Report

14 March 2021 16:27

Summary

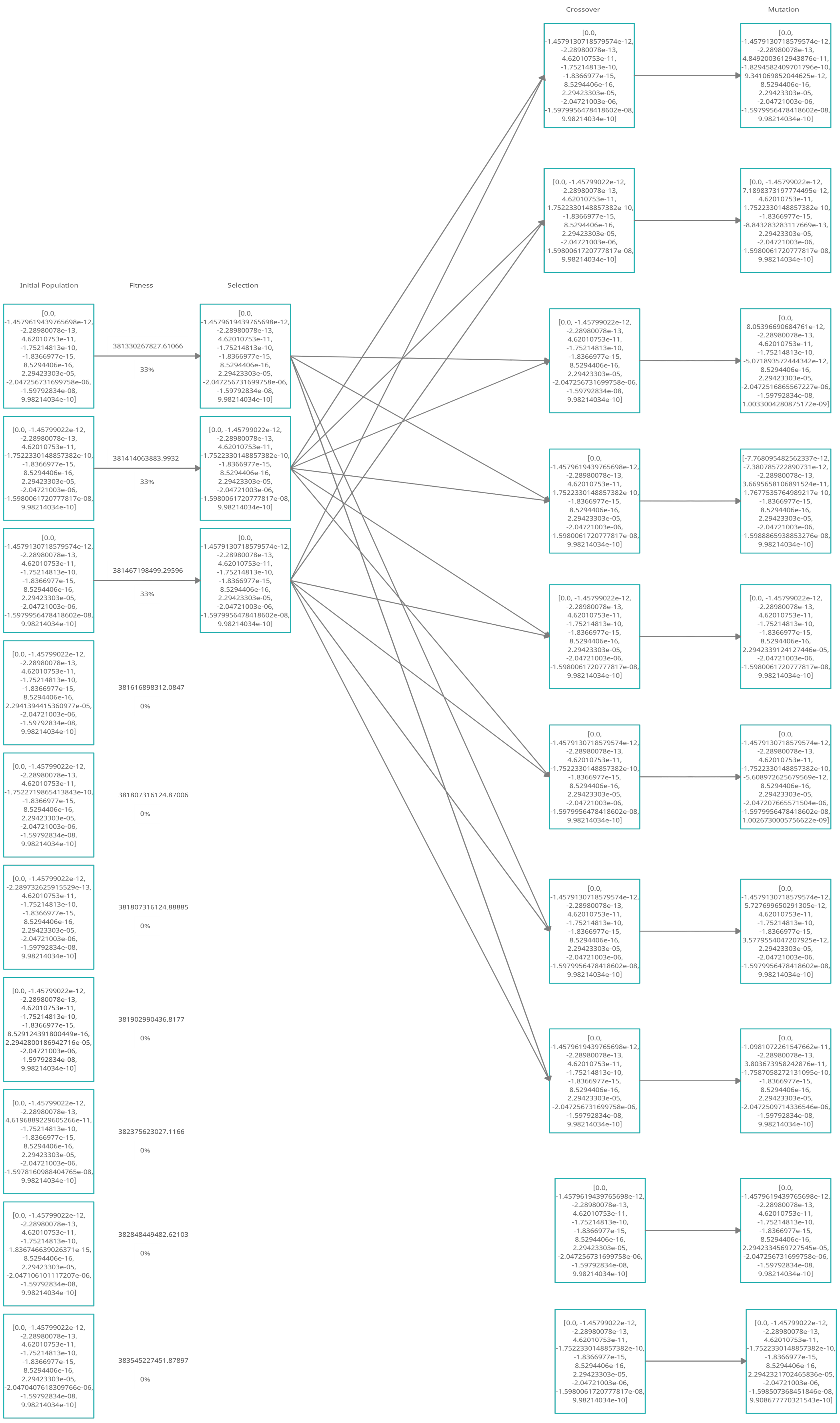
Implementation of genetic algorithm:

- Initialize population
- Until the given iterations end repeat the following
    - Calculate the fitness of population
    - Select some of the population as parents
    - Crossover to get the children
    - Perform mutation on the new population

Every individual is a vector of size 11 with 11 floating point values in the range of [-10, 10].

