Robot Perception & Intelligence

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Technical University of Munich
WS 2023 / 24
Outline

- General Information
  - About the seminar
  - Registration

- Topics
- Questions
How is the seminar organized?

- **Slides / Material**: seminar webpage
  - [https://srl.cit.tum.de/teaching/w23/seminar_rpi](https://srl.cit.tum.de/teaching/w23/seminar_rpi)
  - Password: rpi_w23 – Material page will go online soon

- **Questions / Meeting arrangement**: contact organizers
  - Use email address from website
How is the seminar organized?

- Seminar meetings: talks and discussion
  - Block Seminar
  - Time: tbd (~November)
  - Room: tbd
  - Attendance is mandatory!

- Talk preparation / contact with supervisor
  - Read through your topic and related papers and write down what you don’t understand
  - **Up to one week before talk** (optional, but recommended) talk: meet supervisor for questions & feedback
  - **Two weeks after** talk: submit your report via email
What about the presentation?

- General setup:
  - Duration: 20-25 minutes talk + 5-10 minutes discussion
  - Make sure to **finish on time**!
  - Rule of thumb: 1-2 minutes per slide → 10-20 slides
  - Do not put too much information on the slides!

- Recommended structure (talk only):
  - Introduction / Motivation
  - Overview / Outline
  - Related Work(s)
  - Method description(s)
  - Experiments and results
  - Personal comments
  - Future work (important)
  - Summary
What about the final report?

● General setup:
  ○ Use LATEX template provided on web page
  ○ Length: 4-5 pages
  ○ Send final report as pdf by email to course email
  ○ Submission deadline: two weeks after talk

● Recommended structure (main text only; can be more comprehensive/extensive than your presentation):
  ○ Introduction
  ○ Related work
  ○ Method description(s)
  ○ Experiments and results
  ○ Discussion of results
  ○ Future work (important)
  ○ Summary
Summary: how will the seminar be graded?

- Presentation
- Final Report
- Contributions to seminar discussions

⇒ Ask questions!
How do you register for the seminar?

- **Step 1:** Official registration via TUM matching system
  - Go to matching.in.tum.de
  - Register for seminar named “Robot Perception & Intelligence”

- **Step 2:** Personal registration via email
  - In the list of topics, select your **three** favorites
  - Write an email ranking these three favorites to course email
  - Email subject: “RPI seminar application [your name]”
  - Include information about related lectures / courses you have taken so far (**Transcript should be attached**).
  - We do **not** need a CV or a motivation letter!
  - **Registrations without email / emails with missing information will be ignored!**

- **Deadline** for both registrations: July 19, 2023
How do we select candidates and papers?

- **Candidate selection**
  - Only students registered in the matching system **AND** with emails containing all required information will be considered
  - Among students meeting the formal criteria, selection will be random (matching system)
  - You will get notified by the matching system about the decision

- **Topic assignment**
  - Topics are assigned after the participant list is finalized
  - We give our best to accommodate your preference list in the assignment
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Recent Advances in Visual Inertial SLAM

Advisor: Sebastián Barbas Laina

Related Papers:

Learning-Based Differentiable SLAM

Advisor: Sebastián Barbas Laina, Simon Schaefer

Related Papers:

Unsupervised Feature Learning for Odometry

Advisor: Sebastián Barbas

Related Papers:
Implicit Mapping at large scale

Advisor: Sebastián Barbas
Laina

Related Papers:
Lidar-based Odometry

Advisor: Simon Boche,
Sebastián Barbas Laina

Related Papers:
Efficient / Real-Time Volumetric Mapping

Advisor: Simon Boche

Related Papers:
Large-Scale Volumetric Mapping

Advisor: Simon Boche

Selection of Related Papers:

Autonomous Exploration
Advisor: Simon Boche

Selection of Related Papers:
Depth Completion using RGB/RGB-D/LiDAR

Advisor: Sebastián Barbas Laina

Related Papers:
Multimodal Learning for Images and LiDAR

Advisor: Simon Schaefer, Simon Boche

Related Papers:

- CMRNet: Camera to LiDAR-Map Registration, Cattaneo et al, 2019
- LCDNet: Deep Loop Closure Detection and Point Cloud Registration for LiDAR SLAM, Cattaneo et al, 2021
Learning-based Multi-modal Perception
Advisor: Simon Schaefer

Related Papers:
Object-level Perception

Advisor: Hanzhi Chen

Related Papers:
- Li, Guanglin, et al. "Generative Category-Level Shape and Pose Estimation with Semantic Primitives." CoRL 2022
Open Vocabulary 3D Scene Understanding

Advisor: Hanzhi Chen

Related Papers:

Mapping Beyond Geometry
Advisor: Hanzhi Chen

Related Papers:
Computationally Efficient NeRFs

Advisor: Simon Schaefer, Hanzhi Chen

(a) None
411k parameters
10:45 (mm:ss)

(b) Multiresolution grid
10k + 16.3M parameters
1:26 (mm:ss)

(c) Frequency
438k + 0 parameters
13:53 (mm:ss)

(d) Hashtable (T=2^{14})
10k + 494k parameters
1:40 (mm:ss)

(e) Hashtable (T=2^{19})
10k + 12.6M parameters
1:45 (mm:ss)

Related Papers:
- Instant Neural Graphics Primitives with a Multiresolution Hash Encoding, Müller et al, 2022
- Plenoxels: Radiance Fields without Neural Networks, Fridovic-Keil et al, 2022
BEV Map Based Perception for Autonomous Driving

Advisor: Dr. Xingxing Zuo

Related Papers:
Learning-based Vector Map Reconstruction for Autonomous Driving

Advisor: Dr. Xingxing Zuo

Related Papers:

Human Pose Tracking with Dynamic Camera

Advisor: Simon Schaefer

Related Papers:

Learning the Human Distribution
Advisor: Simon Schaefer

Related Papers:
- VPoser: Variational Human Pose Prior for Body Inverse Kinematics, Pavlakos et al, 2019
- Pose-NDF: Modeling Human Pose Manifolds with Neural Distance Fields, Tiwari et al, 2022
3D Human Pose Estimation
Advisor: Simon Schaefer

Related Papers:
- 3D Human Pose Estimation for Free-from and Moving Activities Using WiFi, Ren et al, 2022
- 3D Human Pose Estimation with Spatial and Temporal Transformers, Zheng et al, 2021
Where can I find the papers?

[arxiv.org]

[IEEE Xplore]

[TUM eAccess]
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Questions?

- Web page: [https://srl.cit.tum.de/teaching/w23/seminar_rpi](https://srl.cit.tum.de/teaching/w23/seminar_rpi)
- Password: rpi_w23
- **Can I present another topic?** You can also suggest a topic / paper that you are interested in! If you have a topic in mind, that you are interested in and that is not in the list, we are always open for suggestions. In that case, attach it to your three favorite papers and we will decide whether it fits.