

인공지능개론

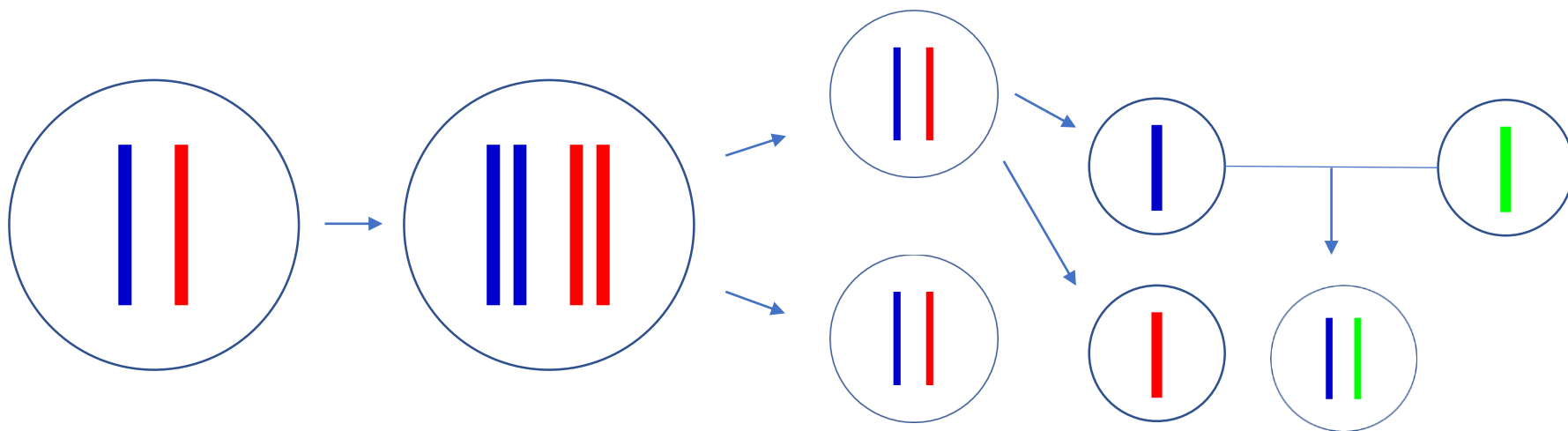
기계학습

Genetic Algorithm

What is the Genetic Algorithm?

An optimization strategy that mimics natural selection

- Natural Selection is a very successful organizing principle for optimizing individuals and populations of individuals
- If we can mimic natural selection, then we will be able to optimize more successfully



Genetic Algorithm

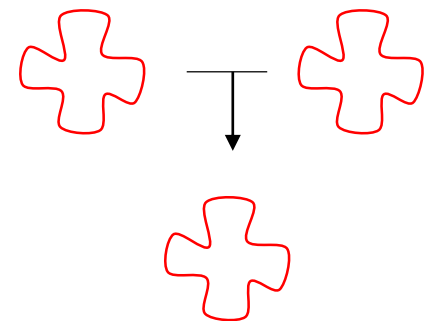
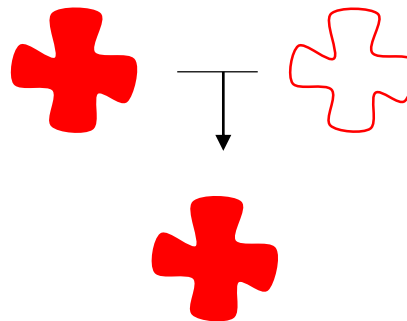
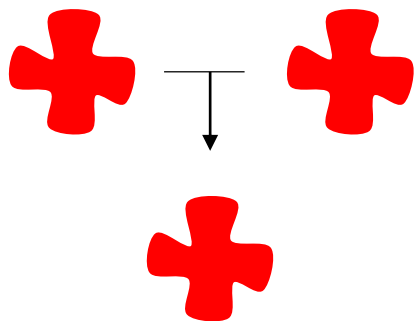
Charles Darwin

