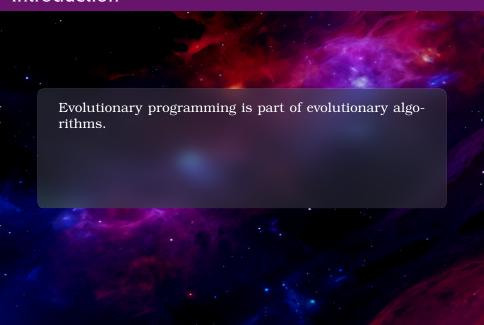
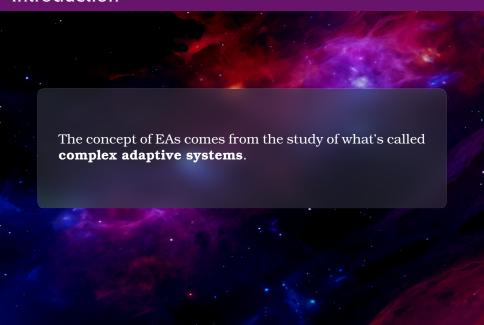
Evolutionary programming

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Its first algorithmic implementation can be traced back to Lawrence and David Fogel's work.

Evolutionary programming is part of evolutionary algorithms.

The concept of EAs comes from the study of what's called **complex adaptive systems**.

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Basic evolutionary process

- One or more populations of individuals competing for limited resources.
- The notions of dynamically changing populations due to birth and death of individuals.
- A concept of **fitness** which reflects the ability of an individual to survive and reproduce.
- A concept of **variational inheritance**: offspring closely resemble their parents but are not identical.

- Formulating solutions,
- then evaluating them:
- the best ones are used, the less useful ones are usually **discarded** and
- some of them are mutated or recombined to create new ones, maybe better.

Evolutionary algorithms are useful for problem solving due to its *complex adaptive behaviour* emulation. Not so different from how humans search for solutions to any problem:

- Formulating solutions,
- then evaluating them:
- the best ones are used, the less useful ones are usually discarded and
- some of them are mutated or recombined to create new ones, maybe better.

Evolutionary programming

Fogel proposed modeling individuals as finite state machines.

Also, he proposed sexual and asexual reproduction of individuals in the algorithm.

The program should start with a N number of initial individuals; and the next generation is determined by combining new individuals into a 2N population, raking them and selecting the best N individuals.

Problem solving

Since simple rules could demonstrate complex behaviour and some sort of intelligent exploration in a space of possible solutions, we can use EAs to solve problems.

Problem solving

Each problem should be modeled in order to find

- An individual definition that satisfies the problem's solution space characterization.
- A fitness function that describes correctly our problem's behaviour.
- A variation operator that generates new individuals from existing ones.
- A **selection operator** that selects the best individuals from the population.

Problem solving

This can be applied, for example, not only to simple problems (like function maximization/minimization) but to more complex ones like ANN's weights tuning, scheduling, energy consumption optimization, etc.