UiT The Arctic University of Norway

Genetic algorithms

An optimization algorithm modelled after Darwin's evolutionary theory

Lecture 2/3 – Selection, crossover and mutation

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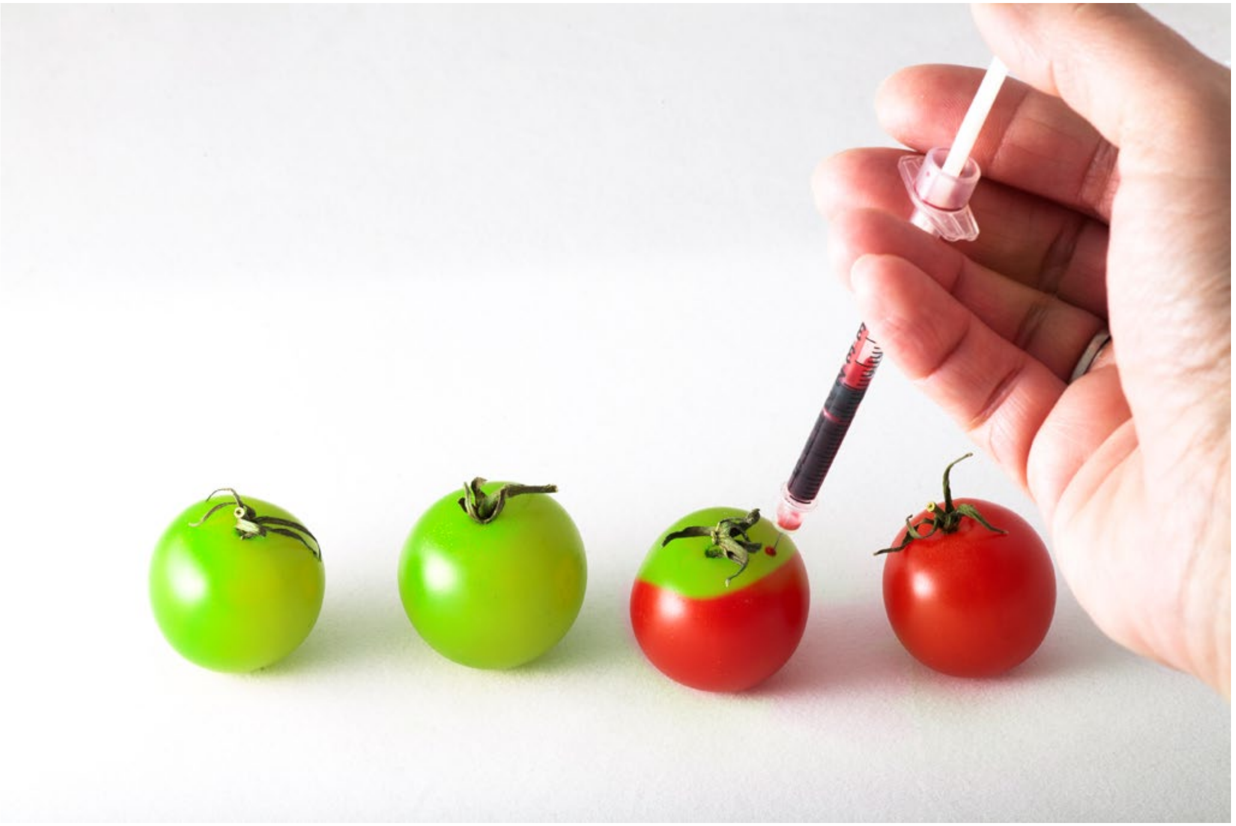
Initial population definition

- All features generated randomly
- Random range should cover all solutions
- How many individuals?
  - The need for genetic diversity
  - Parallelization

Operators

- Selection
- Crossover
- Mutation
- Inversion



Selection

- How individuals are selected for crossover
- Based on fitness score
- Most common:
  - Elitist selection
    - Only the top % fittest (elite) is considered
  - Roulette wheel selection
    - All individuals are assigned a random chance based on their fitness

Crossover

- How features from each “parent” combine to form offspring
- Single-point
  - Genes are “cut” and “pasted” at a certain point
- Multi-point
  - Multiple genes from each parent are combined in the offspring
- Arithmetic
  - Gene values are “mixed” to make a new value

