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Combinatorial Optimization and bio-inspiration

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The Combinatorial optimization problems are characterized by a discrete set of algorithmic solutions or whose possible solutions can be reduced to a discrete set. The main goal is to optimize (maximize or minimize) function aim to resolve instances of problems (finding the optimal solution), by exploring the space of possible solutions. When the complexity of the search space is greater, the cost of implementation of these algorithms increases exponentially, given the possible combinations of the variables involved.

An optimal solution is a balance between finding the best solution and the use of limited - or limited - resources in a considerable time. The most commonly used in combinatorial optimization techniques are the heuristics and metaheuristics, taking a subset of bioinspired technics.

The bioinspired technics seek to solve problems and process information in a manner similar to how biological systems would make it, such is the case of neural networks, genetic algorithms, evolutionary computation, and artificial vision, among others. In a traditional way, bioinspired methods are focused on solving problems whose solutions is finite; however, there are multiple strategies to solve every problem with an exponential number of candidates for a solution or instance. The Solution Strategies may include:

- The simplest solution: test all candidates (high consumption of resources and time) .
- Methods of approximation such as: voracious strategies, branches and pruning and similar (medium consumption of resources and time, but it is necessary to structure all possible solutions).
- Methods of approximation: simple random search.
- Approximation methods: random search optimized. The Bio-inspired methods are in this category.

The fundamental characteristics of the Bio-inspired algorithms are:

- Few restrictions on its use.
- They generate populations of solutions and not specific responses (greater consumption of resources)
- Parallels can be considered intrinsically
- They can create efficient outcomes or premature convergence.
- It is necessary to ensure the diversity of the population

The generic procedure to a bioinspired algorithm can be divided into the following sections:

- Generate population (based on the characteristics of the problem)
- Evolutionary mechanisms (based on the technique used)
- Mechanisms of evaluation (based on the characteristics of the problem)
- Condition of completion (based on the characteristics of the solution)

In general, algorithms, techniques and procedures bioinspired looking to obtain an optimal solution of a finite set of solutions, with finite resources, but with exponential combinations of variables, having to choose a solution of n possible. They are considered simple algorithms, but whose implementation can be in any field labor, academic or social, being of the most used techniques nowadays.