Spatial, functional and temporal Analysis of Wi-Fi hotspots during covid-19 curfew

In selected EU cities Rome, Thessaloniki, Nicosia, Kaunas.

by Marius Ivaškevičius

Behavior of people in extreme condition is one of the main target of the eUMaP project, funded under European Union's Horizon 2020 project Marie Slodowska-Curie Actions.

Problem and Relevance

In order to model behavior of people in extreme conditions we need recorded data that represents this behavior.
How to measure behavior of people?
Exact data representing behavior is very sensitive and can be used in illegal ways even by accident, therefore we want approximate data.

Hypothetical scenario and Data availability

In modern world Internet became almost free and highly popular means of worldwide communication.
Wi-Fi became one of most po-pular means to deliver internet to end user.
Gatherings of people create temporary or more permanent Wi-Fi hotspots to share internet.
Wi-Fi hotshots broadcast basic information on open channels. It becomes public information. Volunteers of WiGLE community (http://wigle.net) gather this data and publish it on their site. It is also possible to gain access directly to database.

WiGLE.net

WiGLE.net is a submission-based catalog of wireless networks. Submissions are not paired with actual people; ra-ther name/password identities which people use to associate their data. It's basically a "gee isn't this neat" engine for learning about the spread of wireless computer usage.
WiGLE concerns itself with 802.11a/b/g/n and cellular networks right now, which can be collected via the WiGLE WiFi Wardriving tool on android. We also have a bluetooth stumbling client for Android, but do not maintain a catalog of bluetooth networks.
WiGLE consolidate location and information of wireless networks world-wide to a central database, and has a user-friendly desktop and web
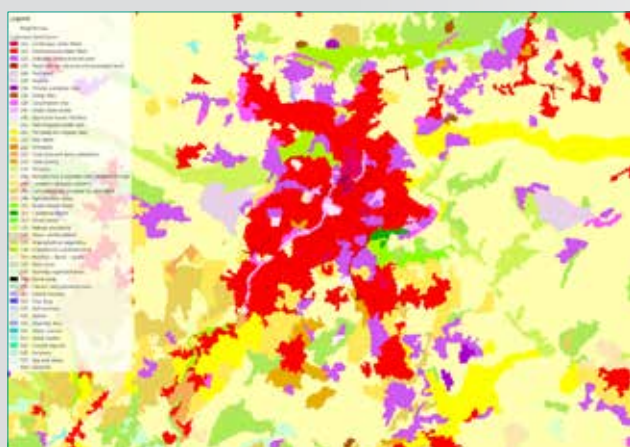
LAND COVER FROM COPERNICUS AND WIFI NETWORK USE FROM WIGLE IN 4 EU CITIES
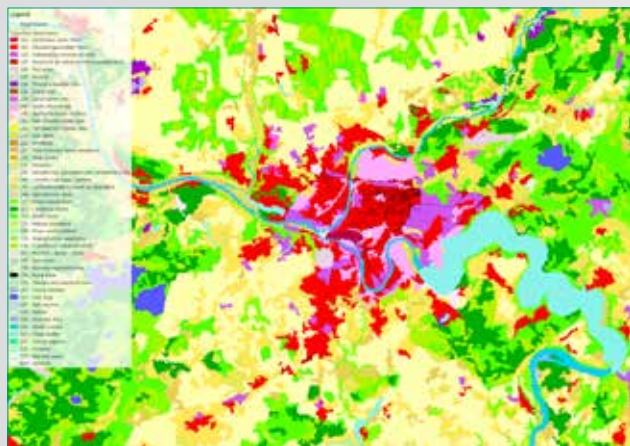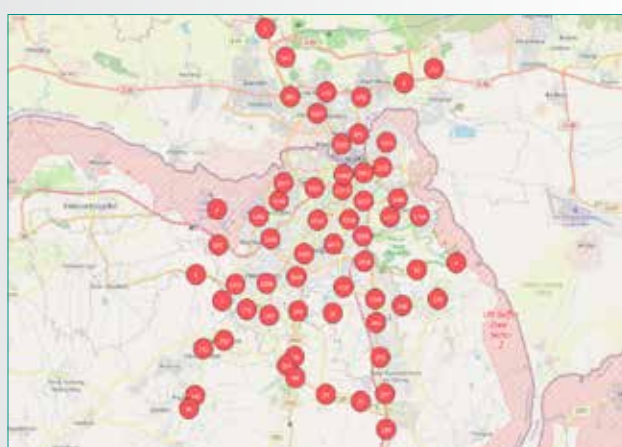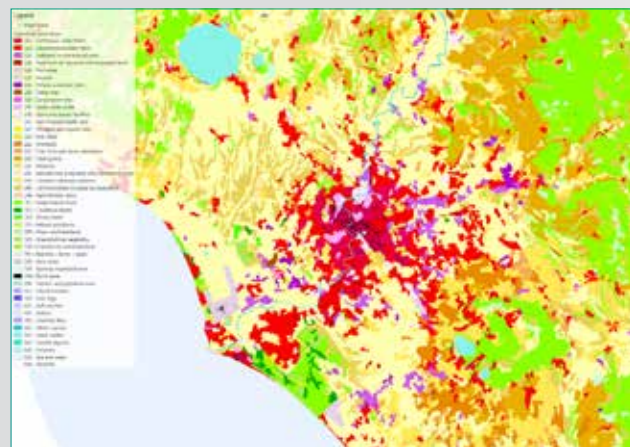

