Modern Approaches to The Rich Vehicle Routing Problem

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Outline

1. Routing in the real world
2. The Vehicle Routing Problem
3. Genetic and Memetic Algorithms
4. Agent-based models and Probability Collectives
5. Human Assisted Routing
6. Conclusions

Routing Irl!

- The Post Office does routing!
- Uber does routing!
- Routing is expensive!

Traveling Salesman

Vehicle Routing Problem

Rich Vehicle Routing Problem

Decentralized Vehicle Routing Problem

Vehicle Routing Problem with Time Windows

Genetic Algorithms I

Genetic Algorithms II

Memetic Algorithms

Hybrid Genetic Search with Advanced Diversity Control

The algorithm.

Initialize population;
while *number of interactions without improvement* $< It_{NI}$, *and time* $< T_{max}$ **do**
  Select parent solutions P_1 and P_2;
  Create offspring C from P_1 and P_2 (crossover);
  Educate C (local search procedure);
  if *C infeasible* **then**
    Insert C into infeasible subpopulation;
    Repair with probability P_rep;
  end
  if *C feasible* **then**
    Insert C into feasible subpopulation;
  end
  if *maximum subpopulation size reached* **then**
    Select survivors;
  end
  if *best solution not improved for* It_{div} *iterations* **then**
    Diversify population;
  end
  Adjust penalty parameters for infeasibility;
  if *number of iterations* $modulo\ It_{dec} = 0$ **then**
    Decompose the master problem;
    Use HGSADC on each subproblem;
    Reconstitute three solutions, and insert them in the population;
  end
end
return best feasible solution;

Might not include in paper

Agents!

Reverse Vickrey Auction

Distributed RVA routing Algorithm

Probability Collectives

Probability Collectives Algorithm I

Probability Collectives Algorithm II

Human Assisted Routing

Routing Irl!

- The HGSADC is the best.
- Probability Collectives is best distributed system.
- Humans are still better than computers at guessing.
- Challenges remain in routing with dynamic constraints.

Column Example

Same genome can lead to different physical structures or behavior depending on environmental factors.