Identifying movement patterns from large scale WiFi-based location data
A case study of the TU Delft Campus

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MSc Geomatics Synthesis Project

• Connects courses and graduation project
• Group project:
  5 students * 8 weeks (10EC)
• Agile Management
  Iterative, Interactive, incremental
Topic: Wi-Fi ‘user’ data

• Eduroam connection data
  Campus-wide
  MAC-address (hashed)
  Network-id (hashed)
  Staff & Students
  Connection-sessions (5 minutes interval)
Three Parallel Project

1. Extracting presence of people at specific places
2. Unravelling patterns of movement between buildings and within buildings
3. Identifying activities and irregular use
Cross Cutting Topics

- Privacy
- Validity and Accuracy
- Representativeness
- Data Collection: system of Access Points
TU Delft Campus
“To understand human motion behaviour for better decision making”
To what extend can movement patterns in and between buildings be identified from large scale WiFi-based location data of the eduroam network?
Wi-Fi log statistics

> 8,800,000 sessions over 2 months collected

+/- 45,000 different users of eduroam network

+/- 86,000 different devices detected
Methodology / workflow

- Wi-Fi log
- Preprocessing
- Sessions
- States
- Movements
- Visualisation
- Movement Patterns
Movement

(a) $a \rightarrow b$
(b) $b \rightarrow c$
(c) $w \rightarrow a$
(d) $a \rightarrow b$

World

Campus

11
Building level

Movement from, to and between buildings
All movement on campus
from, to and between buildings
All movements between buildings
Movements from and to the campus

![Graph showing movements from and to the campus](Image)

- Blue line: to campus
- Red line: from campus
- Gray line: lecture

**X-axis:** Time (6:45 to 23:45)

**Y-axis:** Movement (Devices/hour)
Week vs weekend
Movements from and to Aula
Movements to and from the Aula
between 12:15 and 13:00
Building-part level

Movement from, to and between large indoor regions
Building graph model
All movement
At the Faculty of Architecture and the Built Environment
All movement
At the Faculty of Architecture and the Built Environment
BK Beats
BK Beats

Main Stage
If you want to see the big guys playing their records, you should certainly go and see the main stage. The Him and Mr. Belt & Wezol are becoming big names in the music world.
Genres: Future house, French house

NOW PLAYING
Movement during BK Beats
Movement during BK Beats
Is our privacy guaranteed?

- Movement patterns (trajectories) are rather unique
- Additional (private) data needed
- Access point map of the campus
Conclusions
Successfully identified movement patterns at two spatial levels

● Building level movement
  ○ Time profiles show the rhythm of the campus
  ○ Movement related to lecture hours
  ○ Most frequent movement between buildings: Aula & Library

● Building-part level movement
  ○ Similar movement patterns can be identified
  ○ Architecture people are less restricted to lecture hours
  ○ Network graph illustrates usage of corridors for movement
  ○ Range AP extends beyond floor level
Thank you for your attention!