EKAmBa: Realtime Configuration of Algorithms with Multi-armed Bandits

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Introduction

Setting: We consider realtime algorithm configuration (RAC), in which we must provide the best possible parameter configuration to an algorithm for a set of instances. In RAC, the problem instances arrive sequentially, and the goal is to solve each instance as fast as possible.
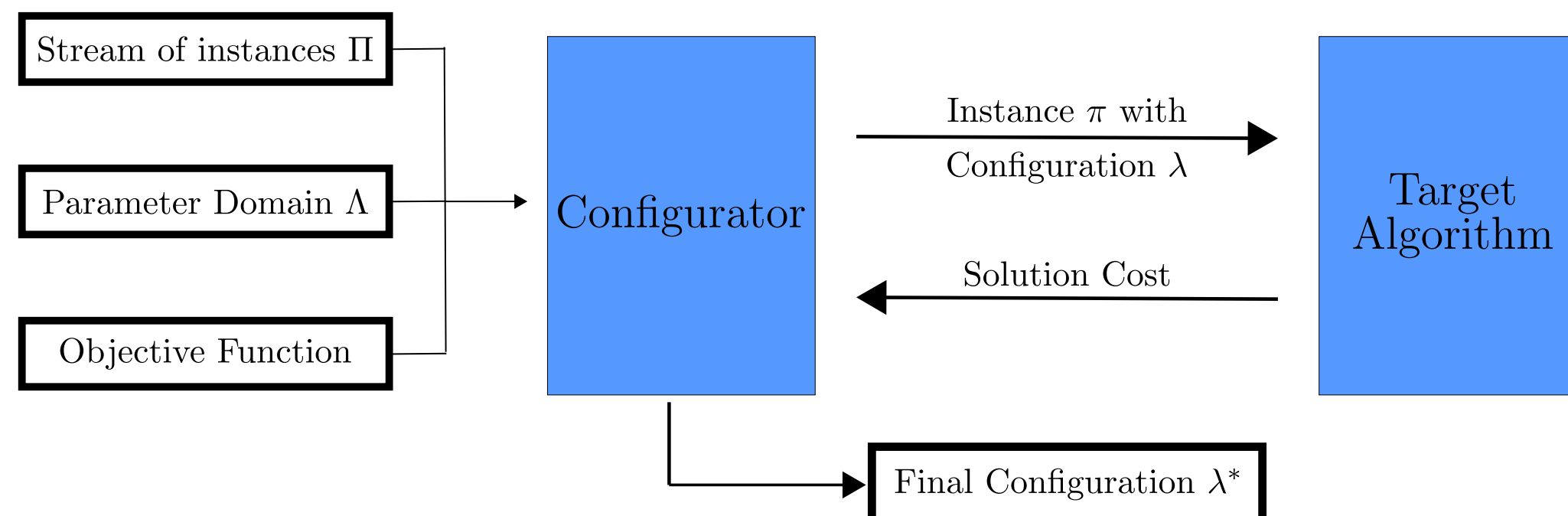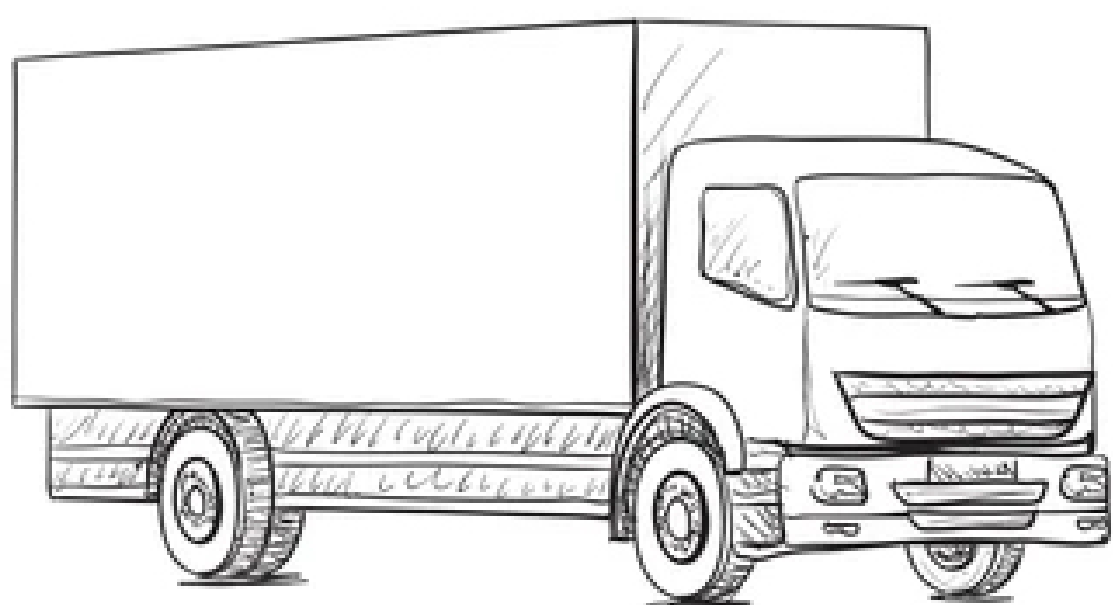

