

Kohti älykästä reititystä pyöräliikenteessä?

Mobiililla liikuntasovelluksella kerätyn big datan
haasteet ja mahdollisuudet

Cecilia Bergman

26.5.2016, Pyöräliikenteen avokonttori, Laituri

- **Supra-projekti (2013-2015) –
Sijaintipohjaisten palveluiden murros**
 - Case: Liikuntasuoritustietojen jalostaminen merkitykselliseksi reittitiedoksi
 - Suosioon perustuva reititys verkolla

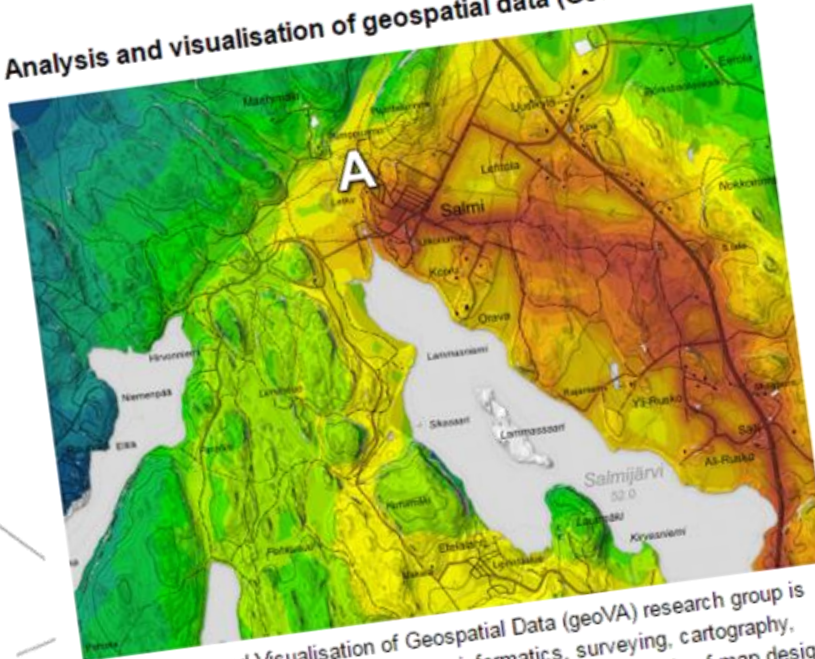
English Suomi Svenska



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- Research groups
- 3D modelling and virtual worlds
 - Analysis and visualisation of geospatial data
 - Publications
 - AGILE 2016 workshop
 - Intelligent Mobility and Geospatial Computing
 - Interoperability and geospatial web services
 - Gravity
 - Mobimap and laser scanning research
 - Satellite and Radio Navigation
 - Sensors and Indoor Navigation
 - Reference systems

Analysis and visualisation of geospatial data (GeoVA)



The Analysis and Visualisation of Geospatial Data (geoVA) research group is comprised of experts in geography, geoinformatics, surveying, cartography, and GIS. The research topics are from the fields of map design, navigation, and location-based services. The aims are to find

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 Research Manager
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Research group members

- Tutkija Cecilia Bergman
- Senior Research Scientist Pyy Kettunen
- Tutkija Christian Koski

Research group projects

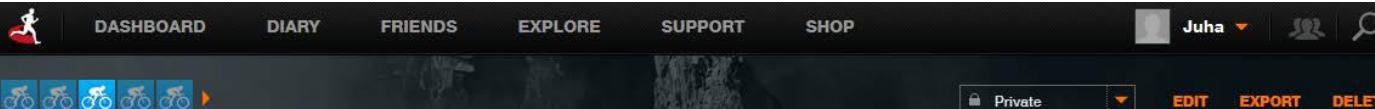
- Revolution of Location-based Services (SUPRA)

Sports Tracker data?

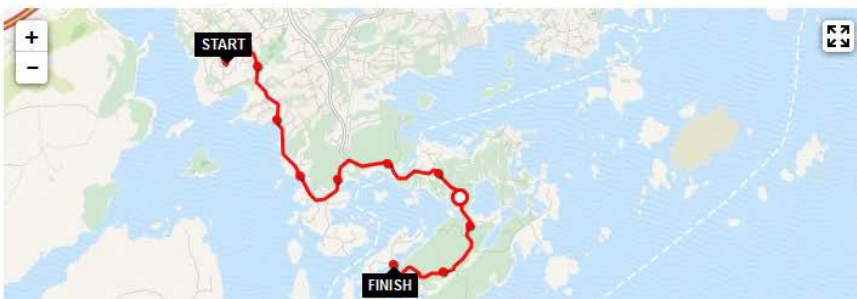
- Ilmainen mobiili liikuntasovellus, jolla voidaan pitää harjoituspäiväkirjaa
- Aloitti 2004 osana Nokiana, 2009 itsenäinen yritys Sports Tracking Technologies Oy, 2015 osa Amer Sports Digital Services Oy:tä

HELSINKI

- 36 757 “julkista” suoritusta, 2424 käyttäjää
- 17.4.2010–21.11.2012



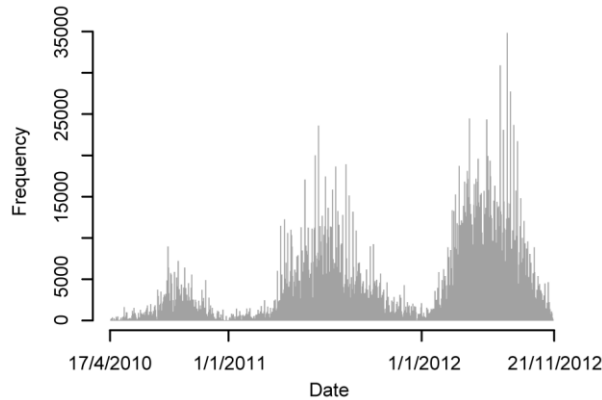
Aug 10, 2014 Sun 5:44 – 6:06 PM
Juha Oksanen



