UBIQUITOUS LOCATION VALUES AND BIG DATA ANALYTICS - CASE FGI

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HOW LOCATION BASED BIG DATA IS OBTAINED ?

TODAY

- Smart phone
  - Apps aplying location data
    - Sport apps
    - Social media

NEAR FUTURE

- Intenlligent traffic
- agriculture and forest automation
- Drones

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SMART PHONE POSITIONING

- GNSS based
- Signals of Opportunity based
- Sensor based
- Vision based

Satellites

GNSS

Sensors

Accelerometers

Gyroscopes

Digital compasses

Camera

RF Signals

RFID/ NFC

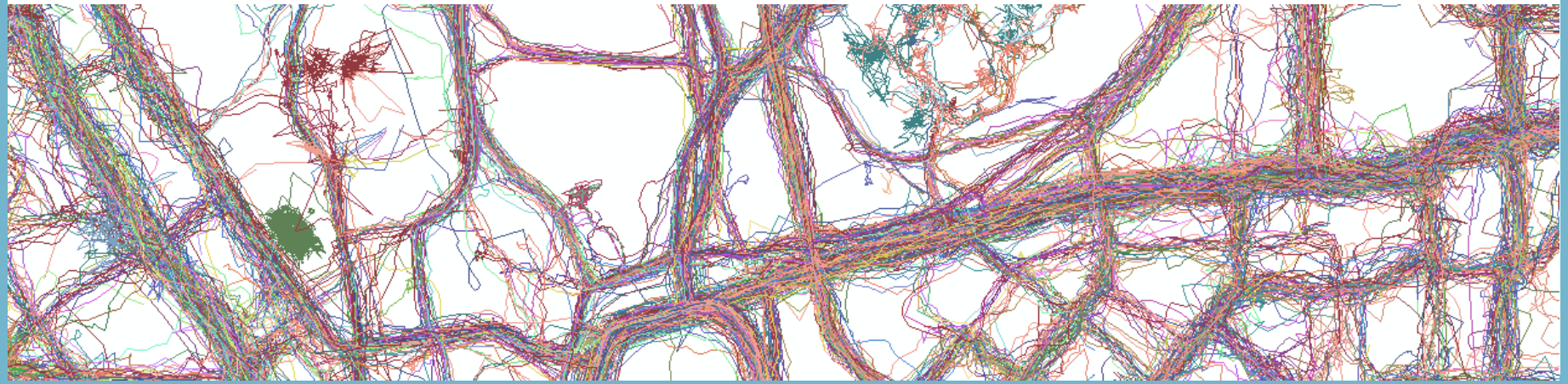
Bluetooth

WLAN

Cellular network & Digital TV

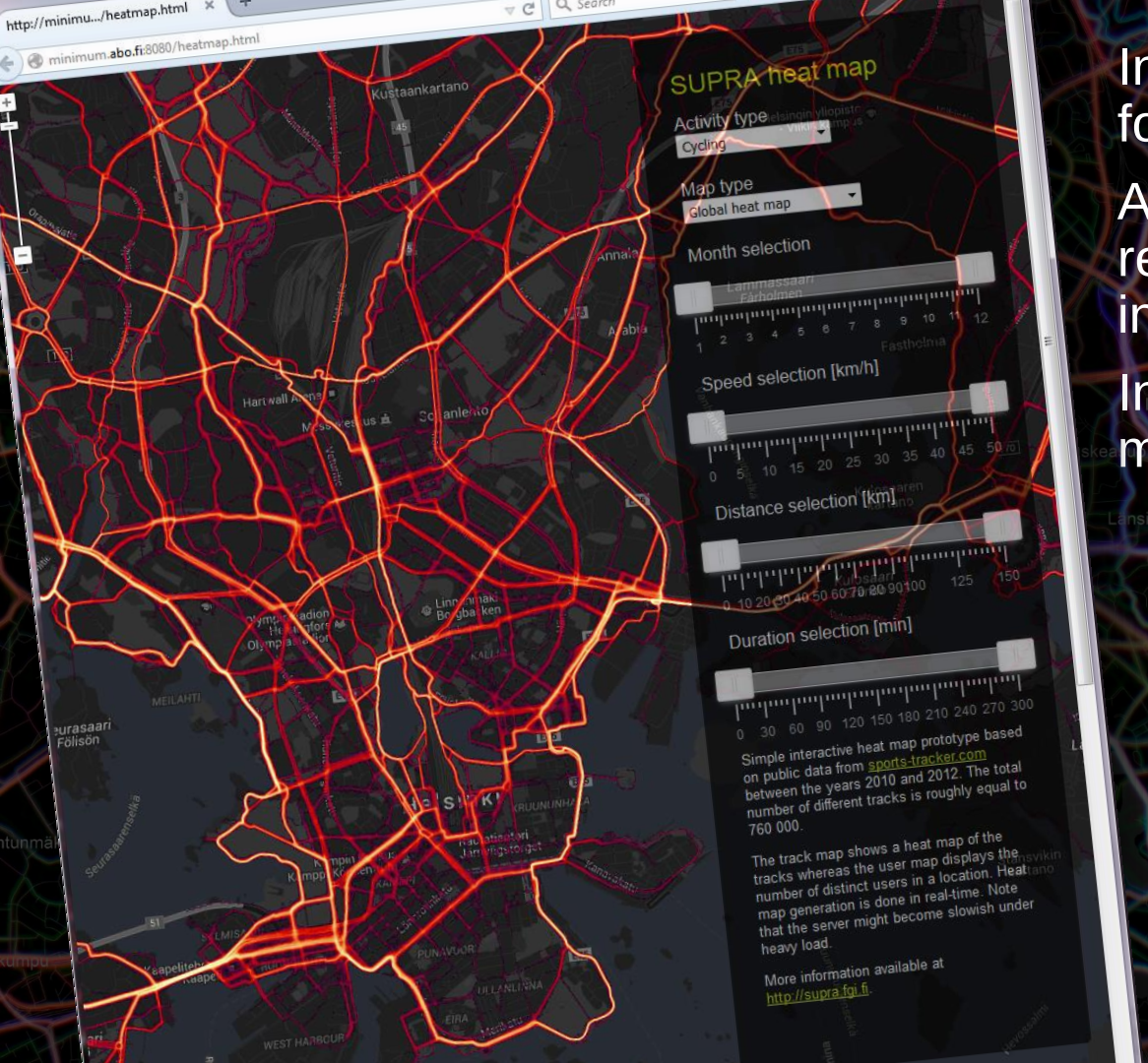
BIG HUMAN MOBILITY DATA

- Research collaboration with Sports Tracking Technologies (currently owned by Amer Sports Ltd)
- A free mobile GPS tracking app aimed at keeping diary about sports activities, competitor of Strava, Endomondo, Runtastic, Garmin Connect, Nike+ etc.
- Basic unit: Public recorded workout (pseudo id, sports type, x,y,z,t)



CHALLENGES

1. How to resolve computational and visualization issues efficiently?
2. How to respect privacy?
3. What does human mobility Big Data tell?