- Species are continually developing
- Variations between species are enormous

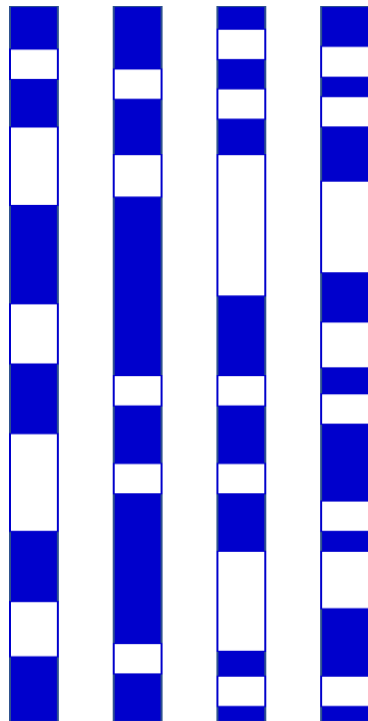
Evolution = natural selection of inheritable variations

Gregor Mendel

- Dominant and recessive character



Genetic Algorithm

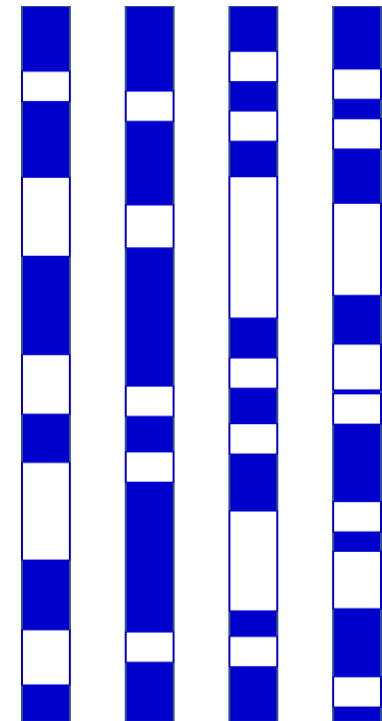


Generation n

1. Selection
2. Crossover
3. Insertion
4. Mutation

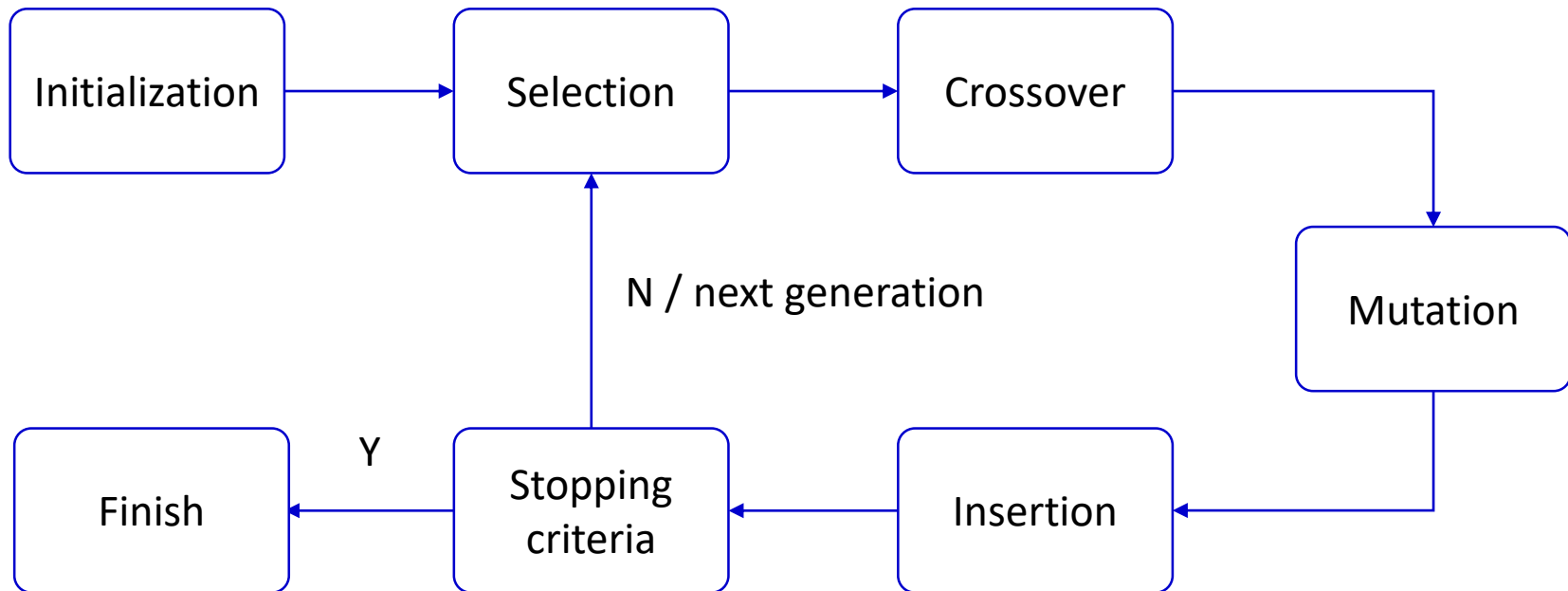


