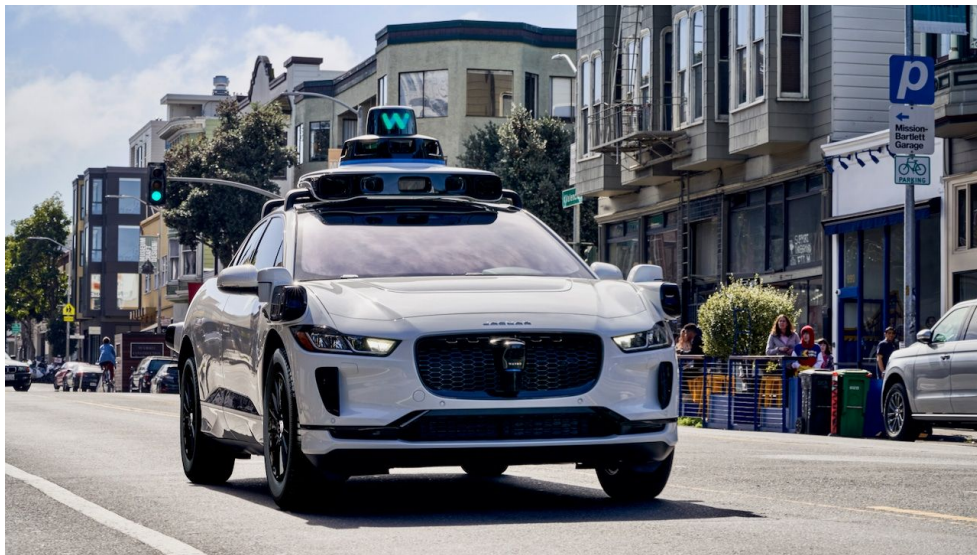




Improvement of intersection coordination

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Background



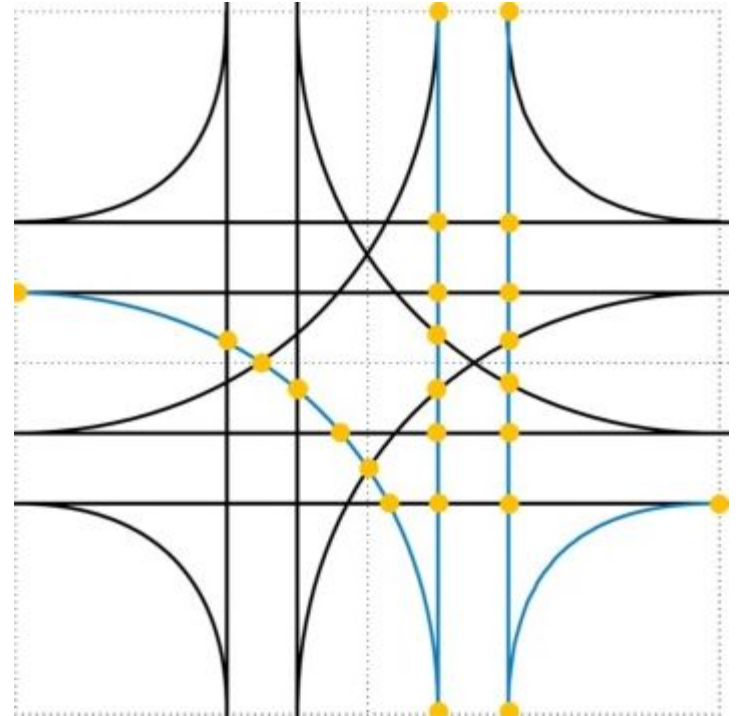
Challenges

- Large search space
- Real time



Problem statement

- Vehicle path is trajectory from entry to exit lane
- Conflict points are intersections
- Intersection manager





Previous work

- Reservation-based strategies (FCFS)
 - Poor solution quality
- Optimization based strategies (MILP)
 - Computationally inefficient



Base paper

- PSL - PBS-SIPP-LP
- PBS - Priority-based search
- SIPP - Safe Interval Path Planning
- LP - Linear Programming
- Runs faster than MILP without compromising the quality.

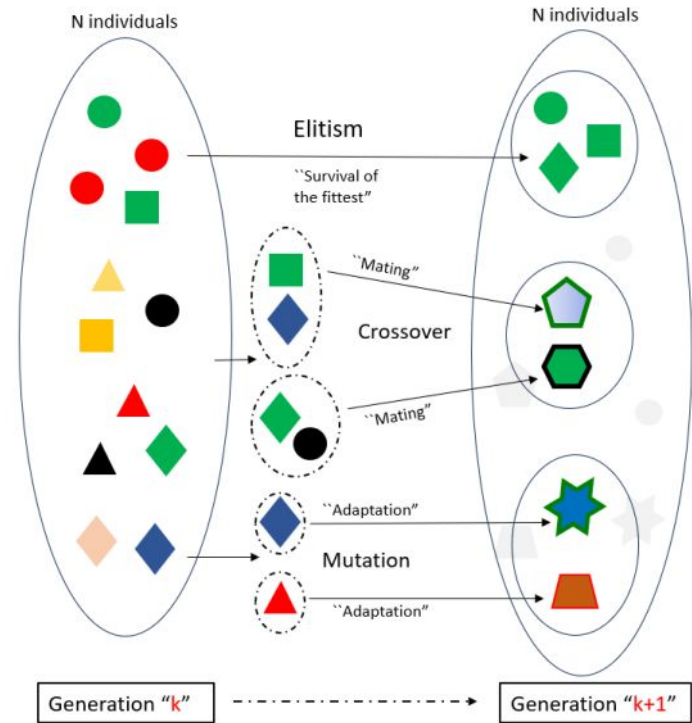


Shortcomings

- Worst case factorial run-time
- No multi-objective optimization
- Does not find global optimum because of its limited to priority ordering

