Deutsches Forschungszentrum für Künstliche Intelligenz
German Research Center for Artificial Intelligence

Rheinland-Pfälzische Technische Universität Kaiserslautern Landau

A Simulation Environment Predicting User Data Demand (UDD-Sim) in Upcoming Wireless Networks and Smart Cities

29. VDE ITG Fachtagung Mobilkommunikation

Matthias Rüb, Jan Herbst, Rudolf Schröder, Hans D. Schotten

Motivation

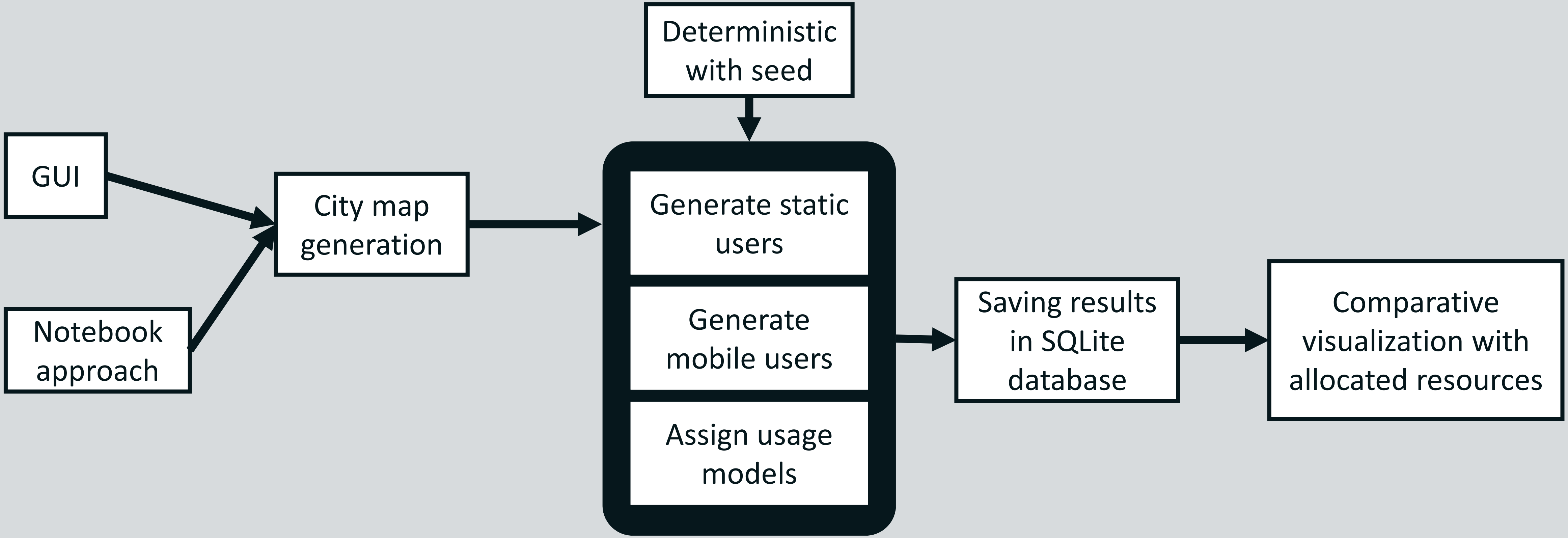
- For mobile traffic demand several simulation approaches exist. [1],[2],[3] (convoluational neural networks, attention mechanisms)
- Different underlying datasets:

Authors of [1] use data from Shanghai, the authors of [2] refer to data of a single European city.

- How to compare different approaches?

  → Unifying framework UDD-sim
  - Reproducible
  - Customizable

Framework overview



Usability description

- What options do I have?
  - Customize cities by hand (GUI)
  - Generate a random city based on given parameters