Genetic
operations



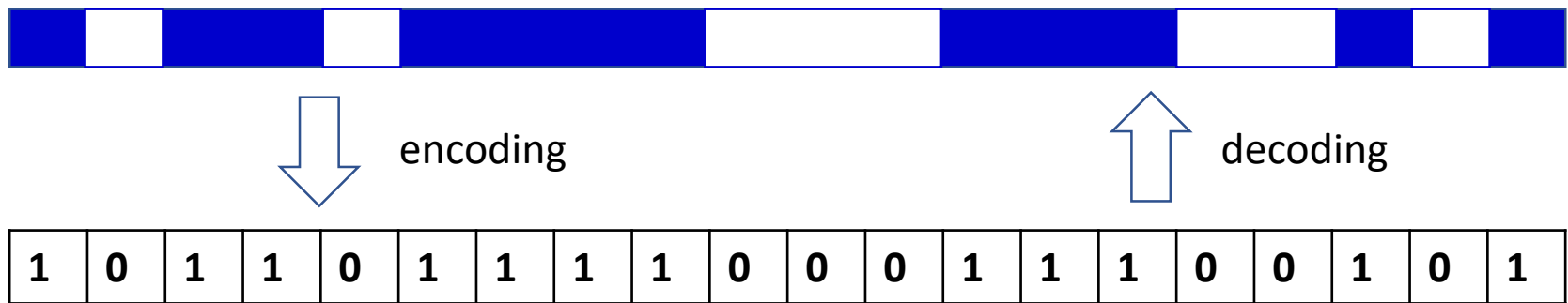
Generation n+1

Genetic Algorithm



Genetic Algorithm

(1) define the representation (encoding-decoding)



(2) define “fitness” function F - incorporate feasibility (constraints) and objectives

Survive: walk , fly, swim...

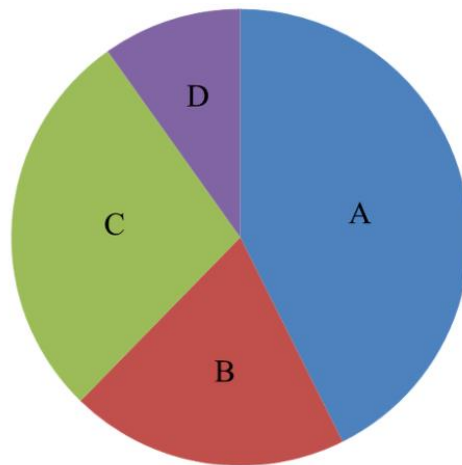
Optimize: error, performance...