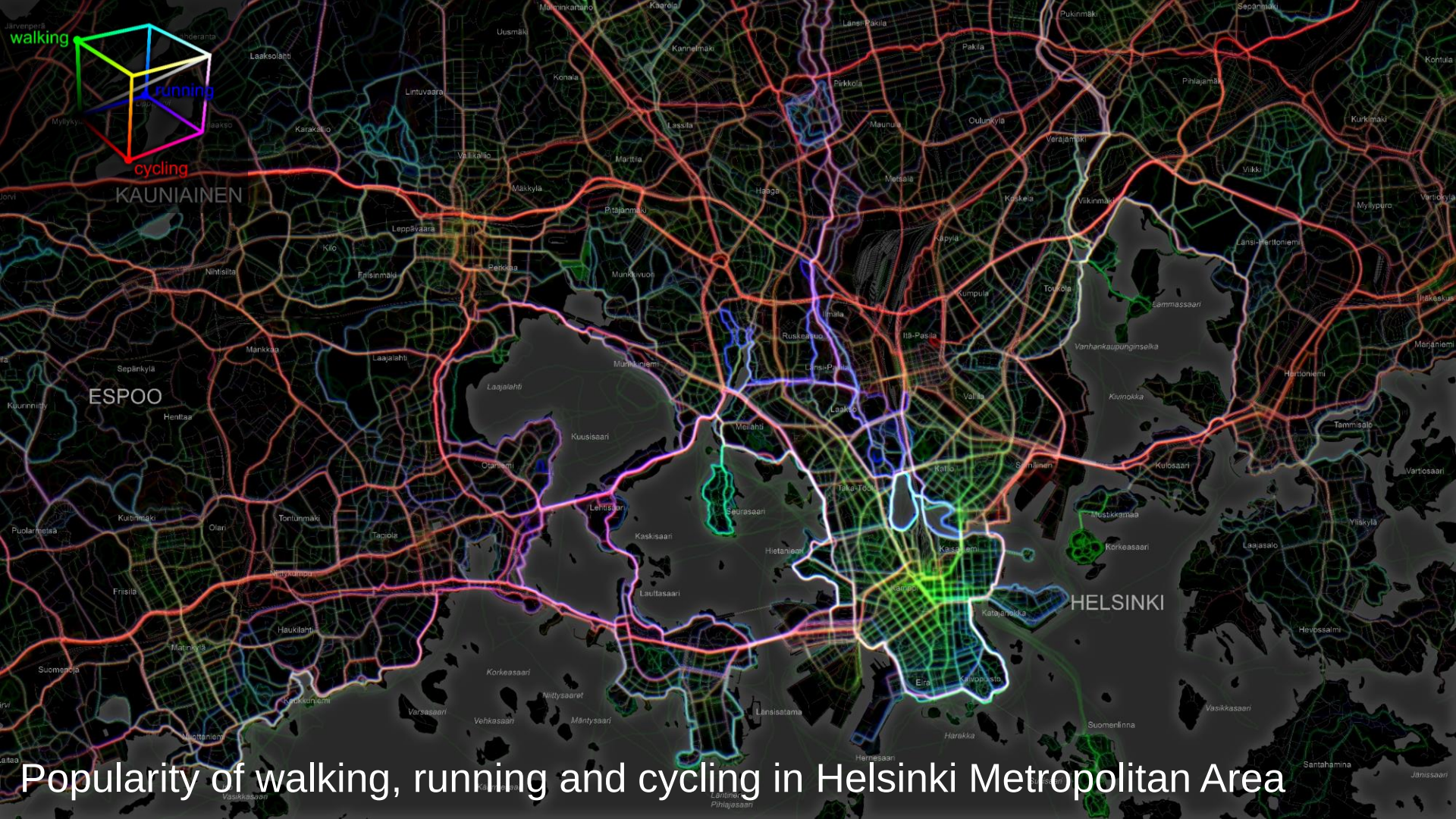


Intelligent pre-processing for interactive web-applications

All data to rasterized multi-resolution tiles, efficient spatial indexing

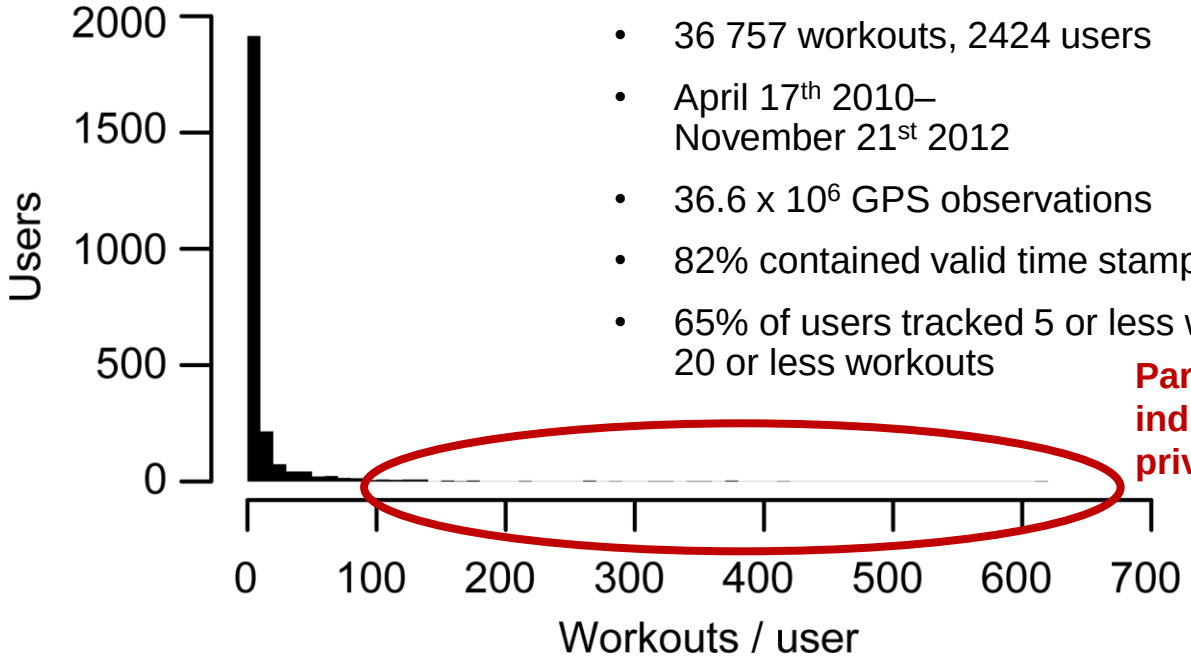
In-memory database for metadata

HELSINKI



Popularity of walking, running and cycling in Helsinki Metropolitan Area

DATA CHARACTERISTICS



- 36 757 workouts, 2424 users
- April 17th 2010–
  November 21st 2012
- 36.6 x 10^6 GPS observations
- 82% contained valid time stamps
- 65% of users tracked 5 or less workouts and 87% tracked 20 or less workouts