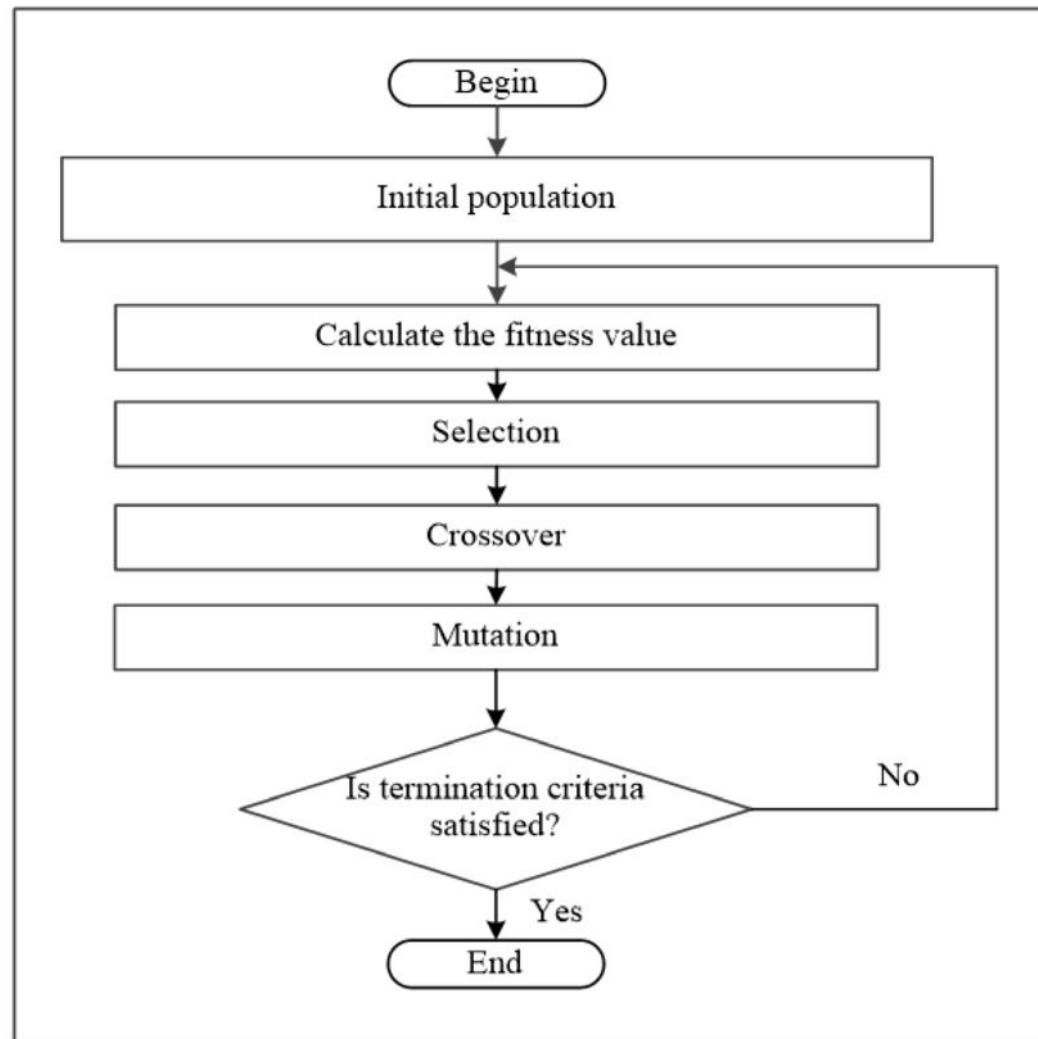
Genetic Algorithms

- Inspired by evolution
- Solution is encoded into a gene
- Best gene is result of the algorithm
- Meta-heuristic algorithm



Algorithm

- Initial population
- Fitness value
- Selection
- Crossover
- Mutation





Our proposal

- Use GA instead of PBS to remove the factorial worst-case
- Fix duration of algorithm to ensure real-time capabilities
- Possibility to extend to multi-objective planning



Initialisation

Use FCFS heuristic

With elitism basecase is always in the population

Fitness value

SIPP + LP path-planning

Ran multiple times so bottleneck

Remove conflict-free paths from GA to reduce size



Hybrid algorithm

Use local search to explore local neighborhood

Requires SIPP + LP call every time so might be inefficient

Conflict clusters

Split agents into conflict clusters to reduce the size of genes in each GA

Finding conflict clusters might be costly



Questions