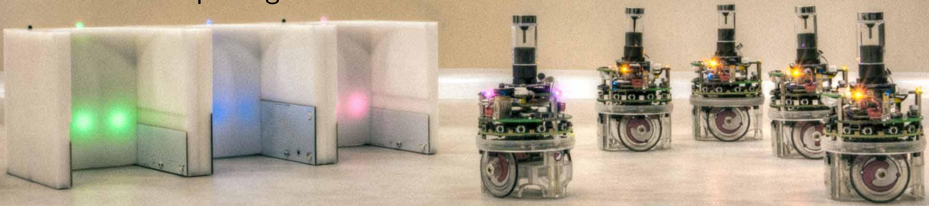
Automatic Design of Robot Swarms:

Towards a free-software implementation

- Swarm Robotics
- Automatic generation of control software
- The Demiurge project
- Public packages



A. Ligot, K. Hasselmann, G. Francesca, and M.Birattari

European Research Council
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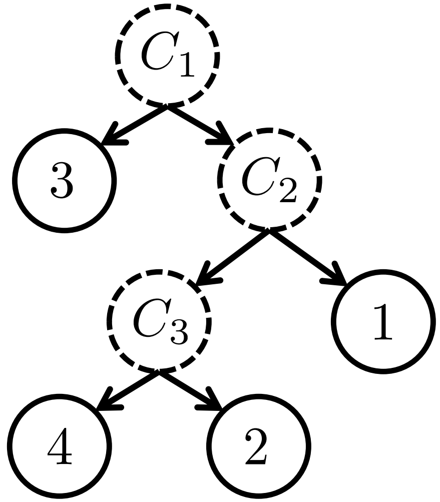
Université Libre de Bruxelles
IRIDIA
Institut de Recherches Interdisciplinaires et de Développements en Intelligence Artificielle

European Commission

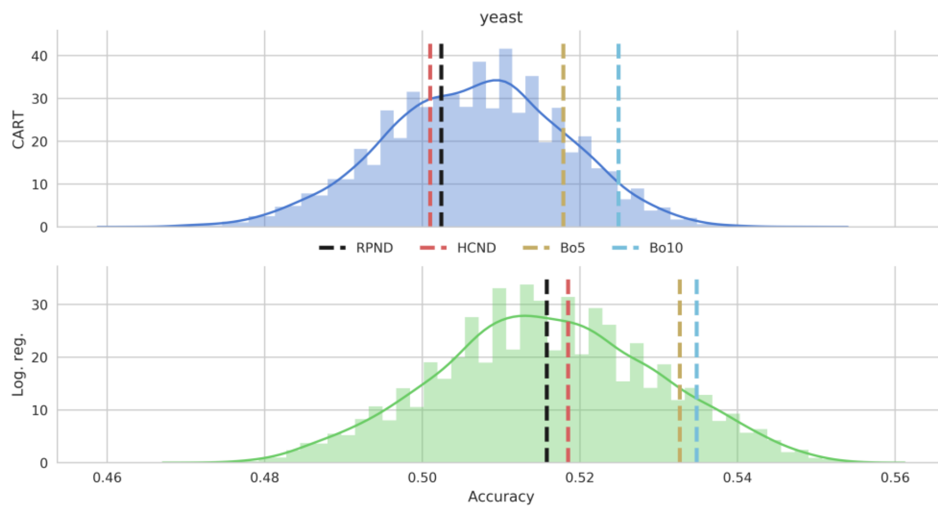
Optimizing the structure of nested dichotomies

- Decomposition of multi-class problems
  - Nested dichotomy (ND) as classifier
  - The space of possible solution candidates is huge