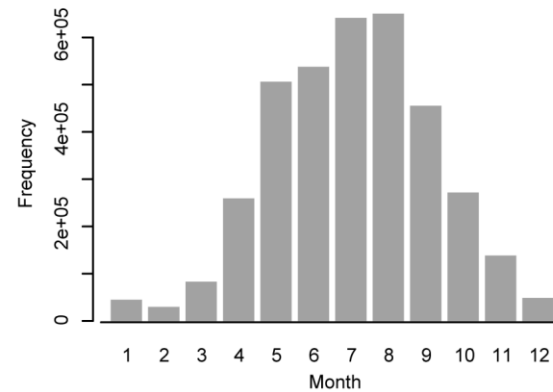
CYCLING	
duration	00:21:45
distance	8.99 km
avg. speed	24.8 km/h
energy	307 kcal
max. speed	39.0 km/h
ascend / descent	90 / 133 m

Haaste 1: Mitä data edustaa?

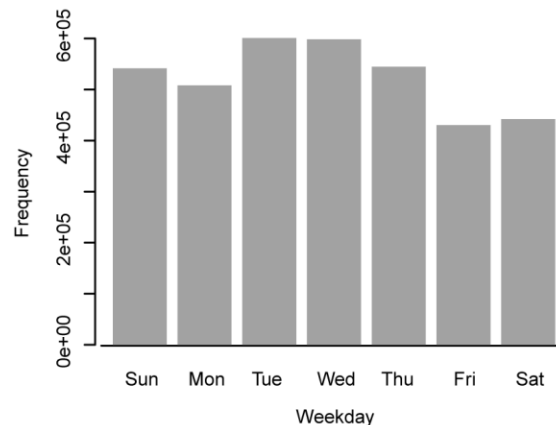
Pisteiden lkm / vko



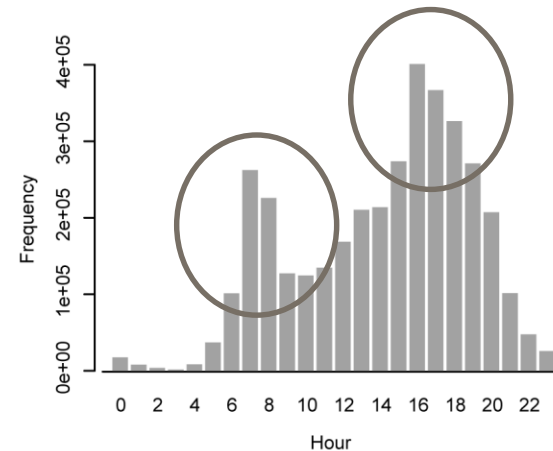
Pisteiden lkm / kk



Pisteiden lkm / viikonpäivä

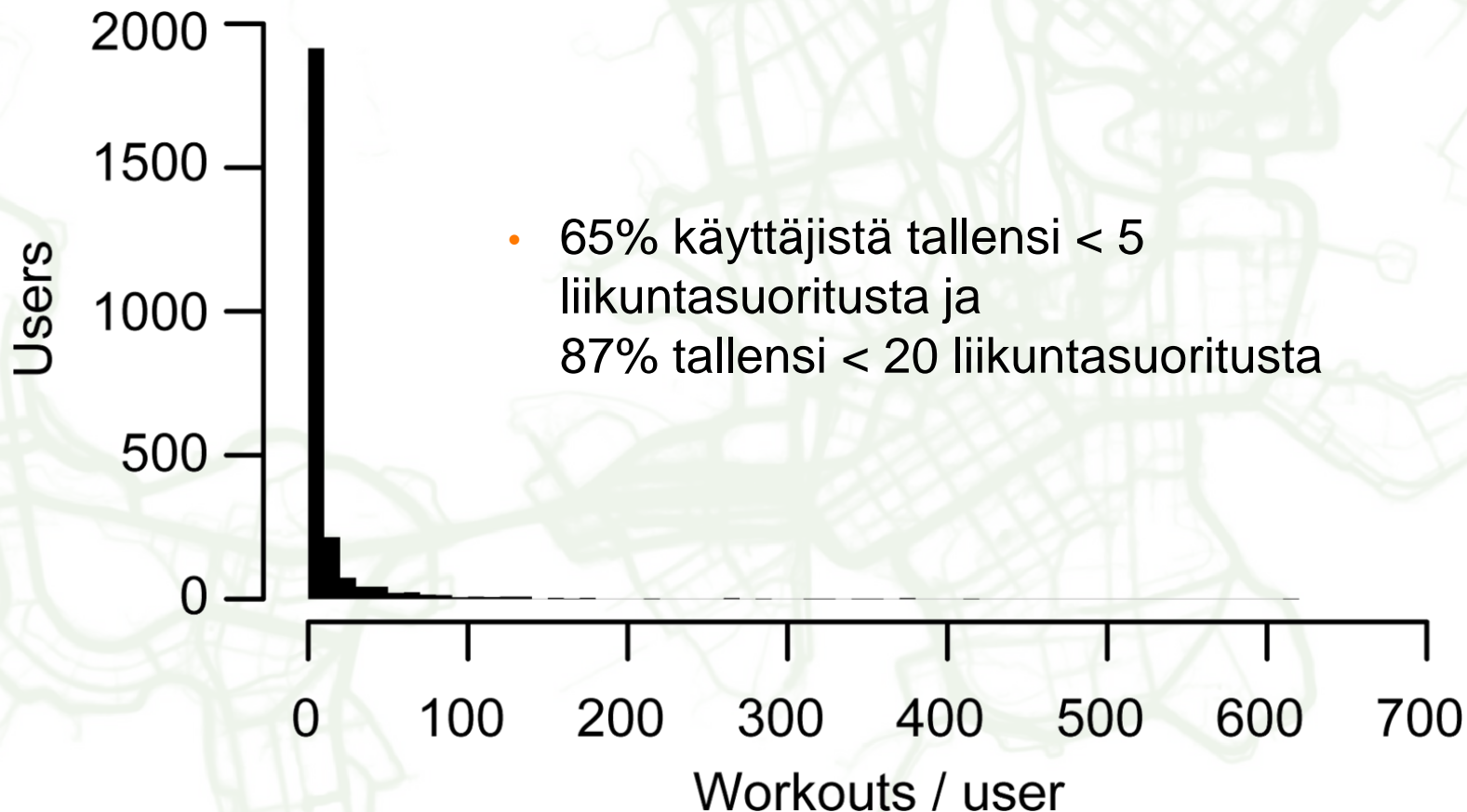


Pisteiden lkm / vuorokauden tunti



