Traffic Butter: Genetic-Based Traffic Optimization

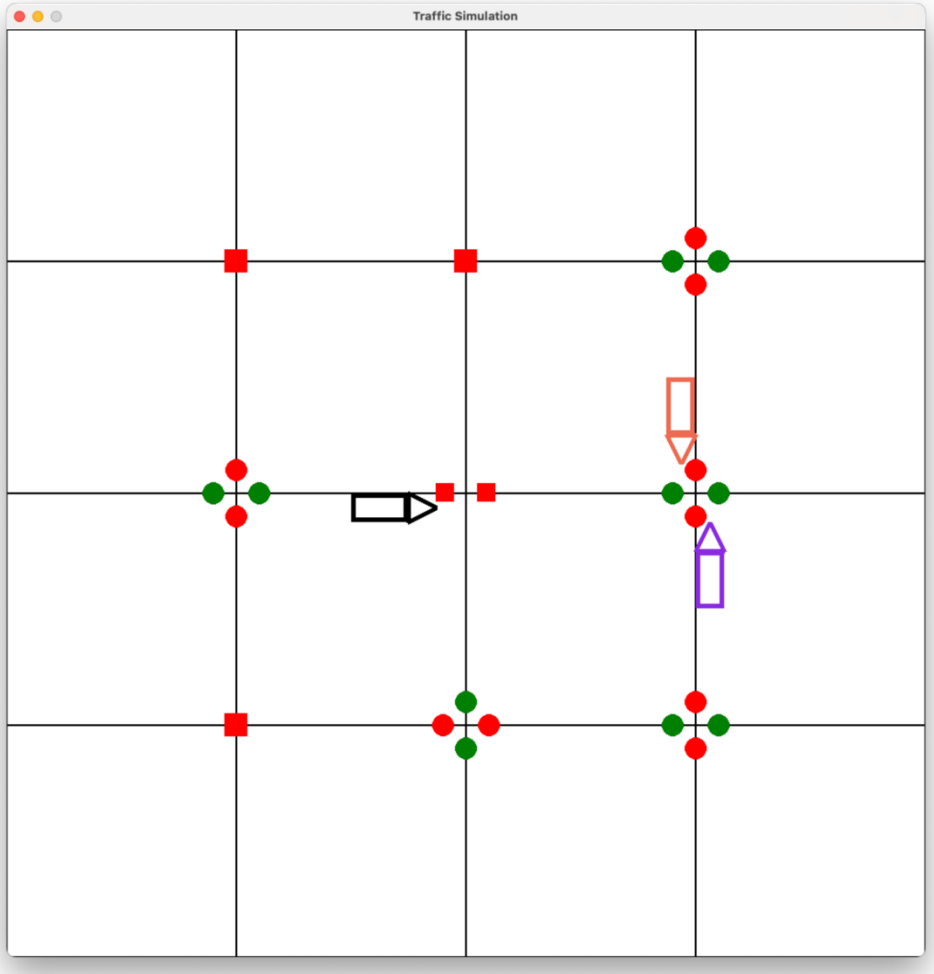
Bich Nguyen, Dilan Piscatello, Zachary Rippas

Problem and Idea

- How can we minimize traffic congestion in urban environments?
- Where should we place traffic lights? Where should we place stop signs?
- Idea – use genetic algorithms to determine optimal placement and characteristics of traffic control measures

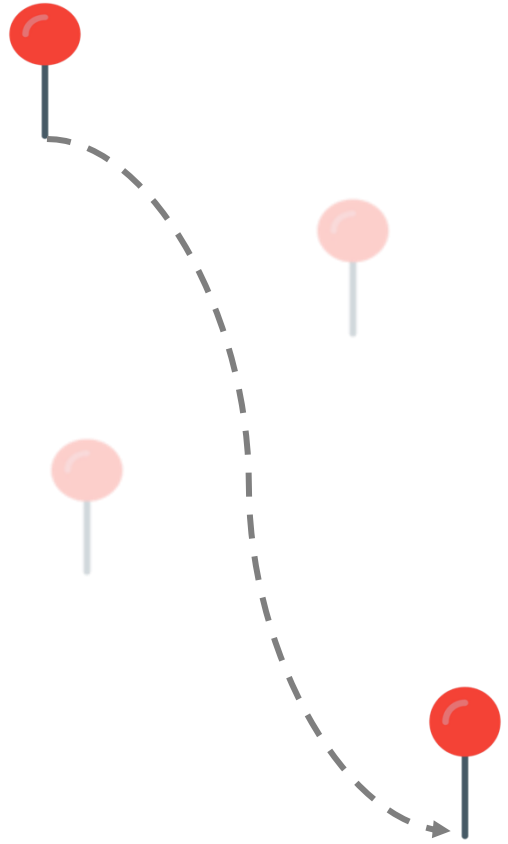
The Simulation

- N cars have random origin and destinations
- Simulate the cars moving through the traffic environment in real time
- Record the average time taken to reach destination