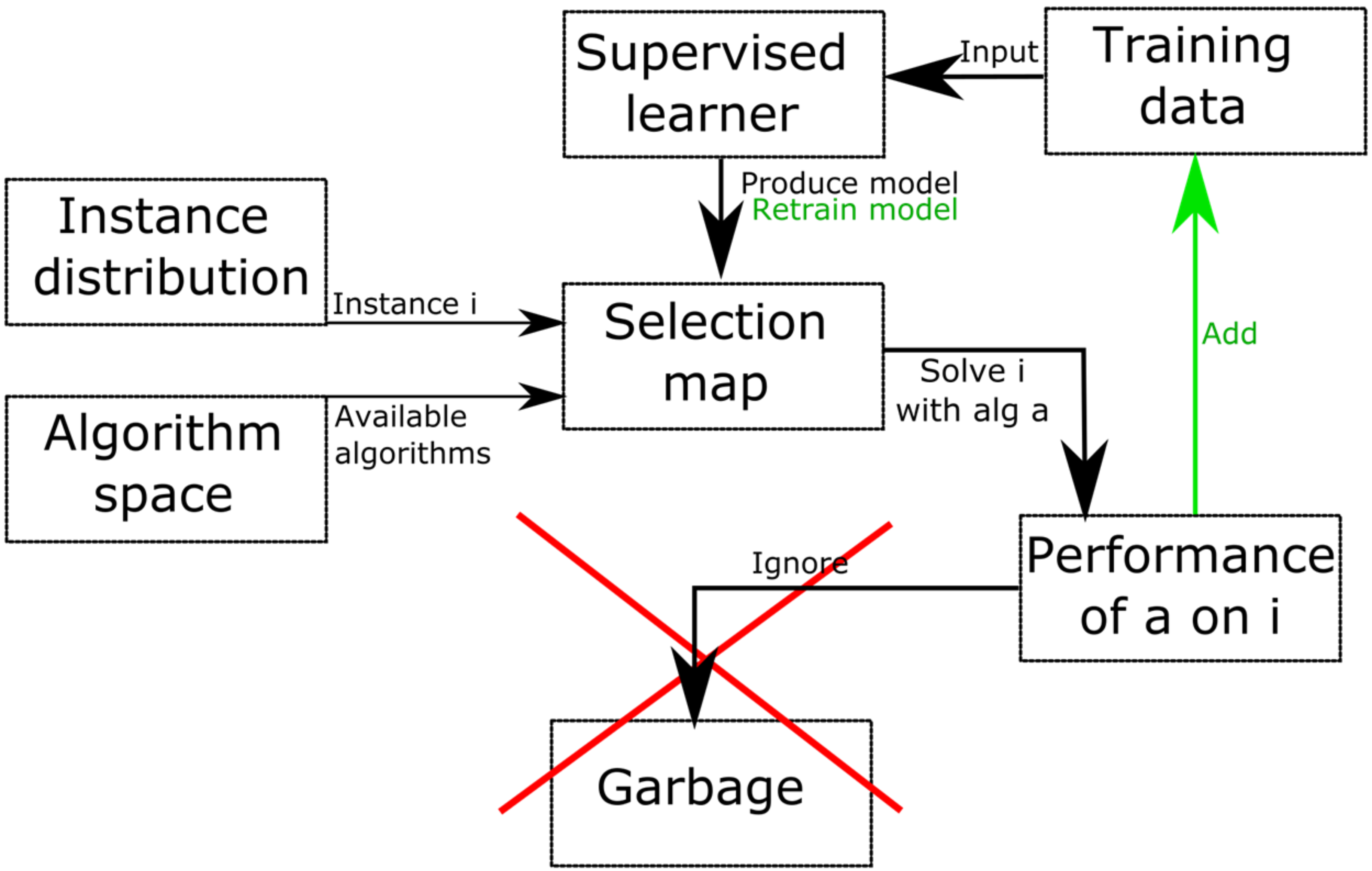


- Question: How to find an optimal ND for a given dataset?

- Empirical comparison of different heuristics for ND generation



Online Algorithm Selection



SATALIA

SolveEngine: **solve.satalia.com**

Website: **www.satalia.com**

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Summary

- Satalia is developing *the SolveEngine*
- A platform empowered by Algorithm Selection (AS) and Algorithm Configuration (AC)
- Forming ties with research communities, including COSEAL
- Internal research: Active Learning
- Speeding up AS using active training sets

Design of IoT Centric Algorithms: Selection & Performance Assessment

Soumya Banerjee [1,2]

Samia Bouzefrane [1]

[1]Le Conservatoire National des Arts et Métiers (France),[2] Birla Institute of Technology, (India)

Genesis :

Internet of Things (IoT) has become an emerging technology for sensors based applications. However, due to diversified cyber physical systems, the structure of IoT could be more versatile. This phenomena drives the different parameters in combinatorial schema, which must be optimal from the design point of view. This presentation is an initiative to introduce formal model of connected graph for the artefact of IoT. It Is also proposed to develop a learning paradigm, to feed the parameters and component of IoT. Hence, as a tool, the system could identify those similar parameters and will contribute in optimal design of Iot and Cyber Physical Systems.

