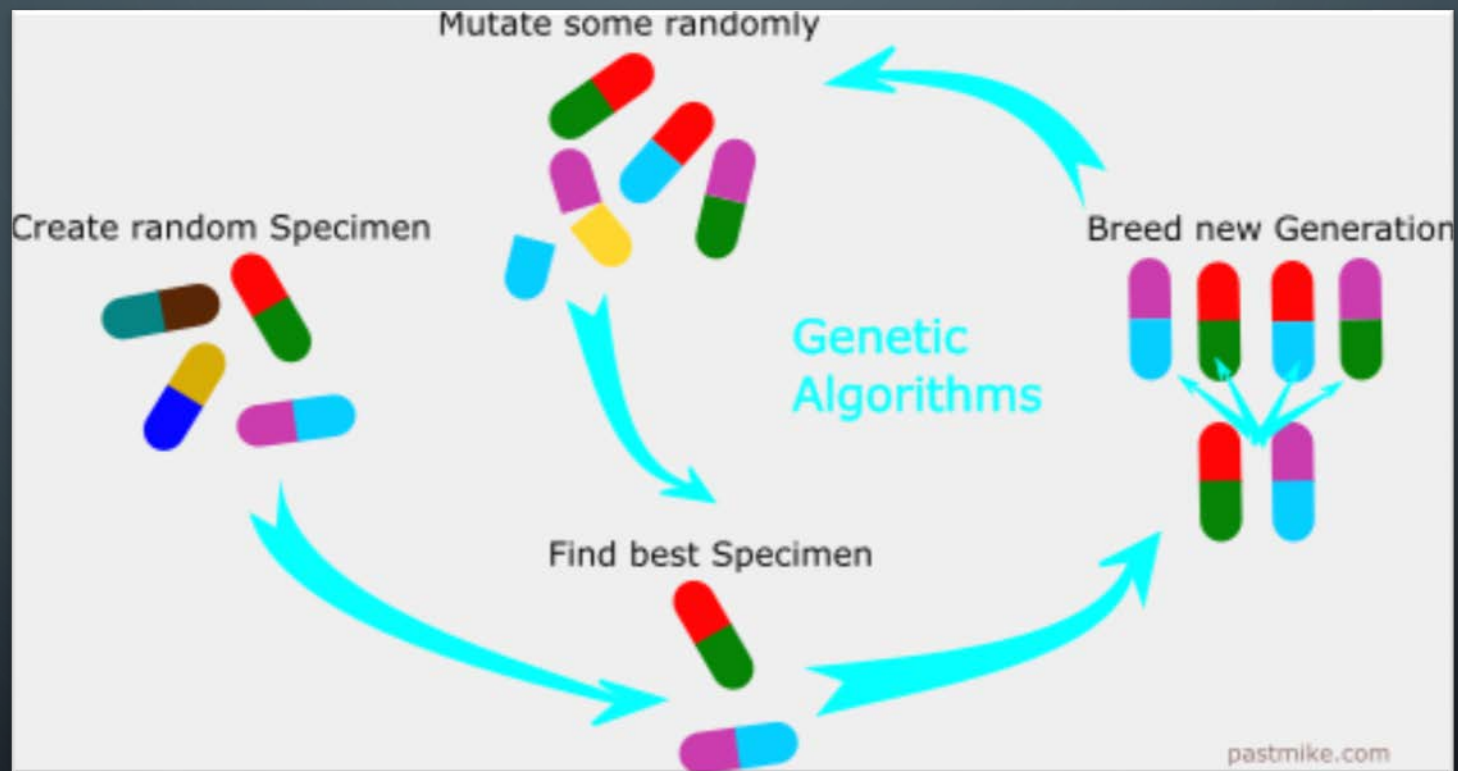




GENETIC ALGORITHM

MOHAMMAD GHODDOSI

WHAT IS GENETIC ALGORITHM



MAIN IDEA

- Selection force
 - Resource
 - Keep population small
- Reproduction force
 - Makes new individuals

