Reacting and Adapting to the Environment
Designing Autonomous Methods for Multi-Objective Combinatorial Optimisation

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Automatic Algorithm Design

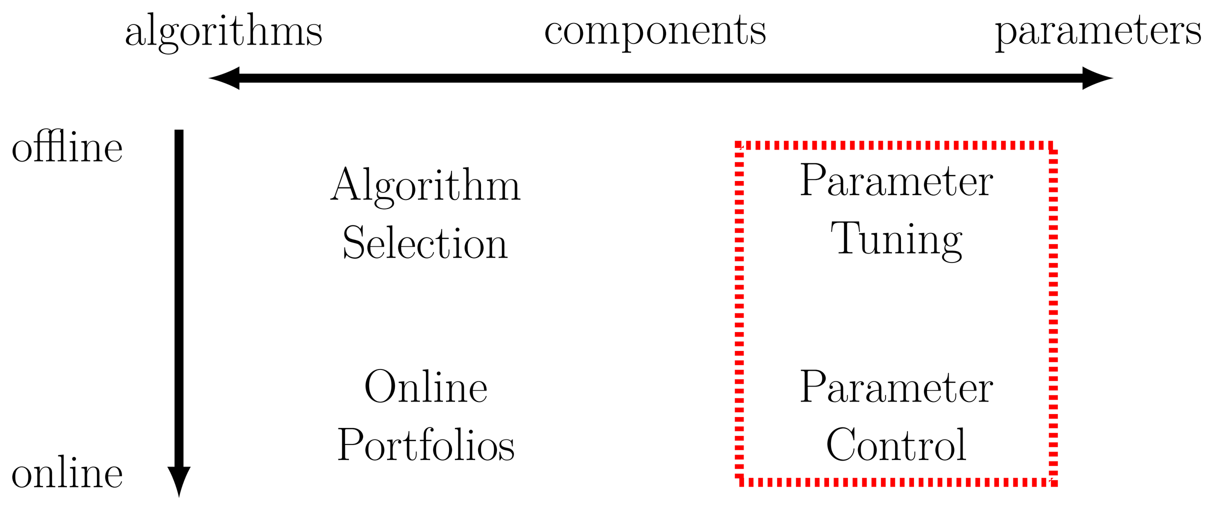

Figure 1: Automatic Algorithm Design overview

Algorithm Configuration / Parameter Tuning

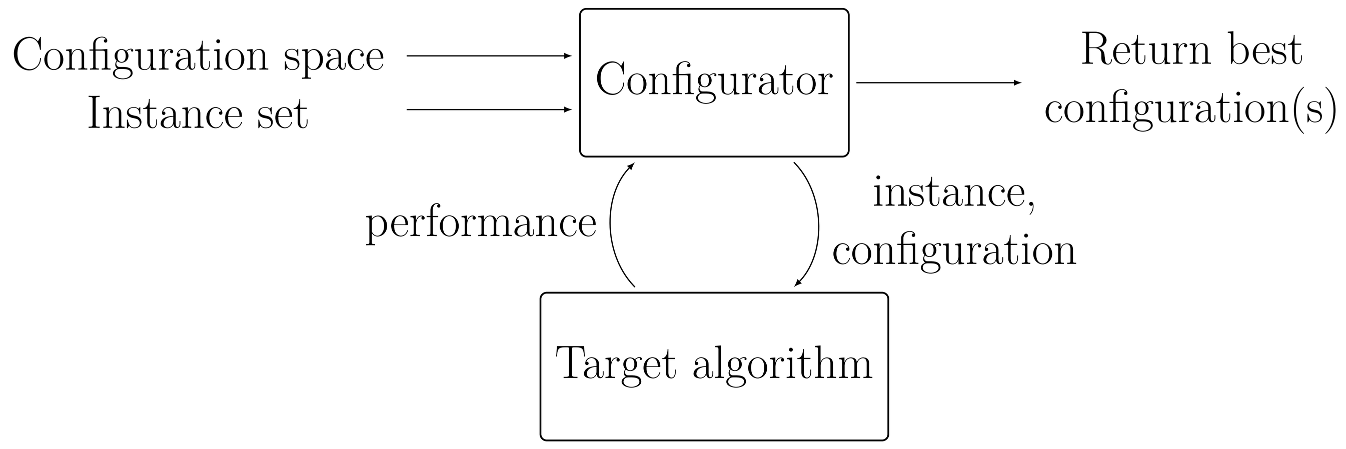

Figure 2: Workflow of Automatic Algorithm Configuration (AAC)