Proposal :

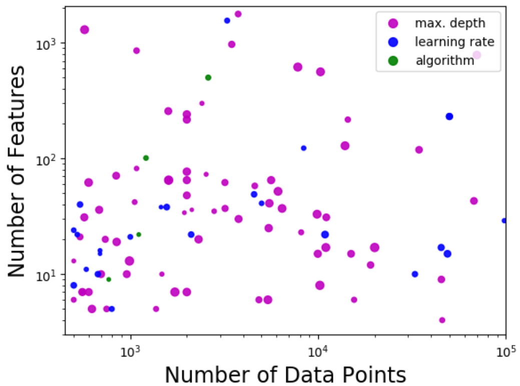
Users, objects and services visualized as Graph

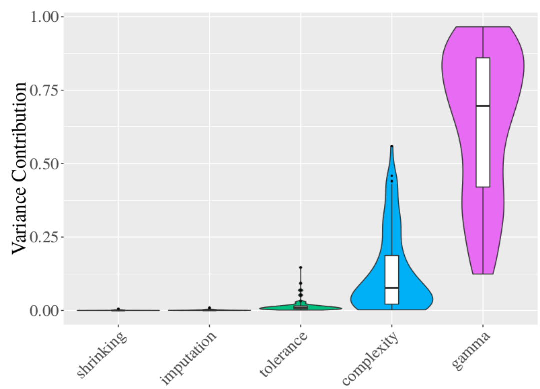
Possibility of weighted Hypergraph

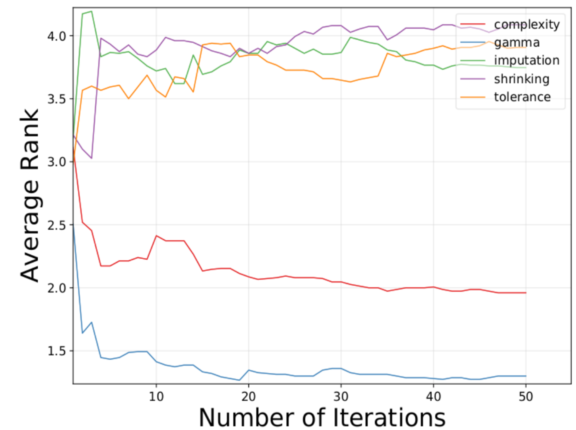
Introducing ML perspectives to mesaure the similarity of IoT design Structures

An Empirical Study of Hyperparameter Importance Across Datasets

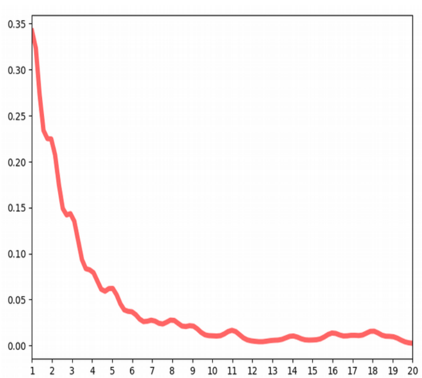
Which are the important hyperparameters?