Kaunas City – Copernicus Land Cover
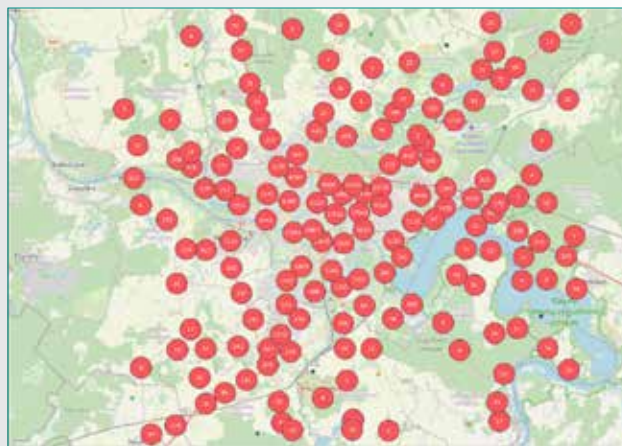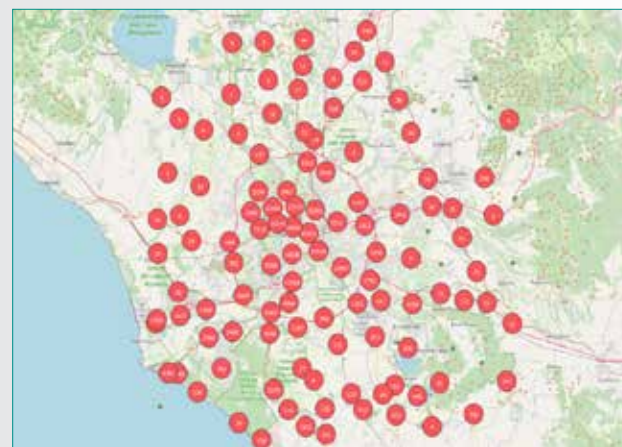

