Spatio-temporal analysis of location data for investigation support of burglaries

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burglaries in apartments and single family houses

- organised offender group
- within 6 months
- stolen goods
  1.8 million Euros
- 109 proven offences
- up to 10 years of imprisonment
crime problem: burglaries in
- apartments
- single family houses
- shops and companies
- vehicles

organized offender groups
- professional approach
- hardly any witnesses and evidence
- use **cars** for their journey to crime
- **communication** via mobile phone
investigator wants to know:

- **WHERE** and **WHEN** is the suspect at a certain location in time?
- **WHAT** burglaries may be assigned to the suspect?

- GPS device on a target vehicle
- backbilling (mobile phone)
- large quantity of data

assistance of sub-department **ANALYSIS**
► spatio-temporal analysis

► data
  ▪ location data (GPS data and call data)
  ▪ offences (burglaries)

► internal procedure

► examples
  ▪ analysis of GPS-data (target vehicle)
  ▪ analysis of call data (mobile phone)
spatio-temporal analysis

► spatio - temporal matching of
  
  - location data of vehicle  with  burglaries
  - location of transmitter masts  with  burglaries

► aim:
  
  - overview of burglaries, that might have been committed by a particular suspect in a spatial and temporal context
  
  - valuable hint for further criminal investigation, interrogation, and court proceedings
# Location Data

<table>
<thead>
<tr>
<th>Source</th>
<th>GPS-data (vehicle)</th>
<th>call data (mobile phone)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS or navigation device</td>
<td>mobile phone</td>
<td></td>
</tr>
<tr>
<td>Origin</td>
<td>surveillance unit</td>
<td>mobile phone operator</td>
</tr>
<tr>
<td>Format</td>
<td>MS-Excel file</td>
<td>MS-Excel file</td>
</tr>
<tr>
<td>Position</td>
<td>x, y – GPS coordinates</td>
<td>x, y – coordinates of transmitter masts</td>
</tr>
</tbody>
</table>
“Crime Monitor“
- database
- offences of the Austrian penal code

visualisation of offences in GIS

spatial analysis of offences in GIS

data of „Crime Monitor“ are up-to-the-minute
**investigator**

- suspect(s)

**GPS device on vehicle**

- backbilling of call data

**GPS data / call data**

**.BK - department Crime Analysis**

- report and interactive map

**spatio-temporal analysis**

**spatio-temporal matching**

**investigator**

- criminal investigation

- interrogation

- court proceedings
first example
analysis of GPS data (target vehicle)

second example
analysis of call data (mobile phone)
analysis of GPS device

- spatio-temporal matching
  - GPS data (GPS device)
  - burglaries

- result
  - vehicle stop
    - short (2 – 10 minutes)
    - middle (10 – 30 minutes)
    - long (> 30 minutes)
  - burglaries, that might have been committed in a spatial and temporal context to the vehicle stop
number of entries (positions) from 9\textsuperscript{th} to 29\textsuperscript{th} April 2010: \textbf{31.409}
The number of entries (burglaries) from 9th to 29th April 2010 is 467.
Route des Zielfahrzeuges
Operative and Strategic Crime Analysis

Analysis of GPS device

Animation of vehicle route
vehicle stops and burglaries

Mögliche WohnungsED

Zielfahrzeug Standzeiten

kurz (2-10 Min.)
mittel (10 - 30 Min.)
lang (über 30 Min.)

Umkreis 250 Meter

WohnungsED:
Tatzeit von: 21.04.2010, 16:00
Tatzeit bis: 22.04.2010, 09:30

WohnungsED:
Tatzeit von: 28.04.2010, 10:15
Tatzeit bis: 28.04.2010, 16:40

Fahrzeug-Stopp:
Datum: 28.04.2010, 15:02
Standzeit: 35 Min.

Fahrzeug-Stopp:
Standzeit: 1 Std. 10 Min.
satio-temporal matching
- call data
- burglaries

result
- locations of transmitter masts
- burglaries, that might have been committed in a spatial and temporal context to the locations of transmitter masts
Operative and Strategic Crime Analysis

13.11.2012

mobile phones logged in

location of transmitter mast

suspect_1

suspect_2

28.1.2008 10:00:00 - 30.1.2008 17:30:00

1:00 Milian Inzersdorfer Straße

suspect_3

suspect_4

Possible Crimes

Senderstandort

Tatort

Tatverbächtliger_1

Tatverbächtliger_2

Tatverbächtliger_3

Tatverbächtliger_4

Senderstandort
► suspect cannot be tracked, but
  ▪ the car/vehicle used by the suspect
  ▪ the mobile phone used by the suspect

► no evidence, but valuable hint

► support for investigator
  ▪ further criminal investigation
  ▪ interrogation
  ▪ court proceeding