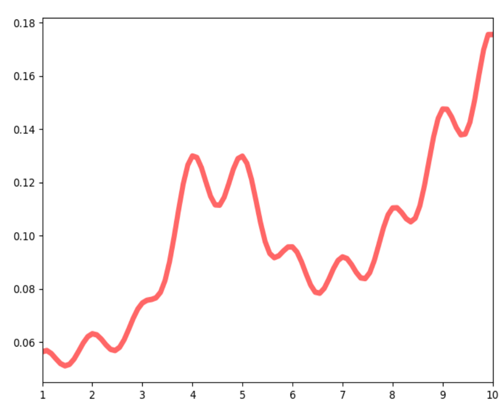




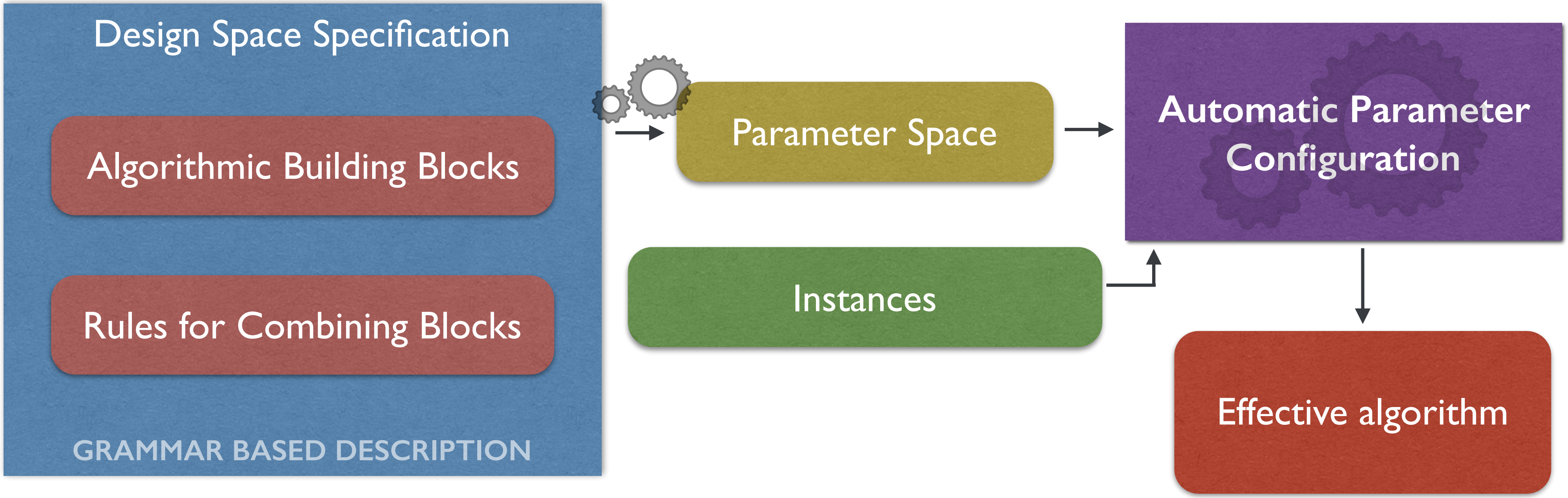


What are good priors/ranges to sample from?



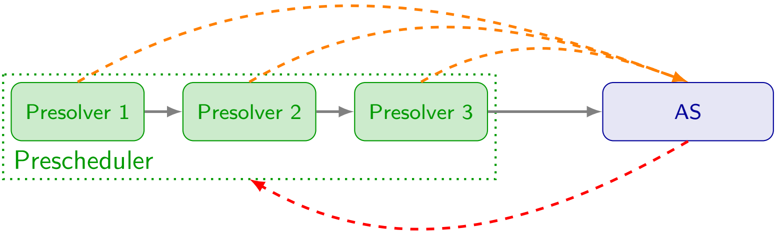


Automatic design of Hybrid Stochastic Local Search Algorithms



- Design Space specification: **EMILI** framework; algorithm compositions represented by grammar
- Automatic Parameter configuration: **irace**

ASAP.V2: Algorithm Selector And Prescheduler



ASAP.V2: Prescheduler + Algorithm Selector (AS)

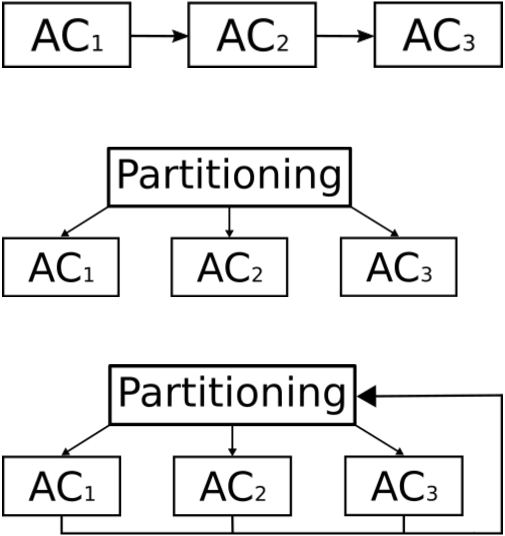
- The Prescheduler and AS must cooperate.
- Sequential optimization:
  - Optimize the AS component (Prescheduler is fixed);
  - Optimize the Prescheduler (AS is fixed).
- ...while preventing overfitting!

