Genetic Algorithms Study

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Genetic Algorithms

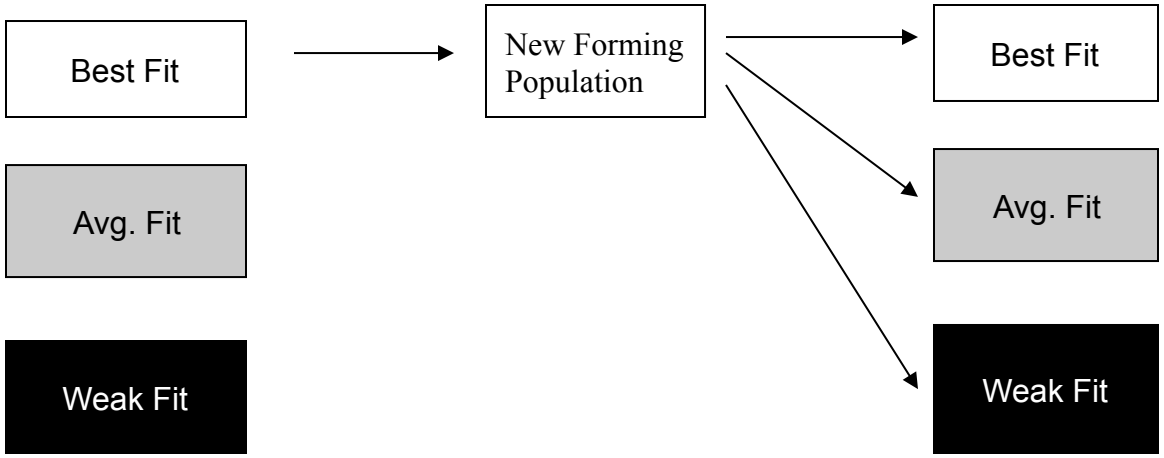
- Problem Solving Process Through Evolution of Genes
- Solutions are “evolved” from a number of generations
- Evolve- a number of generational iterations which converges on itself

Two Algorithms

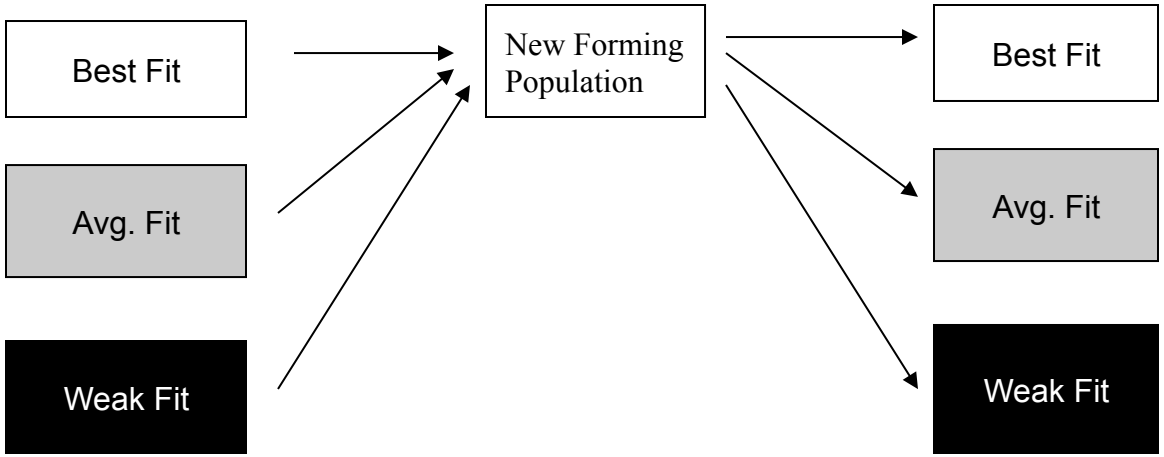
- Take best 1/3 of population
  - Split
  - Survivors mutated genes from best 1/3

- Take best 1/3 of population
  - Split
  - Filled genes by randomly mutated

Algorithm 1



Algorithm 2



Q: “Why would I even think about using genes less fit than what I’ve already got?”

A: “Sometimes, the less fit genes can lead to other genes which may be even better for the individual.”

- Three fitness functions testing individuals:

$$Y = X^2$$

$$Y = X^4 + 7X^3 + 6X^2 + 72X$$

$$Y = X^2 \text{ for } 1 \leq X \leq 3$$

$$= -X^2 \text{ for } 0 < X < 1 \text{ or } 3 < X$$

Comparisons of Programs

- $Y_{max} - Y_{actual}$
  - Finds how much error
- then divide by Y_{max} and multiply by 100
  - Finds percentage error
- Avg. Root Mean Square Error
  - The square root of the squared sums of the percentage errors / the total number of instances

Results

Reproduction Technique	Root Mean Square Error	% of Errors
Algorithm: 1 Fit. Equation: 1	0.13 %	8 %
Algorithm: 2 Fit. Equation: 1	0.12 %	16 %
Algorithm: 2 Fit. Equation: 2	0.57 %	18 %
Algorithm: 1 Fit. Equation: 2	0.06 %	10 %

Points to Note

- The third fitness equ. could not compute negative values.
  - The program would converge at the highest negative value
    - A minimum value
- The programs allowed for alterations in the code .
  - Had to find a set of variables so each program could work acceptably.