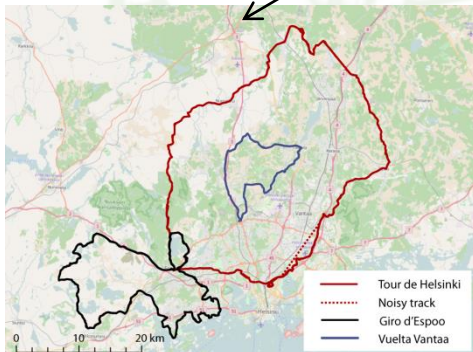
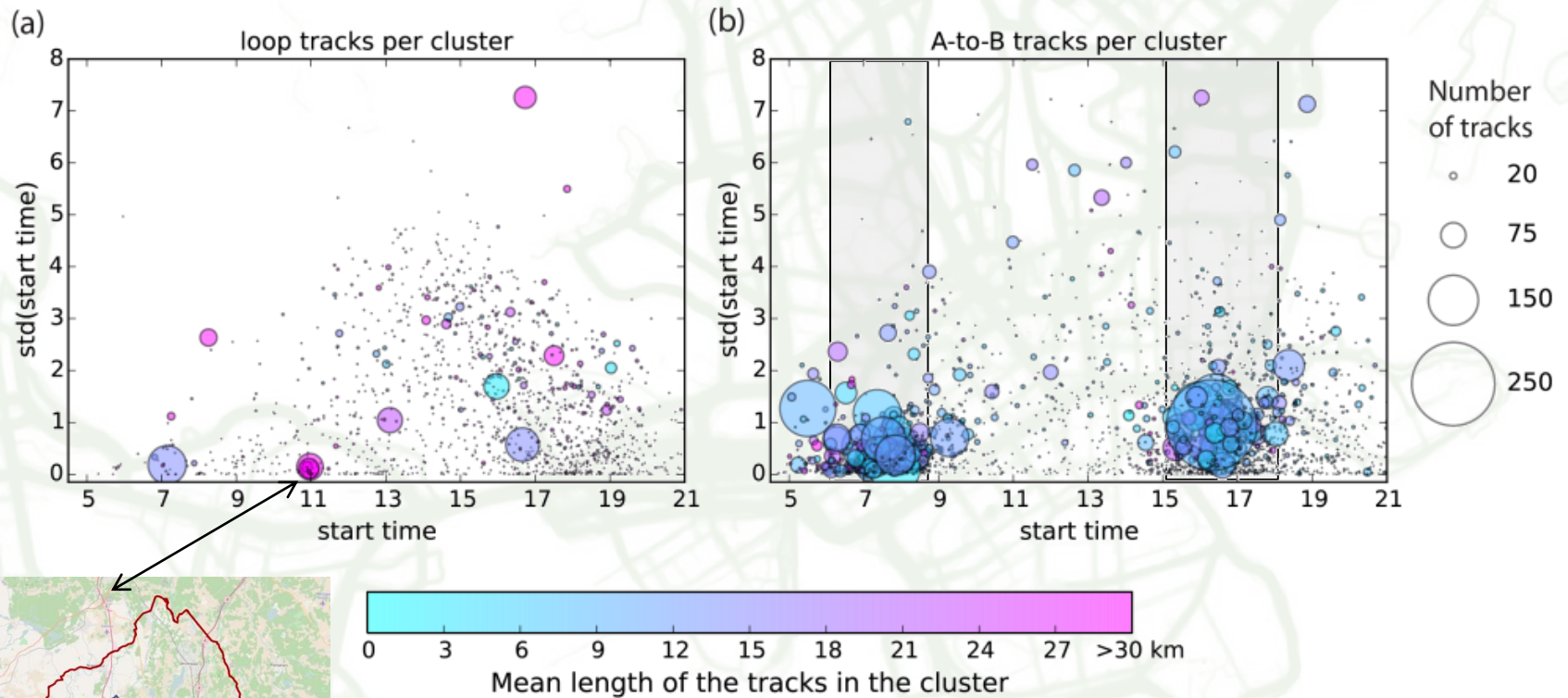
Oksanen et al. (2015). Methods for deriving and calibrating privacy-preserving heat maps from mobile sports tracking application data. *Journal of Transport geography*, Vol 48: 135-144.

Haaste 2: Epätasainen jakauma



Haaste 1: Mitä data edustaa?

Haaste 2: Epätasainen jakauma



Ennen: 38 % LOOP, 62 % A2B

Jälkeen: 55 % LOOP, 45 % A2B

Haaste 3: Yksityisyys

Haaste 4: Ei avointa dataa!