Kraken: An Iterative Partitioning Approach for Per-Instance Algorithm Configuration

Hydra:

ISAC:

Kraken:



ML-Plan: AutoML through Hierarchical Planning

- Problem: Automated ML Algorithm Selection/Configuration
- Solution: Global Best Search of an HTN-spanned tree
- Highlights:
  - Beats current state-of-the-art tuner on most data sets
  - Dedicated anti-overfit strategy

Accompanying Algorithm Selection with a Configurable Algorithmic Framework

Mohamed Amine EL MAJDOULI

Highlights (Early Stage work)

This poster describes a basic idea of a communication scheme between an Automatic Selection system and an Configurable Algorithmic Framework. The inherent problem of prediction accuracy in Automatic Selection is targeted. Indeed, the described approach tries to figure out the performance of unselected algorithms during predictions and acts on this basis to (I) enhance, if possible, the prediction output in term of quality and (II) evolve new algorithms using Automatic Configuration with the aim of exploring improved solving for new instances but also reducing the Algorithms Set size which explicitly affects the prediction system complexity.

Revisiting Simulated Annealing: a Component-Based Analysis

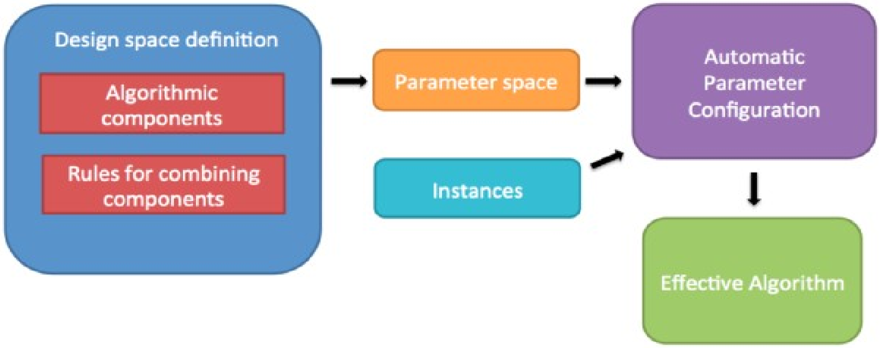
Alberto Franzin, Thomas Stützle

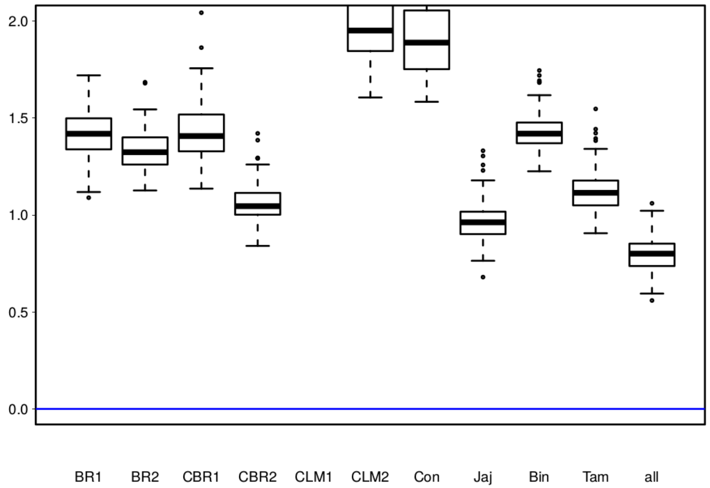
We take a component-based perspective of algorithms to analyse Simulated Annealing.

We identified 7 algorithmic components of SA, and collected several options available in the literature for each of them into the EMILI framework.

We can reinstantiate existing SA algorithms from the literature and, pairing the use of the framework with irace, we can improve the algorithms and generate new SA algorithms tailored for the given problem. We also show some basic analysis we can do.

We report experiments on the Quadratic Assignment Problem.

