

Robert Schriver

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Introduction

For this project, I changed a few things from the default algorithm presented in class. First, I added an additional cost function, based on minimizing the maximum value. I found that the sum of squared error cost was highly dependent on the target chosen, and that choosing a different target meant that the parameters for each objective needed to be retuned. In addition, I normalized each cost using the current best solution cost. Normalizing the cost meant that I did not have to tune the parameters when changing problem scale, so I could use the same parameters on the test dataset as the real dataset. This normalization also made some intuitive sense, since I was choosing parameters based on the percentage of how much worse a solution performed. For each method, a summary of the results is provided, with a full list of harvests and their plot numbers at the end of the paper.

Simulated Annealing

For the simulated annealing objective, this meant that the starting and minimum temperature were much lower than in the example, since the cost was typically between -1 and 1 (ie 100% better or worse than the current solution). These lower values also removed the need to add a 'Boltzmann Constant' parameter.

Parameters

| | |
|-------------------|--------|
| start_temperature | 1 |
| end_temperature | 0.0001 |
| alpha | 0.99 |
| repetitions | 1000 |

I found these parameters to provide relatively robust solutions while still reducing processing time to less than a minute.

Results

| Harvest Number | Volume |
|----------------|------------|
| 0 | 439579.0 |
| 1 | 439535.2 |
| 2 | 439717.72 |
| 3 | 439707.58 |
| 4 | 439570.927 |

Threshold Accepting

For the threshold accepting objective, I found success in setting the ending threshold to be less than one, which in our minimization case means at some point we only accept solutions which are improvements over the last solution. Without this change, I found that the algorithm would slowly, randomly move to a very poor solution, and not be able to recover. This is potentially due to my choice to normalize the cost based on the current solution cost, which would not punish a bad solution if the current solution was equally wrong.

Parameters

| | |
|-----------------|--------|
| start_threshold | 0.01 |
| end_threshold | -0.01 |
| threshold_step | 0.0001 |
| repetitions | 500 |

I found these parameters to be a good balance of speed and performance. The algorithm was highly sensitive to the starting threshold, if this was set too high it quickly moved to a local maximum and was not able to extract itself.

Results

| Harvest Number | Total Volume |
|----------------|--------------|
| 0 | 439673.0 |
| 1 | 439497.5 |
| 2 | 439646.74 |
| 3 | 439650.458 |
| 4 | 439579.495 |

Appendix

Simulated Annealing

Harvest 0

[394, 215, 1867, 194, 100, 565, 1592, 1527, 883, 248, 769, 1925, 334, 1889, 1096, 304, 637, 652, 930, 628, 54, 9, 77, 845, 952, 24, 1823, 1937, 116, 425, 1500, 1351, 680, 1031, 935, 1936, 1943, 1946, 885, 397, 1043, 1069, 1403, 1688, 448, 408, 1048, 1385, 813, 1986, 1423, 219, 53, 1389, 276, 1254, 702, 553, 1861, 421, 1449, 384, 260, 387, 947, 1394, 1731, 922, 343, 1873, 11, 953, 1988, 898, 1405, 271, 648, 910, 197, 503, 1376, 1801, 1643, 1320, 780, 1888, 499, 177, 1572, 1954, 955, 412, 1684, 323, 919, 1610, 1067, 139, 426, 1547, 1023, 984, 685, 1378, 1858, 224, 1314, 58, 510, 1414, 1899, 713, 1337, 1807, 1136, 768, 928,

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Harvest 1

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Harvest 2

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Harvest 3

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Harvest 4

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Threshold Accepting

Harvest 0

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Harvest 1

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