日本—ドイツ、ハンガリー、スペイン
国際共同研究「レジリエント、安全、セキュアな社会のための ICT」
2022 年度　年次報告書

研究課題名（和文）	ディープラーニングを用いた都市モビリティのピーク予測　（DARUMA）
研究課題名（英文）	Deep Learning Anticipated Urban Mobility Peaks (DARUMA)
日本側研究代表者氏名	Jan-Dirk Schmöcker
所属・役職	京都大学　大学院工学研究科　准教授
研究期間	2021 年 4 月 1 日～2024 年 3 月 31 日

1．日本側の研究実施体制

氏名	所属機関・部局・役職	役割
Jan-Dirk Schmöcker	Associate Professor, Kyoto University, Department of Urban Management	PI, Overall responsibility for the project. Co-ordination of collaboration between the different partners.
Wenzhe Sun	Research Fellow, Kyoto University, Department of Urban Management	Main person leading the data fusion and deep learning model development. Further supporting the advice of research students from all member universities.
Kouji Fukuda	Senior Research Fellow, Hitachi	Mainly overseeing the machine learning work package in the project.
Satoshi Nakao	Assistant Professor, Kyoto University, Department of Urban Management	Supporting various data acquisitions and involved in the Kyoto case study
Toshiyuki Nakamura	Associate Professor, Nagoya University, Institute for Innovation for Future Society.	Supporting the Kyoto case study and data collection.
Tadashi Yamada	Professor, Kyoto University, Department of Urban Management	Advising the project group on inclusion of supply-chain aspects.

2．日本側研究チームの研究目標及び計画概要

Our goals are threefold in line with the three work packages that are the topic of this year. Firstly, we aim to proceed the analysis of the various mobility data that have been collected. Specifically, we aim to clarify in how far Twitter data, “Google Popular Times” data and spatial mobile phone statistics reflect the changes in mobility due to COVID impacts. As part of this we aim to understand correlation between these datasets and time lags between initial trends and significant changes in travel patterns. Secondly, we will utilize traffic data from Kyoto to build a simulation framework and estimate origin-destination flows in the core part of the city. The overall goal of both these items is to obtain critical points under which cases the “urban mobility state” would significantly change. Thirdly, and as part of achieving this, we will explore the foundations of a machine learning framework where the data are fused and the complex interactions in mobility patterns are estimated. For all three goals we aim to work closely with our European partners who have similar goals for the Budapest and Madrid case study.

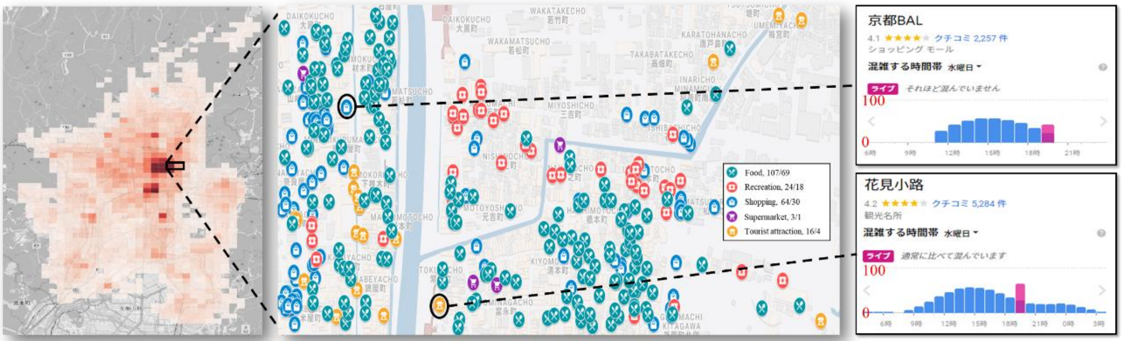
3．　日本側研究チームの実施概要

In the second project year we have been able to utilize the data collected in the first project year in various studies and we have been making progress with three key work packages (WPs) of this project.

In WP3, Data fusion, we have been able to fuse Google Popular times with Mobile Spatial Statistics to obtain activity patterns in different areas in Kyoto. We analyzed geotagged tweets and related these to “points of interests” to show activity trends. Overall, we could show that we can extract characteristics of city areas and that crowdsourced data can be used to illustrate how activities changed over the Covid period. The figure at the end of this report illustrates some of the data we have been fusing for the Kyoto case study. In collaborative work with our project partners, we conducted similar analysis for Madrid.

As part of WP4 we have been creating a mesoscopic simulation model of traffic in Kyoto. We use the “SUMO” open-source platform and have been calibrating the model by using mobile spatial statistics and traffic flow data. The time-varying travel times in the network will also be part of our deep learning model.

The framework and input data of this framework have been established as part of WP5. We have created for 500m2 zones of Kyoto features such as population per hour, land-use characteristics and busyness of locations in the meshes through the usage of Google Popular Times data. WP4 is used to define the travel costs between the zones. We are now in a position to run a graph convolutional network model to predict populations in meshes. Similar to WP4, in close collaboration with all our project partners we are also supporting the case studies in the two European cities.



(a) Presence of people from mobile phone data

(b) Various types of urban activity attractions from Google Points of Interest

(c) Scaled busyness of activity attractions from Google popular times