

Online complex bin packing

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Abstract

Online bin-packing is a problem in which you need to make an immediate decision about the placement of items of various size into fixed capacity bins. The decision can be based on a policy in which each bin that can be chosen is scored based on its remaining capacity and the size of the current item to be placed. The item is then placed into the bin with the highest score. The goal is to maximize the average bins fullness.

The proposed thesis aim to formalize a complex problem as an online bin-packing problem and to solve it with traditional methods and with the usage of metaheuristic techniques.

1 Complex bin packing problem

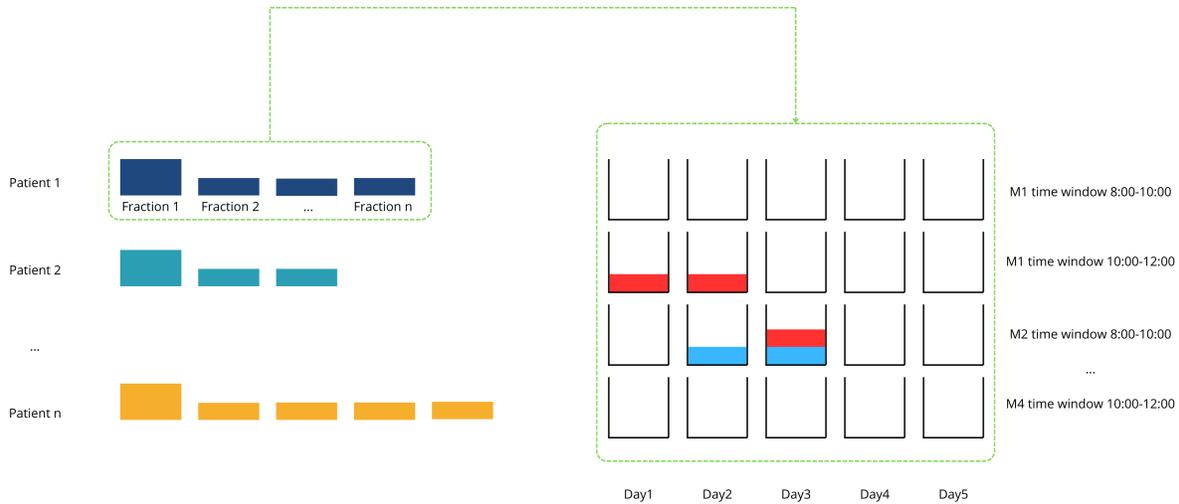


Figure 1: Complex bin packing

2 Solving with standard heuristics

Well known heuristics are First Fit, Best Fit and Worst Fit [1], [2], [4]

3 Solving with metaheuristics

Ozcan and Parkes in [3] represent the heuristic as a matrix covering the various potential decision and evolve it with an evolutionary algorithm.

4 Solving with generated if-else policy by LLM

Try to use a LLM trained on code to generate an if-else program that will decide the policy to use.

References

- [1] Edward G Coffman et al. “Bin packing approximation algorithms: Combinatorial analysis”. In: *Handbook of Combinatorial Optimization: Supplement Volume A* (1999), pp. 151–207.
- [2] David S. Johnson et al. “Worst-case performance bounds for simple one-dimensional packing algorithms”. In: *SIAM Journal on computing* 3.4 (1974), pp. 299–325.
- [3] Ender Özcan and Andrew J Parkes. “Policy matrix evolution for generation of heuristics”. In: *Proceedings of the 13th annual conference on Genetic and evolutionary computation*. 2011, pp. 2011–2018.
- [4] Wansoo T Rhee and Michel Talagrand. “On line bin packing with items of random size”. In: *Mathematics of Operations Research* 18.2 (1993), pp. 438–445.