1. Introduction

Socio-psychological barriers such as trust are found to lead to low participation rate in ridesharing. In order to overcome such barriers, this work studies whether the additional detour costs of limiting shared rides to, or giving priority to contacts in social networks would be prohibitive.

This work builds a ridesharing model that compares the successful matching rate and detour cost of ridesharing with three types of social connections (i.e., friends) in a small-world network: direct friends, direct or indirect friends, and anyone.

2. Hypotheses

✓ Ridesharing with social contacts does not significantly increase detour cost.
✓ A matching algorithm giving priority to friends can significantly increase the ratio of matching between friends

3. Implementation

✓ Agents are distributed on a 100-by-100 gridline network.
✓ Agents have small-world social network connections: direct (first degree) friends, indirect (second degree) friends, and strangers.
✓ Detour cost is calculated in travel time.
✓ Spatial distribution of friendship has significant influence on matching result.

✓ Detour tolerance and upholding willingness are influenced by social connection types
  - Heterogeneous: considering social network
    - Direct: 30% detour, 100% willingness
    - Indirect: 25% detour, 80% willingness
    - Stranger: 7% detour, 100% willingness
  - Uniform: regardless of social network
    - 30% detour, 100% willingness
✓ Three matching patterns:
  - MP1: matching direct friends only;
  - MP2: matching direct and indirect friends;
  - MP3: matching anyone.

4. Matching strategy

Option: to maximise the total amount of matched people subject to space-time budget and socio-psychological constraints.

Constraints:

a. Space-time budget

b. Socio-psychological constraints:

Detour cost = real travel time in a shared ride − shortest individual travel time;
Detour cost ≤ Detour tolerance (social type).

c. Feasibility of matching:

The merged travel must be shorter than travel individually [3]:

\[ TTC(p1) + TTC(p2) > TTC(p1 + p2) \]

Decision-making:

In lieu of global optima, egoistic agents are assumed to achieve their best interest by trial-and-error.

a. In latest starting time sequence, each agent asks their current potential best choice.

b. The role to be a driver or passenger is not fixed until initially making a decision. It is based on the instant utility of a person.

c. Former decisions have influence on later ones, since multiple people may have the same best choice.

5. Future work

✓ Dynamic model for demand-responsive transport
✓ Autonomous vehicles with decreased amount of traffic
✓ Dynamic social network equilibrium for optimal collaboration

References:

Notes

Figures and diagrams are not included in the natural text representation.