CNFgen
A generator of crafted CNF formulas

Marc Vinyals

KTH Royal Institute of Technology
Stockholm, Sweden

Joint work with Massimo Lauria, Jan Elffers, and Jakob Nordström

20th International Conference on Theory and Applications of Satisfiability Testing
August 30 2017, Melbourne, Australia
Benchmarks

How to test a SAT solver? Benchmarks!
Benchmarks

How to test a SAT solver? Benchmarks!

Industrial

Pros
- Close to reality
- Cover interesting applications

Cons
- Few instances
- Results hard to compare
Benchmarks

How to test a SAT solver? Benchmarks!

Industrial

Pros
- Close to reality
- Cover interesting applications

Cons
- Few instances
- Results hard to compare

Crafted

Pros
- Can scale (no cactus plots)
- Can choose to be extremal with respect to a measure

Cons
- Crafted
Beyond Cactus Plots

- Cactus plots great to compare mixed formulas
- But lose a lot of information
Beyond Cactus Plots

Solved instances vs. Time

- Cactus plot

Marc Vinyals (KTH)
Beyond Cactus Plots

Solved instances vs. Instance size

- Cactus plot
- Asymptotic plot

Time vs. Solved instances vs. Instance size

Marc Vinyals (KTH)
CNFgen: a generator of crafted CNF formulas
Beyond Cactus Plots

Cactus plot

Solved instances

Time
Beyond Cactus Plots

- Cactus plot
- Asymptotic plot

Marc Vinyals (KTH)
Beyond Cactus Plots

- Cactus plots great to compare mixed formulas
- But lose a lot of information

- Need asymptotic plots to understand behaviour
Easy Benchmarks

What are good benchmarks?
Easy Benchmarks

What are good benchmarks?

- Easy for solvers: no fun

Marc Vinyals (KTH)
Easy Benchmarks

What are good benchmarks?

- Easy for solvers: no fun

- Provably hard $\Rightarrow$ hard for solvers: no fun
Easy Benchmarks

What are good benchmarks?

▶ Easy for solvers: no fun

▶ Provably hard $\Rightarrow$ hard for solvers: no fun

▶ Easy for method of reasoning, hard for solvers: interesting!
  ▶ e.g. easy for resolution, hard for CDCL
CNFgen

Generator of tricky CNF formulas.

Features

- Many formula families
- Easy to extend
- Python library with common constructs

Use Cases

- SAT competition 2016: easy formulas, hard in practice
- [ENSS, PoS'16]: evaluation of CDCL heuristics on tricky formulas
CNFgen

Generator of tricky CNF formulas.

Features
▶ Many formula families
▶ Easy to extend
▶ Python library with common constructs

Use Cases
▶ SAT competition 2016: easy formulas, hard in practice
▶ [ENSS, PoS’16]: evaluation of CDCL heuristics on tricky formulas
Take Home

Suggestions

- Use crafted benchmarks for scalability
  - Beyond cactus plots
  - Easy instances
- Send feedback, requests, patches

Website: http://massimolauria.github.io/cnfgen/
GitHub: https://github.com/MassimoLauria/cnfgen/

Install:
$ easy install networkx cnfgen
or
$ pip install cnfgen

Thanks!

Marc Vinyals (KTH)
Take Home

Suggestions

▶ Use crafted benchmarks for scalability
  ▶ Beyond cactus plots
  ▶ Easy instances
▶ Send feedback, requests, patches

Website  http://massimolauria.github.io/cnfgen/
GitHub  https://github.com/MassimoLauria/cnfgen/
Install  $ easy_install networkx cnfgen
        or $ pip install cnfgen

Thanks!