

# NAT Tutorial 6: Metaheuristic Algorithms

1. Recall the main algorithms that we were dealing with (i.e. GA, ES, GP, ACO, PSO and possibly variants of these, if this makes a difference) and classify them according to Dorigo's criteria for the classification of solvers of combinatorial optimisation problems:
  - a. Is the solution obtained by direct construction or by the use of local search?
  - b. Are population of solutions used or not?
  - c. Is a memory used within the search process or not?
  - d. Is the evaluation function fixed or is it modified during search?
  - e. Several neighbourhoods or only a single one?
  - f. Inspired by nature or artificial?You could represent the answer to this question as a table containing check-marks, unless more specific answer are appropriate.
2. How can optimisation problems be solved if the search space is continuous and the fitness function is analytically known? (This relates to our topic only indirectly.)
3. Suppose you want to evaluate the usefulness of metaheuristic algorithms
  - a. in comparison to the canonical version or a version which has been proposed by a competitor,
  - b. in comparison to standard or problem-specific direct algorithms for a specific application,
  - c. in comparison to other types of metaheuristic algorithms for a specific application,
  - d. same as c) but in more general sense.How would you design the experiments in each of these tasks? How would you present the results?
4. Compare the representations of GA and PSO as model-based search/optimisation.
5. Natural computing comprises also topics such as artificial immune systems, neural networks, cellular automata, amorphous computing, artificial life, self-assembly, gene regulatory networks, evolving ecosystems (predator prey models), non-conventional computers and social computing (just to name some of those that are hardly covered in this course). Choose one of these, find some background information, and discuss whether and how they can be used in applications.
6. Look at [http://www.inf.ed.ac.uk/teaching/exam\\_papers/](http://www.inf.ed.ac.uk/teaching/exam_papers/) for problems in previous years' exams of the courses Natural computing (NAT) and Genetic algorithms and genetic programming (GAGP). Identify at least one problem which is not easily solvable.