Self-Organising Systems

Rudolf Mayer

Institut für Softwaretechnik & Interaktive Systeme
(mayer@ifs.tuwien.ac.at)

SBA Research
(www.sba-research.org)

Exercises – topics

- Group Work

- Two types
  - Using self-organising systems for problem solving
    - Pick your algorithms and problems
    - |algorithms| + |problems| >= 5
  - Custom topics (see document in TUWEL for more details)
  - (A custom topic by yourself, if it fits within the scope and is approved by me; contact me in **due time**)

GA/Ants/Agents: Comparative experimentation

- Take 2-3 self-organising techniques presented so far (Ants, CAs, GAs, ...)
  - Can (shall!) re-use existing implementations

- Find a set of 2-3 different problem tasks, and compare how these techniques fit to solve them
  - Compare relative runtimes in regard to size of the problem
  - Compare time needed to find (good) solutions
  - Analyse for which type of problem which solution works better
  - Focus is on representing the problem domain & analysis
    - E.g combinatorial problems.: TSP, Vehicle Routing, Knapsack problem, Cutting Stock, Nurse scheduling..
    - Also: Rastrigin function (specific evaluation problem)

GA/Ants/Agents: Comparative experimentation

- Also some custom, specialised topics available, solving problems in e.g. Machine Learning:
  - Finding optimal subsets in a data anonymisation task
  - Finding optimal combination of data exchange in a federated machine learning setting
  - Optimising synthetic data generation
  - See provided details in TUWEL

EAs for ML (IP Protection, attacks, ..)

- Trained machine learning models are valuable IP
- Stealing them, or preventing theft, gains attention

- Evolutionary algorithms are used in some approaches
  - Finding better ways how to steal these models
    - Optimising the querying, …
  - Finding ways how to detect theft
    - Optimising watermarking patterns, …

- EAs also used e.g. for finding adversarial examples, …

EAs for optimising other aspects

- E.g. optimising
  - Finding bayesian network structures
  - Optimal local anonymisation subsets
  - ...

- Topics will be provided in TUWEL

- Custom topics based on your ideas also possible!

Finding optimal subset for anonymisation

- K-anonymous datasets provide anonymity for persons whose informations are contained
  - There are multiple ways to achieve the same level of k-anonymity!
- Motivation: distribute k-anonymous datasets in such a way that each recipient gets a different instance of the dataset
- Datasets differ with regard to data utility, therefore we want datasets:
  - With low information loss
  - That are mutually very similar
- The goal: find such a subset while optimizing:
  - Average information loss of the subset
  - Variance of information loss of the subset
  - Size of the subset
  - ...