Per-class AS for black-box optimisation

AS for BBO scenarios without feature computation by selecting based on a priori known features.

A Per-Class Automated Algorithm Selection Framework for General Black-Box Optimisation

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Summary

Main idea

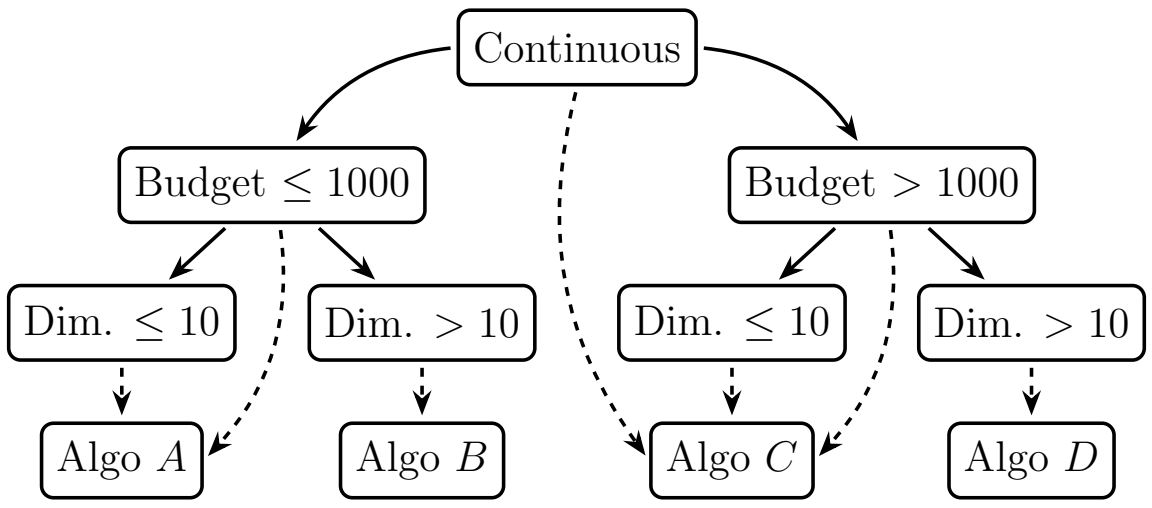
- **Instance-specific features**: Too costly, not always available
- **Per-class AS**: Only use a priori known features
- **BBO known features**: Variable type, evaluation budget, . . .
- **Group instances in classes**: More specific than the SBS

Results

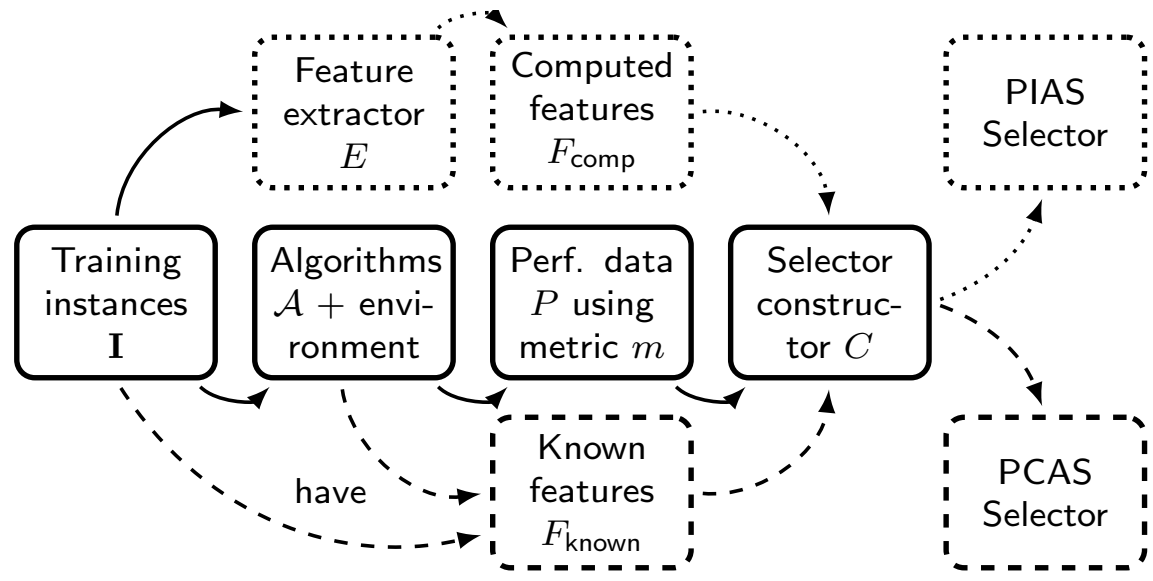
- Definition of per-class algorithm selection
- Framework for principled and reproducible PCAS construction
- PCAS more accurate and specific than hand designed selectors

