

RA 10 Robotic Routing

Tomáš Krajník

Faculty of Electrical Engineering, CTU

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Robotics and Advanced Industrial Production
CZ.02.01.01/00/22_008/0004590

RA10 people: FEE + CIIRC



prof. Jan Faigl (PI)



doc. Tomáš Krajník



Dr. Miroslav Kulich



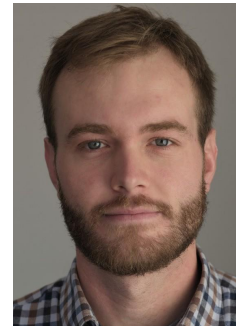
Jan Mikula (PhD student)



Jan Bayer (PhD student)



Tomáš Rouček
(PhD student)



Zdeněk Rozsypálek
(PhD student)



David Woller (PhD student)

+3 positions (acquiring)



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RA 10.1: Routing solvers w. solution quality estimates

Faigl, Kulich:

finding trajectories for (teams of) autonomous vehicles

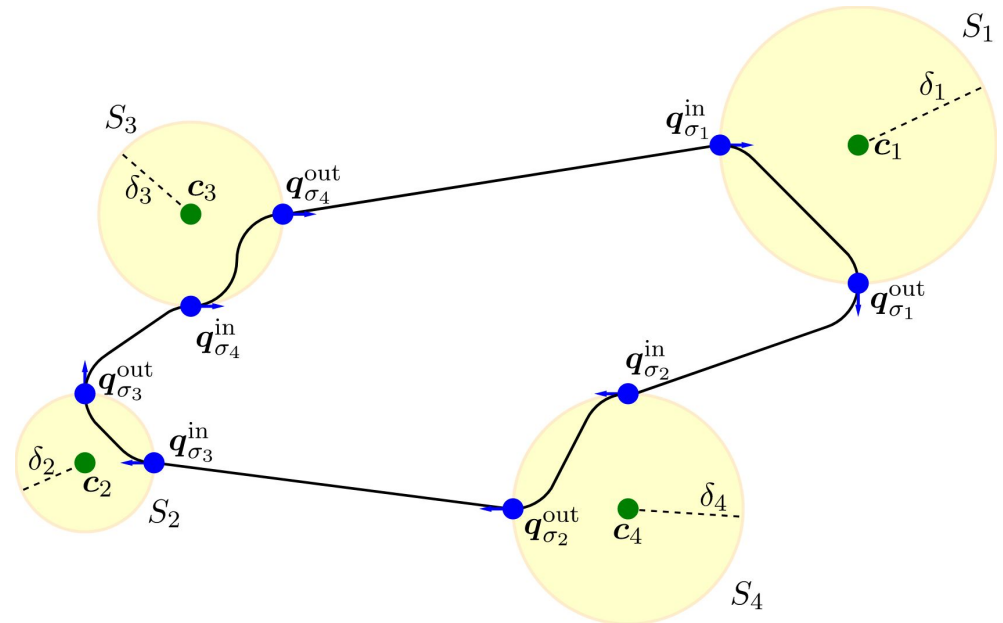
stable solutions with guaranteed quality

multiobjective optimisation

constraints on vehicle dynamics

environment uncertainty

- Month 30: **Robotic routing solvers with the solution quality estimates.**
 - 2-3 Q1/Q2, 2-3 Conf A/A*, 1 SW.
- Month 42: **Efficient solvers to practical routing problems with solution quality guarantee.**
 - 3-4 Q1/Q2, 1-2 Conf A/A*, 1 SW
- Month 60 - **Stability of (optimal) solutions and dynamic routing**
 - 2-3 Q1/Q2, 1-2 A/A*, 1-2 SW



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RA 10.2: Data coll. planning in spatio-temporal fields

