UiT The Arctic University of Norway

Genetic algorithms

An optimization algorithm modelled after Darwin's evolutionary theory

Lecture 1/3 - Introduction

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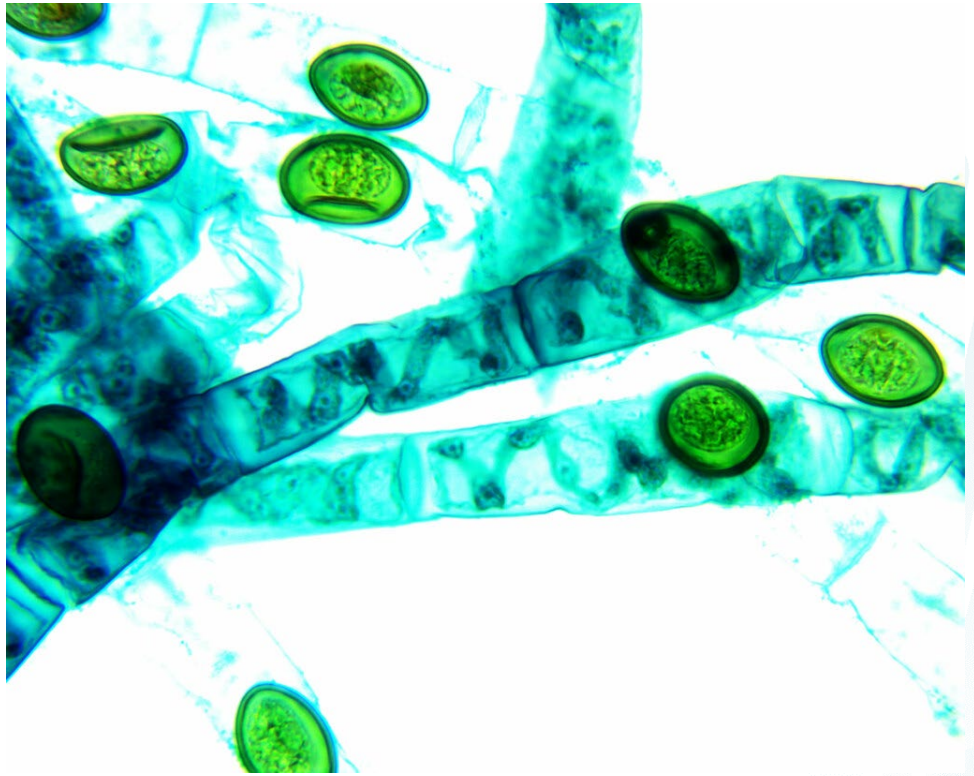
Background

- First described by John Holland (1964)
- Based on evolutionary theory
  - Key concepts include:
    - Representation
      - Chromosomes
      - Genes
    - Crossover
    - Selection
    - Fitness
    - Mutations

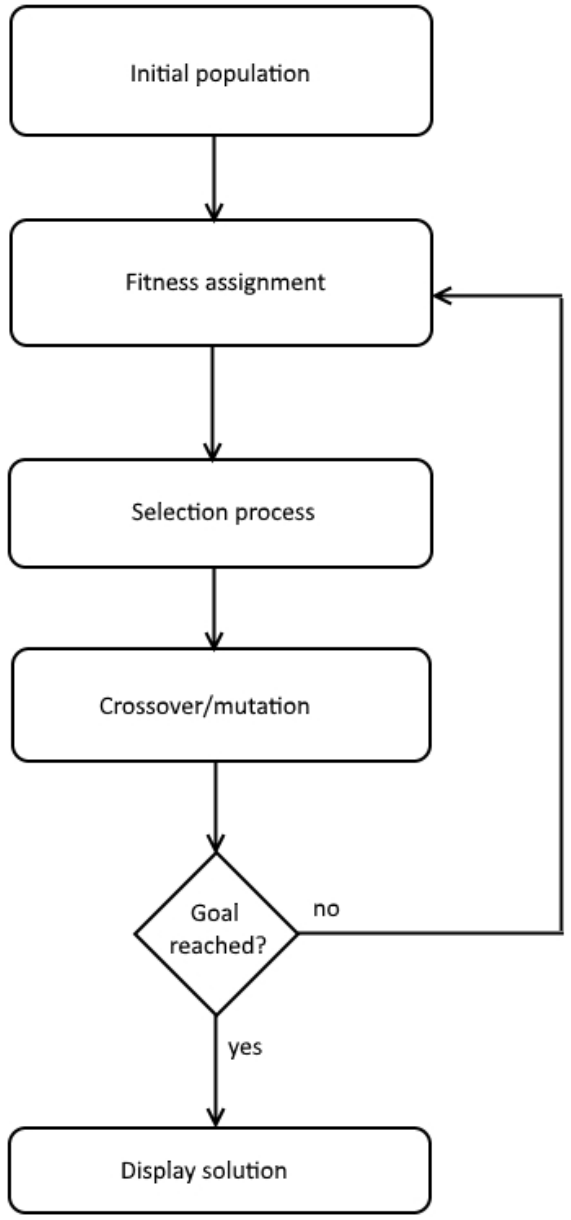


Application areas for genetic algorithms

- Multi-dimensional search
  - Multiple parameters
- Optimization problems
  - Design of mechanical parts
  - Visual design
- Pattern recognition
- Text analysis