Participation inequality induces unexpected privacy problem

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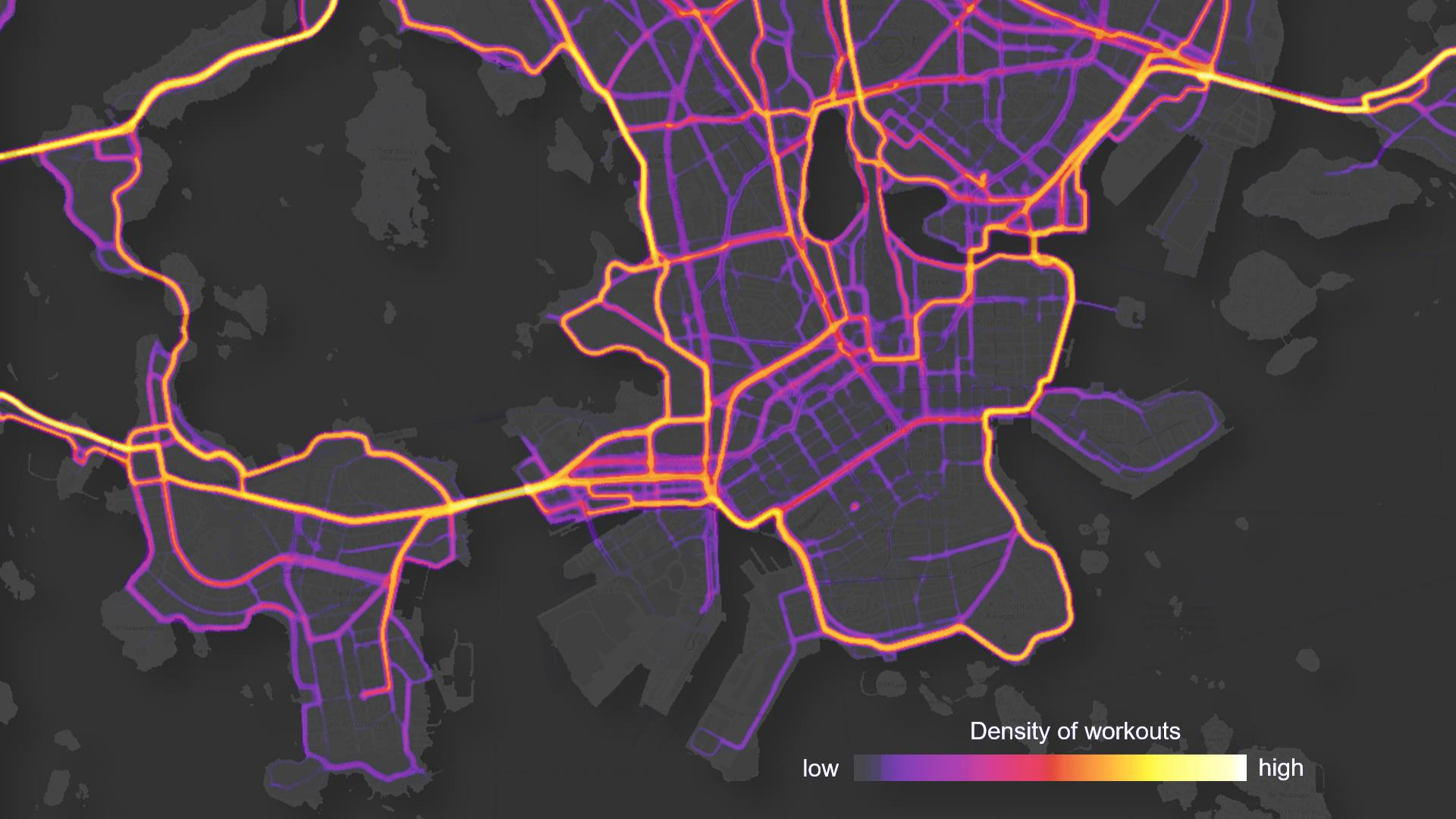
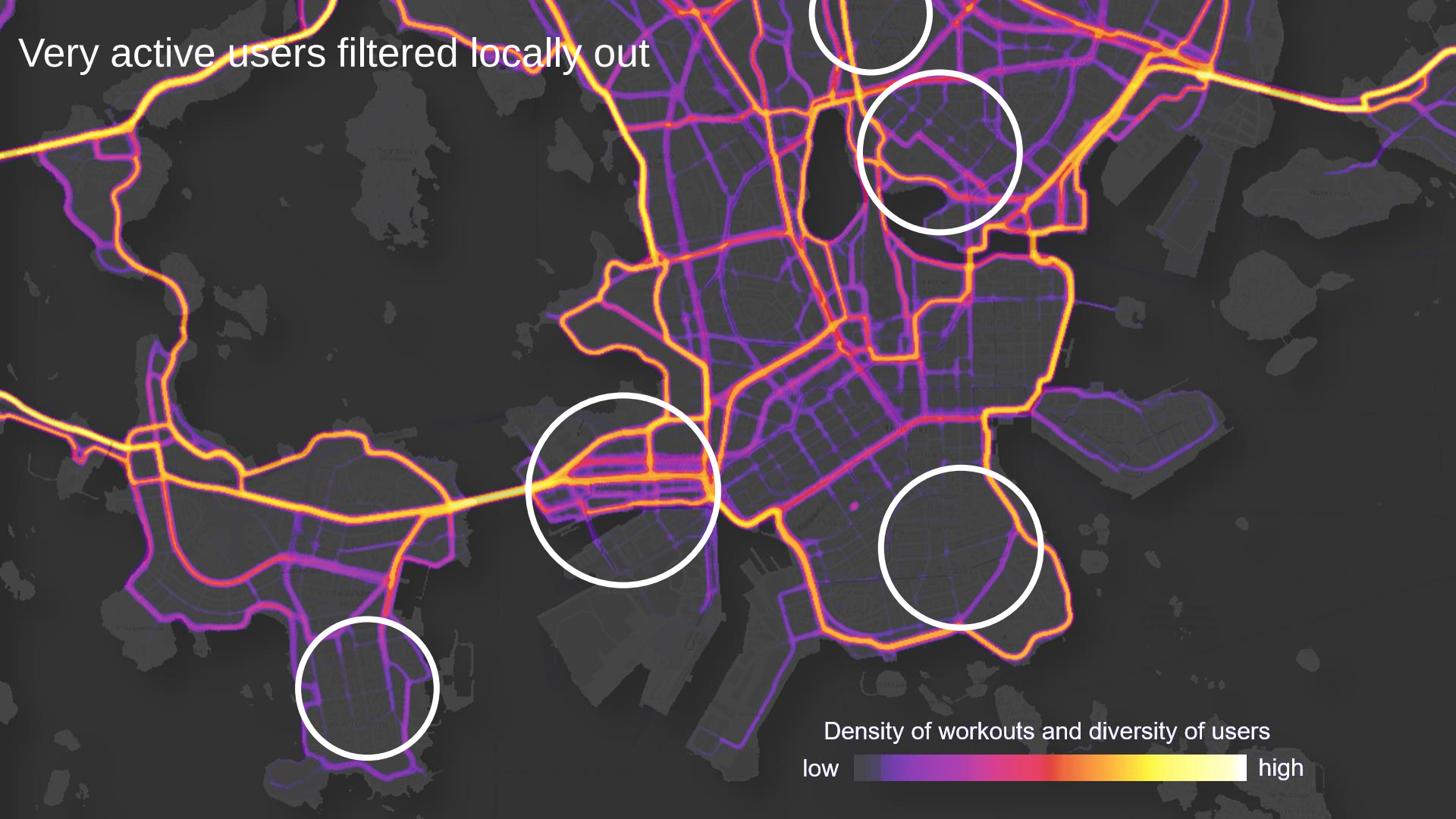
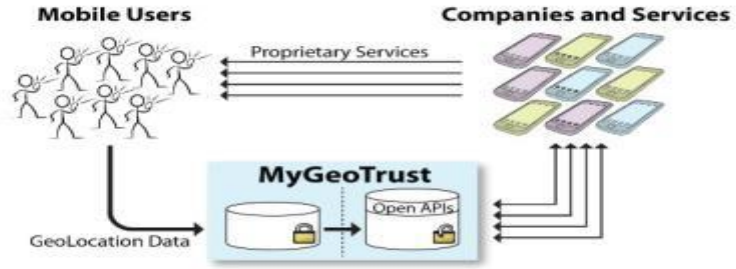