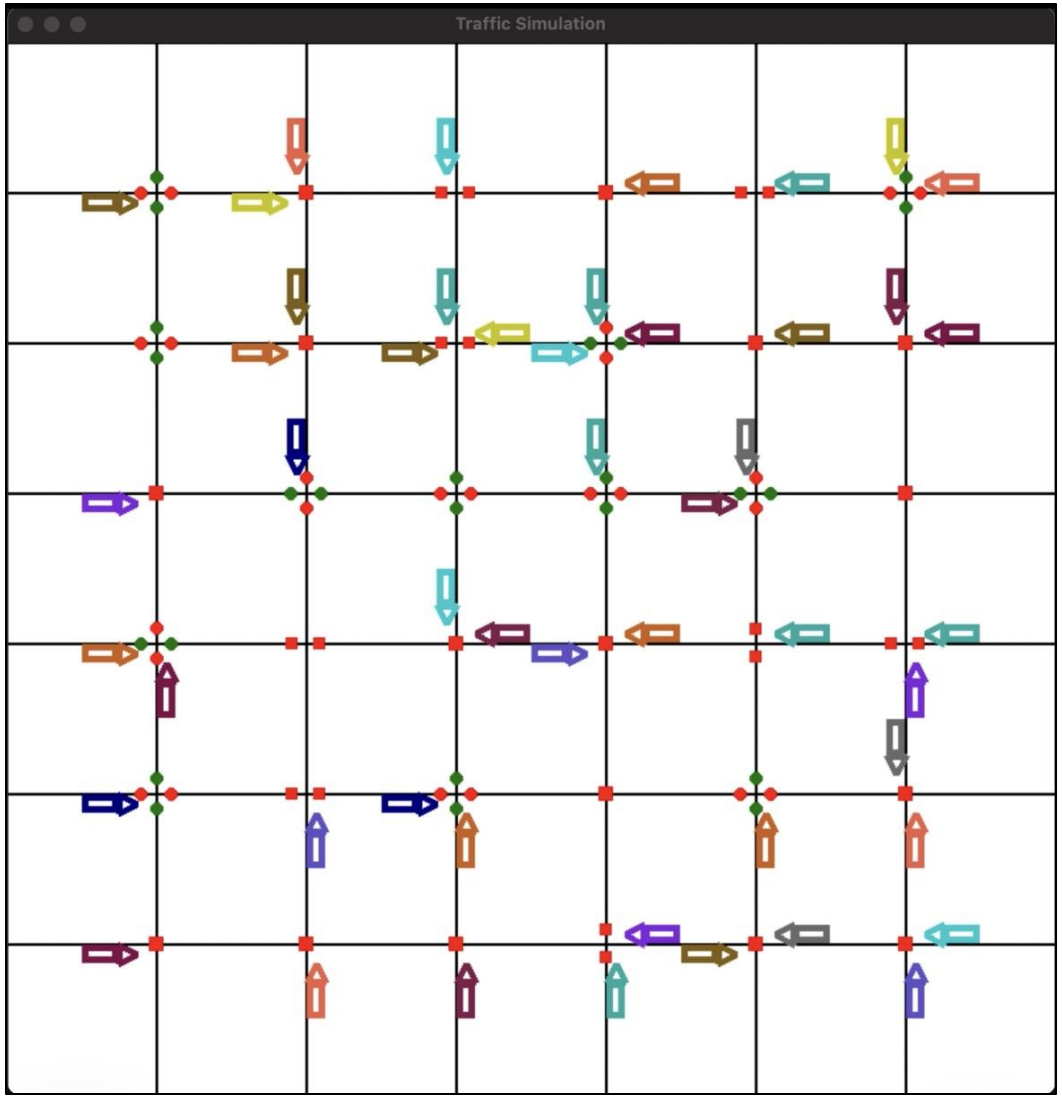


Route Finding

- A* with Manhattan distance as heuristic
- Traffic lights > 4 way stop > 2 way stop
- Location on grid