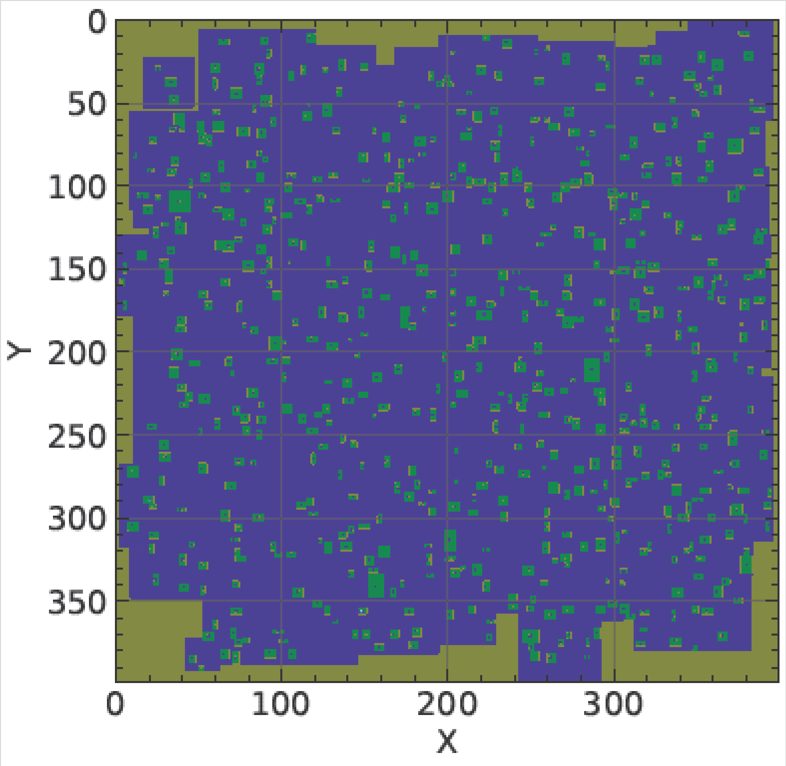
- The hash code:
  - Seed
  - Building counts

  752397#H-600#I-5#CO-11#HO-1#TS-7#EI-2s

→ 600 private houses, 5 industrial facilities, 1 hospital, 2 educational institutes

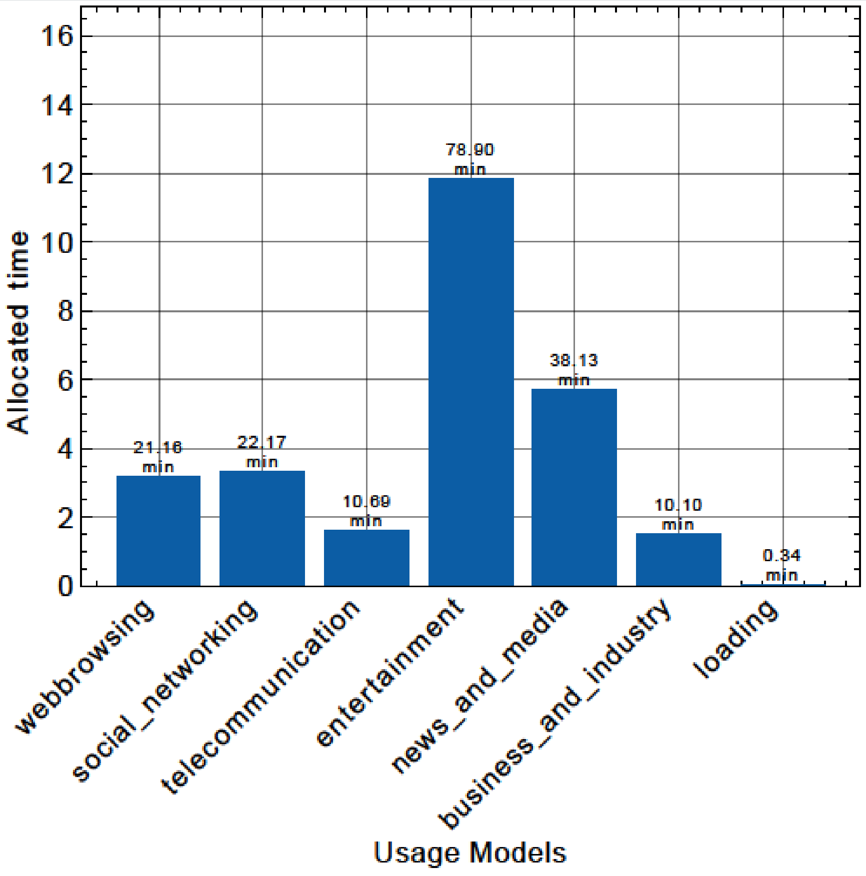
Map construction

- Option for algorithm testing: simple salt and pepper automated placement
- Zones excluded from placement probability