Density of workouts
low
high

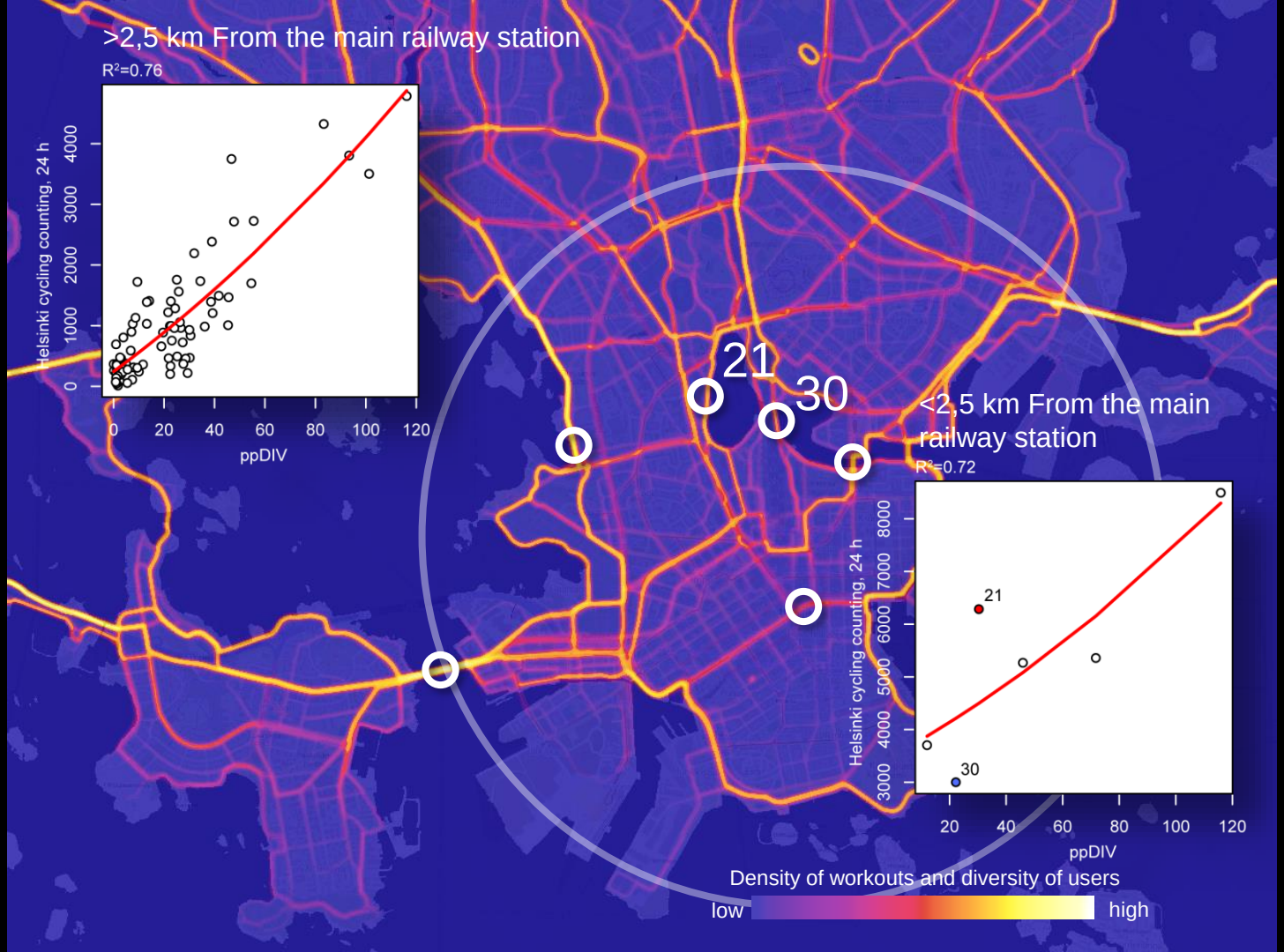

Very active users filtered locally out
Density of workouts and diversity of users
low
high

Flagship Project

GeoTrust



Credit: Dr. Juha Oksanen G&C/FGI


>2,5 km From the main railway station
R²=0.76
Helsinki cycling counting, 24 h
0
1000
2000
3000
4000
0
20
40
60
80
100
120
ppDIV
21
30
<2,5 km From the main railway station
R²=0.72
Helsinki cycling counting, 24 h
3000
4000
5000
6000
7000
8000
21
30
20
40
60
80
100
120
ppDIV
Density of workouts and diversity of users
low
high

