**Report for Project 2**

**(NCS and OLMP)**

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1. **Algorithm description**

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| **Main Idea of NCS** | * Search with a population of individuals ←→ a population of search agents (processes). * NCS aims to control each search agent to search the part of the search space that other search agents will not search * NCS first calculates the negative correlation (i.e. search behavior diversity) between different search agents * Then, selects the search agents that have higher negative correlation with other search agents. |
| **Applications of NCS** | Minimizing the Symbol-Error-Rate (SER) for Amplify-and-Forward Relaying Systems is nontrivial since the SER surface is non-convex and has multiple minima. |
| **Main Idea of OLMP** | The idea is to transform the threshold tuning problem into a constrained optimization problem (i.e., minimizing the size of the pruned model subject to a constraint on the accuracy loss), and then use powerful derivative-free optimization algorithms to solve it. |
| **Applications of OLMP** | OLMP  LMP  DNN compression  DNN  ANN  Handwritten character recognition |

1. **Parameter description**

|  |  |  |  |
| --- | --- | --- | --- |
| Parameters | Your final values and results | | |
| F6 | F12 | OLMP |
| lambda | 0.942 | 0.944 | 0.000000001 |
| r | 0.99 | 1 | 100 |
| epoch | 3 | 5 | 1 |
| n | 1 | 8 | 92 |
| Final Result | 390.01148260552054 | 683.2432304597523 | 0.9889914106747684 |
| Running Time | 48.58 | 75.34 | 59.89 |

**Parameters Summary:**

1. epoch

epoch controls the iteration times for each period.

1. For F6, the best range is [1,30], when larger than 30, it has approximately no effects on result, and the results are very large.
2. For F12, the best range is [1,6], when larger than 20, it has approximately no effects on result, and the results are very large.
3. For OLMP, epoch has no relation to the result.
4. lambda

lambda can affect the search process and consequently the performance of NCS.

1. For F6, there is no certain range for it, I chose the smallest value in my tests, which is 0.942.
2. For F12, the best range is [0.3,1.7], and the results of them are equal, so I chose 0.944.
3. For OLMP, lambda has no relation to the result.
4. r

r is a parameter that is suggested to be set beneath 1.

1. For F6, there is no certain range for it, I chose the smallest value in my tests, which is 0.99.
2. For F12, the best range is [0.0,1.0], when larger than 1.0, the results become very large and changes irregularly.
3. For OLMP, r has no relation to the result.
4. n

n controls the initially generated population.

1. For F6, the best range is [1,6], when larger than 9, the results become very large and changes irregularly.
2. For F12, the best range is [1,11], when larger than 11, the results become very large and changes irregularly.
3. For OLMP, it is irregular in any range of n, so I test all ns, and chose the smallest one.
4. **Tuning procedure**

I wrote a program to test the parameters with input or randomly generated values. At first, I test them separately. For integer parameters, such as epoch and n, I tested them with all possible values, and then chose a value with the smallest result. For float number values, firstly I tested them with random numbers, and then find out the best range to be tested next, and then do these steps cyclically.