# Notes from MOVE working days

28-29 October 2011

/HSP

## Hans Skov-Petersen and Reto Rupf: Wellcome to the Move Showcase – Working days on tracking recreational behaviour

Introduction to the scope and structure of the working days

## Reto Rupf: MAFREINA

Recreation an nature management

How can visitor environmental management be improved

We need a tool for a priory assessment

National park: 200 km2

1200-300 m ASL

Spatial and temporal of outdoor use (monitoring started in 206) – much was known about animal behaviour

GPS: two weeks of logging. 50 hours of action

Precision: 4 m

550 winter trips

1100 summer trips

sensor camaras installed

eco counters installed (50% error rate), on the slaps it is only 10%

for future endavors SP is applied

## Daniel Köchli: : Automated processing and plausibility testing

* Data collection
* Data processing
* Plausible/feasible

Logging freq. 5 sec

Motion detector (out of motion): 2 min = stand by

Motion detection is based on a mercury switch. I.e. if walking around at one site during break, is not detected as a pause.

Pink (personal profile), yellow (activity report), and grey (raw data)

Raw data is cut into trips at midnight

Data loaded into a SQL DB (later into a ESRI PersGB)

The attribute ‘Route’ (generated by manual assessment) states start/run/end.

Discussions of feasibility (plausibility):

Qualitatively: mapping

* Visual inspection
* Visual inspection by selection of respondents (Steffan van der Speck has tried it via the Net)

Quantitatively:

* Compare speed profiles (average and average going up vs down) compare to yellow sheet
* Problems with multi modalilties (e.g. hitchhiking or taking a bus during hiking)
* Assessment y camaras at location/respondents where qualtitative assessment of activities disagrees with stated activities (yellow sheets)

Daniel Köchli: Where do people rest? What is considered to be a break?

Motivation what can be demarcate resting points in ‘new’ areas.

How do we define a break?

Weighted waypoints?

Desintymaps are ‘place-oriented’

How do we define a break?

Thresholds:

* Distance
* Temporal
* (speed)
* Angular deviation

## Hans Skov-Petersen: Move Showcase – Working days on tracking recreational behaviour

Description of the characteristics of recreation as a special case of spatial behaviour. Further also the special data needs for configuring an agent-based model was discussed.

## Martin Wyttenbach: Assessing the spatio-temporal pattern of winter sports activities to minimize disturbance in capercaillie habitats

550 trips

cameras

(Line based) kernal assessment of pressure

temporal profiling can be important – depending on the given spies’ behaviour. One minor disturbance frequently can be worse than major ones infrequently.

Somayeh Dodge

Knowledge discovery…

Patterns and structures inmoment data

PhD thesis

Similarity of different trajectories e.g. in speed, even when not in space

Movement parameters profiles: sped, direction, acelleration

Sinuosity (freq. in variation)

Similarity:

‘edit distance’ as a measure of similarity. Can be normalized in to NWED

## Hans Skov-Petersen: A frame work for analysing tracking data – applications in recreation planning

A frame work for analysing tracking data was proposed (see table xx). One one hand analytical approaches are divided into local, focal, zonal and global types. Originally this approach was invented and adapted by Dana Tomlin as part of his ‘Mapalgebra’. A main difference is that the mapalgebra was entirely aimed at spatial analysis the present takes the points’ temporal position into account. For instance in focal analysis it is the closest points in time that is considered where a classic focal analysis is considering points adjacent in space. Since time/space often is highly correlated (objects seems to move to a location close to the one they are presently at) the (spatial) terms of the mapalgebra often makes very good sense when transferred to a temporal domain.

One the other hand the framework divides analysis into descriptive and inferential approaches. A descriptive approach can be performed entirely on the tracking data (for instance stop/go, curvature and speed) and bringing into account information from other data sources (for instance evaluation of a track in terms of altitude zones covered). Finally an inferential approach to data analysis could include assessment of characteristics of locations where stops take place og analysis of movement speed as a function of slope.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Description** | | **Inference** |
|  | **Locations only** | **Additional layers** |  |
| **Local**  Individual points | Where is (x, y)?  What is the PDOP of..? | Distance to paths’ and points of interest. | Where do stops occur? |
| **Focal**  Spatial/temporal | How fast?  Stop/go? | How steep? | Speed/slope relations  Choice of ‘next point’ (relative to options) |
| **Zonal**  Single track/tours/routs | How far?  Round trip?  Average speed?  Altitude difference? | Min/max altitude along a track  Land cover distribution | Choice of route (relative to options) |
| **Global**  All tours, for an individual or all respondents | Data mining  Spatial/temporal clustering  Area of interest | Path pressure  Kernel distribution | Relation of congested locations |

Tabel xx: A proposed analytical framework for tracking data

Based on the framework the presentation gave examples of results from analysis of the data set provided for the working day assignment. The involved analysis was performed by an application developed in Python/OGR(GDAL. Example results include:

* Zonal analysis, description (without additional layers): Analysis of speed, length, duration, number of points in subtracks,
* Zonal analysis, description (with additional layers): start-, end-, min-, max-, and average altitude of subtracks
* Global analysis, description (including additional layers): pressure (number of points per unit length) on path segments.
* Focal, inferencial: Relation of slope versus speed
* Focal, inferencial: Creation of data for a discreet choice experiment. The actual selected next point along the track was evaluated in terms of a set of alternative points, that was not evaluated.