Genetic Algorithm

(3) define the genetic operators - initialization, selection, crossover, mutation, insertion

Initialization (ex: random generation)

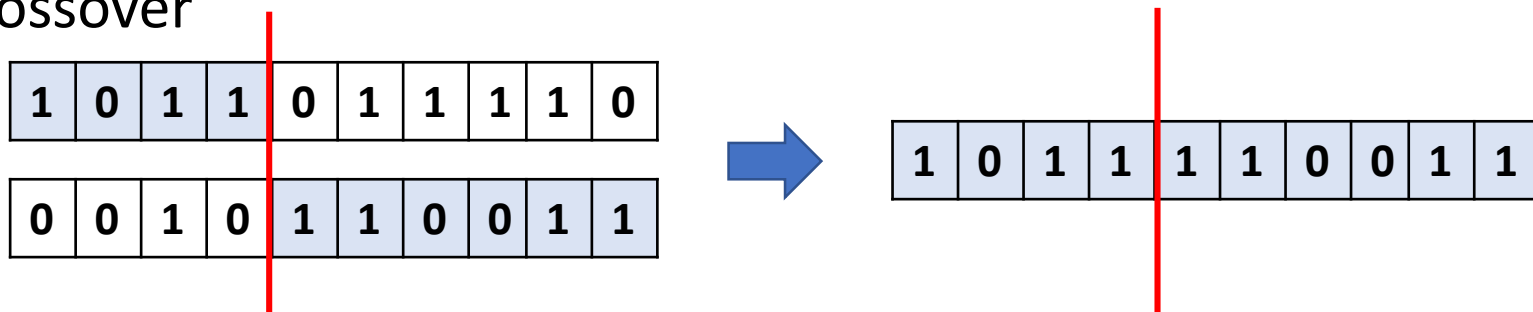
Selection (ex: roulette wheel selection)



Genetic Algorithm

(3) define the genetic operators - initialization, selection, crossover, mutation, insertion

Crossover



Mutation



Insertion

Genetic Algorithm

(4) execute initial algorithm run - monitor average population fitness - identify best individual

(5) tune algorithm

- adjust selection
- insertion strategy
- mutation rate

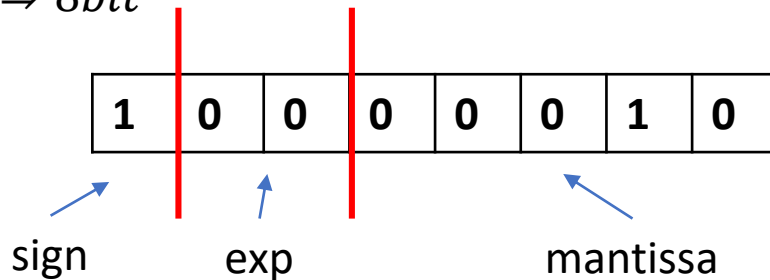
Genetic Algorithm: example

We want to solve the following equation

$$x^2 + x - 2 = 0 \quad x < 0$$

(1) define the representation (encoding-decoding)

$x \Rightarrow 8bit$



(2) define “fitness” function F - incorporate feasibility (constraints) and objectives

