Human Steerable Genetic Alogrithm Application

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Introduction

Genetic Algorithm(GA) which imitates the process of natural selection has been applied into Artificial Intelligence area for a long time. From when GA was introduced to now, GA has been discussed and developed so many times. For some specific problems, we want to make some changes for GA. In our research, we will develop a human steerable genetic algorithm and apply it on the Optimization of Urban Design problem.
To optimize the Urban Design problem, we will take dynamic factors and human preferred factors into account, such as:

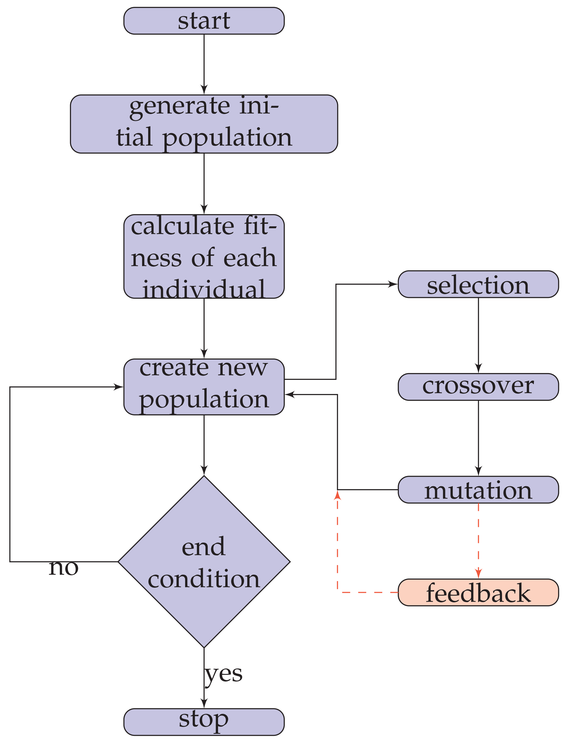
1. the location and height of a building
2. wind energy and solar energy
3. use wind to blow the air pollution

Also, the human steerable GA could consider people's opinions. It will ask feedback from the users, which could change the direction of GA reproduction process.

By using the human steerable genetic algorithm, we expect to have a human preferred solution for urban design problem. Human can select different method for selection, crossover, and mutation operations. When we run the human interacted GA, people can change the fitness value for some of the chromosome based on their preference. With considering the feedbacks from the user, we expect to change the direction of GA reproduction process.

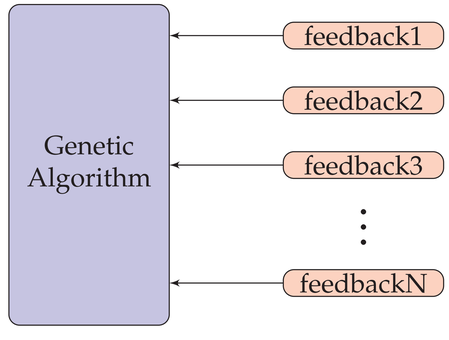
Our method will be a good referencese for the future cities designers. Designers could use it to make a cleaner, more eco-friendly, and more comfortable city. Moreover, citizens could also participate in the city design, by giving feedback to the GA system.

GA Explanation



- User specified parameters: number of variables, possible value of each variable, size of population, number of generations, fitness function, crossover probability, mutation probability, selection type, crossover type, and mutation type.
- Generate new population: generate the first generation of the solution
- Create new population: applying selection, crossover, and mutation to the previous generation, and get a new population, which should improve the solution.
- Encoding method: binary encoding, use binary string to represent each variable
- Selection: selection a pair of parents and do the crossover and mutation operation on them. Support methods are roulette-wheel,
- Crossover: exchange bits of binary string between two parents based on crossover probability and produce two children. Support methods are single-point,
- Mutation: mutate bits of children's binary strings based on mutation probability. Support methods are single-point,

Steerable GA



- GA is running at server side.
- Different users give feedback to GA. In our case, those feedback could be the suggestion of the height or location of a building, if the user like a particular solution or not, etc.
- GA takes users feedbacks into account and reproduces the solutions.
- While users keep giving the GA feedback, GA could generate user preferred solutions.

Current Results

References

[1] Laurent Magnier and Fariborz Haghighat. Multiobjective optimization of building design using trnsys simulations, genetic algorithm, and artificial neural network. *Building and Environment*, 45(3):739–746, 2010.

Future Research

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