- Julkinen
 - Suoritus visualisoidaan ST web-sovelluksessa
 - Dataan ei pääsyä, paitsi omaan dataan
- Yksityisyyden suoja todellinen haaste myös julkisessa ST datassa
 - Paljastaa käyttäytymishahmoja
 - Esim. kodin ja työpaikan sijainti pääteltävissä

MailOnline

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Thieves using apps Strava and MapMyRide to spy on cyclists and steal their expensive bikes after finding out where they live

- Apps are used to record detailed map routes, average speed and elevation
- Users often start app recording from their home - revealing their address
- They also sometimes add make and model, which gives burglars options
- Humberside Police is warning cyclists to check privacy settings first

By GEMMA MULLIN FOR MAILONLINE

PUBLISHED: 12:47 GMT, 27 January 2015 | UPDATED: 09:40 GMT, 28 January 2015



Reititys pyöräilyssä tänään

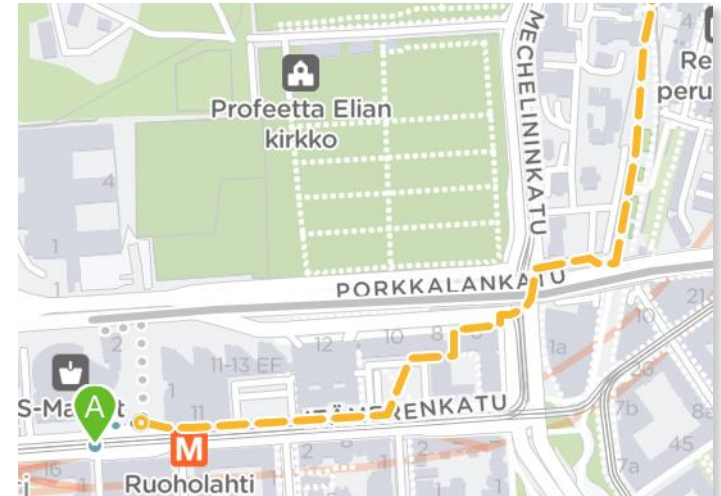
VISUAALINEN TULKINTA

ALGORITMI

EX
ANTE



© Cecilia Bergman



© HSL (<https://beta.reittiopas.fi/>)

EN
ROUTE



© Cecilia Bergman



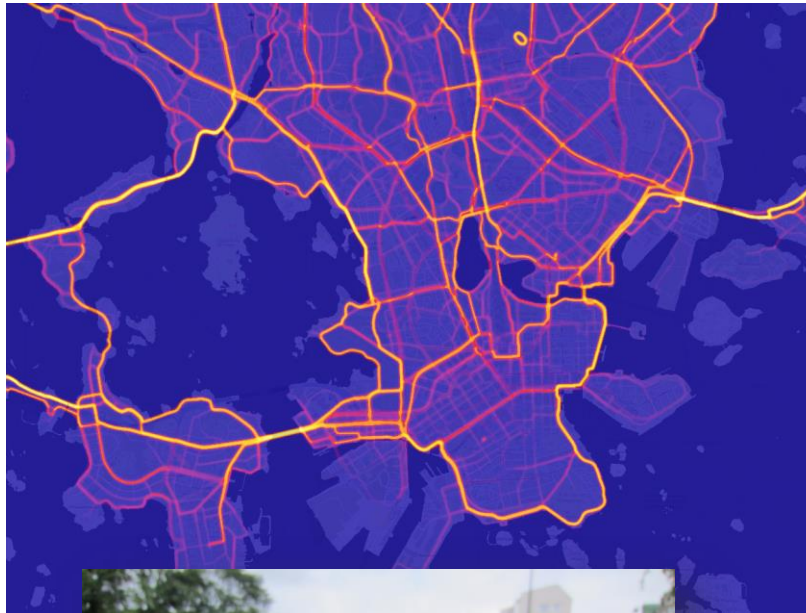
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Reititys pyöräilyssä huomenna?

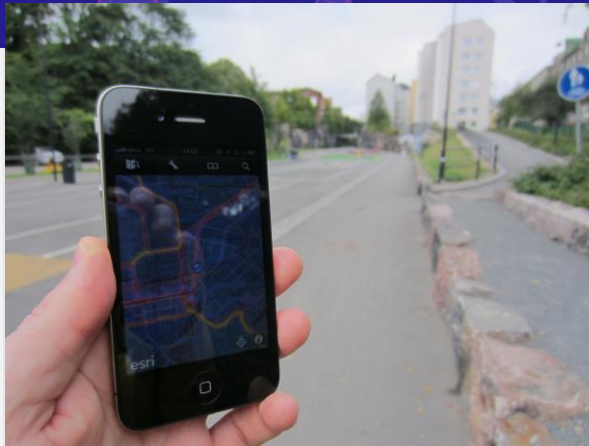
VISUAALINEN TULKINTA

ALGORITMI

**EX
ANTE**



**EN
ROUTE**



© Juha Oksanen

© Juha Oksanen

**ALYKÄS suosioon
perustuva reititys
liikenneverkolla
paikasta A
paikkaan B**

?