MO-ParamILS [1, 2]

- Java framework to optimise algorithm configurations
- Extension of ParamILS, state-of-the-art single-objective configurator
- Optimises multiple performance indicators at once
- Efficient to configure both single- and multi-objective algorithms

Parameter Control

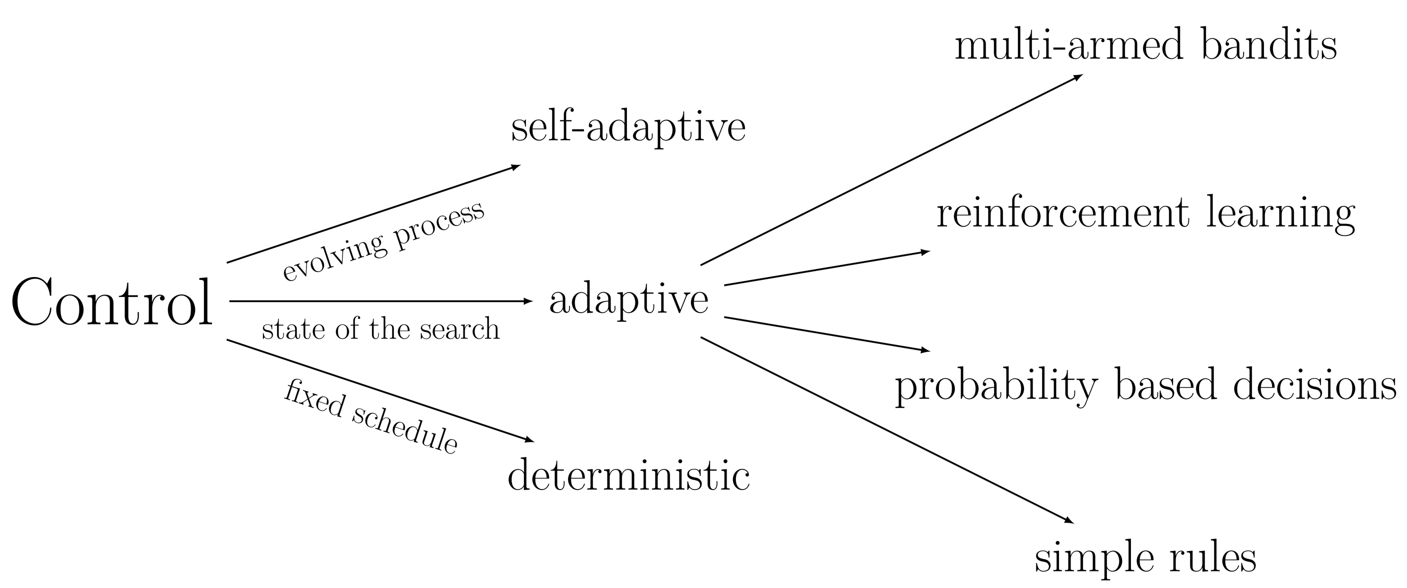

Figure 3: Parameter independent control classification

Multi-Objective Local Search Algorithms [3]

