Multi-agent Dynamic Algorithm Configuration

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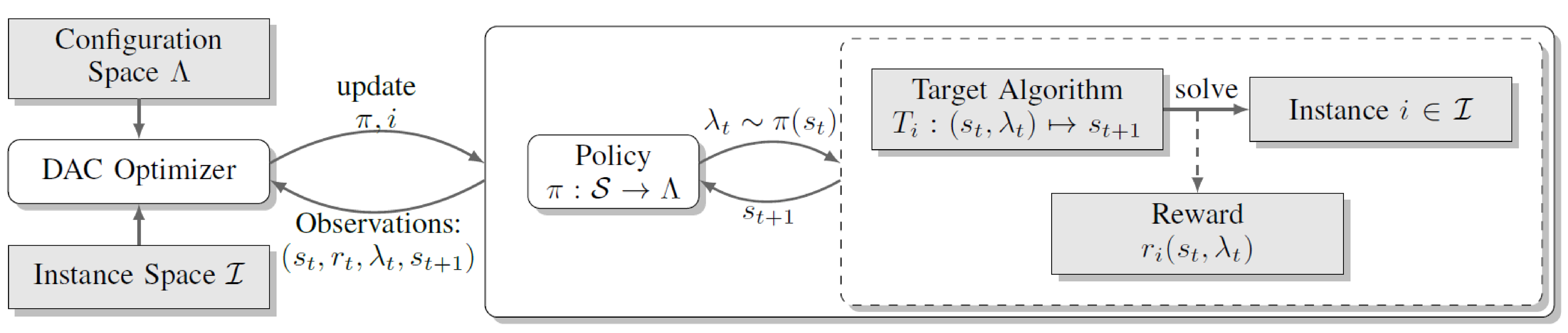
Dynamic Algorithm Configuration

Dynamic algorithm configuration (DAC) aims at dynamically adjusting the configuration of an algorithm during its optimization process



[Eimer et al., IJCAI'21]

The objective of DAC is to find policy maximizing the total return:

$$\pi^* \in \arg\min_{\pi \in \Pi} \int_{i \in \mathcal{I}} p(i) c(\pi, i) \mathrm{d}i$$

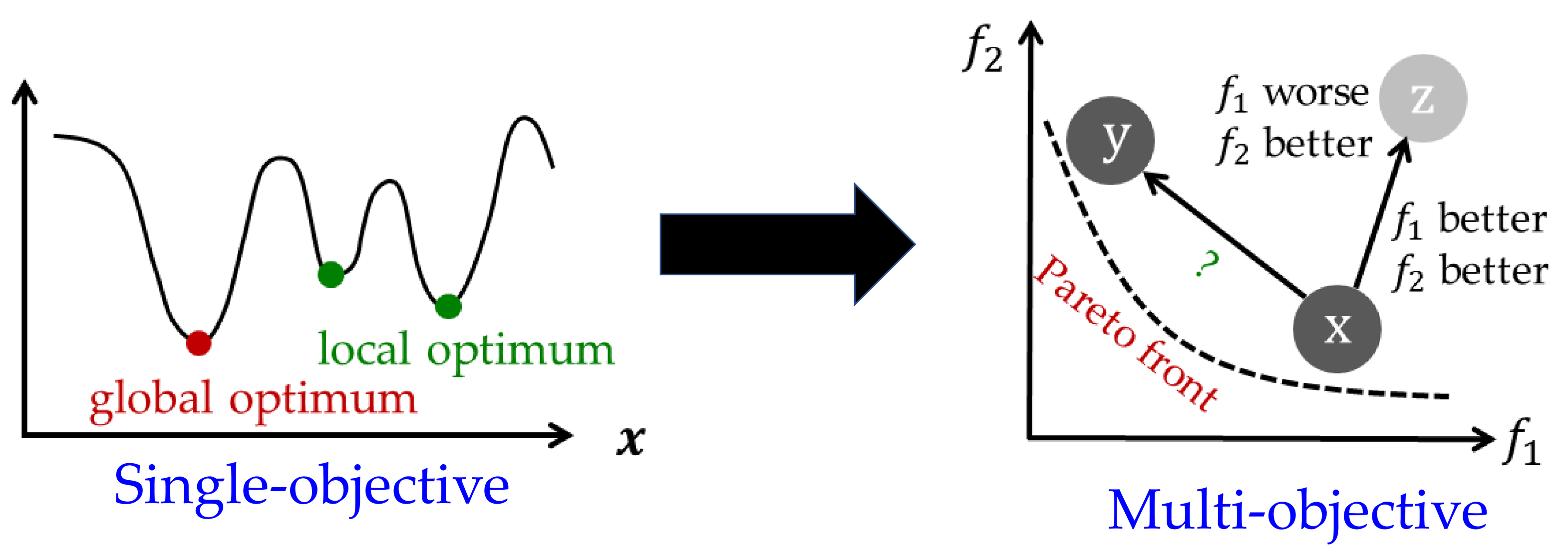
DAC has been successfully used to adjust:

1) Learning rate of DNN optimizer
2) Step-size control of CMA-ES
3) Heuristic selection in AI planning

The task of DAC typically focuses on a single type of hyperparameter

However, due to the increasing complexity of real-world problem modeling (e.g., from single to multi-objective), there are many algorithms whose performance rests on multiple types of hyperparameters, which are hard to tune

