Activity-based modelling for exposure assessment

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Exposure for activity information-available situations (SPALDIA).

-> Activity schedule and probability -> Sample a schedule

-> Correspond to a person's geographical locations and relate to air pollution maps

identified (e.g. with known home, work, activity locations)

predicted (e.g. activity location is close to home)

simulated (e.g. unknown work locations).

-> Exposure assessment

Exposure for information-sparse situations (SCN and EPIC-NL).

-> Relationships between occupation and socioeconomic to the activity patterns -> classify patterns -> clustering activities.

Activity schedule

Econometric models, which impute personal day activities (Bowman 2000)

$$P(\text{schedule}) = P(\text{pattern})P(\text{tours}|\text{pattern})$$

a hypothetical schedule:

7:30 AM	Drive alone from from home in zone A to work in zone B.
noon	Walk for lunch and personal business, returning to work
4:40 PM	Depart for home, stopping at the bank in zone C
5:00 P.M.	Depart for home from the bank.
7:00 PM	Drive with family to mall in zone C for shopping.
10:00 PM	Return home.

P(schedule) = P(pattern)P(tours|pattern)

Pattern: a function of the attributes of all its available tour alternatives.

Tour: has a base point that a person will start the trip from and return to, it can consists subtours, e.g. break at work. The tour model is hierarchical:

A tour has a **tour type:** defined by the number, purpose and sequence of activity stops o the tour. For example: (1) home -> work -> home, (2) home -> school -> home -> additional activity.

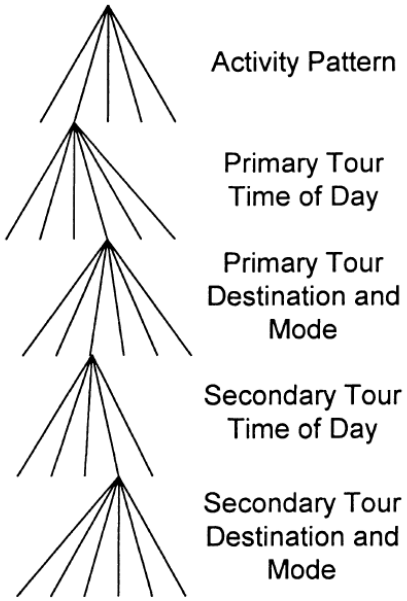

Figure 1

Secondary tour:
constrained_activity = [“home”, ‘’work’’, “work related”, “shopping”]
unconstrained_activity= [“sports”]

Probability of tours:
All the tours are assigned a **priority**. The tour contains highest priority activity will be given the highest priority (highest probability)

A primary activity: = [“home”, ‘’work’’, “work related”]

Activity priority: {“home”:0.6, “work”:0.3, “work related”:0.05, “shopping”:0.05, “sports”: 0.05}

Pattern

- characterised by the
  - primary activity,
  - the **type of tour** for the day's primary activity,
  - the number and purpose of secondary tours.

  the pattern can be classified based on the socioeconomic groups.

Pattern

- Pattern = {
- [fulltime_worker:
- primary_activity = “work”,
- type_of_tour = “home2work2home”
- number_purpose_secondary_activity = 1_unconstrained],

- [student:
- primary_activity = “school”,
- type_of_tour = “home2school2home2activity2activity”,
- number_purpose_secondary_activity = 2_unconstrained]
- }

Primary and secondary tours

The secondary tour is conditioned on the primary tour

- P(tours|pattern) = p(primary tours|pattern)p(secondary tours|pattern)
- P(tour) = p(timming)p(mode, destination|timing)

Example

#Assume a person A is a student and 80% he will follow the student pattern.

- Pattern_ = Pattern[“student”]
- P(pattern) = 80% # defined from spaldia

- Tour_type, tour_primary, tour_secondary = retrieve_from (Pattern_)

- P(primary_tour|pattern) = f(activity_priority, tourtype, timming, mode)
- P(secondary_tour|pattern) = f(activity_priority, tourtype, timming, mode)

- P(tours|pattern) = p(primary tours|pattern)p(secondary tours|pattern)
- #P(tour) = p(timming)p(mode, destination|timing)
- P(schedule) = P(pattern)P(tours|pattern)

SPALDIA Data and process defined/ predicted/ simulated from data

Data

- Days per week of cycling, vehicles, walking.
- Primary commuting tools to work, if public transport, the time needed to the public transportation.
- How many hours per day and days per week at work place.
- 10pm – 6 am activity (one hour somewhere?)
- Occupation (outdoor, indoor)
- Work location, home location.

Process:

1. Define the primary activity
2. Predict probability for each activity, tour, time, to calculate P(schedule)
3. Sample schedule, retrieve space-time locations and calculate exposure.
4. Classify patterns from socioeconomical variables