A Parking Location Choice Model for MATSim

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Why is parking important?

- Some studies identified 30% to 50% of traffic at central business district as parking search traffic
- Other studies report that parking policy can influence both transportation mode and traffic volumes
Problem definition

For a given activity destination, select from the set of public parkings in the neighbourhood so that the agent’s utility is maximized?

Parking characteristics
• price
• walking distance
• capacity
• parking access
• parking type
• (Etc.)

Parking Location Choice (not Parking Search!)
Demand Optimization in MATSim

MATSim (Multi-Agent Transport Simulation)
Demand Optimization in MATSim
Demand Optimization in MATSim

MATSim (Multi-Agent Transport Simulation)
No changes to the MATSim simulation

Till now

car

With parking

car

walk

P

walk
Parking location choice - implementation overview

Gathering parking related statistics during simulation
Add parking score to overall score

Allow agents to select new parking
Parking scoring function for experiments

- Components of the parking scoring function:
  - ParkingPriceScore
    - Parking duration, parking price, income
  - ParkingAccessScore
    - Access time, any other access disutility
  - ParkingWalkingScore
    - Distance, target activity duration and type
  - ParkingCapacityViolationScore
    - How full is parking at arrival time (this can be explicit or implicit)

- Weightes chosen:
  - Parking gets a total score between 0 and 5
  - ParkingCapacityViolationScore gets 10 times higher weight than other 3 Scores
Parking location choice - replanning

Select, which parking to replan from all parkings done during the „previous“ day:

If (setOfParkingsWithCapacityViolation not empty) {
    Select randomly one parking from setOfParkingsWithCapacityViolation;
} else {
    Select randomly one parking from all parkings.
}
Parking location choice – replanning (cont.)

Try to find parking with potentially higher score for the selected target activity (based parking statistics/estimates gathered during traffic simulation) in neighbourhood of target activity:

(the parking type choice also happens in this step)
Experiments and sensitivity analysis results

• Using small test scenario
• Run with one million agents on the test network tried out
Scenario layout (chess board)
Does system relax? How many iterations?
Relaxation measure 1: capacity violation reduction
Relaxation measure 2: walking distance
Scenario layout – grouping of parkings
Parking price and income

- Two groups: one with very high and one with very low income (50% of people belong to each group)
- Parkings close to home and work are MUCH more expensive than the parkings further away.
Parking price and income (cont’t)

![Graph showing change in traffic volumes due to price change.](image)
Parking supply
Introducing parking access constraints
Don’t look at single agents!

- System is changing in each iteration (trying to optimize)
- Don’t look individual agents but on aggregate values!

- This means, that it may happen that isolated agents may have wrong parking behavior, but average behavior should be right

- Experiment
  - Enumerate agents from 1 to 99 and each agent departs one minute ahead of time than the next agent
  - This means that there is a clear temporal advantage towards the parking for agents departing earlier
  - Even though this advantage can get lost (e.g. agent 32 may get a worse parking than agent 33)
  - Aggregated statistics should be right!
Temporal aggregated advantage

Parking type (in progress)

Working on test cases
- Reserved disabled people parking at shops
- (or reserved electric vehilce parkings)
Future Work

- Integrating into official MATSim release
- Improve replanning algorithm for better optimization

Long term:
- Add parking search into QueueSim (within day replanning)
Questions?