Kaunas City Features count 246,482

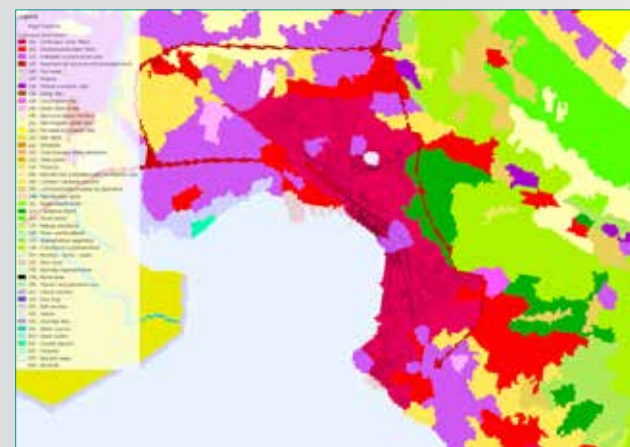Nicosia – Copernicus Land Cover

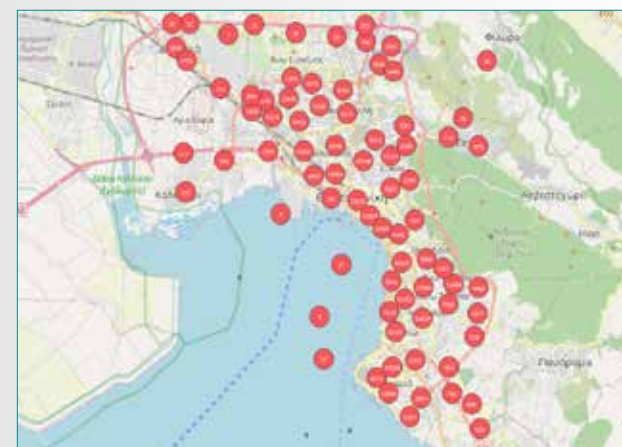Nicosia – Features count 116,033

Rome – Copernicus Land Cover

Rome - Feature count 407,632

Thessaloniki – Copernicus Land Cover

Thessaloniki - Feature count 465.497

Fig. 1 – Land Cover from Copernicus and WIFI network use from WIGLE in 4 EU Cities
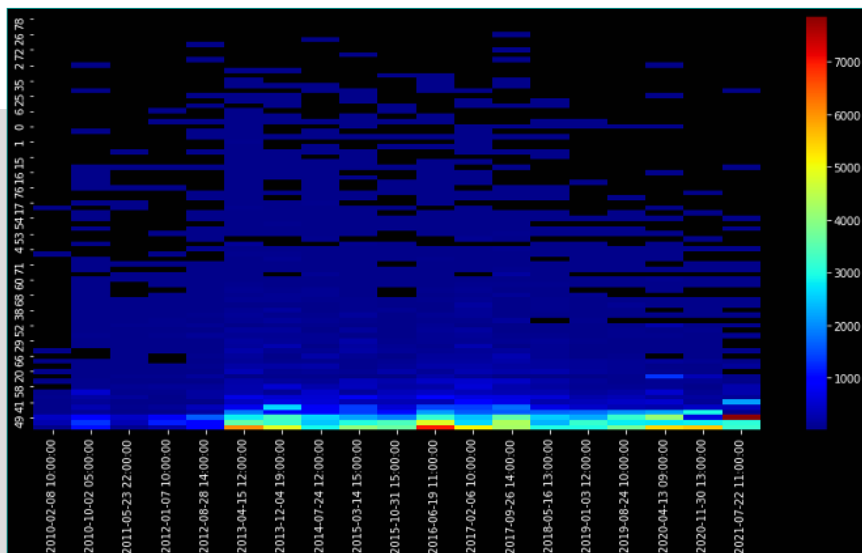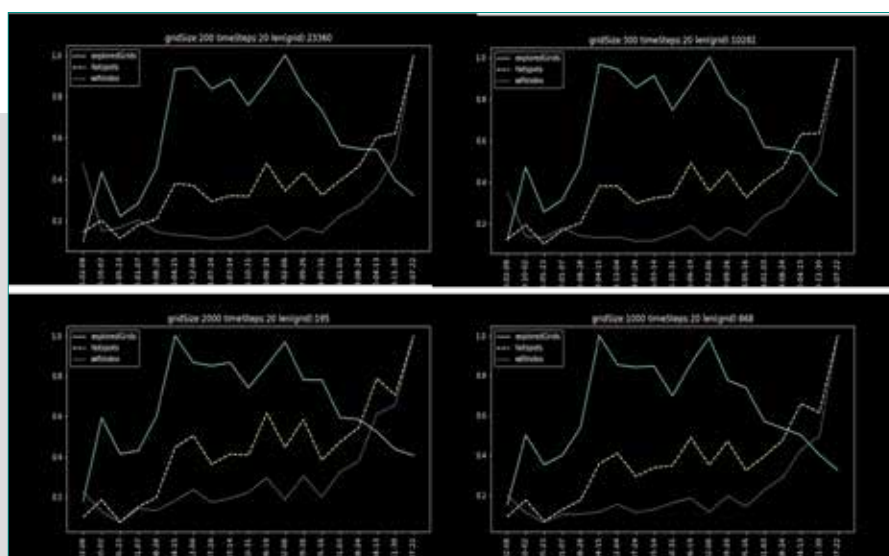
Fig. 2 - Time slice analysis in Kaunas City.

