Solving a Travelling Salesman Problem using SA and GA

Simulated Annealing

Brief introduction

Simulated annealing mimics the slow cooling process of metals. It is a stochastic global search algorithm meaning that it makes use of randomness during the search.

My simulated annealing algorithm has 3 parameters, initial temp, stopping temp, and cool down factor. In order to tune these parameters I am going to start with some initial values based on research and then modify the value of one parameter at a time until I find the value at which it produces the best result. I will repeat this process for the other parameters.

30 trail runs

Trail Number	Initial temp	Cool down factor	Stopping temp	Iterations	Final distance
1	500	0.85	1	38	57595
2	500	0.86	1	41	52666
3	500	0.9	1	58	50248
4	500	0.92	1	74	56135
5	500	0.94	1	100	49451
6	500	0.96	1	152	44073
7	500	0.98	1	307	38859
8	500	0.99	1	618	42557
9	1000	0.98	1	341	41965
10	1500	0.98	1	361	39578
11	2000	0.98	1	376	41981
12	2500	0.98	1	387	39763
13	3000	0.98	1	396	37746

14	3500	0.98	1	403	43965
15	4000	0.98	1	410	42381
16	3000	0.98	10	282	40924
17	3000	0.98	0.1	510	37637
18	3000	0.98	0.05	544	41303
19	3000	0.98	0.1	510	44811
20	3000	0.98	0.1	510	39380
21	2500	0.98	0.1	501	48715
22	3500	0.98	0.1	517	39751
23	3000	0.95	0.1	200	47715
24	3000	0.99	0.1	1025	42536
25	3250	0.98	0.1	514	36282
26	3300	0.98	0.1	514	43423
27	3275	0.98	0.1	514	36691
28	3275	0.98	0.1	514	42268
29	3250	0.98	0.1	514	40059
30	3250	0.98	0.1	514	42533

Average of 30 test and result

Parameters and result

- Initial temp: 3250
- End temp: 0.1
- Cooling rate: 0.98
- Average distance: 39819 to the nearest whole number
- Standard deviation: 1930 to the nearest whole number

Genetic algorithm

Brief introduction

Genetic algorithms are inspired by the process of natural selection. It uses generational cycles to produce better quality solutions

The parameters used in my genetic algorithm are mutation probability, number of generations, population size, tournament size, elitism. I tuned these parameters using the same method I used for my simulated annealing algorithm.

30 trail runs

Trail Number	Population size	Generations	Mutation rate	Tournament size	Elitism	Final distance
1	100	100	0.3	2	True	80191
2	100	100	0.3	3	True	51469
3	100	100	0.3	4	True	42735
4	100	100	0.3	5	True	40021
5	100	100	0.3	6	True	40959
6	100	100	0.3	7	True	44988.5
7	100	100	0.4	5	True	46137
8	100	100	0.2	5	True	50448
9	100	200	0.3	5	True	43188
10	100	300	0.3	5	True	38906
11	100	400	0.3	5	True	39843
12	100	400	0.3	5	True	41148
13	200	300	0.3	5	True	34124
14	300	300	0.3	5	True	33218
15	400	300	0.3	5	True	34518
16	400	300	0.3	5	True	33952
17	300	300	0.3	5	False	33752

18	300	300	0.3	5	False	35131
19	300	300	0.2	5	True	32060
20	300	300	0.1	5	True	35153
21	300	300	0.15	5	True	35914
22	300	300	0.175	5	True	35447
23	300	300	0.2	6	True	33592
24	300	300	0.2	4	True	34824
25	350	300	0.2	5	True	34564
26	350	350	0.2	5	True	34348
27	300	350	0.2	5	True	34958
28	300	300	0.2	10	True	35912
29	300	300	0.2	10	False	33744
30	300	300	0.2	10	False	34071

Average of 30 test and result

Parameters and result

- Population size: 300
- Generations: 300
- Mutation probability: 0.2
- Tournament size: 5
- Elitist: True
- Average Distance: 35146 to the nearest whole number
- Standard deviation: 2093 to the nearest whole number