# Evolutionary Computation

## Optimization problems

The process of finding the best solution for a given optimization problem with a given resource and temporal budget.

* **Tractable**: if there is an algorithm that solves it polynomial time.
* **Intractable (hard)**: if there is no algorithm that solves the problem in polynomial time, NP problems.

### Iterative stochastic methods

Multi-purpose and often easy to adapt

* Generate and evaluate an initial collection of candidate solutions, S.
* Select elements of S. Produce and evaluate a new set of candidate solutions S’ by means of modifications of the selected elements.
* Replace some elements of S with some elements of S’ and return to Step 2.

## Nature inspired methods

Neural networks, genetic and evolutionary algorithms

## Evolutionary computing

Given a search space with all possible solutions, E.C often takes use of two functions:

**Crossover operator**: combines characteristics of two or more individuals (local search)  
**Mutation**: generates new individuals with different characteristics (global search)

The result of this combination is a function that is pseudo random.   
*Random* as in operators are non-deterministic   
*Directed* as the selection is controlled by the fitness function that tends to improve the quality of solutions.

Exploration: Long-term benefit concept where the agent improves knowledge due to stochastic events.

Exploitation: Choose a greedy approach to get the largest reward.