Introduction to AI
Assignment# 01

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Problem: Wall-Following Robot

In this assignment, I have implemented Genetic Algorithm to solve this particular problem. Genetic Algorithms are evolutionary algorithms inspired by the process of natural selection and are metaheuristic. I have implemented multiple variations of GA to find a variant that gives best optimal result.

Implementation:

Following is the detailed description of how I implemented each step in GA:

1. **Initialization**:
    a. For initialization, I have randomly generated 20 solutions as initial population of my GA. I have chosen 20 because I think because I think in this way I can see how GA evolves.

2. **Selection**:
    a. I have made a fitness function that tells how much percentage of blocks with walls my robot has covered w.r.t total number of blocks it has to cover.
    b. For selection, I randomly select two solutions from parents' sample and select one whose fitness is greater than the other and repeat this process 20 times.

3. **Cross-Over**:
    a. I shuffle my selected solutions so that randomness remains.
    b. I make pairs of two consecutive solutions and cross-over them at some random point.
    c. I do cross-over with probability 0.9.

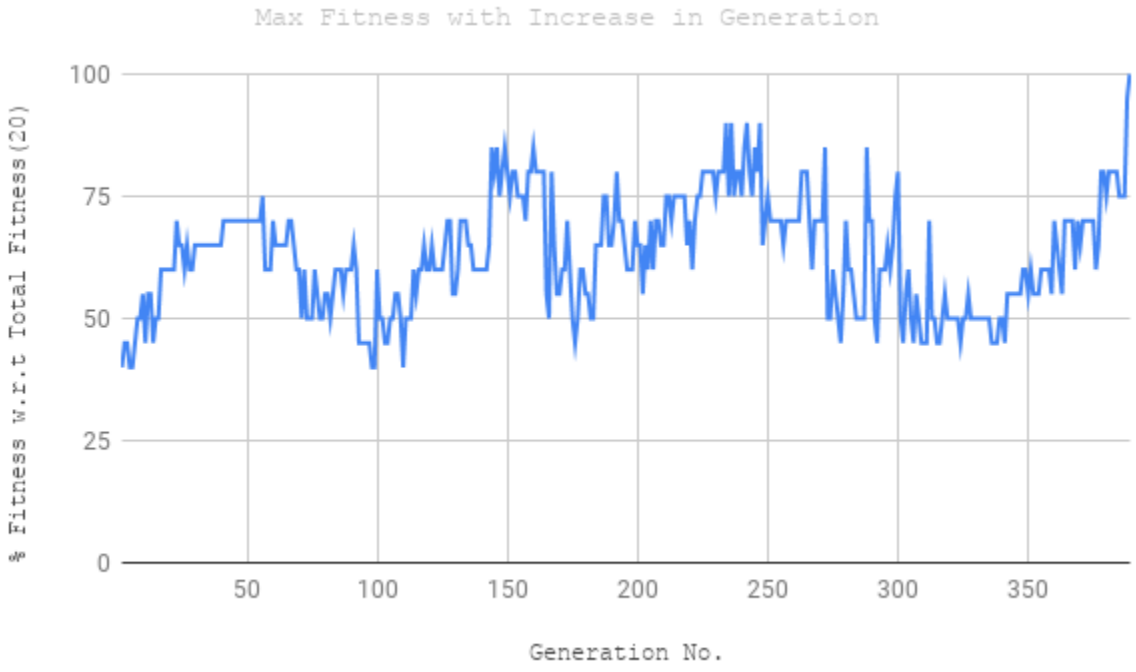
4. **Mutation**:
    a. For mutation, I mutate each bit of each solution with probability 0.05.

    I have run the above step for 1000 generations and compared mean,

median and mode fitness values of each generation.

Evaluation:

Following graph shows how maximum fitness value changes in each generation and in this graph we can clearly see how GA evolution has taken place. More specifically, we can see that from generation# 01 where maximum fitness is 40/100 and finally in generation# 389, I got 100/100.



As we can see from graph, there are bumps in the graph, but GA still reaches to optimal solution. This is due to the fact that GA does not stop at local maxima but always go for global maxima. These bumps in the graph are evident of this statement and hence, shows the power of genetic algorithms.