An Energy-Efficient Ride-Sharing Algorithm Using Distributed Convex Optimization

With the burgeoning role of ride-sharing in transpiration, current algorithms for routing often only prioritize times. The authors suggest to instead optimize the energy consumption by formulating a distributed convex optimization problem for networks of local vehicles. The midterm report covers the combinatorial optimization problem of rider pickup and how a simple loss function for energy can be designed via information about the vehicle and routes. The authors then design an optimization procedure whereas each car optimizes its energy usage and which in turn minimize the system wide energy usage.

Constructive feedback:

(a) The report looks great and is well-written to explain the motivation behind the problem. The technical contributions are however unclear and could use more highlighting/sign-posting.

(b) If your main result relies on prior work on the distributed convex optimization, it would be great to include additional detail about their proofs / derivations.

(c) Experimental evaluation would help validate the approach. Designing a simulation to convince readers that your algorithm is correct would greatly contribute to the report.

Alternative Approaches:

(a) Experimental simulation would probably be the best addition to the report. It would let you simulate the types of vehicles and ridership, showing the (near) optimally of your algorithm. You could vary the number / type of cars / locations to show different scenarios.

(b) The difference between your algorithm and baselines would really help quantify the degree of improvement. For example, how much worse is a greedy approach of choosing whose total trip is the shortest.

(c) Are you treating the simulation as a continuous process? You may consider rollouts where there is an expectation of a rider showing up in specific locations, as I believe this is more similar to current rider-driver matching schema.

(d) In light of the limited carpool trips (due to Covid) is there another way to formulate the problem so that next-pickups are economical?

Questions/comments for the final report:

(a) Does routing (i.e. directions from Maps) effect eco-friendliness? Does the newly released eco-directions match your cost function?

(b) Could you reformulate the problem to allow drivers to pickup riders after a dropoff?

(c) Please include details about the efficiency of carpooling on these systems. In personal experience, I was often not matched with others on trips.

Tentative Score:

(a) Clarity/organization: 4
The report does a great job of describing the problem of rider-driver matching. Sections are well-organized and allow novice readers to understand the motivation and formulation. The only caveat is the lack of clarity in what is prior work vs. what is novel contribution.

(b) Technical Score: 3
It is not immediately clear to me what the technical contribution of the report is in relation to prior work. On the understanding that the main result is the reformulation of the objective, I rate this as a 3 as it simplify redefines an objective without making use of the structure. The approach appears unoriginal, and there are little to no experimental results to support the claims.