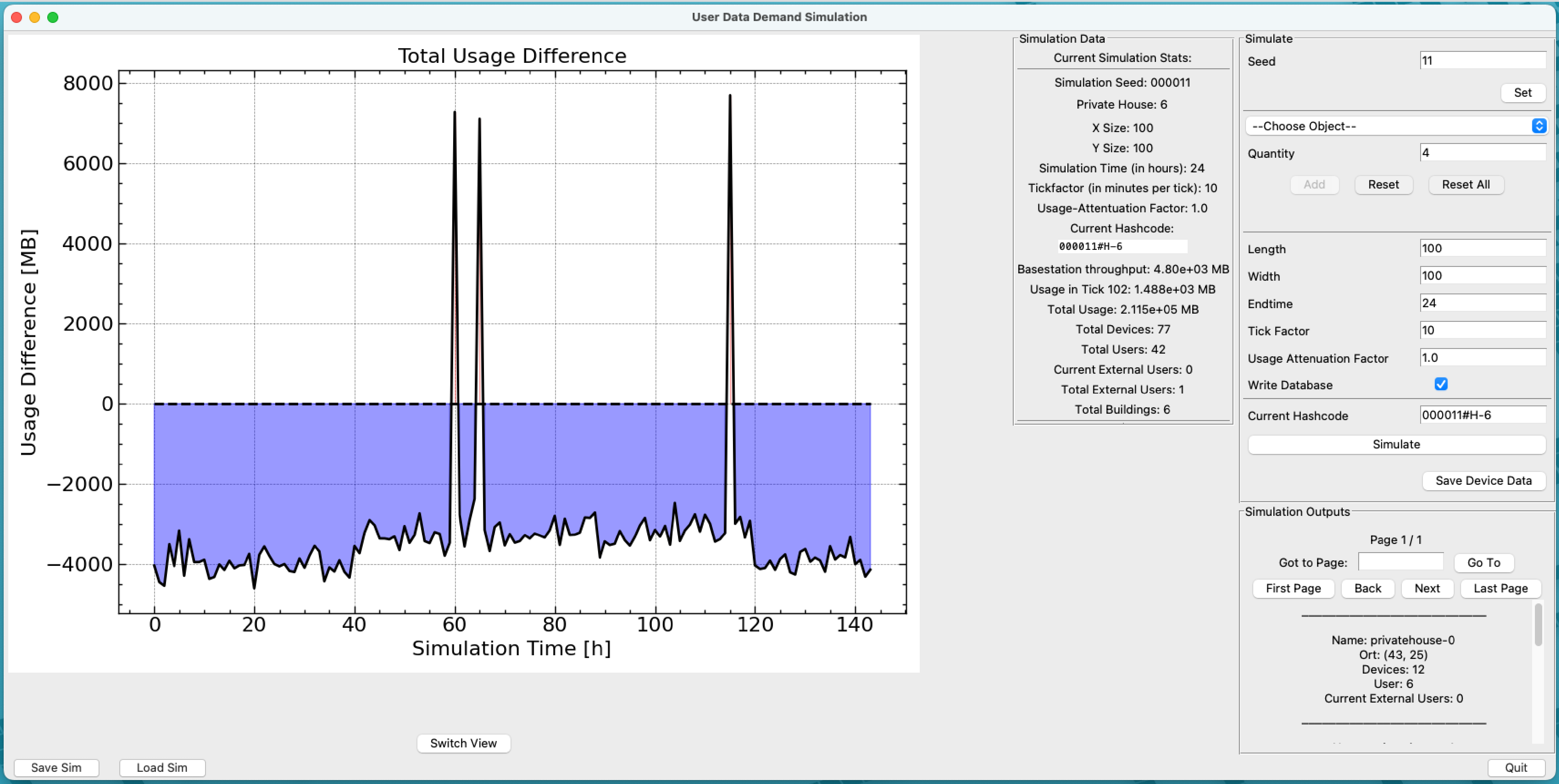


- Limitations:
  - Currently, there is no probability density mapping
  - No automated clustering (residential, industrial, etc.)

