13th International Conference on Parallel Problem Solving from Nature.

Ljubljana, Slovenia.
13–17 September 2014.

Poster Session 7.
Wednesday, 11:00 –12:30.

Dirk Thierens

Shuffle and Mate: A Dynamic Model for Spatially Structured Evolutionary Algorithms.

Carlos M. Fernandes, Juan L. J. Laredo, Juan Julian Merelo, Carlos Cotta, Rafael Nogueras, and Agostinho C. Rosa.

Problem: 2-dimensional grid of nodes where individuals interact and self-organize into clusters.

Approach:

- N individuals distributed over M-nodes grid ($M > N$).
- Individuals interact with neighbors and move to neighboring states.

Results:

- Dynamic structure better preserves genetic diversity than static topologies $\Rightarrow$ search process improved.
- $M : N > 4 : 1$
  $\Rightarrow$ highly dynamic global island-like model emerges.

Parameter Prediction Based on Features of Evolved Instances for Ant Colony Optimization and the Traveling Salesperson Problem.

Samadhi Nallaperuma, Markus Wagner, and Frank Neumann.

Problem: Predict the best parameter setting of Max-Min Ant System for TSP instances.

Approach:

- 2 key ACO parameters: importance of the pheromone values and of the heuristic information.
- Identify relevant features of evolved TSP instances.
- Nearest-neighbor classifier as prediction model.

Results:

- Successfully predict the best parameter setting for a wide range of instances from TSPLIB.

Messy Coding in the XCS Classifier System for Sequence Labeling.

Masaya Nakata, Tim Kovacs, and Keiki Takadama.

Problem: Sequence labeling data is a time-series classification problem with a sequence of input/class pairs.

Approach:

- Original XCS-SL uses a fixed interval coding.
- Here, messy coding of previous inputs used.
- $\{1\#0\} \Rightarrow \{(1,0),(0,2)\}$.

Results:

- Messy coding results in higher classification accuracy and a smaller population size than the original interval coding.

Evolutionary Constrained Optimization for a Jupiter Capture.

Jeremie Labroquere, Aurelie Heritier, Annalisa Riccardi, and Dario Izzo.

Problem: Search for an interplanetary capture trajectory to reach a desired target orbit with minimum fuel consumption. Constraints: maximum thrust level, maximum time of flight, and minimum closest distance to the planet.

Approach:

- Combine Differential Evolution algorithm with different constraint handling techniques: death penalty, adaptive penalty, immune system, repair methods.

Results:

- Adaptive penalty (= co-evolution) technique only one able to find feasible ballistic solutions when maximum thrust level constraints are added to the problem.

Evolving Mixtures of n-gram Models for Sequencing and Schedule Optimization.

Chung-Yao Chuang and Stephen F. Smith.

Problem: Design of an Estimation of Distribution Algorithm (EDA) that addresses sequencing problems.

Approach:

- Probabilistic models estimated from n-gram statistics.
- Use of 2-gram, 3-gram, and 2-gram + 3-gram models.
- Adaptive mixture model of 2-gram and 3-gram.
- Experiments on 10 TSP instances (16 to 105 cities).

Results:

- 2-gram: OK; 3-gram: premature convergence.
- Adaptive 2-gram + 3-gram similar success rate as 2-gram while requiring less function evaluations.

Boosting Search for Recursive Functions Using Partial Call-Trees.

Brad Alexander and Brad Zacher.

Problem: Evolve recursive functions in genetic programming.

Approach:

- Test cases used to evaluate fitness in GP provide poor guidance in the search for the recursive clause in recursive functions.
- Improve search using additional information in the form of partial call-trees.

Results:

- Call-Tree-Guided Genetic Programming significantly outperforms Grammatical Evolution both in terms of the reduced number of evaluations required and the number of times a benchmark was correctly evolved.

On the Impact of Multiobjective Scalarizing Functions.

Bilel Derbel, Dimo Brockhoff, Arnaud Liefooghe, and Sebastien Verel.

Problem: MOEAs using a set of single-objective, scalarized optimization problems.

Approach:

- Define a set of search directions in objective space and specify the corresponding scalarizing functions.
- $(1+\lambda)$-EA in each search direction on biobjective NK-landscapes.

Results: Not the actual choice of the scalarizing function or their parameters makes the difference in terms of performance, but rather the general properties of the resulting lines of equal function values in the objective space.

Distance-Based Analysis of Crossover Operators for Many-Objective Knapsack Problems.

Hisao Ishibuchi, Yuki Tanigaki, Hiroyuki Masuda, and Yusuke Nojima.

Problem: Improve performance of MOEAs on multi-objective knapsack problems by recombining similar parents or exchanging only a small number of genes.

Approach:

- NSGA-II on 500-item knapsack with 2-10 objectives.
- Measure parent-parent and parent-offspring distance.
- Specify a distance-based crossover where the closest parent-offspring distance is a user-defined parameter.

Results: Appropriate parent-offspring distance is surprisingly small (also improves diversity maintenance).

A Portfolio Optimization Approach to Selection in Multiobjective EAs.

Iryna Yevseyeva, Andreia P. Guerreiro, Michael T. M. Emmerich, and Carlos M. Fonseca.

Problem: New selection method in MOEAs inspired by portfolio selection in finance.

Approach:

- Portfolio optimization based on expected return and risk.
- Fitness assignment: allocation of capital to individuals, considering individual quality and population diversity.

Results:

- Resulting selection procedure unifies parental and environmental selection.
- Multiobjective multidimensional knapsack problem: preserving diversity and promoting convergence towards the Pareto-optimal front.

Travelling Salesman Problem Solved 'in materio' by Evolved Carbon Nanotube Device.

Kester Dean Clegg, Julian Francis Miller, Kieran Massey, and Mike Petty.

Problem: 'In materio' computation: technique that uses search algorithms to configure materials for computation.

Approach: A single-walled carbon nanotube (SWCNT) / polymer composite material deposited on a micro-electrode array is configured using static voltages so that voltage output readings determine the path order in which to visit cities.

Results:

- Computation with the SWCNT material is able to solve small TSP instances as efficiently as an EA performing the same computation in software.
- SWCNT computation seems to scale linearly.

Tuning EMO for Closed-Loop Estimation of Chromatographic Operating Conditions.

Richard Allmendinger, Spyridon Gerontas, Nigel J. Titchener-Hooker, and Suzanne S. Farid.

Problem: Purification is costly step in the production of biopharmaceutical: optimize all operating conditions simultaneously using MOEAs.

Approach:

- NSGA-II, MOEA/D, SMS-EMOA, and ParEGO.
- Performance of a MOEA depends on the setting of the population size, and on the strategies used for constraint and resourcing issues.

Results: MOEAs, in particular SMS-EMOA and ParEGO, are able to discover within 100 evaluations operating conditions that lead to high levels of yield and product purity.

Local Optima and Weight Distribution in the Number Partitioning Problem.

Khulood Alyahya and Jonathan E. Rowe.

Problem: 1-bit flip landscape properties for the number partitioning problem.

Approach:

- Relation between variability of the weights and number of local optima (resp. average local search cost).
- Small instances to allow exhaustive enumeration.

Results:

- Number of local optima and average local search cost strongly and negatively correlated with the variability.
- Formula to estimate the average number of local optima depending only on the problem size and the variability.

Enjoy the last PPSN XIII session.