Simulation Demo

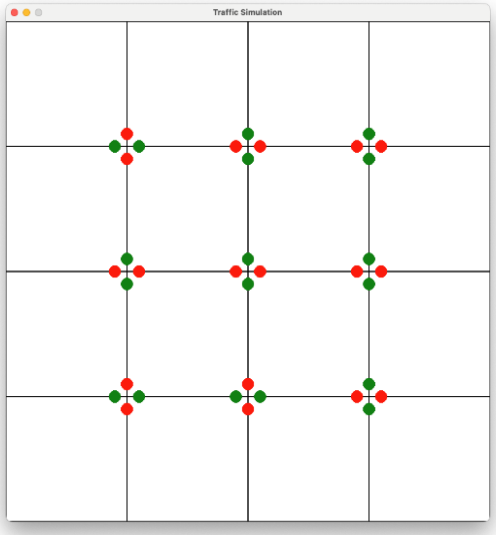


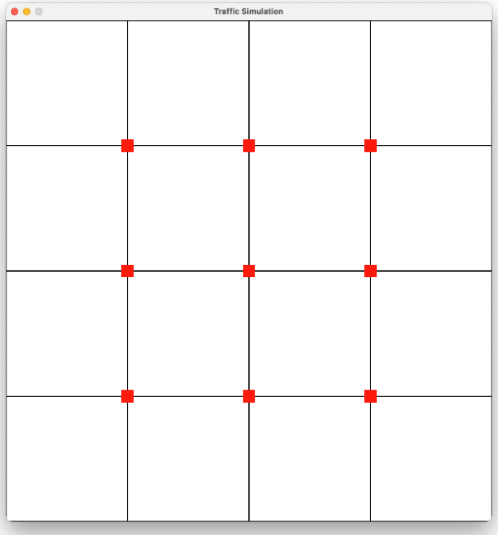
9x9 grid, 100 cars

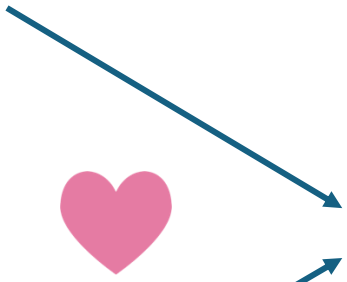
Genetic Algorithm

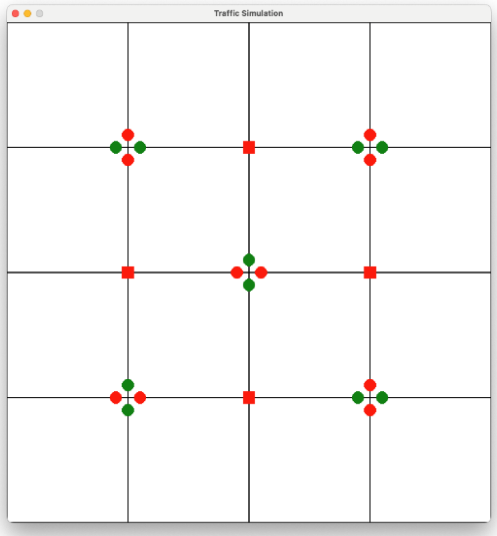
- N candidates in population
- Run M simulations on each candidate in parallel
- N/2 best performers survive each generation
- Crossovers and mutations to repopulate
- Random restarts to escape local optima