OSM-verkon esikäsittely

Highway type (key=highway)

Requirements related to additional tags of access permissions^a

Cycleway

No additional requirements

(all)

Keep if

Bicycle=yes |designated |official |lane

Primary^b, secondary^b, tertiary^b,
trunk^b, residential, living_street,
unclassified, track

Drop if

Bicycle=no or (tunnel=yes and
(access=no |private))^c

Service

Drop if

Bicycle=no or access=private |no
or service=parking_aisle

^a Key=value; if many possible values are related to the same key, they are separated by |

^b Also with _link-tags

^c The usage of additional tags access=private and access=no was very heterogeneous, and hence they have not been excluded more comprehensively

(a)

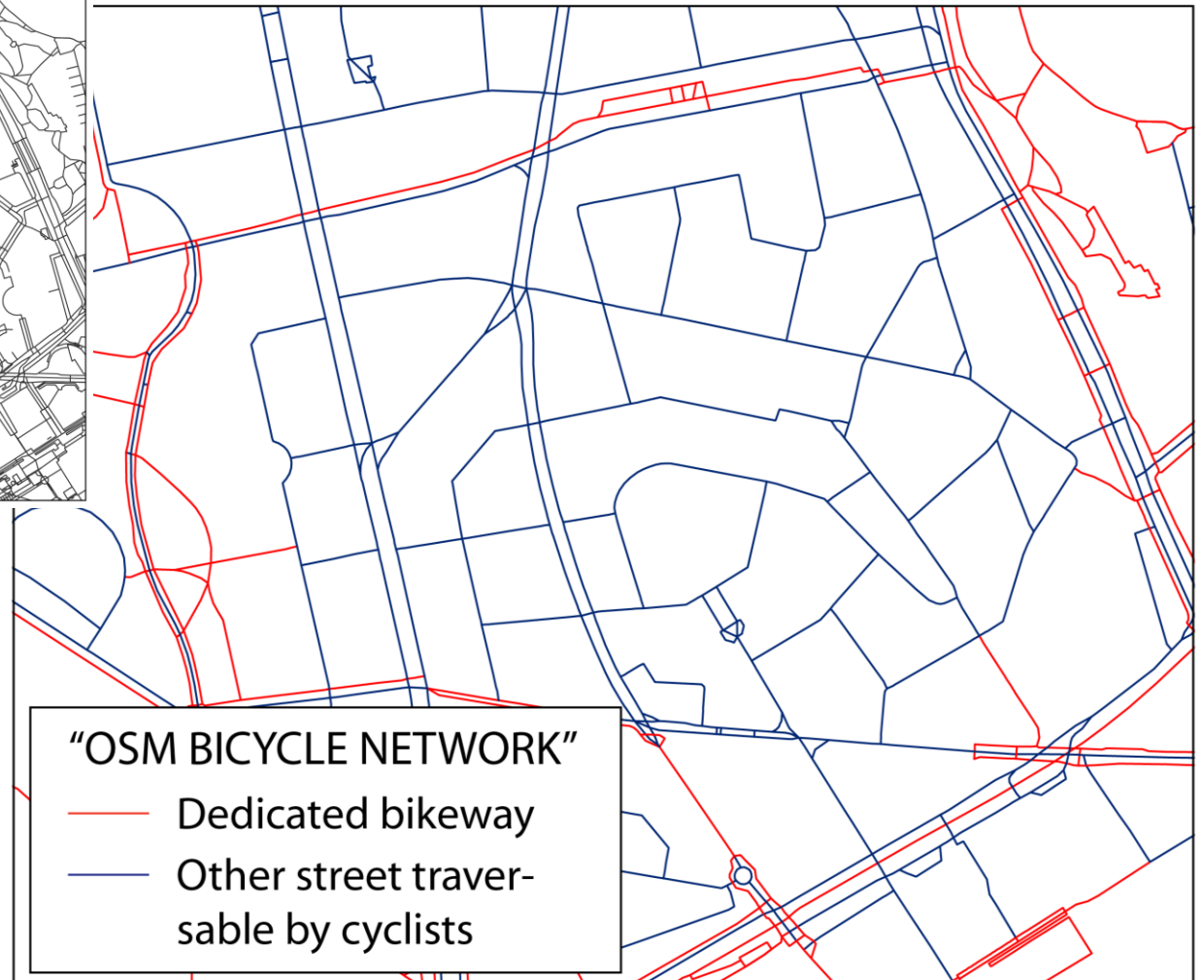
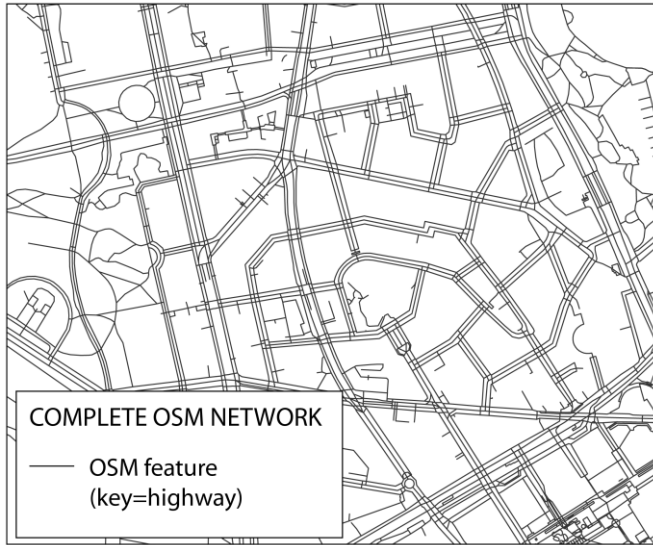


