Evolutionary computing and combinatorial optimisation

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Among the different techniques that exist to solve combinatorial optimisation problems, some recent ones were inspired by life sciences. Unlike the classical local optimisation techniques that create or modify a single solution, these techniques handle a set of candidate solutions, called population of individuals, that evolves. The rules that control this evolution define each so-called evolutionary algorithm.

The similarities and differences of the following evolutionary algorithms are discussed during the presentation:

- Genetic Algorithm (GA).
- Ant System (AS).
- Population-Based Incremental Learning (PBIL).
- Evolution Strategy (ES).

A quick overview of the design of the C++ library APPEAL[1] (Advanced Parallel Population-based Evolutionary Algorithm Library) is given. This library, currently under development, aims at helping to write complex hybrid evolutionary algorithms for any optimisation problem. It allows the use of the same framework for the different evolutionary algorithms by defining the interfaces between three types of classes. First the algorithmic classes that are provided in order to implement most of the classical evolutionary algorithms. Second, the classes that encode candidate solutions (the most useful ones, such as boolean vectors, are provided). And finally, the classes that describe combinatorial optimisation problems. As these last classes highly depend on the problem, no *a priori* knowledge is available about them. Therefore they mainly consist of interfaces of virtual classes which are defined in order to ease the development of new problem specific programs. Some examples will be shown of how to use the library for a practical optimisation problem (radio transmitter siting) and a classical problem (graph coloring problem).

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