Session 5 in a Nutshell

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Session Contents

12 papers

- 5x (Adaptation, self-adaptation and parameter tuning)
- 1x (Constraint handling)
- 1x (Dynamic and uncertain environments)
- 1x (Estimation of distribution algorithms and metamodelling)
- 2x (Genetic Programming)
- 4x (Multiobjective optimization)
- 3x (Real-World Applications)
- 1x (Theory)

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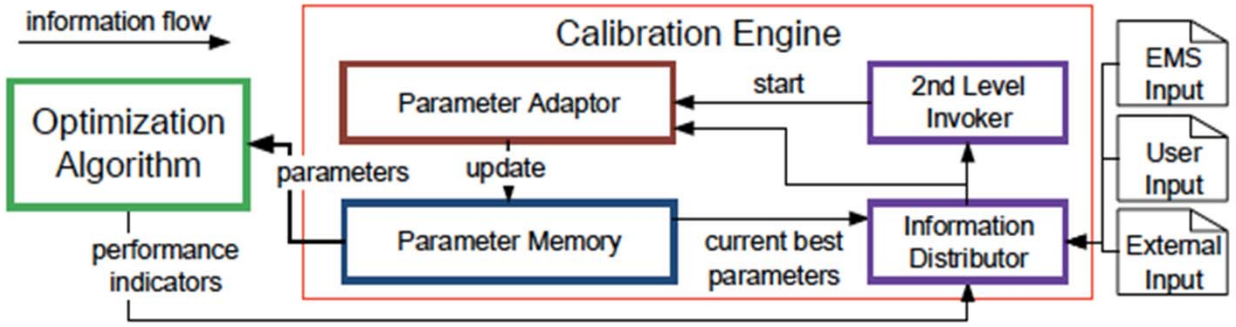
Run-time Parameter Selection and Tuning for Energy Optimization Algorithms

Ingo Mauser, Marita Dorscheid, and Hartmut Schmeck

- Energy management and optimization in smart buildings



- Metaevolutionary parameter tuning
- Decrease average electricity costs while reducing the running time per optimization process

VLR: A Memory-Based Optimization Heuristic

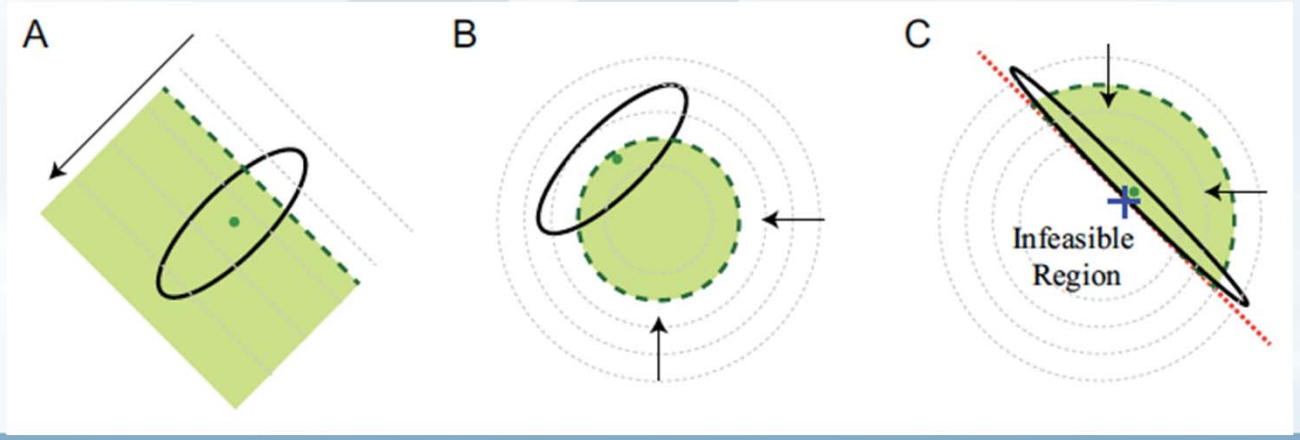
Hansang Yun, Myoung Hoon Ha, and Robert Ian McKay

- VLR = Visited-Local-Region
- Keep archive of already visited areas.
- Use a "threshold of uncertainty" to control exploration.
- Comparison with state-of-the-art algorithms and sensitivity analysis.

Viability Principles for Constrained Optimization Using a (1+1)-CMA-ES

Andrea Maesani and Dario Floreano

- Viability evolution: time-changing boundaries are defined to drive the search.
- Adapt CMA-ES to decrease the variance in the direction of boundary violations
- Competitive results with SotA.



Adaptation in Nonlinear Learning Models for Nonstationary Tasks

Wolfgang Konen, Patrick Koch

- Adaptation of learning rates in nonstationary learning environments.
- Incremental Delta Bar Delta: Learning rates are not predefined but they are adapted as hyperparameters
- Non-linear case: adding non-linearity can turn the system unstable.
- Add weight decay: fast and stable learning.