Iteration diagrams

Iteration 1


Crossover
Mutation
Initial Population
Fitness
Selection
381330267827.61066
33%
381414063883.9932
33%
381467198499.29596
33%
381616898312.0847
0%
381807316124.87006
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381807316124.88885
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381902990436.8177
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383545227451.87897
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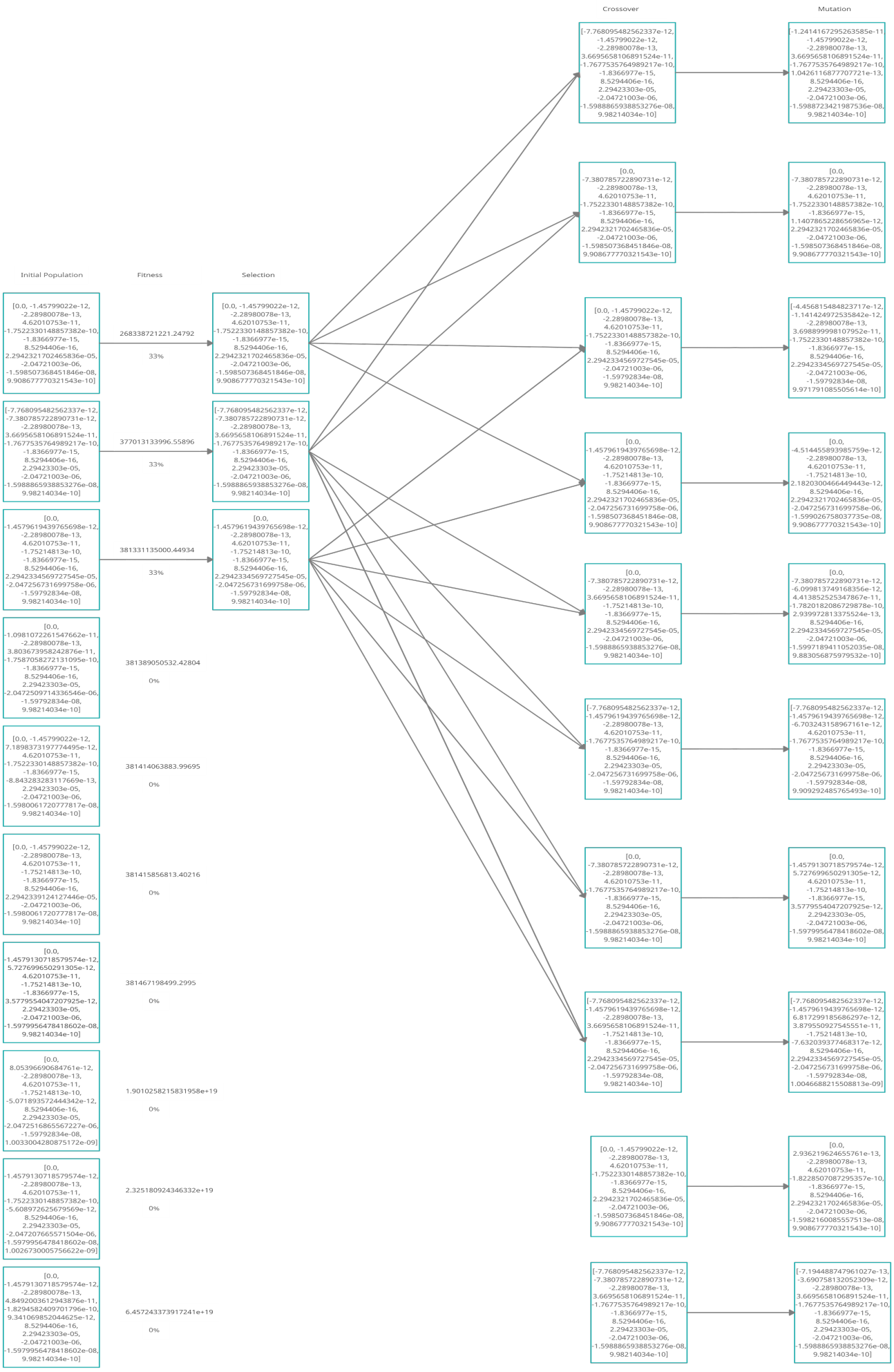
Iteration 2


