

Mutation and Fitness Scalling in GAs

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Important GA Operations

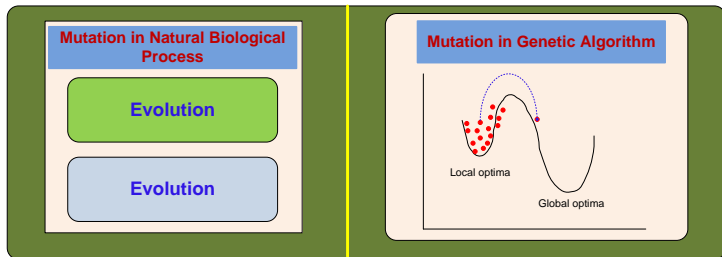
- 1 Encoding
- 2 Fitness Evaluation and Selection
- 3 Mating pool
- 4 **Reproduction**
 - Crossover
 - Mutation
 - Inversion
- 5 Convergence test

This lecture includes ...

- 1 Encoding
- 2 Fitness evaluation and Selection
- 3 Mating pool
- 4 Crossover
- 5 **Mutation**
- 6 **Inversion**
- 7 **Convergence test**
- 8 **Fitness scaling**

Mutation Operation

- In genetic algorithm, the mutation is a genetic operator used to maintain genetic diversity from one generation of a population (of chromosomes) to the next.
- It is analogous to biological mutation.
- In GA, the concept of biological mutation is modeled artificially to bring a local change over the current solutions.



Mutation Operation in GAs

Like different crossover techniques in different GAs there are many variations in mutation operations.

- **Binary Coded GA :**

- Flipping
 - Interchanging
 - Reversing

- **Real Coded GA :**

- Random mutation
 - Polynomial mutation

- **Order GA :**

- **Tree-encoded GA :**

Mutation operation in Binary coded GA

Mutation Operation in Binary coded GA

- In binary-coded GA, the mutation operator is simple and straight forward.
- In this case, one (or a few) 1(s) is(are) to be converted to 0(s) and vice-versa.
- A common method of implementing the mutation operator involves generating a random variable called **mutation probability** (μ_p) for each bit in a sequence.
- This mutation probability tells us whether or not a particular bit will be mutated (i.e. modified).

Note :

- To avoid large deflection, μ_p is generally kept to a low value.
- It is varied generally in the range of $\frac{0.1}{L}$ to $\frac{1.0}{L}$, where L is the string length.

Mutation in Binary-coded GA : Flipping

- Here, a **mutation chromosome** of the same length as the individual's chromosome is created with a probability p_{μ} of 1's in the bit.
- For a 1 in mutation chromosome, the corresponding bit in the parent chromosome is flipped (0 to 1 or 1 to 0) and mutated chromosome is produced.

1	0	1	1	0	0	1	0
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offspring

1	0	0	0	1	0	0	1
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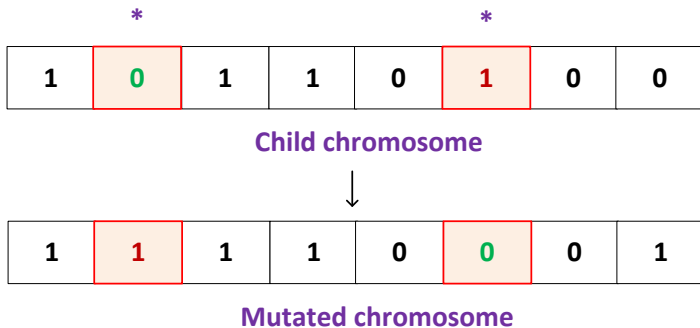
Mutation chromosome

0	0	1	1	1	1	0	0
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Mutated offspring

Binary-coded GA : Interchanging

- Two positions of a child's chromosome are chosen randomly and the bits corresponding to those position are interchanged.



Mutation in Binary-coded GA : Reversing

- A positions is chosen at random and the bit next to that position are reversed and mutated child is produced.