From Expected Improvement to Investment Portfolio Improvement: Spreading the Risk in Kriging-based Optimization

Rasmus K. Ursem

- Fast-to-compute surrogate models for time-consuming simulations.
- Kriging-based prescreening:
  - Lower bound
  - Probability of improvement
  - Expected improvement
- Investment Portfolio Improvement (IPI) prescreening.
  - Define IPI function
  - Each DE-individual has a target.
- Experimentation with engineering-like functions.

Improving Genetic Programming with Behavioral Consistency Measure

Krzysztof Krawiec and Armando Solar-Lezama

- Assesing the intermediate values (breakpoints) of the program in addition to the quality of the output.

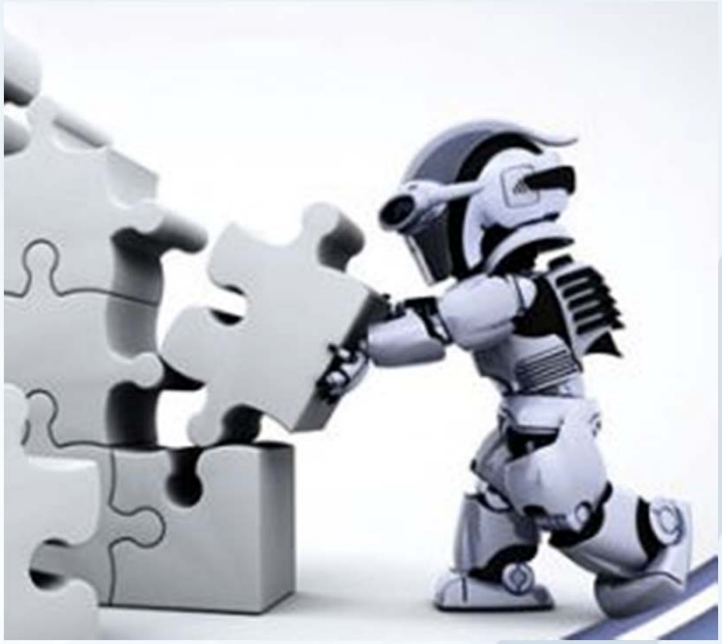
New fitness measure based on information consistency (using conditional entropy).

Scalar aggregation or multi-objective.

The MO approach brings substantial benefits to a GP search algorithm

Automatic Design of Evolutionary Algorithms for Multi-Objective Combinatorial Optimization

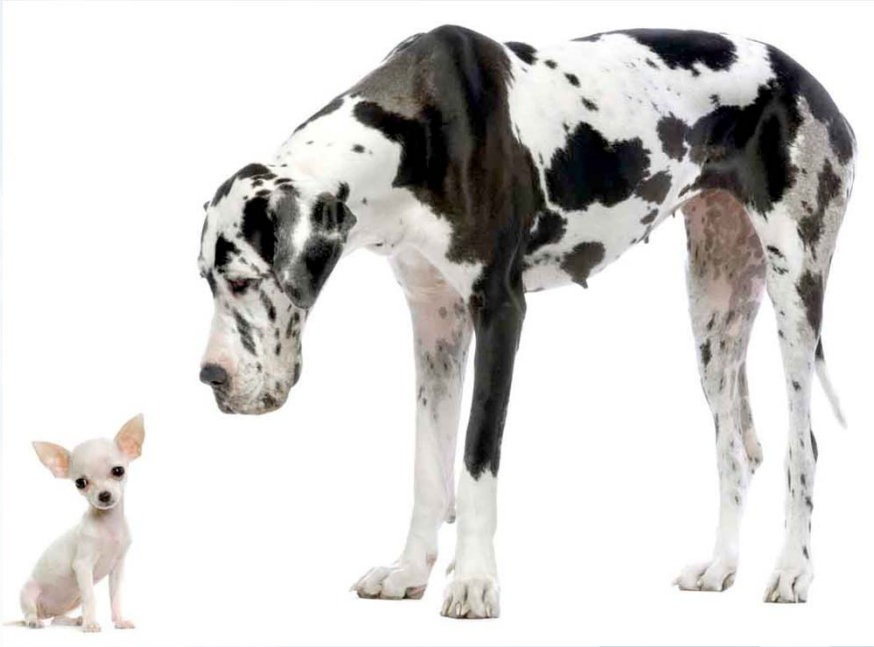
Leonardo C. T. Bezerra, Manuel Lopez-Ibañez, and Thomas Stützle



- Component-wise view of MOEAs.
- Define a framework for instantiating MOEAs combining different libraries (PISA, PaGMO, ...)
- Irace method for automatic design.
- AutoMOEAs compared with traditional MOEAs on four permutation flowshop variants.