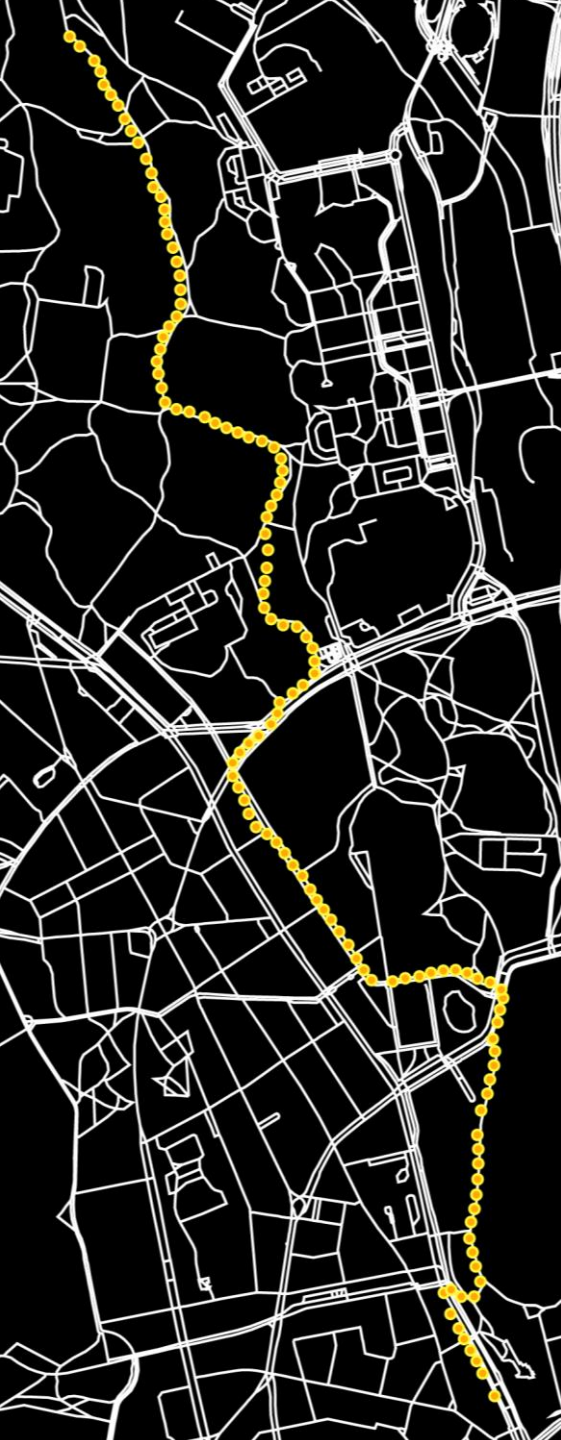
Table 2 Classification of bikeways in the study area based on OSM tagging

Highway type

Requirements related to additional tags^a

Cycleway
(all)

No additional requirements
Cycleway^b=lane |shared_busway |opposite_lane,
bicycle=yes |designated |official