Initial Population
Fitness
Selection
Crossover
Mutation
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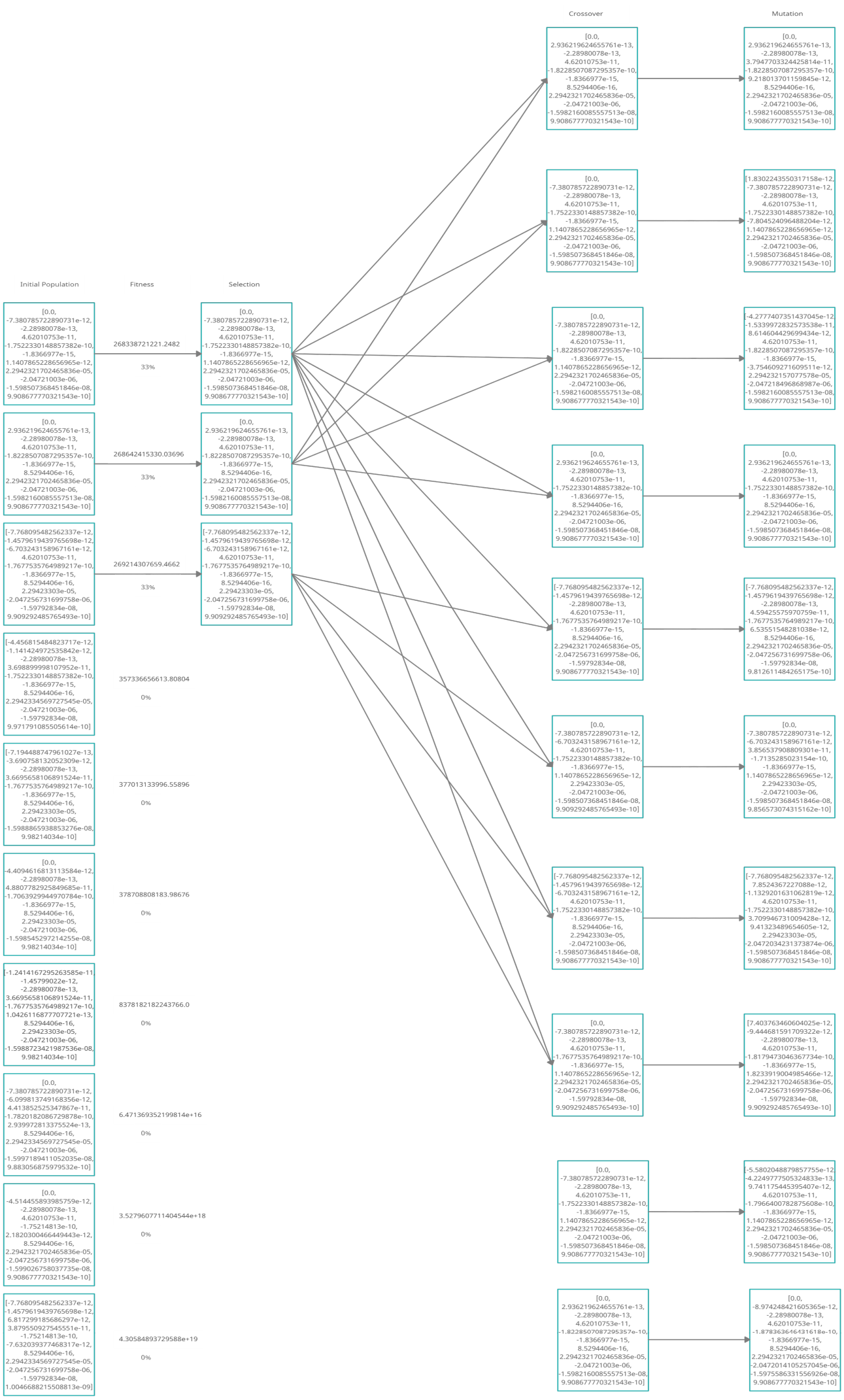
Iteration 3



Fitness

In this function, get_errors function is called for the individual and it return train and validation errors for that particular vector.

Fitness of the vector is calculated as absolute value of 'Train Error * Train Factor + Validation Error'

Here train factor is varied between 1 and -1 depending on the train and validation for the population. We kept 1 as train factor whenever we see train error is significantly large so that there will be balance in both the errors and we wanted them to reduce simultaneously. And we kept -1 as train factor when difference between errors is comparably large so that we get alike values for both errors. We kept -1 as train factor as we believed that vectors which low less variation between both the errors will be selected.

Crossover

Any two individuals are picked randomly from the top 20% of the population in order of fitness(low to high).
Crossover is performed in way such that the parents genes are interchanged at a probability of 6/10. We have taken this as the probability since very low and very high doesn’t made any improvisation.

Mutation

Mutation is performed on initial population slightly to increase some diversity in the group.

After forming a new population every time, they are mutated. In mutation, every gene of a particular individual, with random probability, a random value within the range of a parameter erval is added or subtracted.

Hyper parameters

Population size: Initially it was kept somewhere around 50 and lastly made it to 10 as firstly there aren't enough requests to run the algorithm and as there can be seen diversity in population for lower sizes we gradually decreased the size to 10 and 20. We changed the population sizes between 10 and 20 and as we compared we found that 10 is better as there are no noticeable changes and as we don’t have ample of requests we fixed the size to 10.

Number of individuals passed down to new generation: We passed 30% of the individuals only to new generation as if we see our population all the individuals are somewhat more diverse and also the population size is also less comparably so we decided to make the number as less as possible and lastly made it to 30%.

Number of iterations are taken as 100.

Heuristics

Mutation range: We initially kept the parameter erval very low (in 10^{-16}) as we thought not to diverse the population more. But as there the algorithm is not showing variation at very early stage so we decided to keep the mutation in the range of 10^{-11} and we have seen somewhat more decrease in both the errors.
Also initially we mutated only for one gene in the chromosome but later we chose a probability for the mutation of the gene and significant changes appeared.

Also, other parameters like number of individuals passed down to new generation, population size were changed for the betterment of algorithm in which some didn’t showed major improvements.

The train and validation error we were able to achieve are 50497579460.484375, 212032663222.92255 respectively. This might do well because this is almost good validation error that was obtained out of all the population generated.