Advances in Multi-Engine ASP Solving

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Context & Motivations

- **Answer Set Programming (ASP)**
  - declarative logic programming paradigm
  - real-world applications: AI, KR&R, ... industry

    $\rightarrow$ **strengths:** *language expressivity & effective solvers*

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- **Key observations:**
  - Several good ASP Engines, common language (ASPCore 2.0)
  - No system/algorithm is the best choice in all domains
- **Take this fact as an advantage:**
  - By applying machine learning to ASP Solving
    - *Algorithm Selection Problem [Rice, 1976]*
  - Design and implement the multiengine solver ME-ASP

Contribution

Extension of ME-ASP to deal with the new standard language ASPCore 2.0

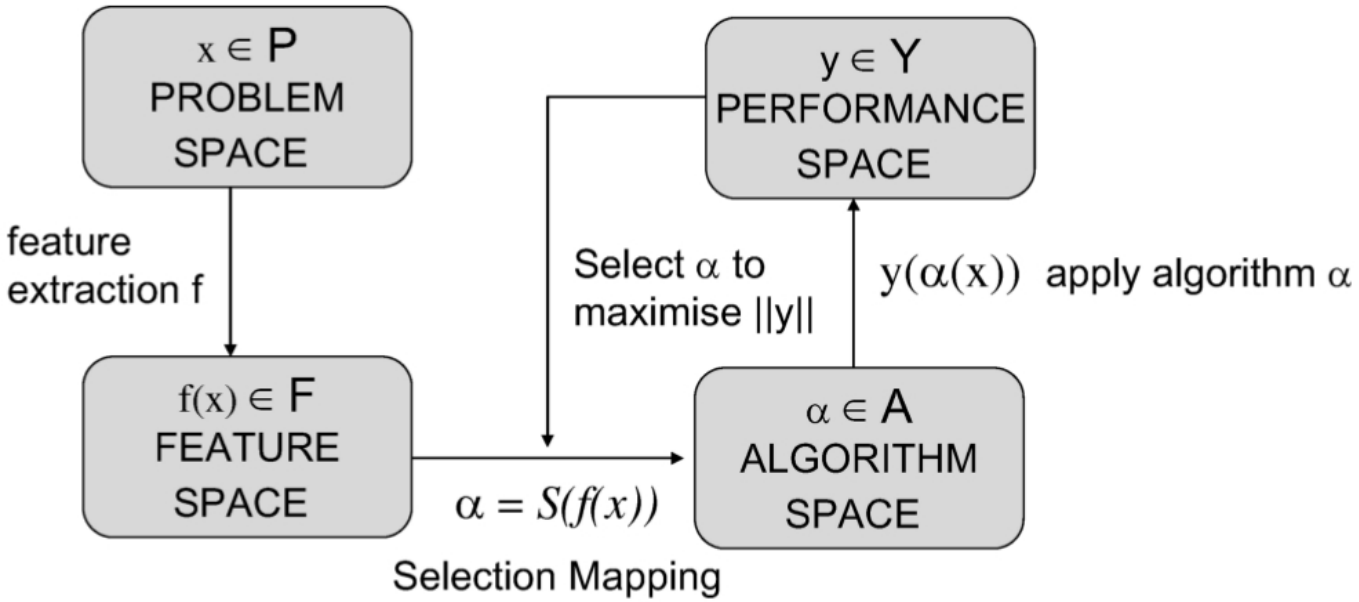
- Previous version (Maratea, Ricca & Pulina, 2012) limited to ASPCore 1.0
- Exploitation of the new features to properly classify benchmarks encoded in ASPCore 2.0

Effective approach

- ME-ASP performs better than its component engines
- ME-ASP outperforms alternative solutions at the state of the art, implemented in CLASPFOLIO ver. 2.2

Algorithm Selection Framework at Work

Rice, 1976 – Key ingredients of the recipe:



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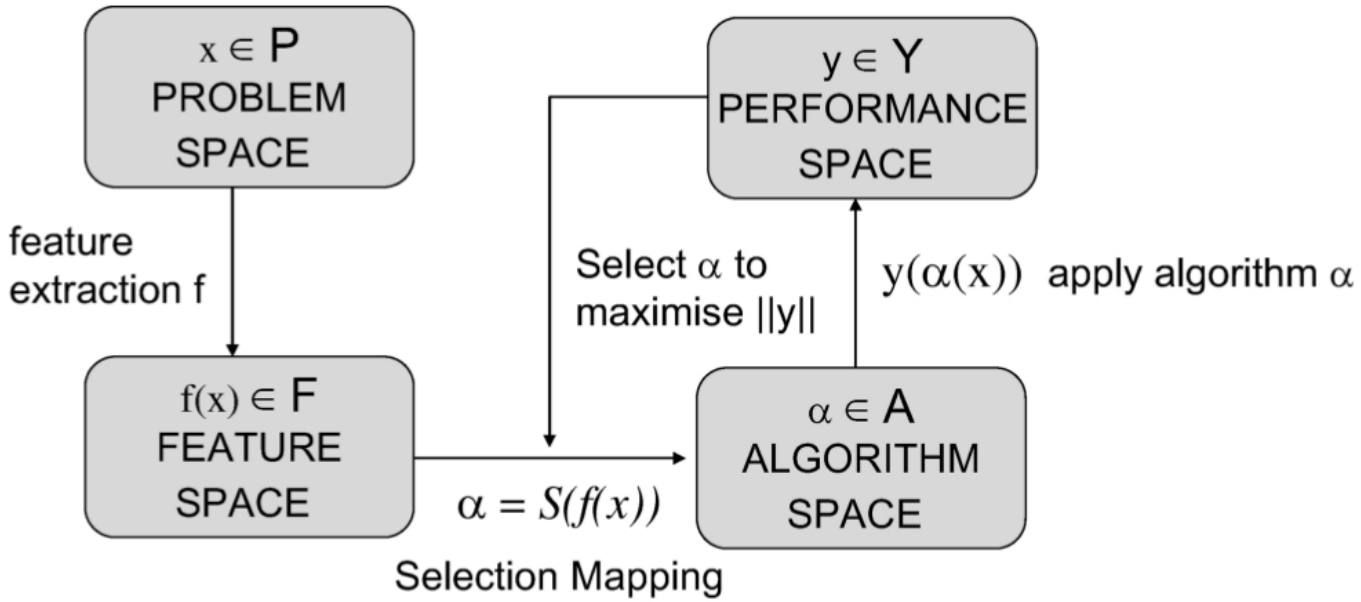

ME-ASP:

- *P*: ground input programs instantiated with GRINGO
- *F*: cheap-to-compute syntactic features
- *S* is determined leveraging machine learning algorithms
- *Y*: computation of the solution within a CPU time limit
- *A*: pool of ASP solver: CLASP, LP2NORMAL2+CLASP, WASP

Experimental results

Solver	Solved	Time
ME-ASP	2378	70144.99
CLASP	2253	63385.74
LP2NORMAL2+CLASP	2198	94560.98
CLASPFOLIO	1841	75044.14
WASP1.5	1532	52478.95
WASP2	1407	46939.06
LP2MAXSAT+CLASP	1387	82500.12
LP2GRAPH	1344	72633.53
LP2SAT3+LINGELING	1334	90644.33
WASP1	1313	87193.62
LP2SAT3+GLUCOSE	1305	73893.54
LP2BV2+BOOLECTOR	1011	57498.48

- Pool of about 3000 instances in ASP Core 2.0
- Time limit: 10 minutes; Memory limit: 2GB