Configuring *irace* using surrogate configuration benchmarks

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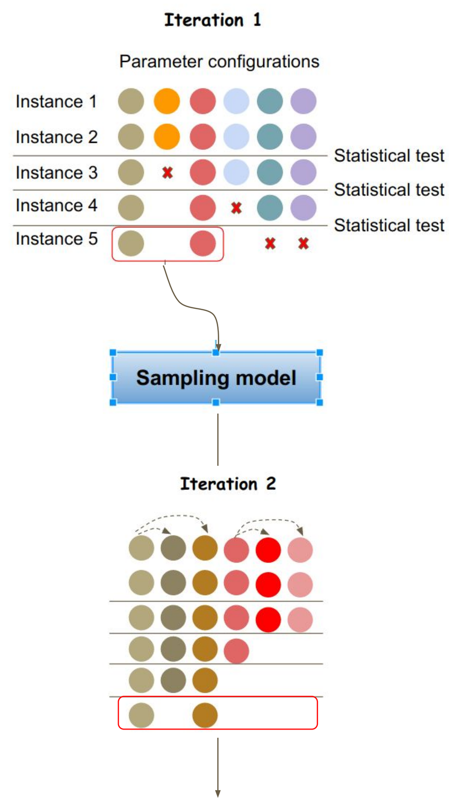
1. *irace* parameters

Parameter	Type	Domain	Default value
N^{iter}	int	[1, 50]	$2 + log_2 n^{params}$
μ	int	[1, 20]	5
T^{first}	int	[4, 20]	5
N^{min}	int	[1, 20]	$2 + log_2 n^{params}$
test_type	categorical	{F-test, t-test, t-test-holm, t-test-bonferroni}	F-test
confidence_level	real	[0.5, 0.99]	0.95
enable_soft_restart	categorical	{true, false}	true
enable_elitist	categorical	{true, false}	true
elitist_instances	int	[1, 10]	1



2. Meta-tuning and algorithm configuration benchmarks

Use an automatic algorithm configurator to configure the parameters of a configurator

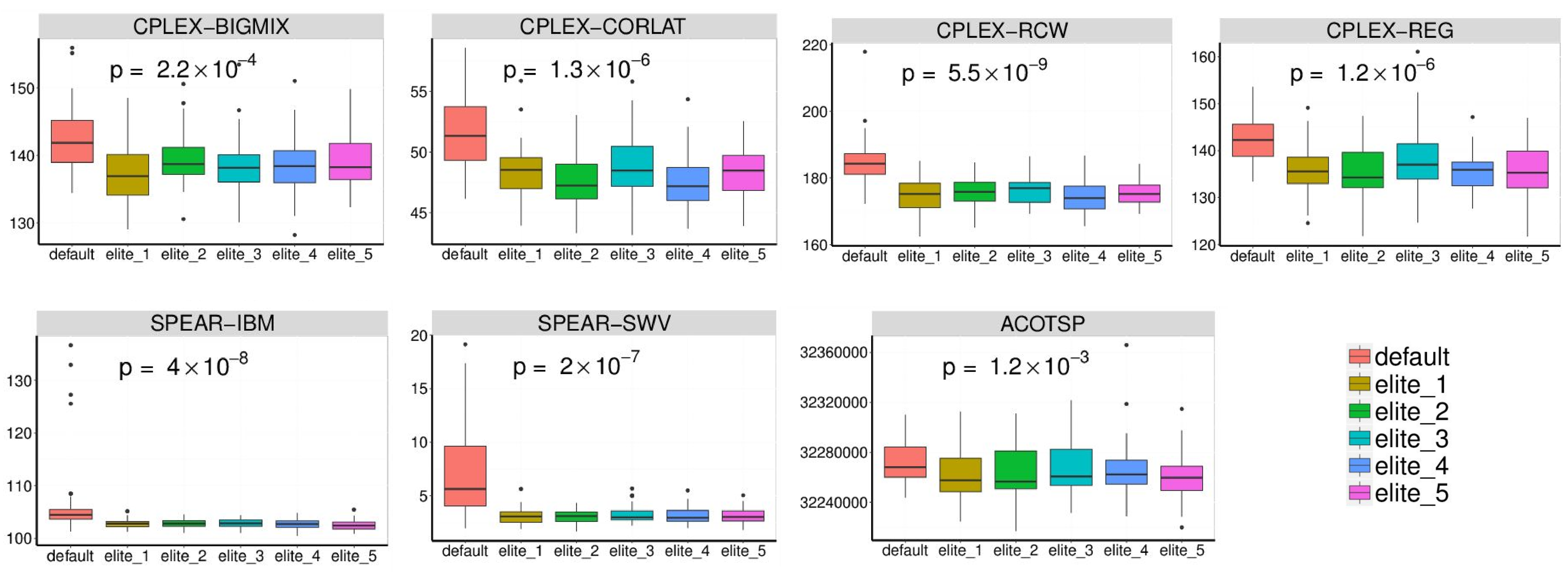
Algorithm configuration benchmarks for meta-tuning:

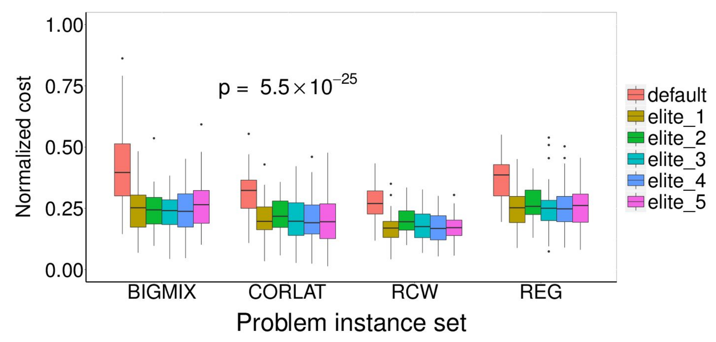
- Real benchmarks: extremely expensive
  - An irace run on SPEAR-IBM (budget: 5000 runs) → 2 CPU days
  - A meta-tuning on SPEAR-IBM (budget: 5000 irace runs) → 27.5 CPU years
- Artificial benchmark set
  - Unclear how to generate
  - Unclear how to match characteristics of real configuration tasks
- Surrogate benchmarks
  - A prediction model: configuration x instance → performance value
  - Build on real benchmark data

3. Empirical Performance Model (Hutter, Xu, Hoos & Leyton-Brown, 2014a)

- Random Forest regression model
- Training: 1000 random configurations x all problem instances

Algorithm	# Parameters (int/real/categorical/conditional)	Problem instance set (#instances)	Performance measure
CPLEX	76 (18/7/45/4)	BIGMIX (1000) REG (1000) CORLAT (1000) RCW (1000)	Running time
SPEAR	28 (4/12/10/9)	IBM (765) SWV (604)	Running time
Ant Colony Optimization	11 (4/4/3/5)	TSP (50)	Solution quality





Meta-tuning becomes computationally feasible

- An irace run on SPEAR-IBM (budget: 5000 runs) → 5 CPU minutes
- A meta-tuning on SPEAR-IBM (budget: 5000 irace runs) → 7.5 CPU days

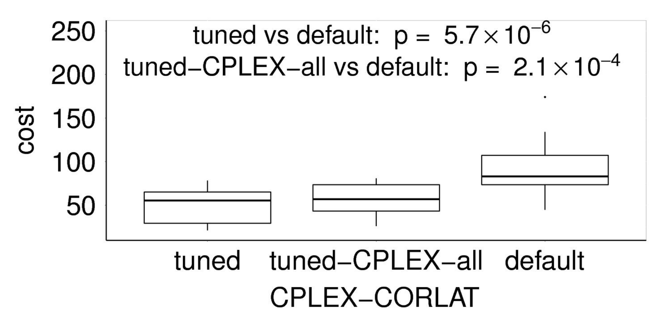
Consistency between surrogate and real benchmarks

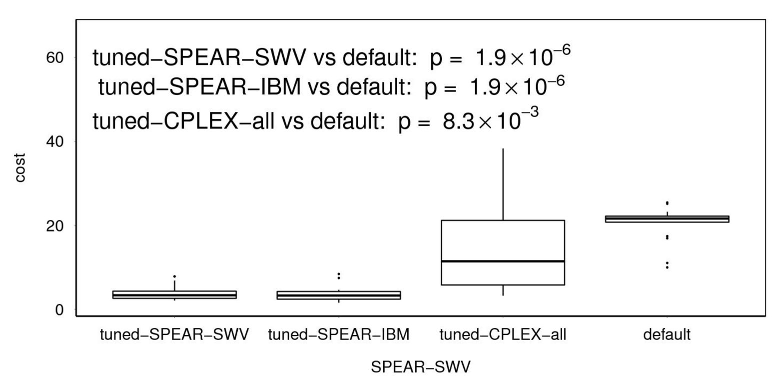
- Prediction accuracy
- Benchmark homogeneity (KendallW)
- Important parameters and pairwise interactions (fANOVA, Hutter et al 2014b)

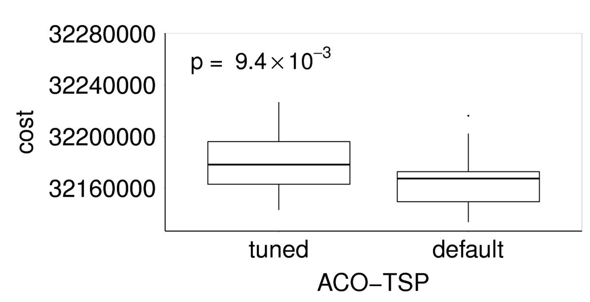
Post-analysis

- fANOVA (Hutter et al 2014b), ablation (Fawcett et al 2016), manual testing
- Most important parameters: N^{iter}, N^{min}, *elitist*
- Complex interactions between irace parameters
- Best irace versions exploit a more intense search than the default version.

4. Mixed results on real benchmarks







6. Ongoing works

- Try a new surrogate modelling method: Eggensperger, Lindauer, Hoos, Hutter & Leyton-Brown, 2017
  - Quantile Random Forest regression model + Hyper-parameter tuning
  - Training data: Trajectories of different automatic algorithm configurators + incumbents' performance + random data points
  - New benchmarks (*aclib2*)
- Collect more benchmarks
- Define quantitative characteristics of an algorithm configuration benchmark
- Meta-tuning on irace with capping
- Study relation between irace parameters and benchmark characteristics
- Study other state-of-the-art configurators

References

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