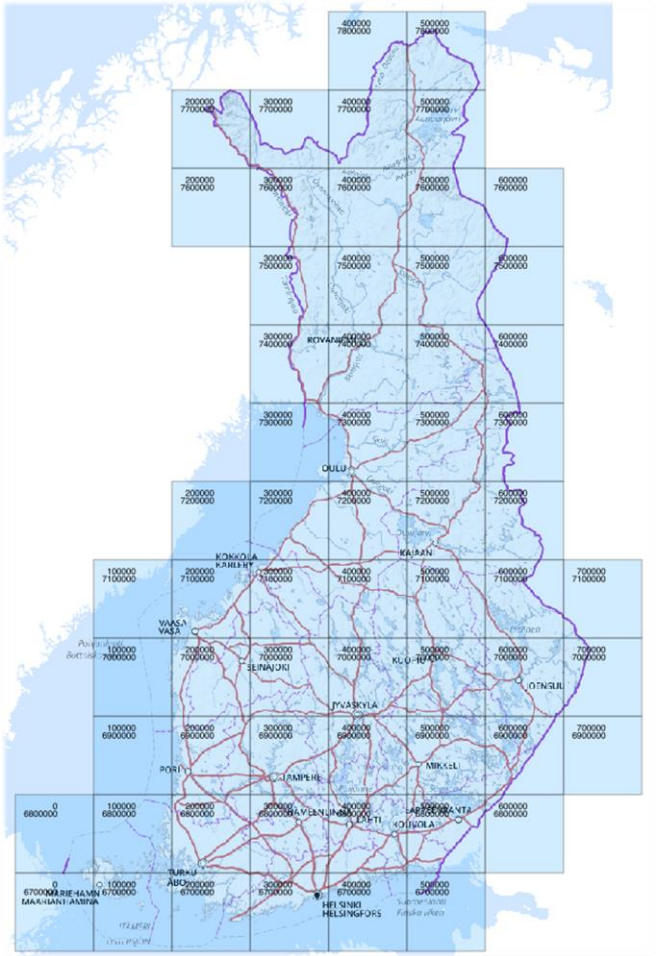

ENVIRONMENTAL BIG DATA

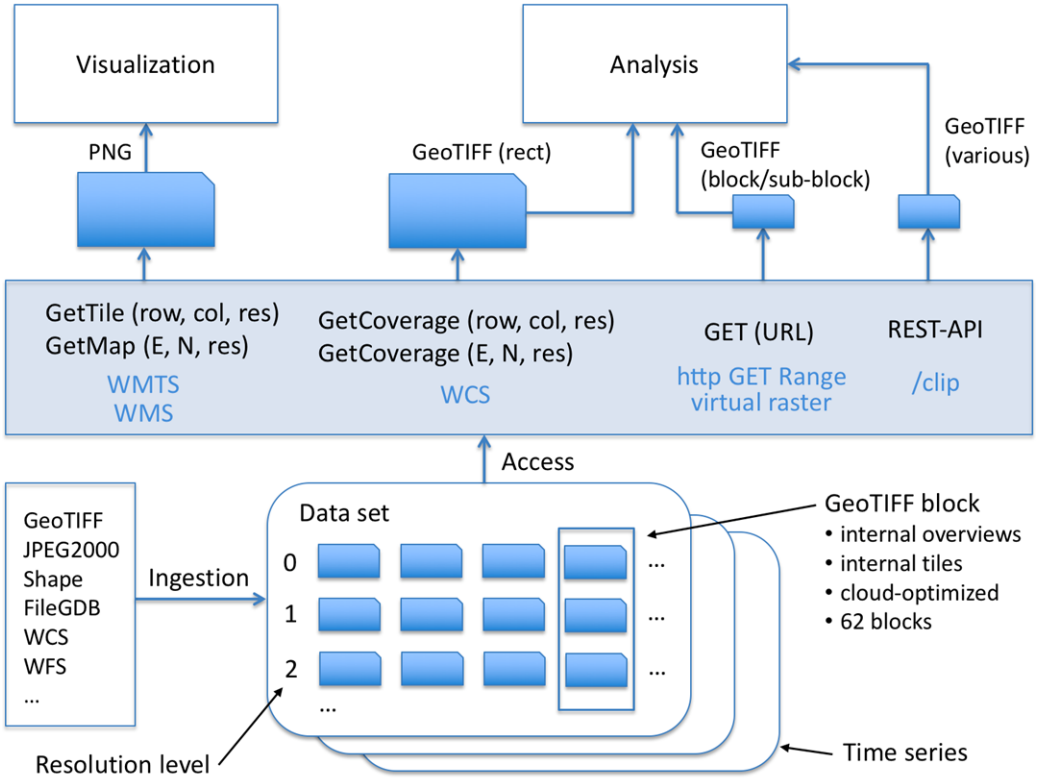
DATA CUBES AS A KEY TO INTEROPERABILITY OF BIG ENVIRONMENTAL GEOSPATIAL DATA

- GeoCubes Finland pilot:
  - An integrated and harmonized set of raster geodata resources made available in a cloud computing platform
  - Harmonized in
    - Georeferencing
    - Resolution in multiple levels
    - Spatial subdivision
    - Access mechanisms
    - Format

GEOCUBES AS A DATACUBE

- Datacube: multi-dimensional raster array
- In geospatial context mostly applied in Earth Observation data
- GeoCubes dimensions
  - Northing, Easting
  - Content layer
  - Timeseries (CORINE 2000, 2006, 2012; Forest inventory 2009, 2015)
- Resolution levels could be seen as separate datacubes