Start Small, Grow Big?
Saving Multi-objective Function Evaluations

Tobias Glasmachers, Boris Naujoks, and Günter Rudolph



- Intuition:
  - Single-objective: Start big, shrink small.
  - Multi-objective: Start small, grow big.
- Dynamic population sizing: fixed vs adaptive schedules (akin to 1/5 rule)
- Experimental evaluation indicates savings of up to 50% FE.

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MH-MOEA: A New Multi-Objective Evolutionary Algorithm based on the Maximin Fitness Function and the Hypervolume Indicator

Adriana Menchaca-Méndez and Carlos A. Coello Coello

Hybridization of maximin fitness function and hypervolume indicator.

Try to solve problems of weak nondominace and diversity.

Use MFF and correct with I_H.

MH-MOEA is able to outperform other MOEAs with both few and many objectives.

Balancing Bicycle Sharing Systems: An Analysis of Path Relinking and Recombination within a GRASP Hybrid

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Petrina Papazek, Christian Kloimüllner, Bin Hu, and Günther R. Raidl

- Find vehicle tours to rebalance stations' fill level.
- Aggregate three objectives:
  - Unbalance
  - Load operations
  - Drivers' working time
- PCH + VND into GRASP.
- PR + VND for recombination.
- Significantly improved average results especially on larger instances

Evolving DPA-resistant Boolean Functions

Stjepan Picek, Lejla Batina and Domagoj Jakobovic

- Differential power analysis is a side-channel attack which involves statistically analyzing power consumption measurements
- Transparency order of BFs related to DPA resistance.
- Evolve BFs. Fitness aggregates:
  - Balancedness
  - Non-linearity
  - Transparency
- GAs and GP. Reference works improved.

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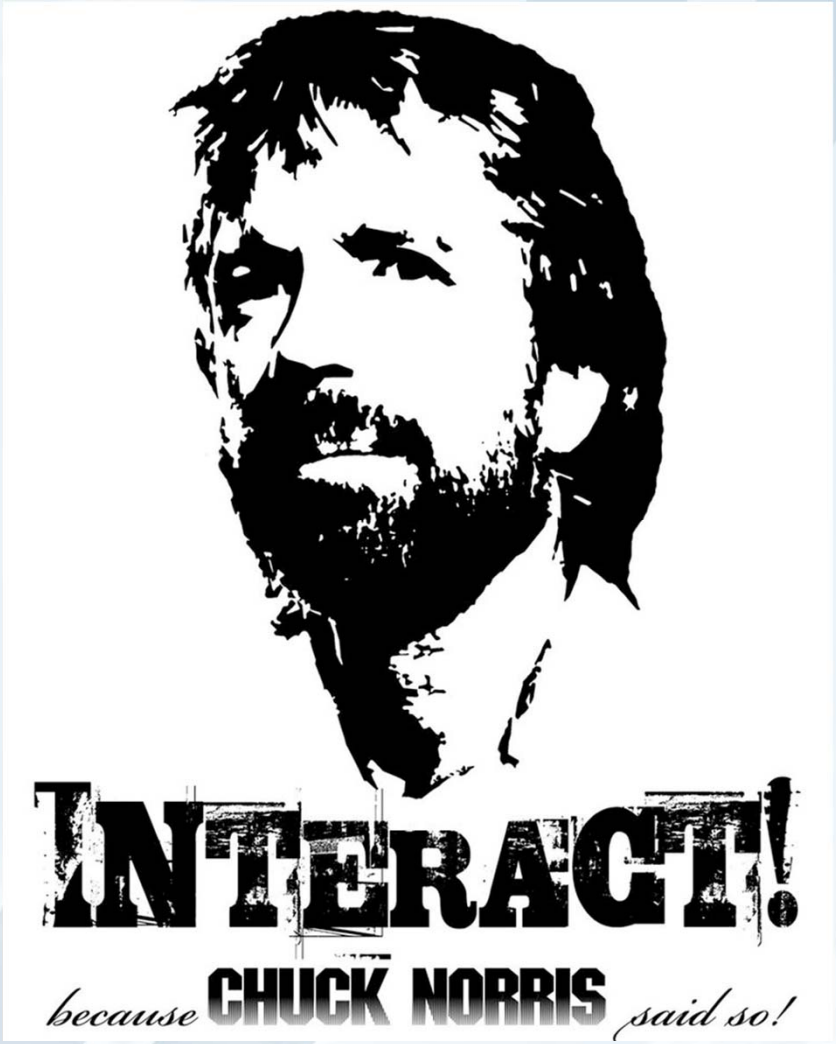
On the Runtime Analysis of Fitness Sharing Mechanisms

Pietro S. Oliveto, Dirk Sudholt, and Christine Zarges

- Similar individuals share resources.
- Analyze expected runtime on the TwoMax function.
- Briefing of results:
  - (2+1)-EA not enough to find both optima in polytime
  - (μ+1)-EA, μ>3, allows successful runs with prob = 1
  - Large λ in (μ+λ)–EA is detrimental.

A final advice...