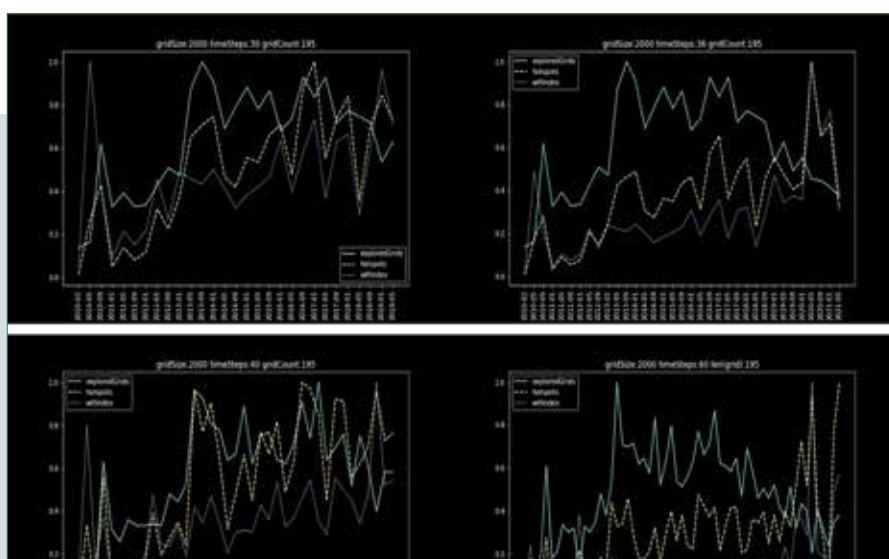
Fig. 3 - Grid Count Scan in Kaunas City.

Fig. 4 - Time step scan in Kaunas City.

applications that can map, query and update the database via the web. Everyone can contribute to this mapping sending wireless network traces (in any of listed formats, usually pairings of wireless sample, names and network hardware addresses - for uniqueness -, data/SNR triples and GPS coordinates) or enter networks manually.
For more information: https://wigle.net/wiki/index.cgi

Data download
WiGLE limits requests per day.
Automated using crontab.
Hosts a web page to monitor progress.

Conclusions
Counting Wi-Fi hotspot by land use categories in multiple time slices can pinpoint human behavior during the lockdown.
Wi-Fi hotspot change centered in the event of curfew start allows to inspect territories by positive or negative trend.
Proposed parameter, Wi-Fi index, can be used to describe the communications state of the city. It reveals temporal trends that could not be detected without it. It represents speed of Wi-Fi hotspot creation normalized by area of explored territory.
Although there are no common trends between cities, differences could potentially be related to macro parameters. This could be validated statistically by including more cities in the research.
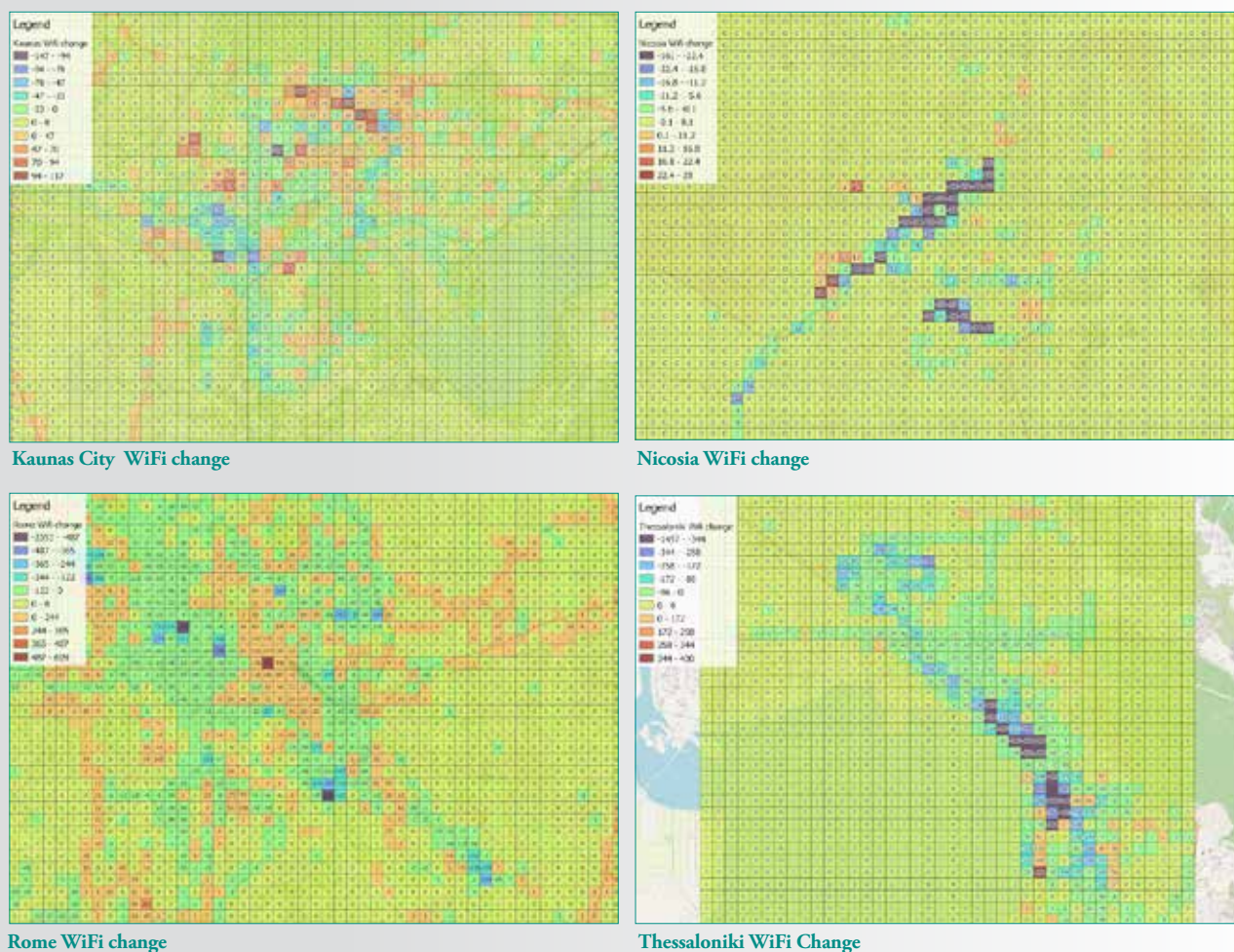
WIFI CHANGE IN 4 EU CITIES DURING COVID 19