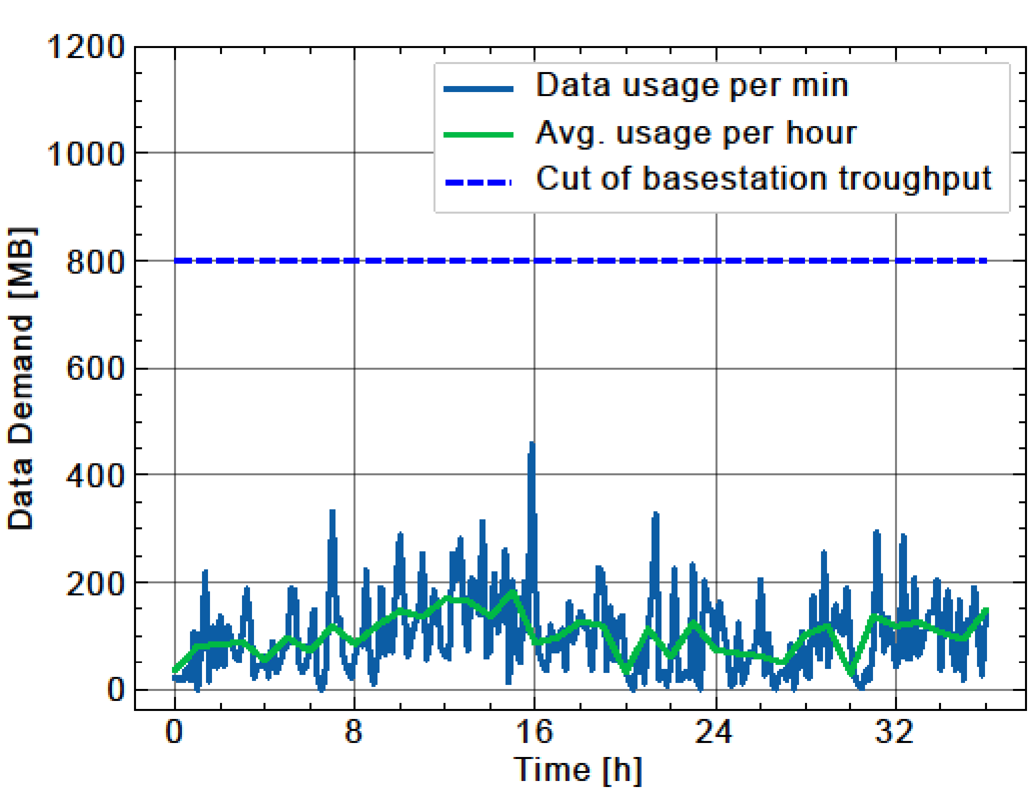
Usage Models



GUI Overview



Evaluation tools - visualization



Conclusion and outlook

Next steps:

- Comparative analysis of SOTA algorithms
- Improve default scenarios with the best-performing solutions

- Integrate benchmarking framework
- Add preset scenarios

References

- [1] J. Feng, X. Chen, R. Gao, M. Zeng and Y. Li, "DeepTP: An End-to-End Neural Network for Mobile Cellular Traffic Prediction," in *IEEE Network*, vol. 32, no. 6, pp. 108-115, November/December 2018, doi: 10.1109/MNET.2018.1800127
- [2] André Felipe Zanella, Antonio Bazco-Nogueras, Cezary Ziemlicki, and Marco Fiore. 2023. Characterizing and Modeling Session-Level Mobile Traffic Demands from Large-Scale Measurements. In Proceedings of the 2023 ACM on Internet Measurement Conference (IMC '23). Association for Computing Machinery, New York, NY, USA, 696–709. https://doi.org/10.1145/3618257.3624825
- [3] K. Xu, R. Singh, H. Bilen, M. Fiore, M. K. Marina,and Y. Wang, "CartaGenie: Context-Driven Synthesis ofCity-Scale Mobile Network Traffic Snapshots," in 2022IEEE International Conference on Pervasive Computingand Communications (PerCom), 2022, pp. 119–129.DOI: 10.1109/PerCom53586.2022.9762395.

dfki ai
Deutsches Forschungszentrum für Künstliche Intelligenz
German Research Center for Artificial Intelligence

RPTU
Rheinland-Pfälzische Technische Universität
Kaiserslautern Landau

Thank you!

29. VDE ITG Fachtagung Mobilkommunikation

Matthias Rüb, Jan Herbst, Rudolf Schröder, Hans D. Schotten