Crossovers & Mutations

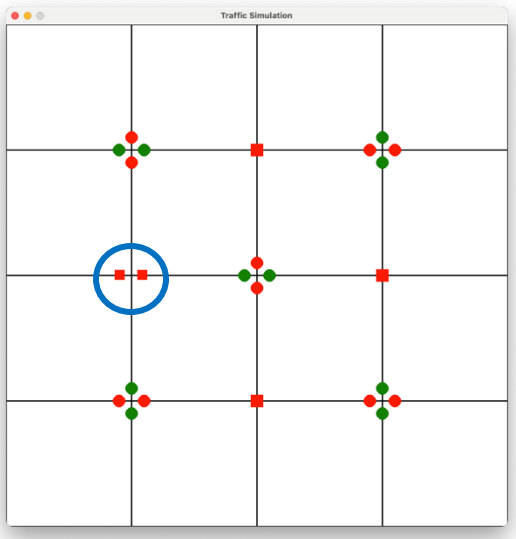




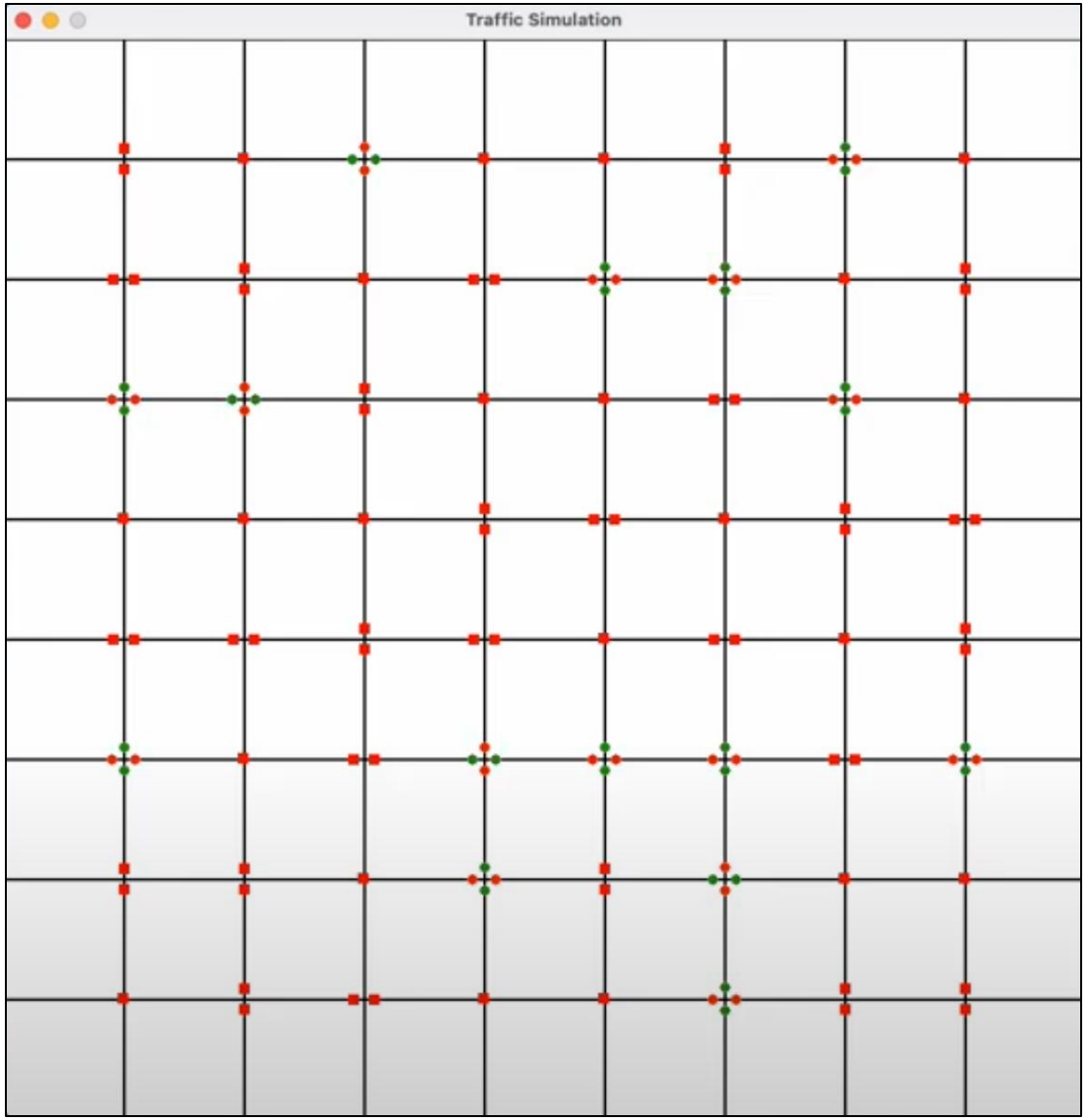




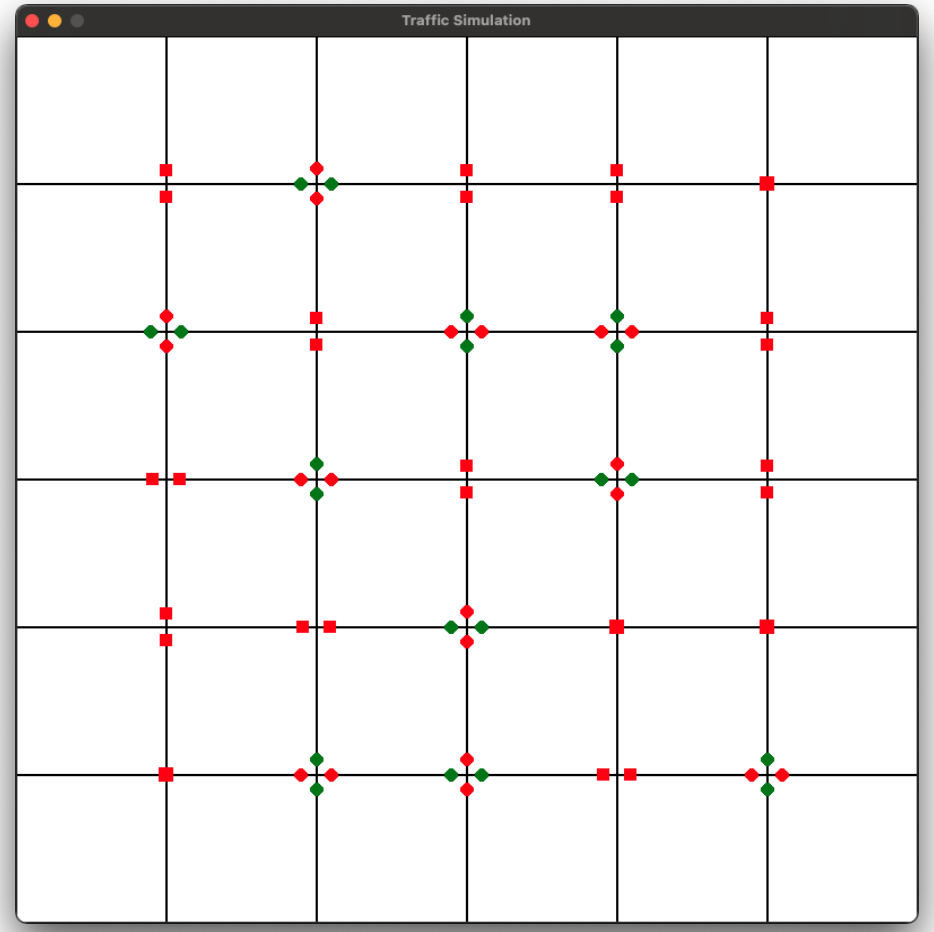