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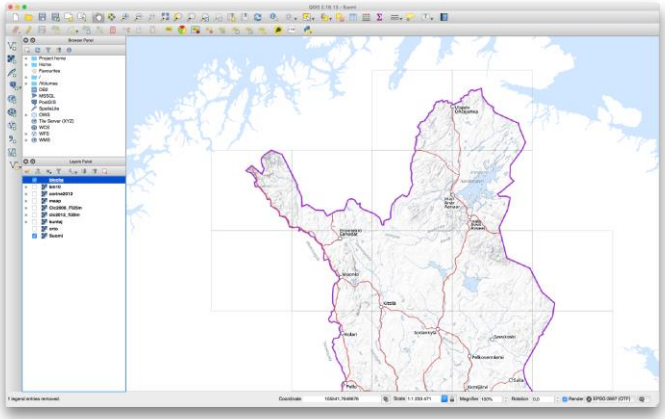
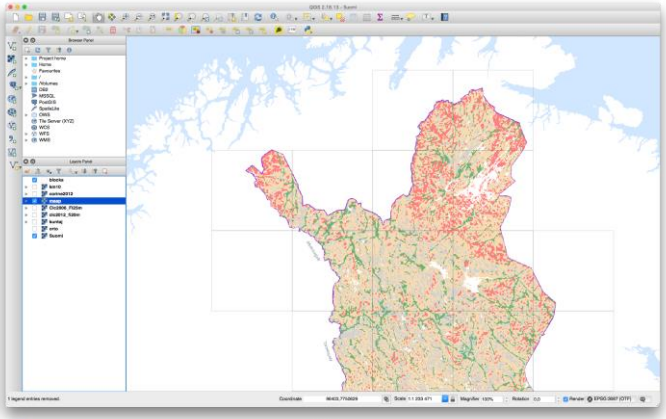
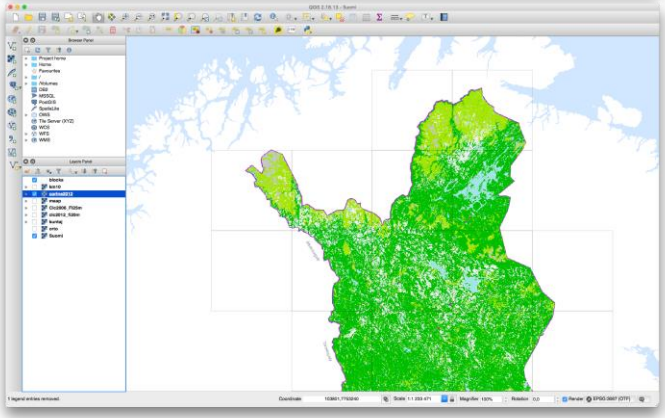
Basemap and administrative units

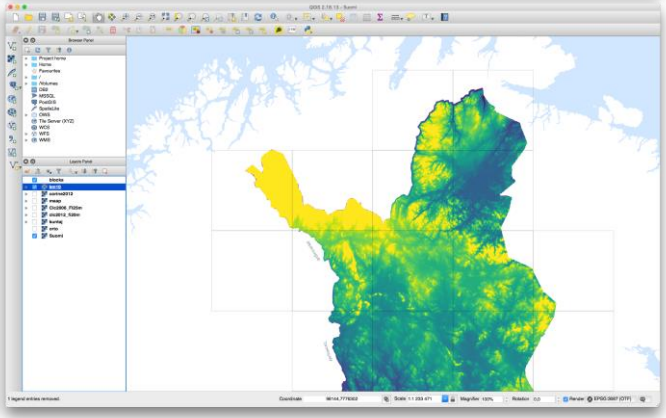


Surficial deposits





CORINE Land Cover



DEM

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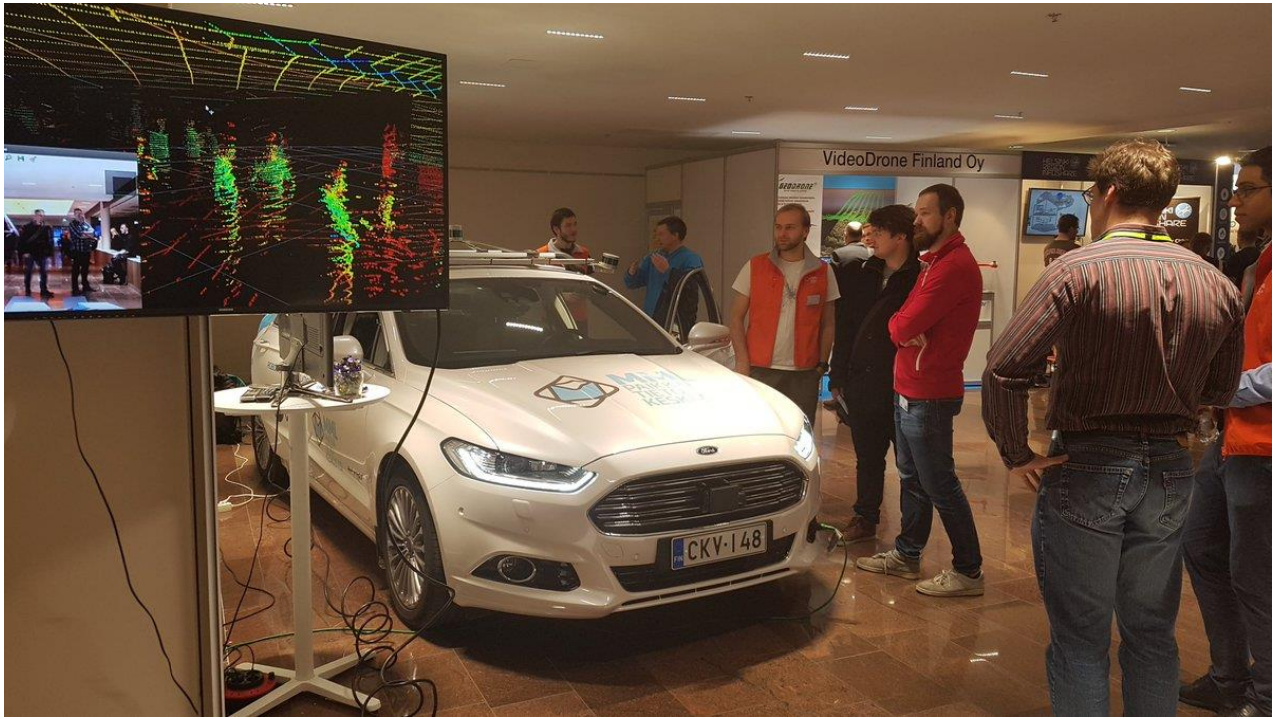
AUTONOMOUS DRIVING