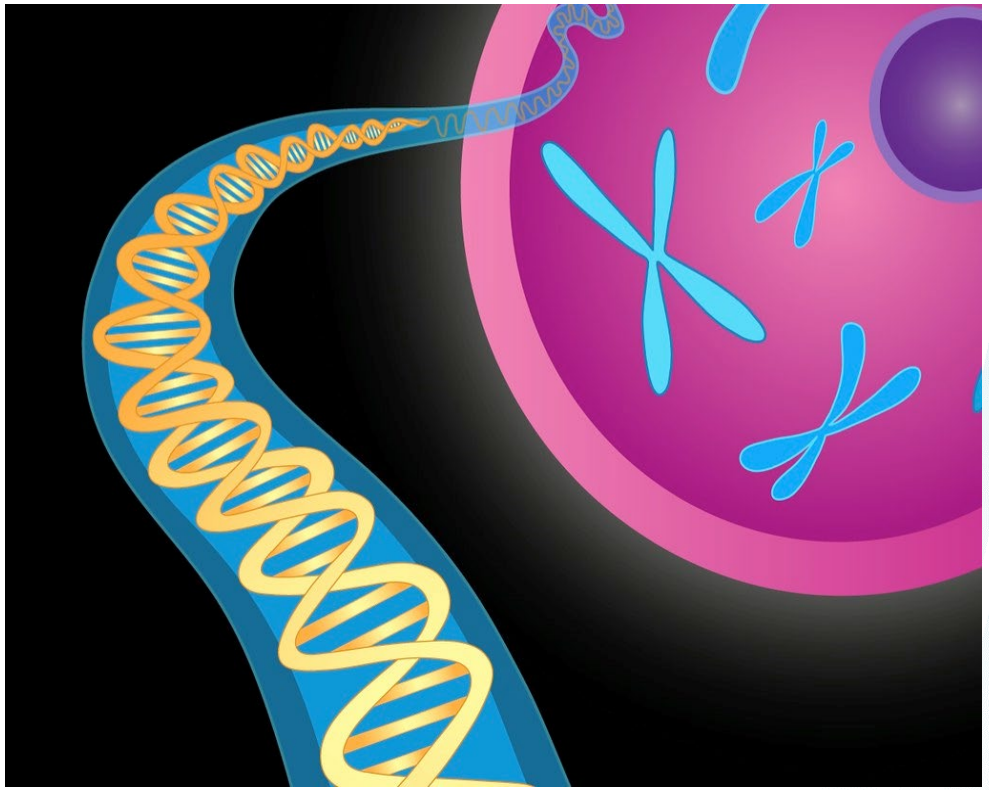
Algorithm overview

- Generate a random initial population
- Assign a fitness score
- Select the fittest individual(s)
- Recombine features
  - Crossover
  - Mutation
- Repeat until termination criteria is met



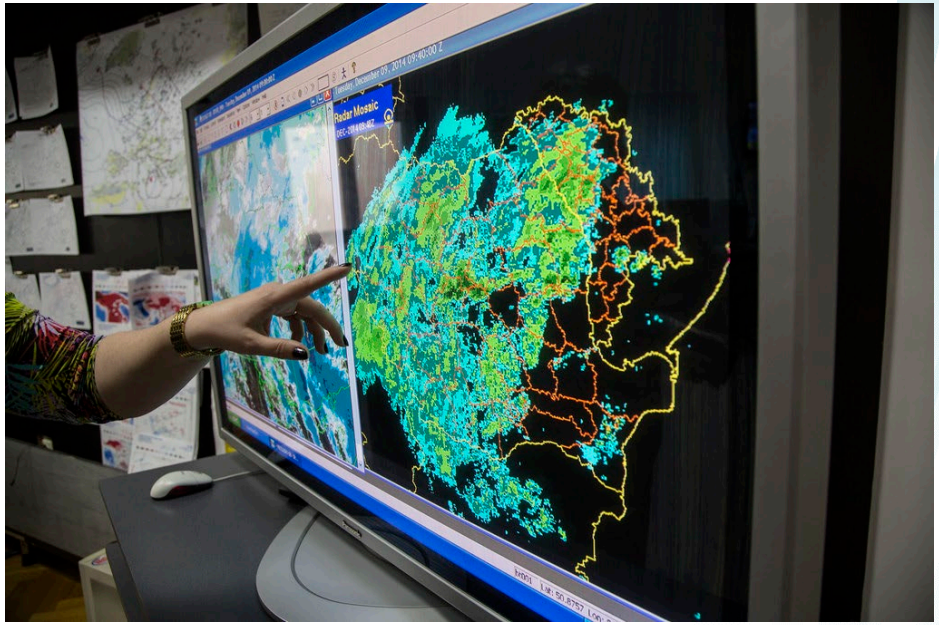
Problem representation

- Chromosomes
  - A set of genes (features)
- High-level representation
  - Feature values are used directly
- Low-level representation
  - Values are mapped to a simpler form
    - Binary strings



Evaluation methods

- Depends on the problem one is trying to solve
- Criteria may be static or change over time
- Determines fitness of individuals
  - How “close” are they to the optimum?
  - May be based on cost, speed, effiency etc.



Coming up

- Initial population definition
  - Encoding
  - Generation
- Selection processes
- Crossover
- Mutation

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