## Salvo:

Point of departure in urban movement

GeoPKDD process:

* Collection of points
* Mobility data
* Mobility patterns

Mainly working on a global scale

To some extent zonal (single tracks/individuals)

Fields of application

* End users (of roaming users)
* Manahers&planers

M-Atlas: developed on PostGress/PostGIS

MAFREINA process:

* Filtering – e.g. quality measure = 0
* Spikes
* Speed limit (upper: 70 km/h)
* Speed filtering could also be performed as ‘spikes’ I speed for a single trip
* A normal distribution plot was made on speed to demarcate the upper threshold

A stop is a place where a respondent stay a certain amount of time.

Analysis of distribition of points as per the temporal distance to the previous point. By error the time to last stop of the previous stop (of the devise (because held still)) was used, not the time to the previous point.

Likewise the spatial distance to the previous point was assessd.

A pause was destinctioned to be a location where more than 300 sec was spend within 50 m radius.

404 distinct trips was recognized.

Distribution (histograms) of lengths of trips was calculated. Likewise for duration and average speed. Was used to evaluate different activity types.

Distribution of activities over hour of the day. Based on individual points (subtrips split over time periods). Differences between hikers/bikers were assessed.

Analysis of relevant places (influenced by the stop detection). Clustering (density based) were applied. Separates clused by ‘open spaces’. Divided in to start/stop. An probability matrix of O/D tours were calculated.

Similarity measures were applied to different trips (i.e. recognizing which tour resembles which).

Possible locations were assessed.

Previously the daily patterns of movement between location were assessed per person. It would – in future applications – be able to make distributions of destination and intenaries given a location of departure.

## Thomas Behr

Analysis of movement data using Secondo

Secondo is a database system.

URL: http://dna.fernuni-hagen.de/secondo

By application of a 15 m trehreshold the data set can be reduced to 10 % of its original size.

The dem is represented af a rectangular set of polygons (not a raster).

**Beaks (stop).** Parameter: trajectory, duration, distance): clusters of points that in sequence do not exceede the max duration and the min distance.

Breakpoints are clusters, as aper a min distace. A centerpo and the number of points in the custer is returned.

Difference to kernal analysis?

**Analysis of places** – using a grid:

Celle size 1x1 km

* Number f different users
* Duration – how much time was used in each cell
* Speed

Al can be further disaggregated in to temporal slices.

Splitting trips

## Maiken, algorithms for trajectory analysis

Geometric algoritmics

Trajectory similarity

How do you select a central trajectory out of a cluster of similar trajectories.

Trajectory segmentation. How do you segment a trajectory into meaningfull sub tours. Criterias:

* Speed
* Heading
* Location
* sinuosity

Soumis (yesteday) edit distance similarity is on example of similarity measures

Fréchet distance is an alternative.

* Can be used to to detech following objects
* Can be used too to perform map matching (!)
* Median trajectories

What is a break?

* A given radius
* A given time

Visualize via KML

## Maike

Estonia

Regional analysis now a dayalso urban applicatipns

Stop detection:

* Time : 300 sec
* Distance: 50 m

Visualize via KML

Stops correlate nicely with the number of photographs regie

Stered in Google Earth

My suggestion: use angular measures to avoid spikes to ruin the extraction of pause locations. I.e. If the noise is bigger than the distance criteria a stop will be disregarded.

Another suggestion: think in terms of ‘degree of stop’. Both for an individual and globally for all respondents.

## Group work on stops.

Criterias:

* Speed
* Time
* (angles)

Scale in stops

* degree of details
* accuracy of ground data
* accuracy of
* GPS unit

Ground truth

* Where many people are resting

Dynamic thresholds

Towards a generic data set.

Attributes: (individual records)

* Id (trip and user)
* Quality, HDOP num of satellites
* Time
* Coords (x, y)
* Altitude
* Static pause data (mercury tricker)
* Speed (optionally)
* IS\_Staics

Attributes (respondent specific):

* Demographic data (gender age etc)
* Activity
* Number of people in group

Attributes (entire data set):

* Mode of GPS trip
* Projection

## Group work on distinction of activity types.

Locational derived parameters:

* Speed
* Acceleration
* Stops
* Distance

Additional layers:

* Dem (slope)
* Path network (on/off, time spend away from the network, etc.)
* Lc

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | season | Speed |  |  | Go to summit |  |
|  |  | Avg | Down hill | Up hill |  |  |
| Snowshooers | W/S | Low | Low | Low | No |  |
| Skiers/snowboarders | W/S | Medium | High | Low | Yes |  |
| Bikers | S/A | Medium | High | Low | No |  |
| Hikers | S/A | Low | low | Low | Yes |  |