

## **Towards the Automatic Design of Algorithms**

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Heuristic algorithms are typically manually designed. They are often developed and tested on the same benchmark instances. However we should separate the instances on which we develop the heuristic from the instances on which we test the heuristic. In other words we should adopt a machine learning methodology with the well-known approach of disjoint sets of training and testing examples. A second inspiration we can take from machine learning is that the training and test examples should be drawn from the same distribution of examples, if we intend the heuristic to generalize from the training set to the test set. A hyper-heuristic approach operates at a higher level of abstraction than standard metaheuristics. Hyper-heuristics are a bridge between optimization and machine learning and allow us to adopt a machine learning approach to optimization problems. There are two methods of realizing this approach. When the design is done "in vitro" it is called Genetic Programming as a Hyper-Heuristic. When the design is done "in situ" it is called Genetic Improvement. We give an example of bin-packing with applications in container shipping in logistics, and scheduling virtual machines in cloud computing.