Example application

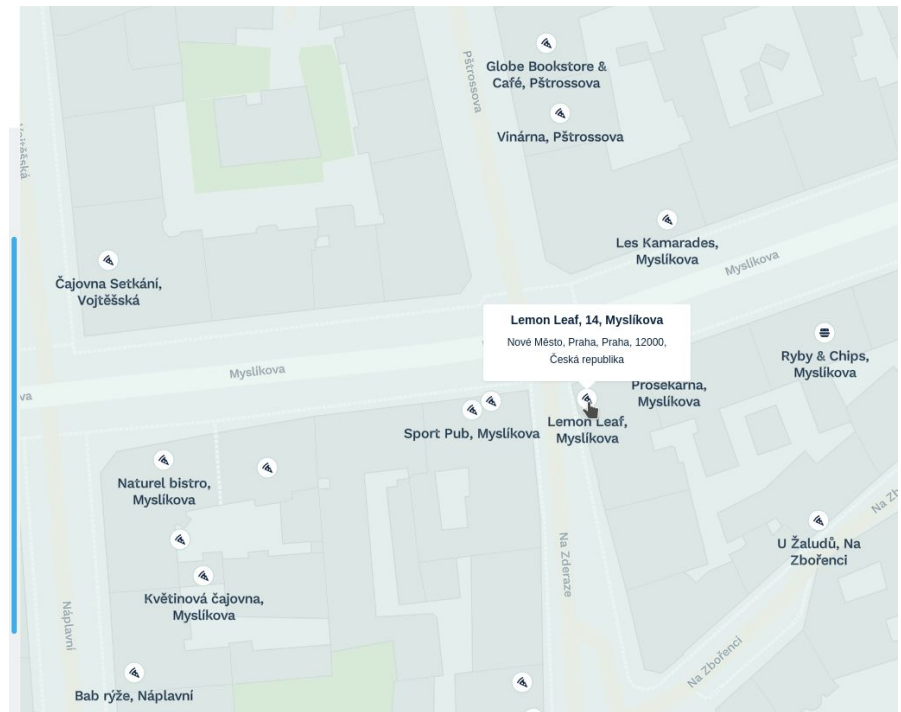
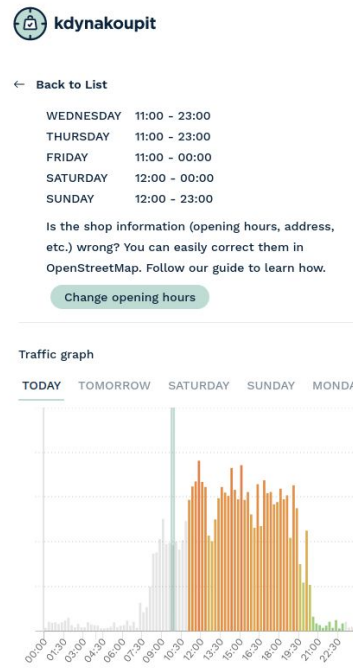
COVID-19 crisis

Infection risk forecasting system “kdynakoupit.cz”

Crowdedness forecasting at 10000+ locations across the Czech rep.

Need for efficient data collection to build, refine and update the models

Information theory-based spatio-temporal exploration



- Month 30 - **Learnable spatio-temporal and traversability models for data collection planning.**
 - 3-4 Q1/Q2, 2-3 Conf A/A*.
- Month 60 - **Online methods for non-myopic decision-making in data collection tasks**
 - 3 - 4 Q1/Q2, 2-3 Conf A/A*, 1 SW



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Collaborations within Roboprox

- **RA6:**

- trajectory planning and task scheduling for spatio-temporal exploration of bio-hybrid systems (2024 planning for IROS, JCEA)
- routing for Visual Teach and Repeat systems operating in dynamic and changing environments
- routing for Visual Teach and Repeat systems with temporal constraints in logistics
- adaptive data gathering in changing environments by visually-guided vehicles

- **RA11:**

- learning for robust spatio-temporal exploration
- learning for robust vision-based navigation systems



International collaborations

Selected collaborations in 2023:

- **University of Lincoln:** J Cox et al.: *Visual teach and generalise (VTAG)—Exploiting perceptual aliasing for scalable autonomous robotic navigation in horticultural environments.* Comp. and El. in Agri.
- **University of Durham:** F Rekabi-Bana et al.: *Unified robust path planning and optimal trajectory generation for efficient 3D area coverage of quadrotor UAVs.* IEEE T-ITS
- **Aalto, Orebro, BOSCH:** TP Kucner, et al.: *Survey of maps of dynamics for mobile robots.* The International Journal of Robotics Research

Joint projects - Graz, Durham, SSSA, METU:

- **EIC PATHFINDER OPEN** RoboRoyale 2022 - 2026: *ROBOTic Replicants for Optimizing the Yield by Augmenting Living Ecosystems*
- **EIC PATHFINDER OPEN** SENSORBEES 2024 - 2029: *ENhanced Self-ORganizing Bio-hybrids for Ecological and Environmental Surveillance*



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www.roboprox.eu



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