Technical Report

Pseudo Code of Genetic Algorithm and Multi-Start Strategy Based Simulated Annealing Algorithm for Large Scale Next Release Problem

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1. Introduction

In this report, we will introduce the pseudo code of two algorithms for the large scale Next Release Problem (NRP). Both of these two algorithms are used for the experiments. We list the pseudo code to show the details for the readers, who are interested in the implementations.

The NRP is a combinatorial optimization problem in search based requirements engineering. The problem model can be found in [1].

2. Pseudo Code of Genetic Algorithm

The Genetic Algorithm (GA) is a classic algorithm, which is a bio-inspired and population-based technology for complex problems, also used for the NRP [2], [3]. We list a kind of implementation of GA for the large scale NRP.

In Algorithm 1, the GA mainly includes the phases of initialization, selection, crossover, and mutation.

There is a repair operator in Line 16, which can generate a feasible solution from an infeasible solution. Many implementations can be done for such repairing. A simple implementation is to randomly remove a selected customer from the solution until the solution is feasible.

Algorithm 1. Genetic Algorithm for the NRP

Input: instance Π,
size α of population,
rate β of elitism,
rate γ of mutation,
number δ of iterations

Output: solution X

// Initialization
generate α feasible solutions randomly;
save them in the population Pop;
// Loop until the terminal condition
for $i = 1$ **to** δ **do**
// Elitism based selection
  number of elitism $ne = \alpha \cdot \beta$;
  select the best ne solutions in Pop and save them in Pop_1;
// Crossover
  number of crossover $nc = (\alpha - ne)/2$;
  for $j = 1$ **to** nc **do**
    randomly select two solutions X_A and X_B from Pop ;
    generate X_C and X_D by one-point crossover to X_A and X_B;
    save X_C and X_D to Pop_2 ;
  endfor
// Mutation
  for $j = 1$ **to** nc **do**
    select a solution X_j from Pop_2;
    mutate each bit of X_j under the rate γ and generate a new solution $X_j{}'$;
    if $X_j{}'$ is unfeasible
      update X_j' with a feasible solution by repairing $X_j{}'$;
    endif
    update X_j with $X_j{}'$ in Pop_2;
  endfor
// Updating
  update $Pop = Pop_1 + Pop_2$;
endfor
// Returning the best solution
return the best solution X in Pop ;

3. Pseudo Code of Multi-Start Strategy Based Simulated Annealing Algorithm

The Simulated Annealing Algorithm (SA) is a typical algorithm for the NRP [1], [4]. We add a multi-start framework [5] to SA for the NRP. Our algorithm is called Multi-Start Strategy Based Simulated Annealing Algorithm (MSSA).

Algorithm 2. MSSA for the NRP

Input: instance Π,
non-linear simulated annealing operator Ξ,
number δ of iterations

Output: solution X

```
// Initialization
```
generate a feasible solution X_{max} randomly;
```
// Loop until the terminal condition
```
for $i = 1$ **to** δ **do**
    generate a feasible solution X_1 randomly;
    generate a new solution by $X_1{}'$ Ξ for X_1 ;
    if $X_1{}'$ is better than X_{max}
        update X_{max} with $X_1{}'$;
    endif
endfor
```
// Returning the best solution
```
return the best solution X_{max} ;

References

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