Figure 1: Illustration of the configuration process.

Real World Example

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- Imagine a delivery company that must determine routes for its vehicles on a daily basis in a limited amount of time.
- Changing business requirements may cause concept drift in the problem structure.

Realtime Algorithm Configuration with Contextual Preselection Bandits

- Our goal is to combine principles of RAC approaches such as ReACT [1] or ReACTR [2] with preselection bandits [3, 4].
- The bandits take instance characteristics as contextual information into account and are used to choose a promising subset of configurations from a pool, which are then used to solve the instance.
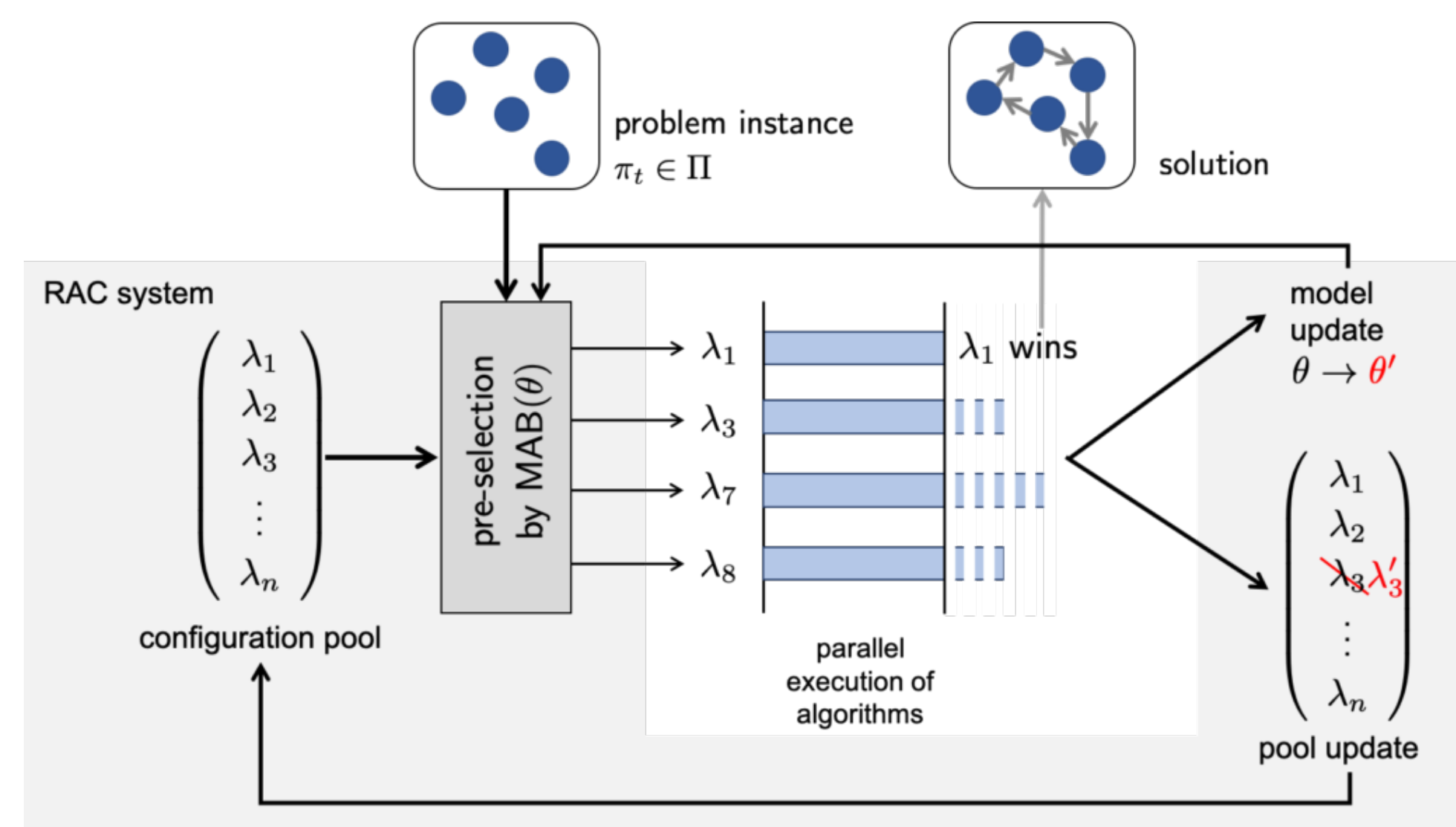