ESIKÄSITTELY

GPS liikeradat

Liikenneverkko

LIIKERATOJEN YHDISTÄMINEN VERKOLLE

Markovin piilomalli

Point-to-curve

KUSTANNUSTEN MÄÄRITTÄMINEN

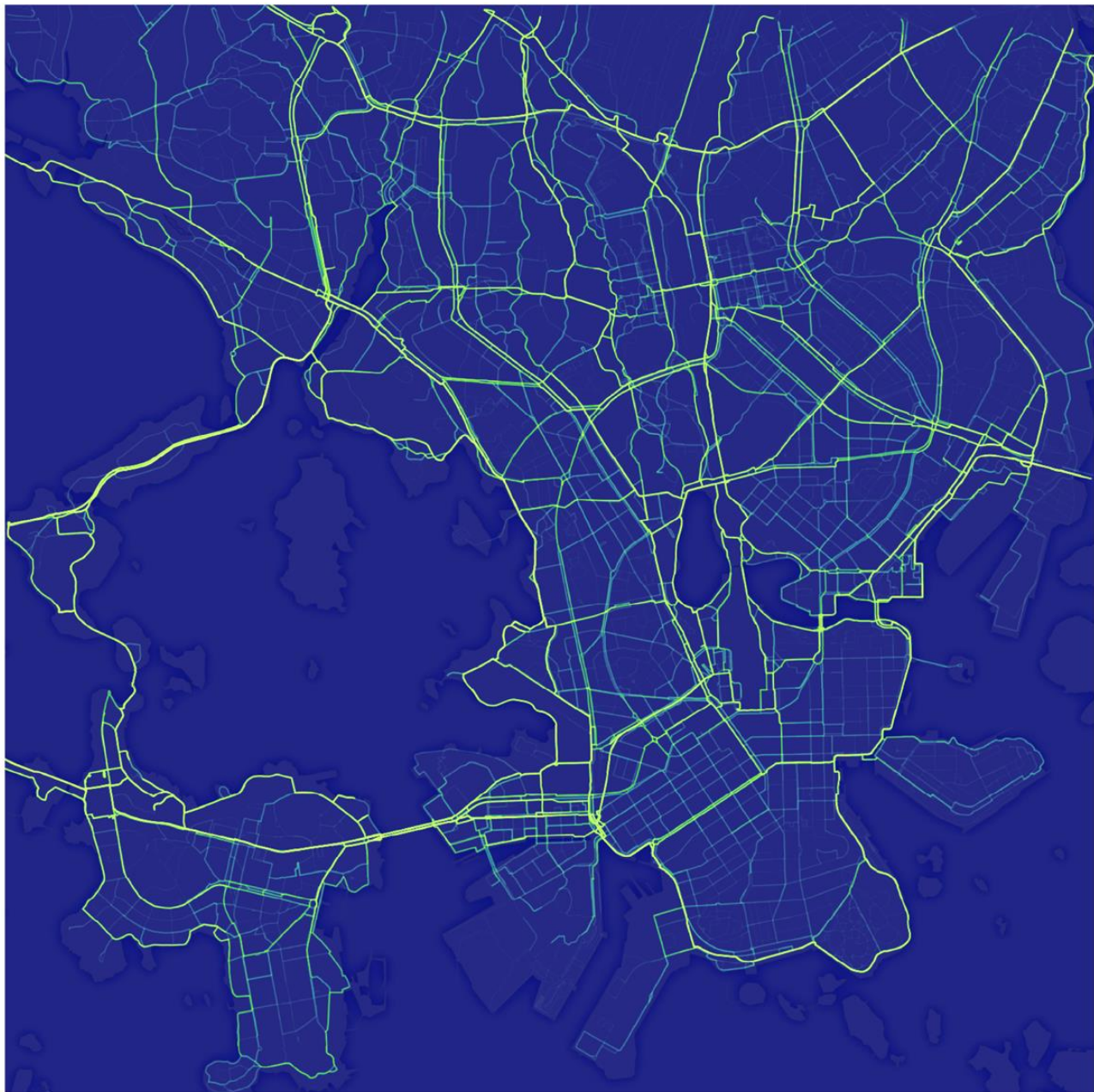
A. Pyöräilijöiden lkm

B. Suoritusten lkm

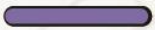


C. Suoritusten lkm kerrottuna Simpsonin diversiteetti-indeksillä

(kuvaa suoritusten jakautumista pyöräilijöiden kesken)

logaritminen asteikko



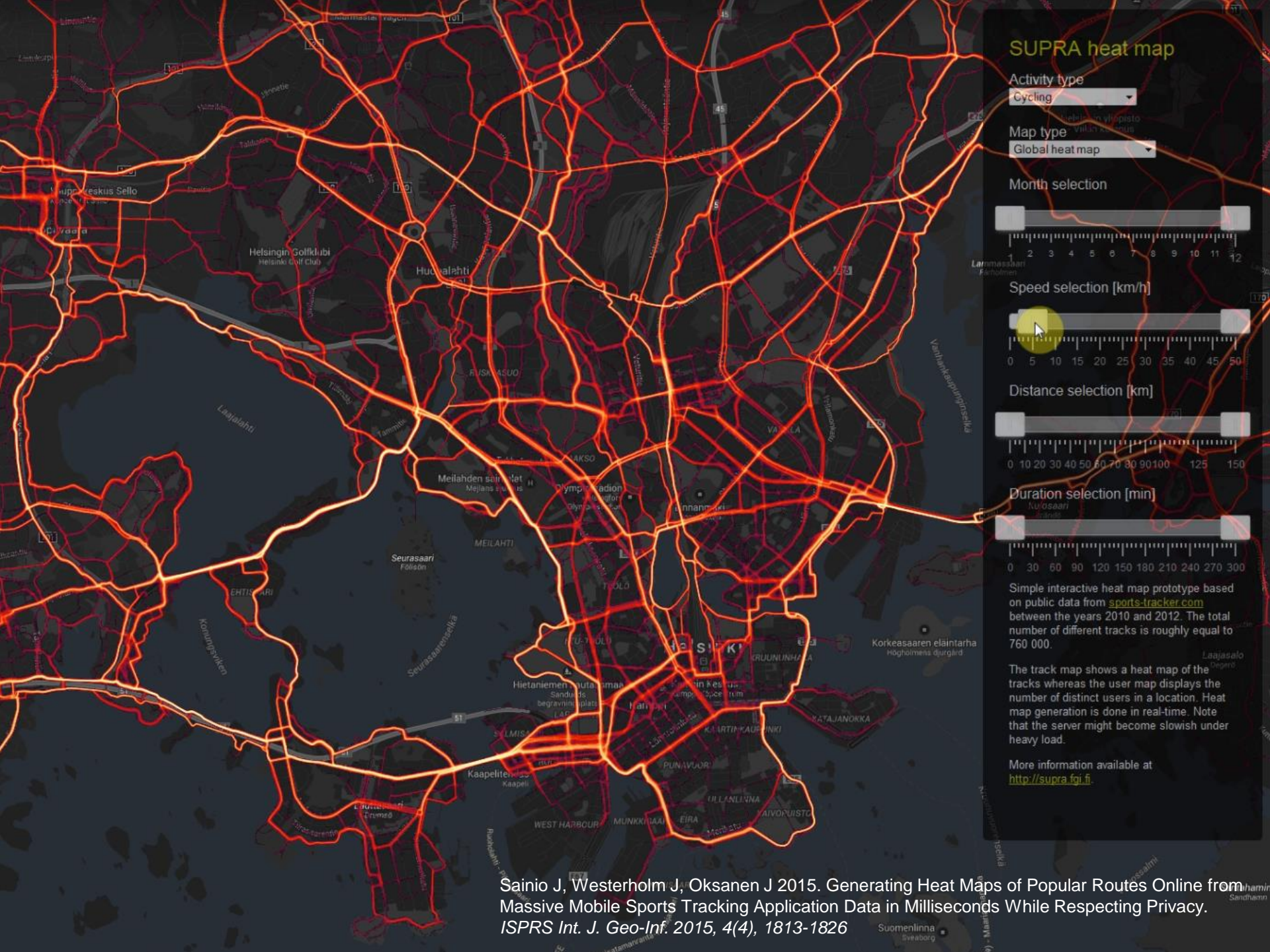
Pyöräilyreitit

-  Käyttäjämäärään perustuva reitti
-  Suoritusten määrään perustuva reitti
-  Lyhyin reitti

