

RA 10 Robotic Routing

Tomáš Krajník Faculty of Electrical Engineering, CTU Date (14. <u>3. 2024)</u>



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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)



Jan Bayer (PhD student)



doc. Tomáš Krajník



Dr. Miroslav Kulich



Jan Mikula (PhD student)





Tomáš Rouček (PhD student)



Zdeněk Rozsypálek (PhD student)



David Woller (PhD student)

+3 positions (acquiring)









RA 10.1: Routing solvers w. solution quality estimates

 S_3

Faigl, Kulich:

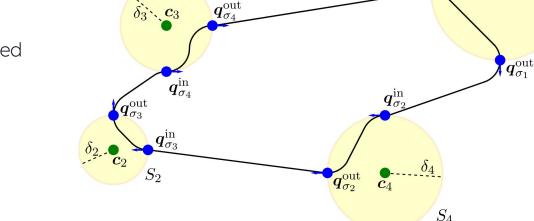
finding trajectories for (teams of) autonomous vehicles

solutions with guaranteed stable 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 0
- Month 60 Stability of (optimal) solutions and dynamic routing
 - 2-3 Q1/Q2, 1-2 A/A*, 1-2 SW Ο









 S_1

 $q_{\sigma_1}^{\text{in}}$

RA 10.2: Data coll. planning in spatio-temporal fields **Example** application (a) kdy

COVID-19 crisis

Infection risk forecasting system "kdynakoupit.cz"

Crowdedness forecasting locations 10000+at across the Czech rep.

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

Information theory-based spatio-temporal exploration

kdynakoupit		Globe Bookstore & Café, Pštrossova	
Back to List		Sanda a a	
WEDNESDAY 11:00 - 23:00 THURSDAY 11:00 - 23:00 FRIDAY 11:00 - 00:00 SATURDAY 12:00 - 00:00		Vinárna, Pštrossova	
SUNDAY 12:00 - 23:00		4	
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- 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 Ο

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Traffic gr TODAY









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











Thank you for your attention!





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