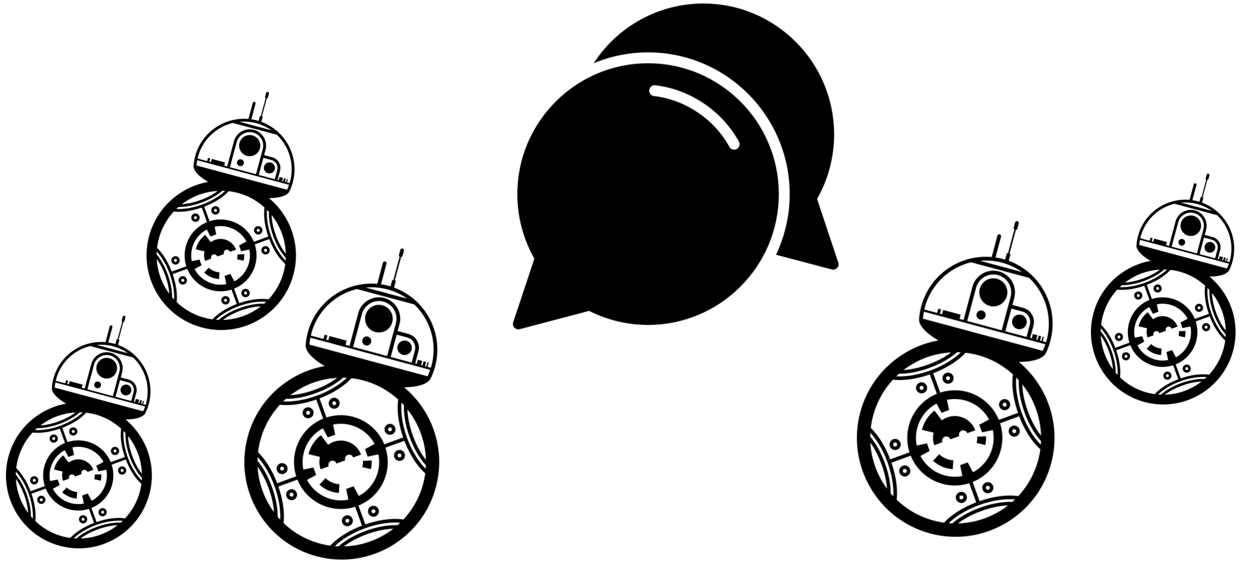




AutoMoDe-Gianduja

Automatic Modular Design for robot swarms,
an experiment on communication between robots

It is possible to automatically design a swarm of communicating robots ?



beams
IRIDIA
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Established by the European Commission
DEMIURGE IRIDIA – Université libre de Bruxelles

Hans Degroote, José Luis González Velarde and Patrick De Causmaecker

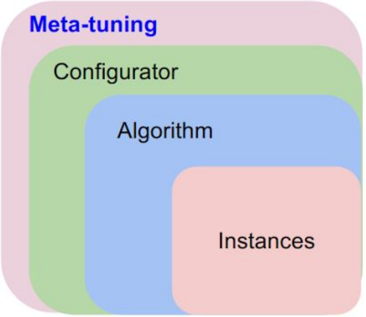
A Java Framework for (online) algorithm selection

- **Object oriented system for algorithm selection**
  - Algorithms automatically selected and executed
- All core components of algorithm selection are explicitly present
  - Overview of core components of algorithm selection
  - User chooses concrete implementation for specific problem scenario
- **Minimal user-input required**
  - Executables + scripts for extracting performance and feature values
- Applied to the **generalized assignment problem**
- Challenges
  - Obtaining execs (and getting them to work)
  - Identifying good features
  - Deciding how to measure performance

Configuring irace using surrogate configuration benchmarks

Nguyen Dang [1], Leslie Pérez Cáceres [2], Thomas Stützle [2], Patrick De Causmaecker [1]

[1] CODeS, ITEC-imec, KU Leuven, Belgium
[2] IRIDIA, CoDE, Université Libre de Bruxelles (ULB), Belgium



Automatic algorithm configurators also have their own parameters (e.g., irace has 9 parameters)

Meta-tuning: Use a configurator to configure the parameters of a configurator

Real AC benchmarks: meta-tuning is extremely expensive

Surrogate AC benchmarks: meta-tuning becomes computationally feasible

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

- Results indicate clear room for improvement over the default parameter configuration of irace
- Mixed results on real benchmarks

On-going works

- Try new surrogate models: Eggensperger, Lindauer, Hoos, Hutter & Leyton-Brown, 2017
- Configure irace with capping
- Study the relation between irace parameters and benchmark characteristics
- Study other state-of-the-art configurators

Hierarchical Decomposition of Multi-Class Problems

A Genetic Multi-Obective Approach

In multinomial classification, reduction techniques are commonly used to decompose the original learning problem into several simpler problems. Optimizing decomposition structures such as nested polychotomies by means of genetic algorithms does not work in a straight-forward way using standard genetic operators. Reducing the evolution of those tree structures to the evolution of labeled hypergraphs helps to overcome these difficulties.