Kaunas City WiFi change

Nicosia WiFi change

Rome WiFi change

Thessaloniki WiFi Change

Fig. 5 – WIFI change in 4 EU cities during COVID 19.

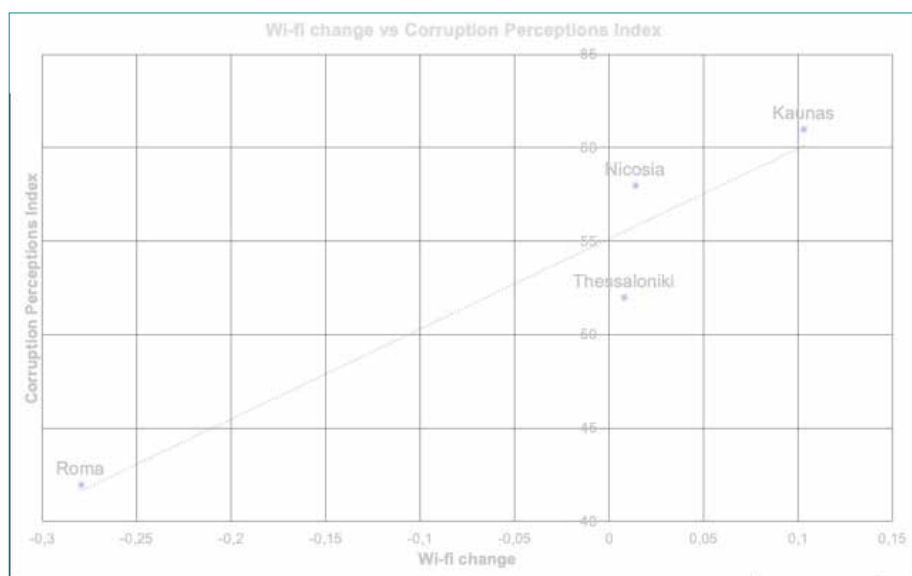Fig. 6 - Possible Dependencies, WIFI index in 4 EU cities.

ABSTRACT
Behavior of people in extreme condition is one of the main target of the eUMaP project, funded under European Union's Horizon 2020 project Marie Slodowska-Curie Actions.

AUTHOR
Marius Ivaškevičius
Kaunas University of Technology
Faculty of Civil Engineering and Architecture
Department of Architecture and Urbanism
Studentų st. 48-303 Kaunas, LT-51367, Lithuania
marius.ivaskevicius@ktu.lt