$$F = f(x)$$

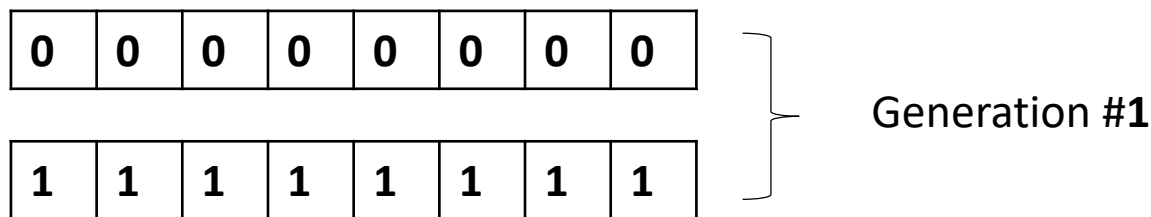
Genetic Algorithm: example

We want to solve the following equation

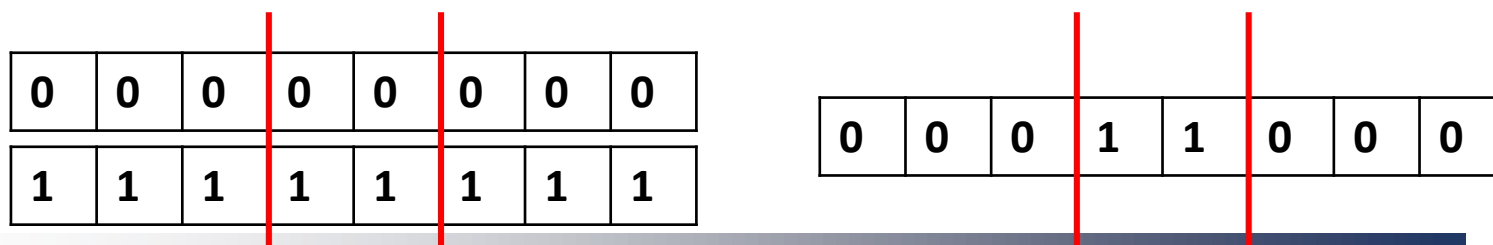
$$x^2 + x - 2 = 0 \quad x < 0$$

(3) define the genetic operators - initialization, selection, crossover, mutation, insertion

a) Initialization & selection



b) Crossover



Genetic Algorithm: example

We want to solve the following equation

$$x^2 + x - 2 = 0 \quad x < 0$$

(3) define the genetic operators - initialization, selection, crossover, mutation, insertion

c) Mutation

0	0	0	1	1	0	0	0
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0	0	0	0	1	0	0	1
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Determine mutation rate

d) Insertion

0	0	0	0	1	0	0	1
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Population

Genetic Algorithm: example

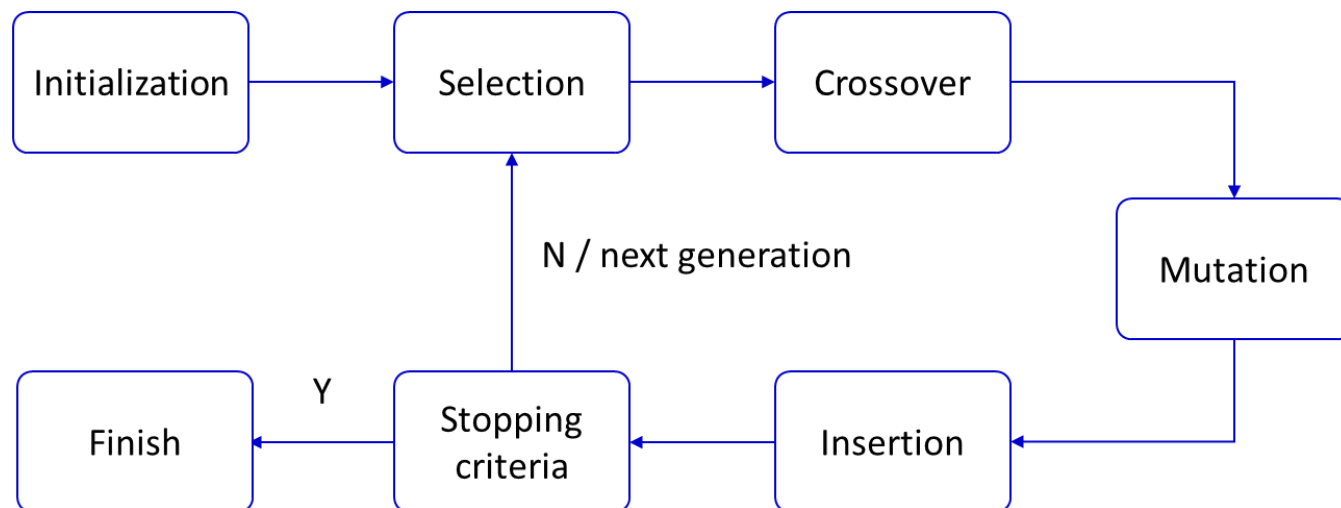
We want to solve the following equation

$$x^2 + x - 2 = 0 \quad x < 0$$

(4) execute initial algorithm run

Check stopping criteria

$f(x) = ?$



(5) tune algorithm