Figure 2: CPPL [5] is an existing method that combines contextual preselection bandits and pool-based RAC.
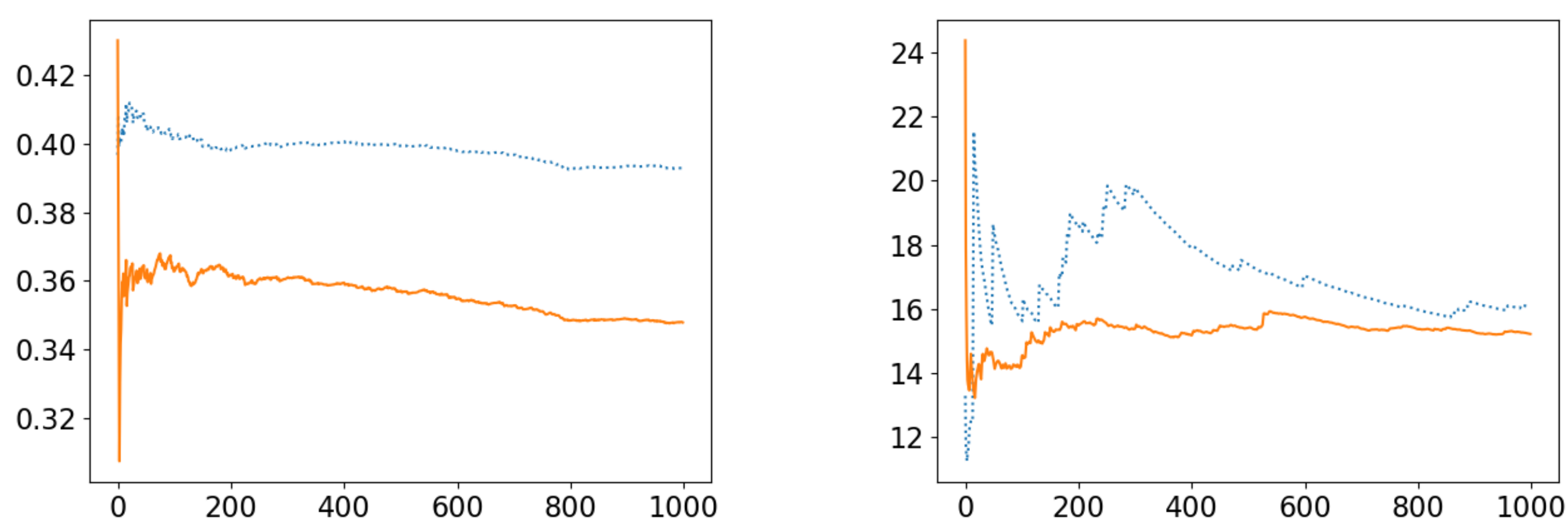
Results

Figure 3: Results from [5]: Comparison of CPPL (orange) and ReACTR (dashed blue) using Cadical SAT solver and modular (left) and power-law (right) instance sets with time in seconds on the y- and number of instances on the x-axis.

References

[1] Tadhg Fitzgerald, Yuri Malitsky, Barry O'Sullivan, and Kevin Tierney. React: Real-time algorithm configuration through tournaments. In *Seventh Annual Symposium on Combinatorial Search*, 2014.

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[4] Adil El Mesaoudi-Paul, Viktor Bengs, and Eyke Hüllermeier. Online Preselection with Context Information under the Plackett-Luce Model. pages 1–14, 2020.

[5] Adil El Mesaoudi-Paul, Dimitri Weiß, Viktor Bengs, Eyke Hüllermeier, and Kevin Tierney. Pool-based realtime algorithm configuration: A preselection bandit approach. In *International Conference on Learning and Intelligent Optimization*, pages 216–232. Springer, 2020.