Benefits

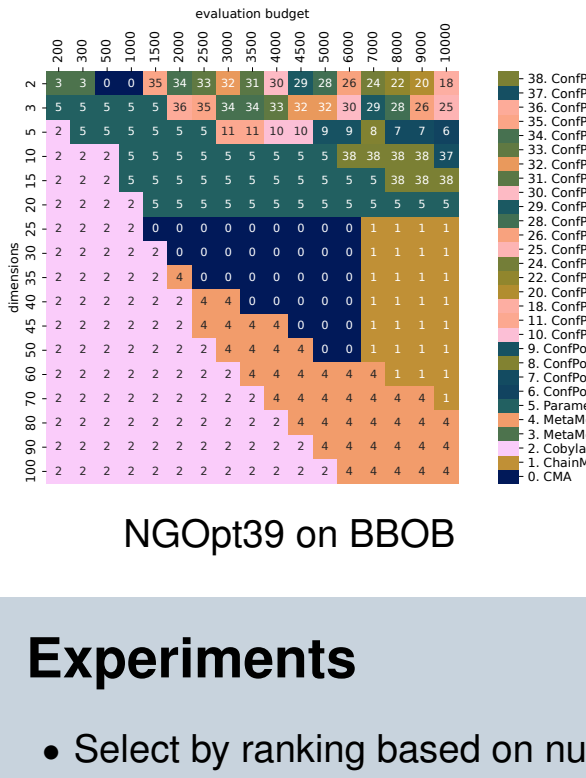
- Quick access to a good initial algorithm for any BBO problem
- AS possible for BBO when no feature computation possible
- Easily integrate grey-box features when available
- Facilitate BBO benchmarking view at each class level
- Possible fallback for PIAS systems when out of distribution



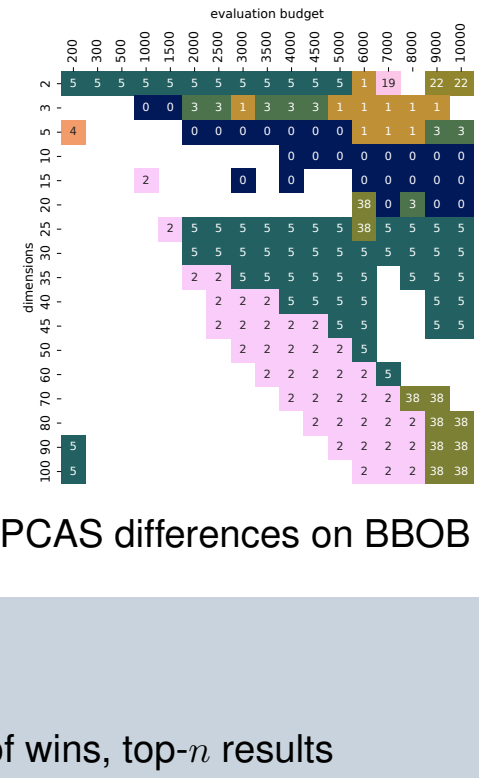
Split instances into classes and select at available detail level



Comparison between PIAS (dotted) and PCAS (dashed) components



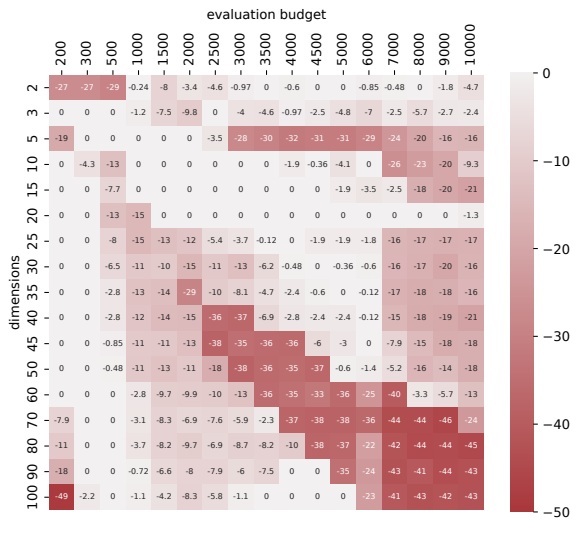
NGOpt39 on BBOB



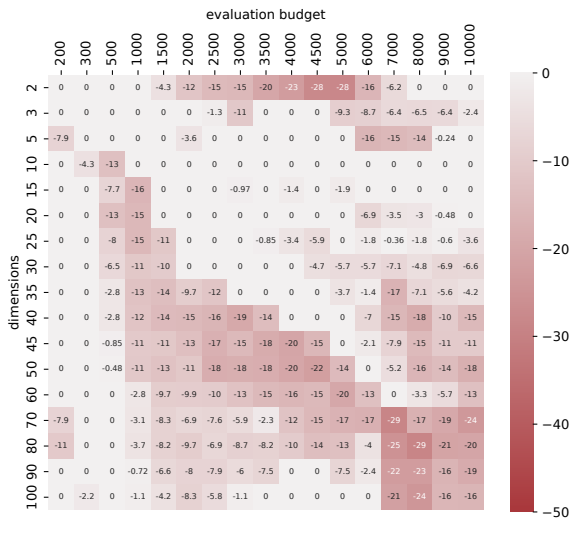
PCAS differences on BBOB

Experiments

- Select by ranking based on number of wins, top-n results
- Compare percentage of instances with non-zero log loss to VBS



NGOpt loss to VBS MA-BBOB



PCAS loss to VBS MA-BBOB

Example setup

- **Training**: 24 BBOB functions, 1 instance, 25 runs
- **Testing**: Distinct BBOB instances, MA-BBOB functions
- **Dimensionality**: $d \in [2, 100]$
- **Budgets**: 200 to 10 000 evaluations
- **Algorithms**: 34 used by NGopt39 (Nevergrad) in same domain

Next steps

- Extend to
  - Problems with constraints, multiple objectives, . . .
  - Grey-box features
  - Other performance measures
- Incorporate more problems/instances and algorithms
- Efficiently choose which algorithms to run on which instances