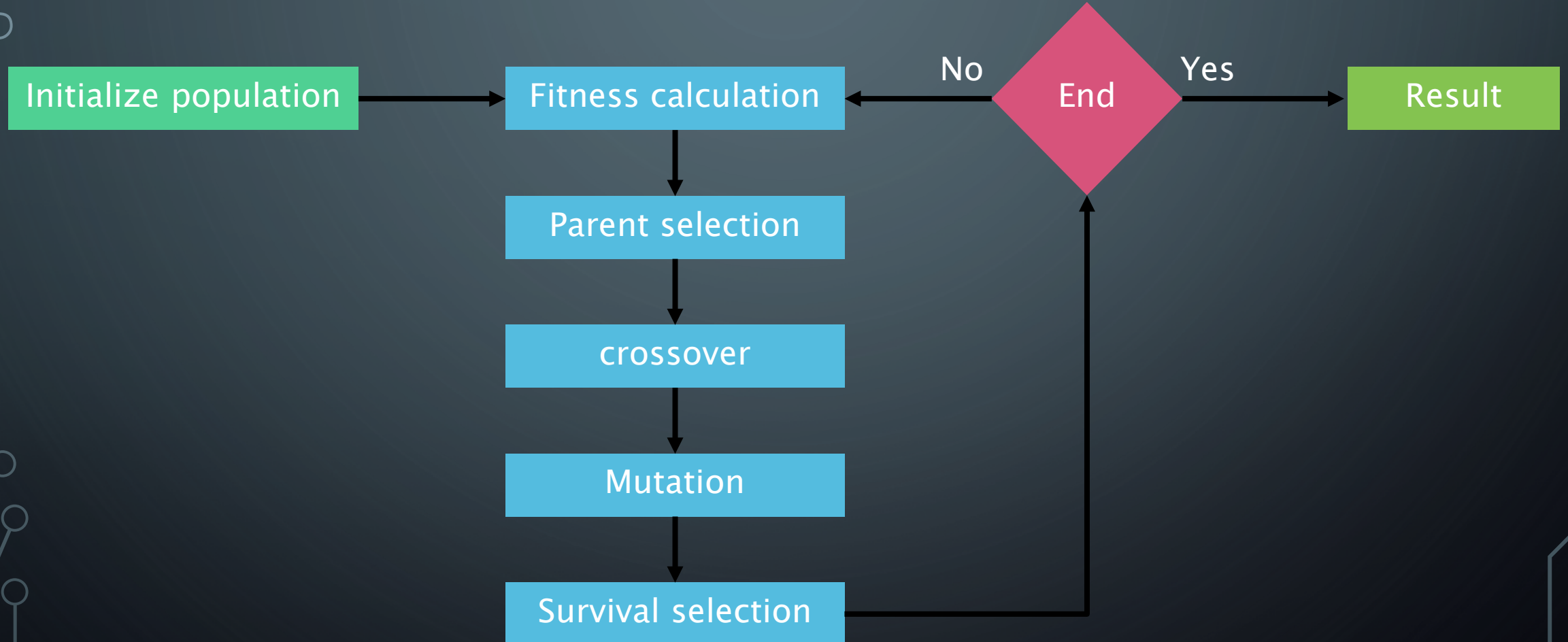
GENETIC ALGORITHM IN NATURE

- DNA
- Chromosome
- Natural selection
- Reproduction
- Evolution

GENETIC ALGORITHM IN MACHINE LEARNING

- We have a set of weights
 - Like DNA and chromosomes
- We want to minimize cost function
 - Fittest individual is the one with lowest cost

GENETIC ALGORITHM



EXAMPLE

- We want to find best weights for a neural network:
 - 10 input neurons – 20 hidden neurons – 3 output neurons
 - $(10 + 1) * 20 + (20 + 1) * 3$ weights = 283 weights
 - We have a chromosome with 283 real numbers
- Make 100 random NNs, each with 283 random weights
- Compute Cost
- Select parents
- ...