Multi-objective optimization



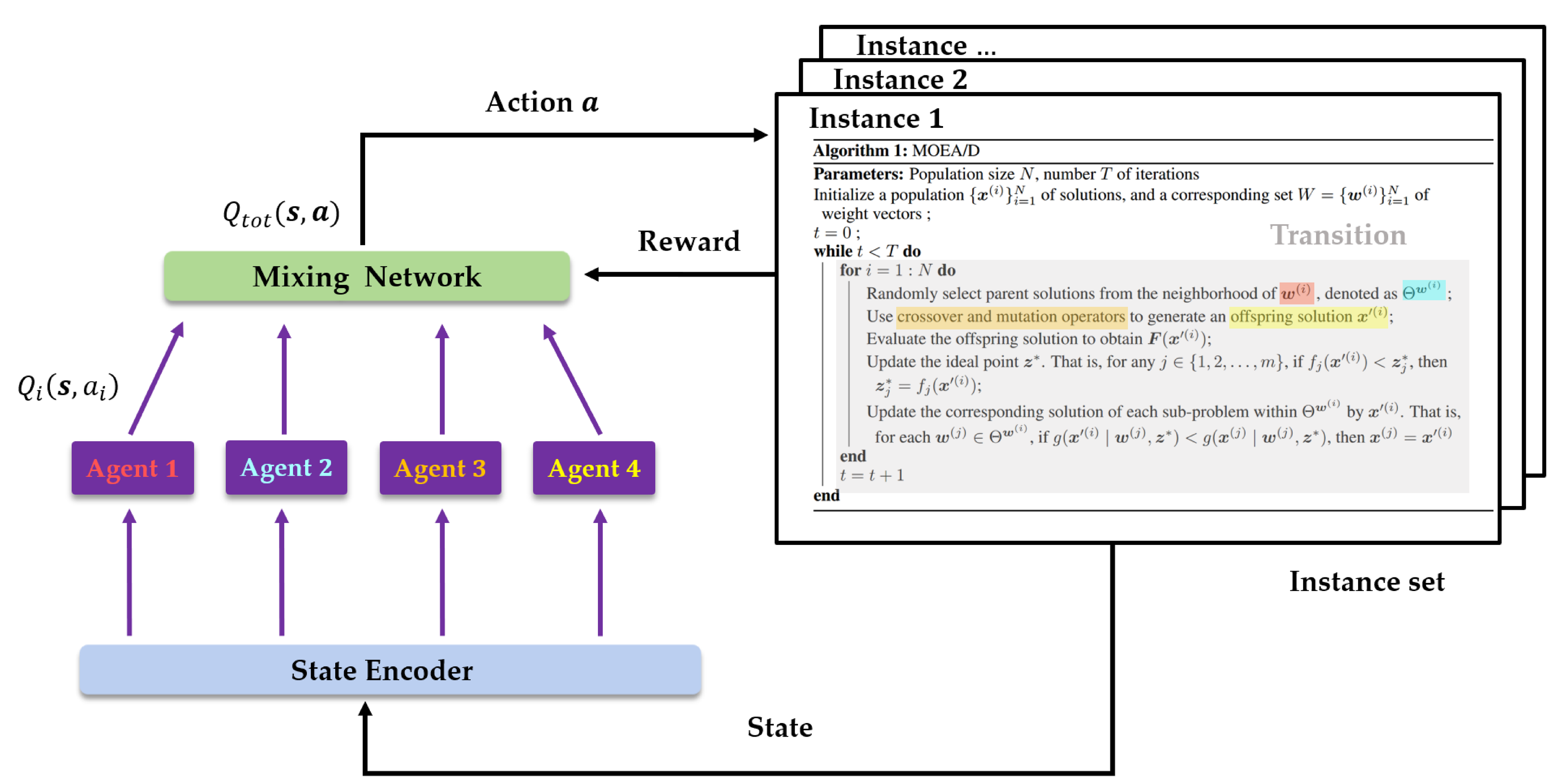
MOEA/D is a representative and popular multi-objective evolutionary algorithm, converting a multi-objective optimization problem into several single-objective optimization sub-problems

It has four different types of hyperparameters

How to dynamically adjust a complex algorithm such as MOEA/D?

Multi-agent DAC

We propose **MA-DAC**, modeling the configuration of a complex algorithm with multiple types of hyperparameters as a ***cooperative multi-agent problem***, where one agent works to handle one type of hyperparameter



We obtain Multi-agent RL for Multi-objective optimization (MaMo) benchmark

Benchmark	Heterogeneous	# of agents	Stochastic	Application scenarios
Matrix Games [8]	×	2	Low	Game
MPE [20]	×	2-3	Low	Game
MAgent [42]	×	2-1000	Low	Game
SMAC [28]	✓	2-30	Low	Game
Active Voltage Control [38]	×	3-38	Low	Control
MaMo (Ours)	✓	2-4	High	Optimization

We hope our new MaMo benchmark can offer a good supplement that could benefit the MARL community

Our code is available at
https://github.com/lamda-bbo/madac

We investigate the following research questions (RQs) in our experiment:
RQ1: How does MA-DAC perform compared with the baseline?
RQ2: How is the generalization ability of MA-DAC?
RQ3: How do the different parts of MA-DAC affect the performance?

Experimental results show the superior performance of MA-DAC