
f_8	Ackley One	30	$[-32,32]^n$
f_9	Ackley Two	30	$[-32,32]^n$
f_{10}	Egg Holder	30	$[-500,500]^n$

2.2 Experiment Specifications

Specifications for each experiment specifies which function to evaluate fitness with, how many dimensions to evaluate on, and the Domain of the search space can be seen in Table 2.1.

3 Statistical Analysis

Across all experiments the ration between Standard Deviation and rang $\frac{SD}{Range}$ is between $\frac{1}{5}$ to $\frac{1}{4}$. This result reflects that the results are from a random distribution as it follows the range rule of thumb, which estimates the standard deviation to be roughly $\frac{1}{4}$ the range when the values are from a normal distribution.
The mean of average, median, range, and standard deviation are all skewed greatly from Rosenbrock's Sadle. The mean for the execution times is not skewed by Rosenbrock's sadle. Execution time accross all experiments varied by from this mean by $-7\%/+20\%$ with Schwefel's execution having the longest execution time. The large difference between Schwefel's execution time and the average may be caused from being the first executable after a period of low CPU usage as all executions after that are vary by only +/-7%.

Table 3.1: Results from 30 Iterations of Blind Algorithm

Problem	Avg	Median	Range	SD	T(s)
f_1	12437.48	12312.92	4198.82	1021.32	0.0104
f_2	98941.35	98867.84	71676.01	15461.78	0.0080
f_3	57474802619.73	53621338112.0	54357405696.0	13209882778.87	0.0085
f_4	2560040.88	2506489.00	2001139.38	439419.52	0.0084
f_5	624.67	617.28	455.04	121.58	0.0086
f_6	0.27	0.21	4.18	1.06	0.0084
f_7	98.45	96.70	44.53	10.90	0.0082
f_8	589.69	598.37	254.13	56.98	0.0084
f_9	586.17	588.61	69.97	14.03	0.0086
f_{10}	-207.10	-168.17	6784.95	1752.64	0.0090
Mean	5747747573.16	5362395751.47	54359032.30	1321034063.30	0.0086

[1] Run on Intel Core i5 2.9 GHz, 16 GB RAM