Mutation

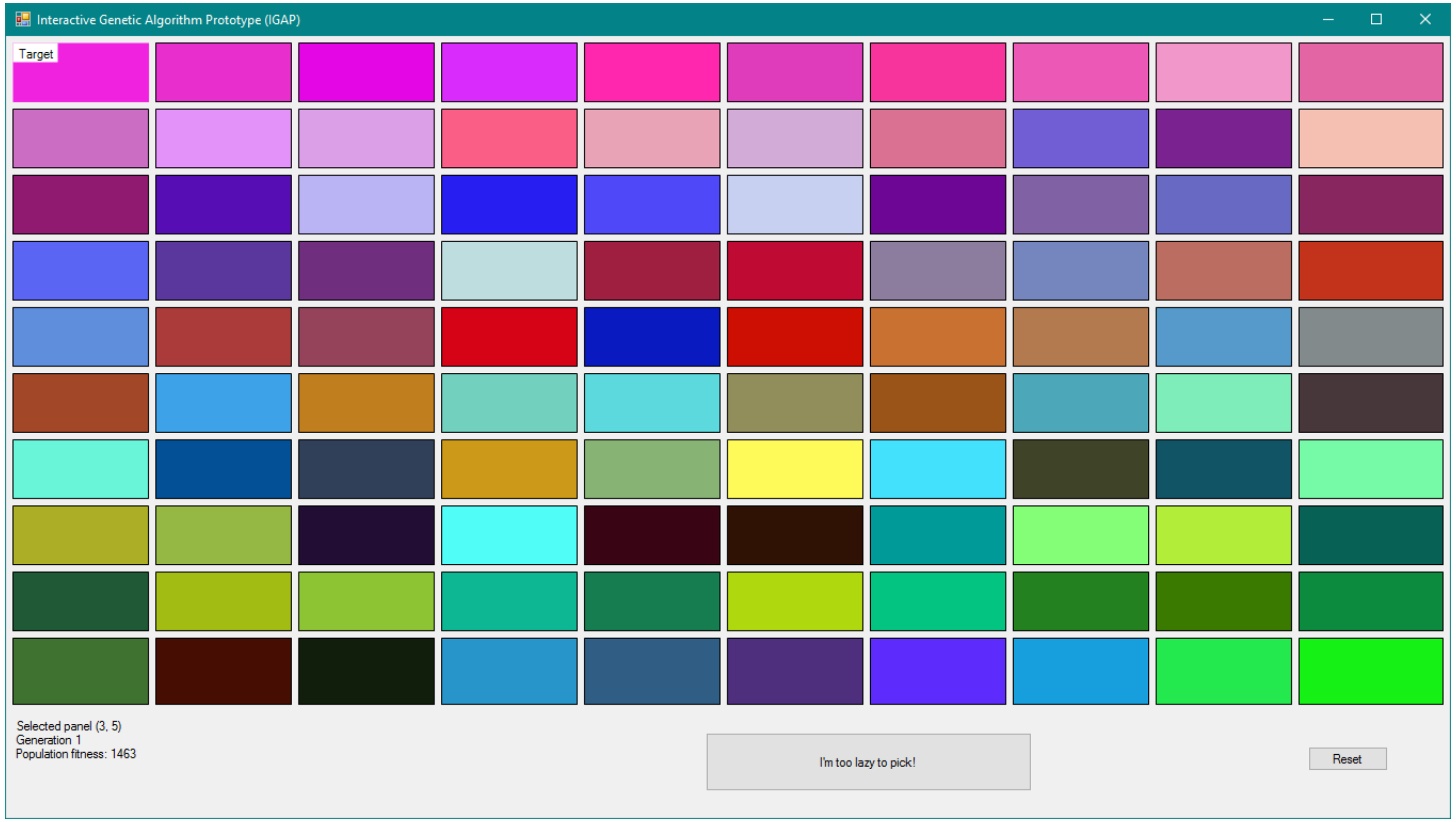
- Genetic diversity
- Adapt to evolutionary pressure
  - Changing conditions
- May produced new, beneficial features
- Avoid getting "stuck" in sub-optimal solutions
- Representation dependent
  - Bit flipping for binary strings

Evolutionary pressure

- How many offspring are created in every generation, and
- How the new individuals are introduced to the population
- Option 1 – the population increases by the number of new individuals
- Option 2 – The least fit are “killed off” and replaced by the new individuals
  - The number of new individuals determine how many of the old are removed. This relationship may be tweaked for different problems

Coming up

- A practical example: colors



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