FITNESS

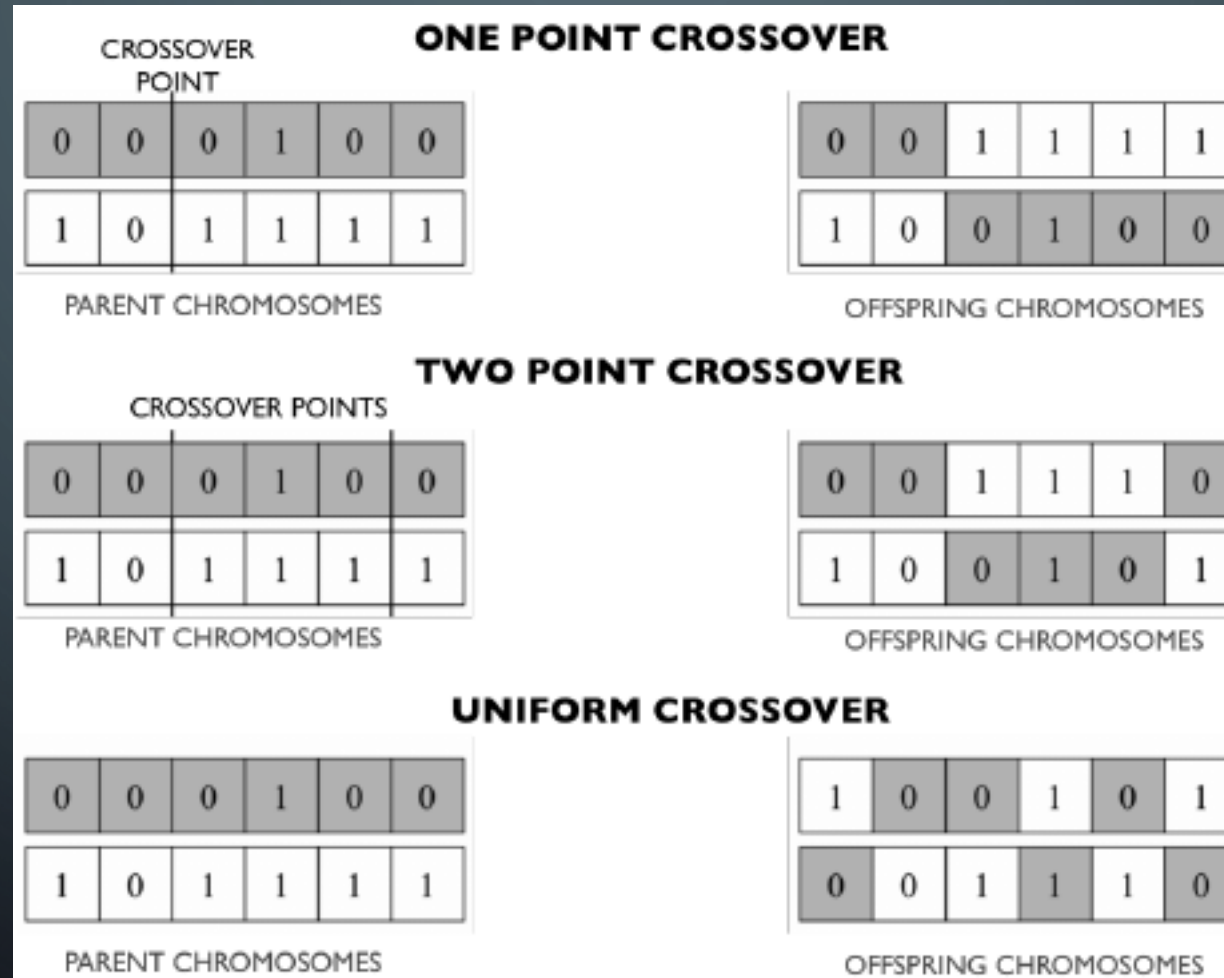
- Fitness is equal to cost function
- MSE
- Cross Entropy
- regularization
- ...

PARENT SELECTIN

- Uniform random
- Fitness proportional

- $P(\text{individual } t \text{ be parent}) = \frac{fitness_t}{\sum fitness_i}$

CROSSOVER



MUTATION

- We have a small mutation chance
- Just reset the weight to a new random number
- Or add a small random number to weight
- Guarantees finding the best solution

SURVIVAL SELECTION

- $(\mu + \lambda)$ Selection
 - Select from parents and offspring
- (μ, λ) Selection
 - Just select from offspring