P(M) = mutation rate



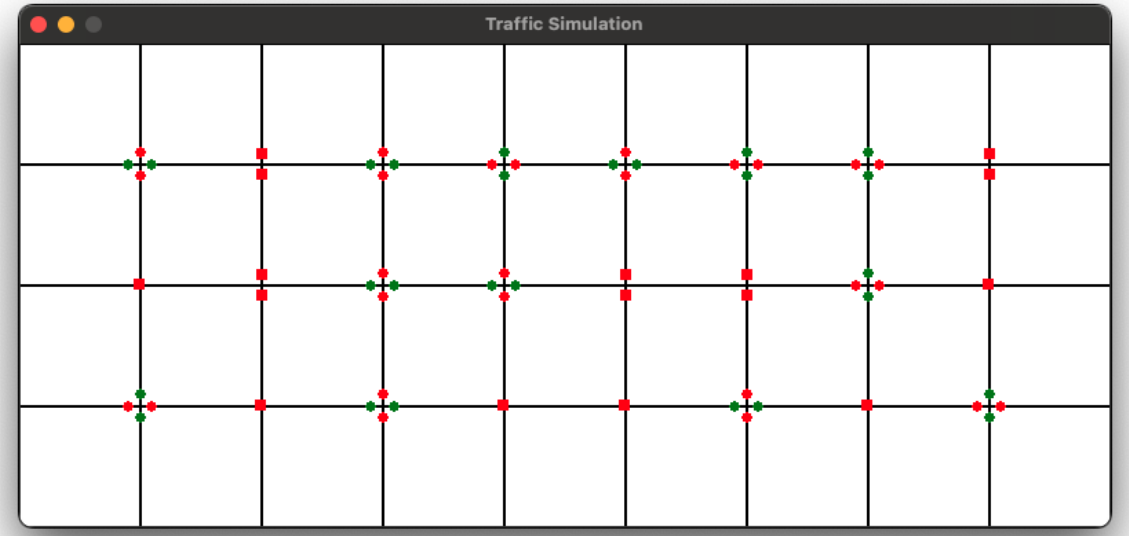
Genetic Algorithm Demo



Results & Takeaways



5 x 5, 100 cars, N = 10



8 x 3, 200 cars, N = 10

Q & A