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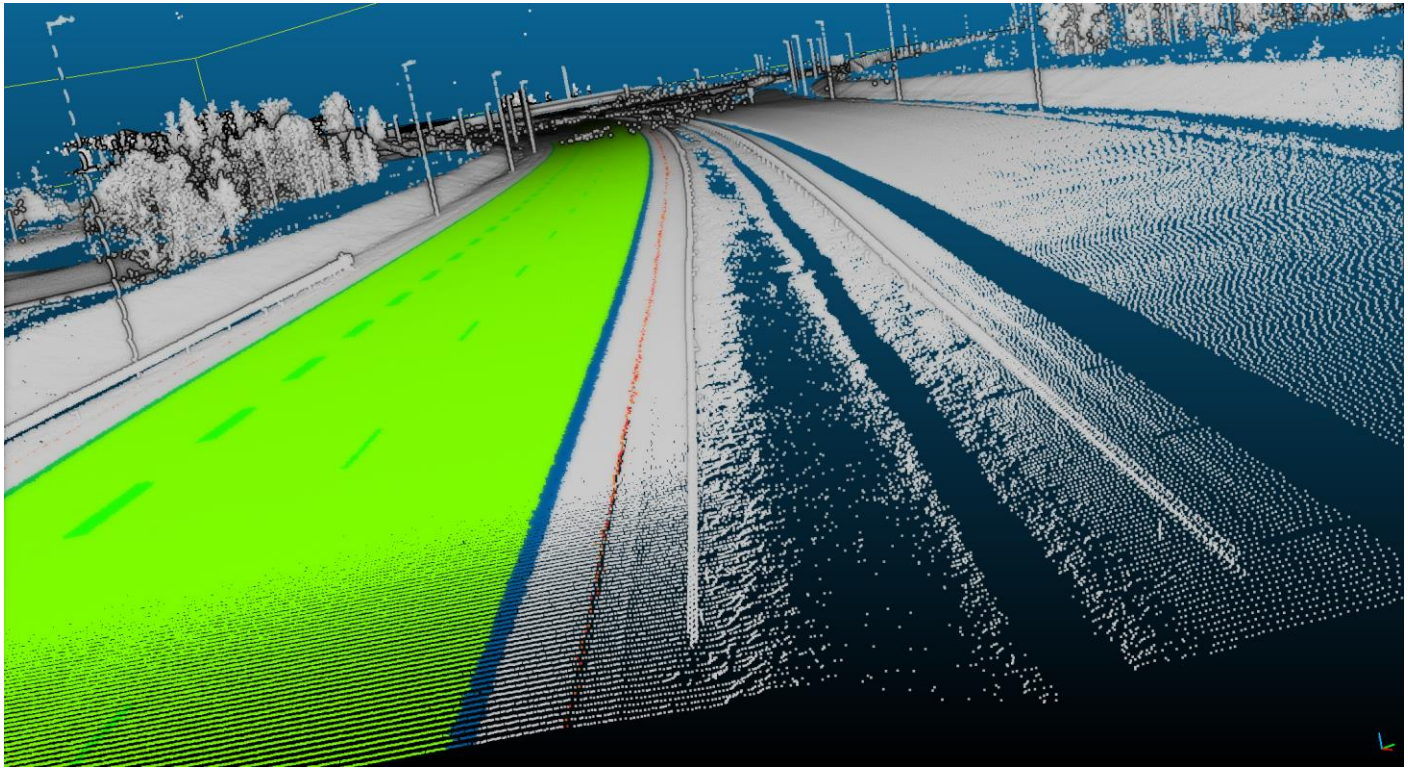
HD-MAPS



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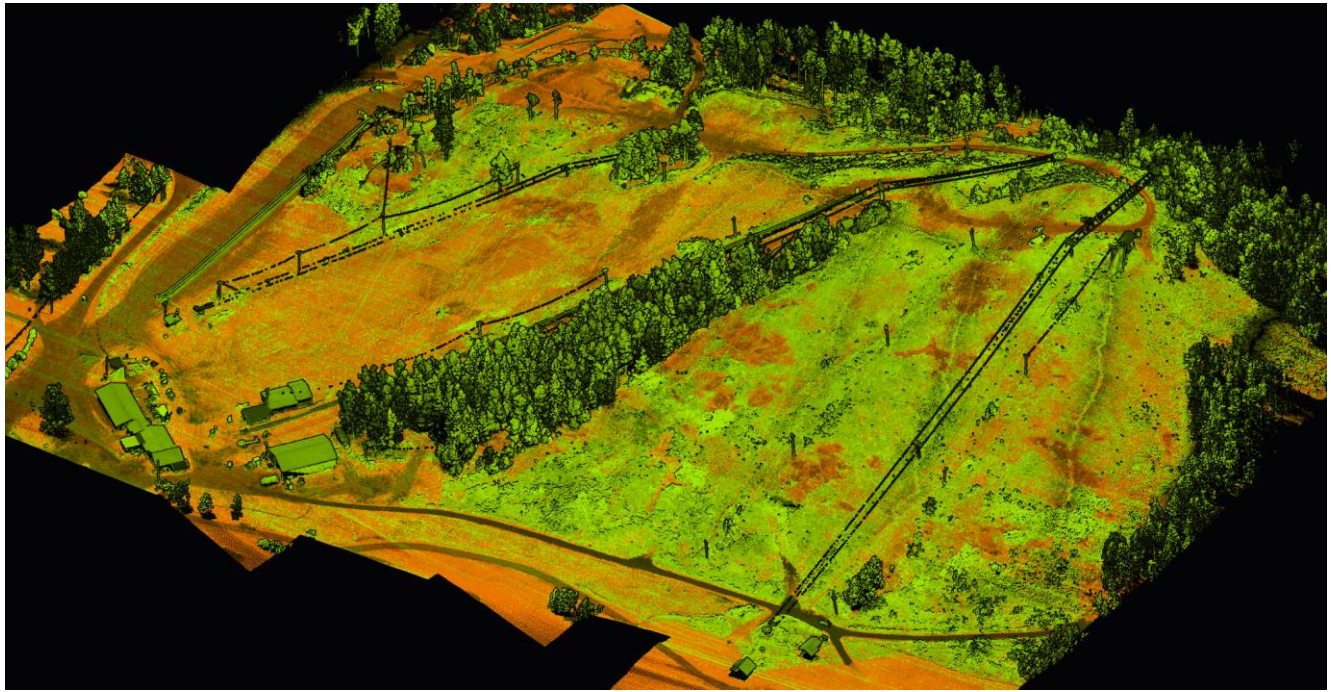
UAV



