NTNU

bioai - assignment 1

fredrik robertsen

ntnu idi

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problem 1 - binary knapsack

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- there are many items, each with a value and weight
- the knapsack you are wearing can only carry so much weight
- you want the most bang for your buck
  - what's the best *combination* of items to keep?
- combinatory problem, np hard
  - approximate using a genetic algorithm
- this is like optimizing your inventory in games like skyrim
  - do you want 400 spoons in your pocket, each worth a dime, or do you want that gold bar that weighs a ton?
- formally, you want to maximize $z = \sum_{j=1}^{n} p_j x_j$ such that $\sum_{j=1}^{n} w_j x_j \leq c$ where $x_j \in \{0, 1\}$
  - for item j: p_j is the profit; w_j the weight; x_j whether to keep it

problem 2 - feature selection

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- similar to the binary knapsack problem
- this time you have many data points
  - each data point consists of *features*
- each data point has an associated *output*
- you wish to eliminate the features that are least influential in producing a given output
  - this is like choosing what items to keep in your knapsack
- this is like weather forecasting
  - hundreds of features in data
    - which are most relevant?
    - which are noise?

general implementation

- generate a population of randomized chromosomes
- calculate their fitness values
- perform a *tournament selection* to choose parent chromosomes
  - more fit individuals are more likely to be selected
  - introduces less diversity
- combine two parents to form two children via *single point crossover*
- mutate children randomly
- merge children into population, evicting the least fit individuals
  - this is the *elitism survivor selection*
- repeat

results

- let's look at the report

conclusion

- it is hard to tune hyperparameters
- it is hard to implement genetic algorithm operators correctly
- it is hard to solve np-hard problems

so, i've had great fun