**Dynaamisuus:
työmaat, uudet yhteydet**

Käyttäjäkohtaiset preferenssit

© OpenStreetMap contributors



SUPRA heat map

Activity type
Cycling

Map type
Global heat map

Month selection
1 2 3 4 5 6 7 8 9 10 11 12

Speed selection [km/h]
0 5 10 15 20 25 30 35 40 45 50

Distance selection [km]
0 10 20 30 40 50 60 70 80 90 100 125 150

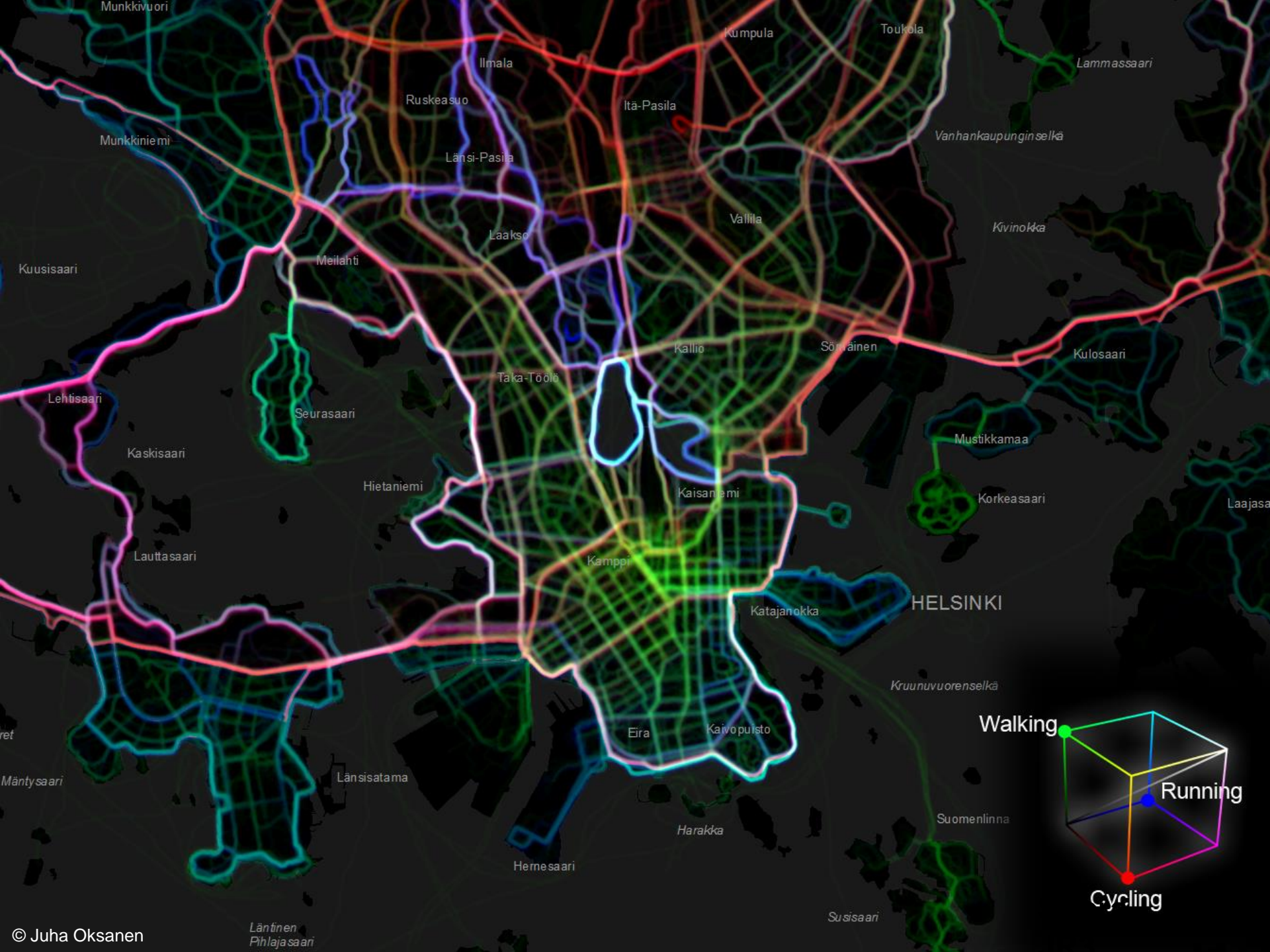
Duration selection [min]
0 30 60 90 120 150 180 210 240 270 300

Simple interactive heat map prototype based on public data from sports-tracker.com between the years 2010 and 2012. The total number of different tracks is roughly equal to 760 000.

The track map shows a heat map of the tracks whereas the user map displays the number of distinct users in a location. Heat map generation is done in real-time. Note that the server might become slowish under heavy load.

More information available at <http://supra.fgi.fi>.

Sainio J, Westerholm J, Oksanen J 2015. Generating Heat Maps of Popular Routes Online from Massive Mobile Sports Tracking Application Data in Milliseconds While Respecting Privacy. *ISPRS Int. J. Geo-Inf.* 2015, 4(4), 1813-1826



**Millainen data
auttaisi ja
mahdollisesti jopa
houkuttelisi entistä
useamman pyörän
satulaan?**

pyöräMaaS?

- Massadata (Big Data) poikkeaa perinteisestä datasta
- Isot haasteet
- Isot mahdollisuudet
- Reitityspalvelut osa pyöräliikennettä
- Dynaamisuus/reaaliaikaisuus ja älykkyyks puuttuvat
- Pyöräilyn MaaS-selvityksessä nostettiin esiin pyöräilyn rooli multimodaaleissa matkaketjuissa
 - Reititys!

Kiitos!

Supra

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Tekes

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Transactions in GIS

tg

Transactions in GIS, 2016, 00(00): 00-00

Research Article

Conflation of OpenStreetMap and Mobile Sports Tracking Data for Automatic Bicycle Routing

Cecilia Bergman and Juha Oksanen

Department of Geoinformatics and Cartography, Finnish Geospatial Research Institute,
University of Finland