Algorithm Configuration Landscapes: More Benign than Expected?

Yasha Pushak
ypushak@cs.ubc.ca
University of British Columbia

Holger Hoos
hh@liacs.nl
Universiteit Leiden and
University of British Columbia

Motivation

Algorithm configuration:

- Automatically finds high quality parameter settings
- Improves performance by several orders of magnitude

Existing configurators:

- Use powerful meta-heuristics
- Assume landscapes are challenging to optimize

Our hypothesis:

- Landscapes are more benign than expected
- Parameter responses are perhaps uni-modal/convex

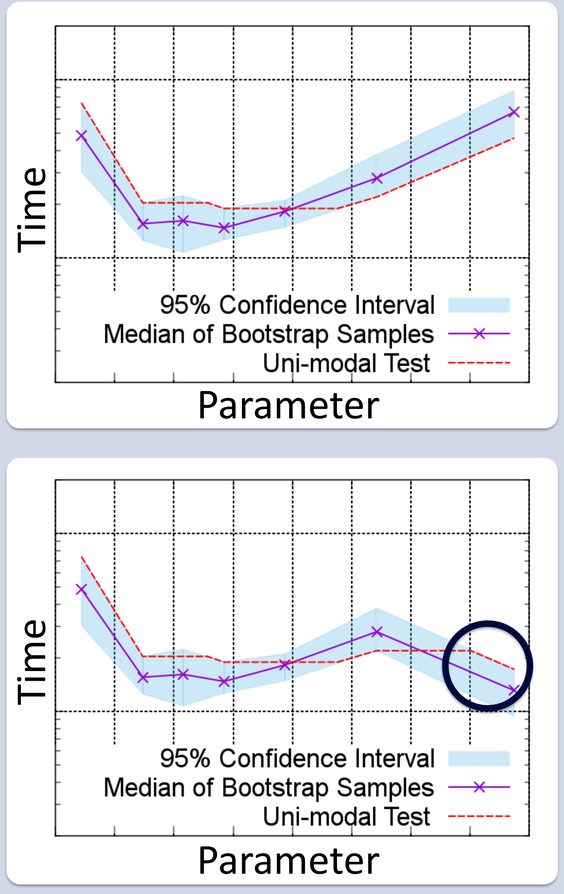
Intuition

Numerical parameters:

too little or ***too much***

Tests

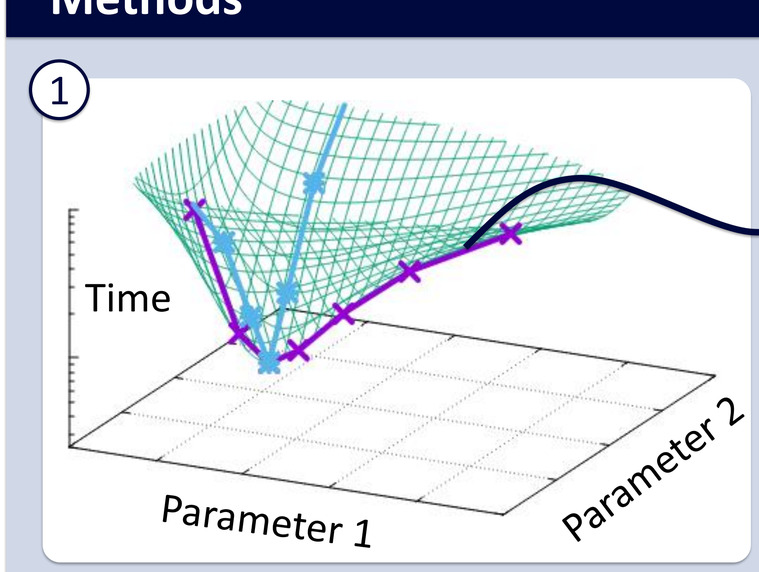
- Uni-modal?
- Convex?
- Interesting? ( or  ?)



Uni-modal? ✓

Uni-modal? ✗

Methods



+ Bootstrap Sampling

Experimental Setup

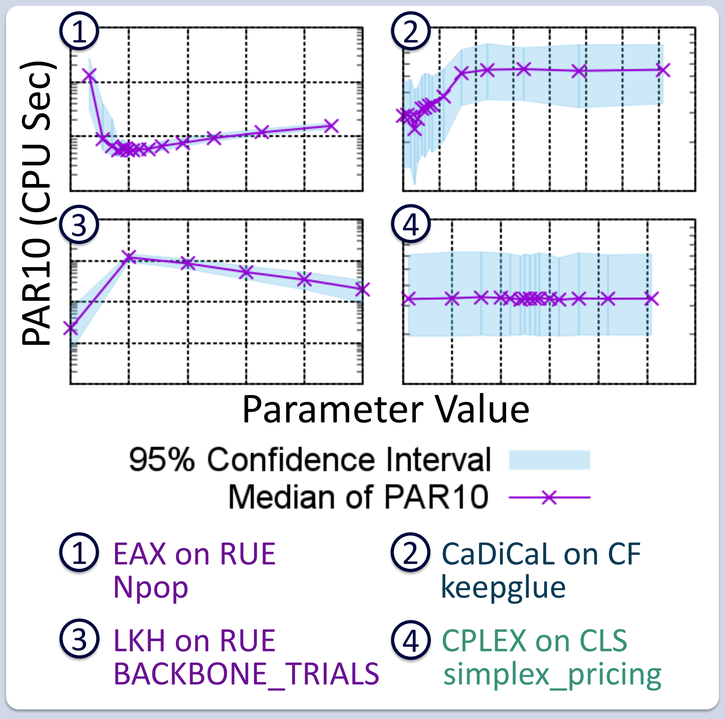
Domains: SAT, TSP, MIP

Algorithms: CaDiCaL, Cryptominisat, lingeling, EAX, LKH, CPLEX

Instance Sets: CF, BMC, RUE, CLS, R

Results

	Instance Sets		Individual Instances	
	% uni	% cvx	% uni	% cvx
All	99.5	99.5	95.3	92.6
	94.4	94.4	76.1	66.1



Conclusions

	Instance Sets	Individual Instances
Uni-modal	✓	✓ + ×
Convex	✓	✓ + ×

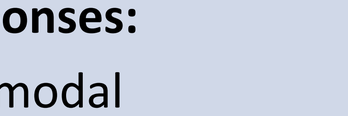
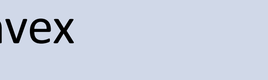
Instance set responses:

- Nearly all uni-modal
- Nearly all convex
- Relatively “smooth”

Individual instance responses:

- Mostly uni-modal
- Mostly convex
- More “noisy”

Future Work

- Exploit! 
- Interactions? 
- Categoricals?  or

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