Artificial intelligence in data science

Game models

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Learn to play games

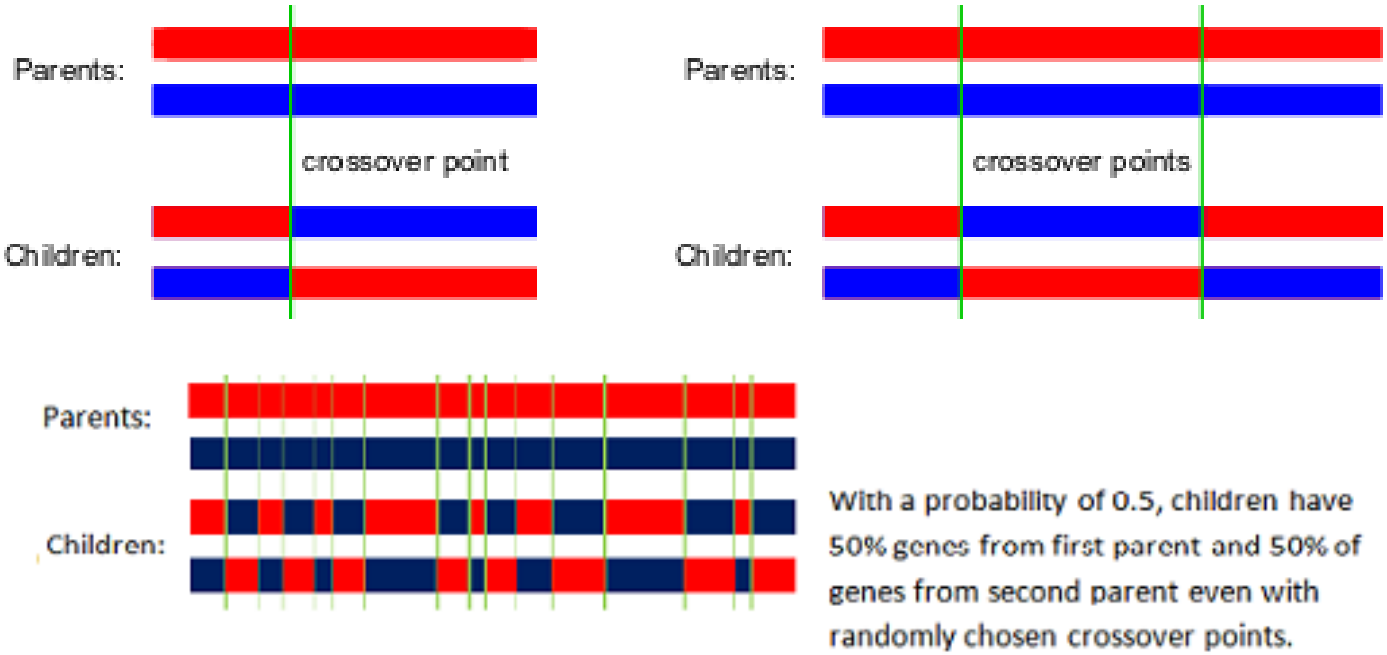
- Rules
- Observables
- Possible moves
- Aim: choose best move from observables
- Two methods:
  - Genetic algorithm
  - Reinforcement learning

Genetic algorithm

- Learn from nature
- Let the fittest to survive
  - Fitness function, e.g. energy, length, etc.
- Combine different strategies
- State is represented by a vector (genetic code or genotype)
  - Phasespace, city order, neural network parameters, etc.
- Offsprings have two parents with shared genetic code
- Mutations
- Those who are not fit enough die out
  - Keep the number of agents fixed

Genetic algorithm: Reproduction

- Two parents and two children

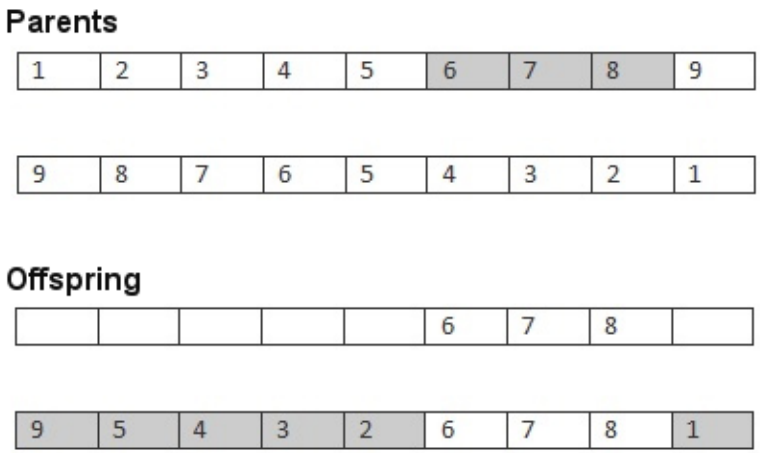


Genetic algorithm terminology

- Chromosome: Carrier of the genetic representation
- Gene: Smallest units in the chromosome with individual meaning
- Parents: Pair of chromosomes, wich produce offsprings
- Population: Set of chromosomes from which the parents are selected. Its size should be larger than the length of the chromosome
- Selection principle: The way parents are selected (random, elitistic)
- Crossover: Recombination of the genes of the parents by mixing
- Crossover rate: The rate by which crossover takes place ($\sim$90%)
- Mutatation: Random change of genes
- Mutation rate: The rate by which mutation takes place ($\sim$1%)
- Generation: The pool after one sweep.

Genetic algorithm schema

1. Start with a randomly generated population
2. Calculate the fitnesses
3. Selection
   - Random
   - Best fitness (keep top 50% and generate new 50%)
   - Roulette (Monte-Carlo) selection
4. Crossover: offsprings must be viable (Sometimes difficult)



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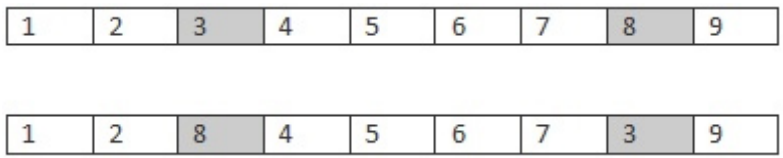
4. Crossover: offsprings must be viable (Sometimes difficult)
   - One-point
   - Two-point
   - Uniform
   - Mutation: small rate



Genetic algorithm example