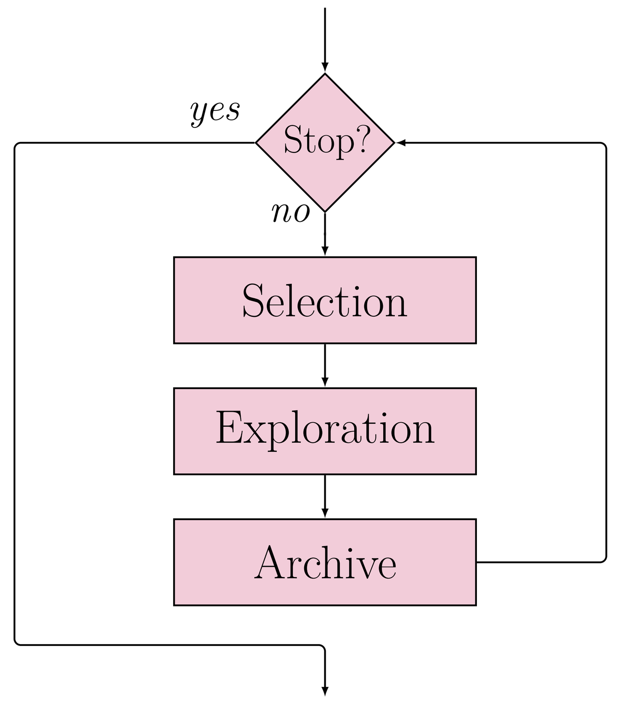

Figure 4: Core MOLS

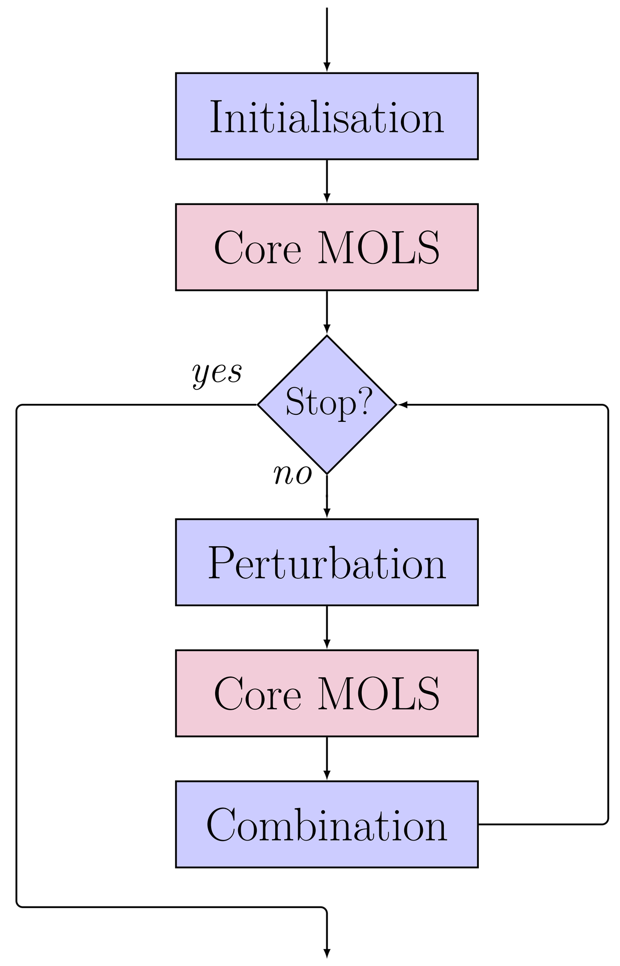

Figure 5: Iterated MOLS

Phase	Parameter	Parameter values
Initialisation	`initStrat`	{`rand`, `neh`, `ig`, ...}
	`initSize`	{10, ...}
	`initTime`	0% – 100%
Selection	`selectStrat`	{`all`, `rand`, `newest`, `oldest`}
	`selectSize`	{1, 2, 3, ...}
Exploration	`explorStrat`	{`all`, `all_imp`, `imp`, `imp_ndom`, `ndom`}
	`explorRef`	{`sol`, `select`, `arch`}
	`explorSize`	{1, 2, 3, ...}
Perturbation	`perturbStrat`	{`restart`, `kick`, `kick_all`}
	`perturbSize`	{1, 2, 3, ...}
	`perturbStrength`	{3, 5, ...}