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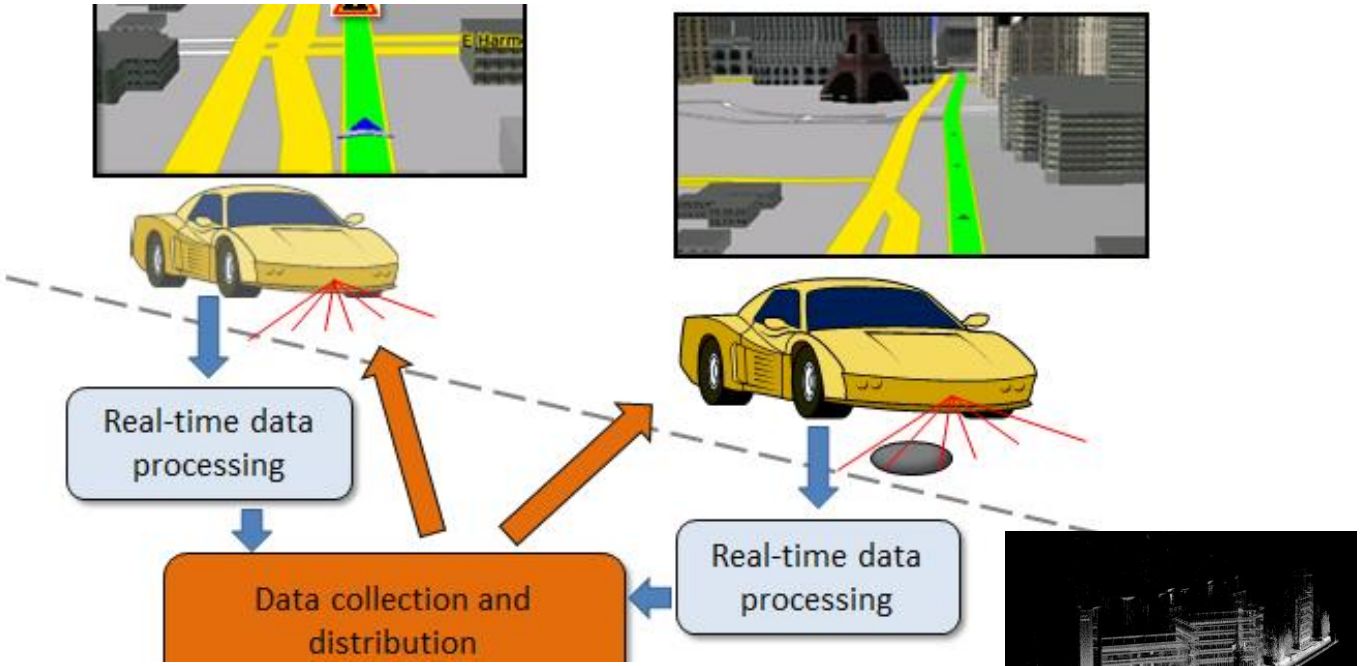
INTELLIGENT TRAFFIC BIG DATA



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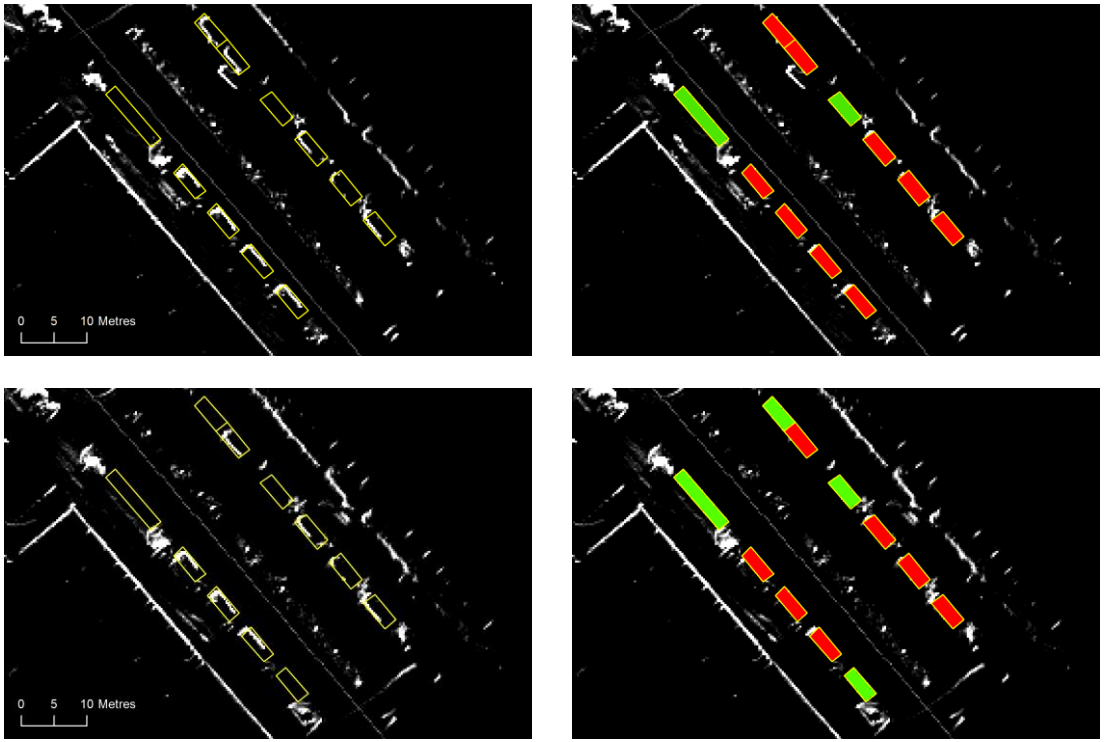

Figure x. Data (left) and classification results (right) for Drives 1 (upper row) and 2 (lower row). Parking places classified as free are shown in green and parking places classified as occupied are shown in red. Digitized boundaries of the parking places are shown in yellow.

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Robotbus project stack
COE, SOHJOA, COMBAT

National Decision Makers

Trafi Board
(@Anna_Jokela)

Minister Kai Mykkäner
(@HarriSantamala)

Peter Vesterbacka
(@pvesterbacka)

HKI, Pekka Sauri
(@satu_helsinki)

Zeit Online

The Guardian

International
Decision Makers

Xinhua News

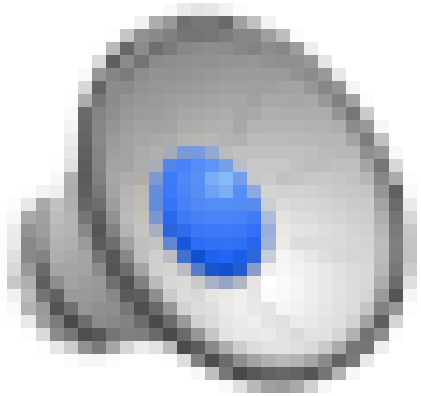
TechCrunch

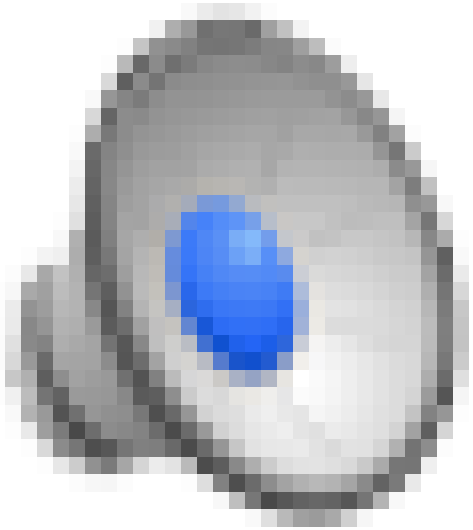
President of Lithuania
Dalia Grybauskaitė
(@hannuhyyppa)

CNN Money

Selected International Media

FOREST HARVESTING AUTOMATION





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SHOWING THE WAY

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