Figure 6: A selected subset of MOLS parameters

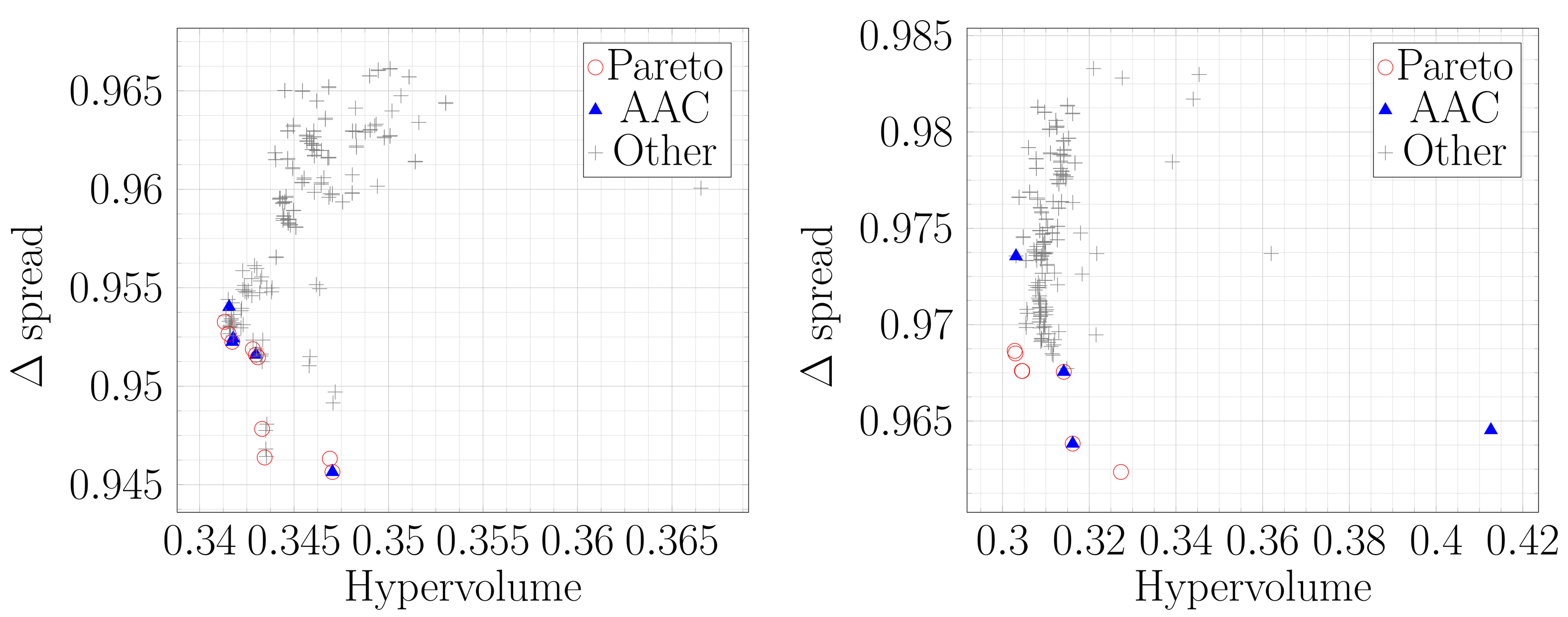

Figure 7: Exhaustive and MO-ParamILS performance over 189 chosen MOLS configurations over two Permutation Flowshop Scheduling Problem (PFSP) instances subset (left: 50 jobs; right: 100 jobs)

AMH: Adaptive MetaHeuristics [4]

- C++ framework to build algorithms from basic components
- Handle the algorithm execution flow
- Eases algorithm design and enable structural modification during the execution
- Offers generic control mechanisms

Current and Future Works

- In-depth study of MO-ParamILS performance
- Study of MOLS components control potential
- Implementation of control mechanisms and design in AMH
- Application of generic control mechanisms to MOLS algorithms
- Improvement of MOLS algorithms performance

References

[1] Aymeric Blot, Holger H. Hoos, Laetitia Jourdan, Marie-Éléonore Marmion, and Heike Trautmann. MO-ParamILS: A multi-objective automatic algorithm configuration framework. In *LION 10*, volume 10079 of *LNCS*, pages 32–47, 2016.

[2] Aymeric Blot, Alexis Pernet, Laetitia Jourdan, Marie-Éléonore Kessaci-Marmion, and Holger H. Hoos. Automatically configuring multi-objective local search using multi-objective optimisation. In *EMO 2017*, pages 61–76, 2017.

[3] Aymeric Blot, Laetitia Jourdan, and Marie-Éléonore Kessaci. Automatic design of multi-objective local search algorithms. In *GECCO 2017*, 2017.

[4] Aymeric Blot, Laetitia Jourdan, and Marie-Éléonore Kessaci. AMH: a new framework to design adaptive metaheuristics. In *MIC 2017*, 2017.

Collaborative work

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