

Learning For Self-Driving Cars and Intelligent Systems

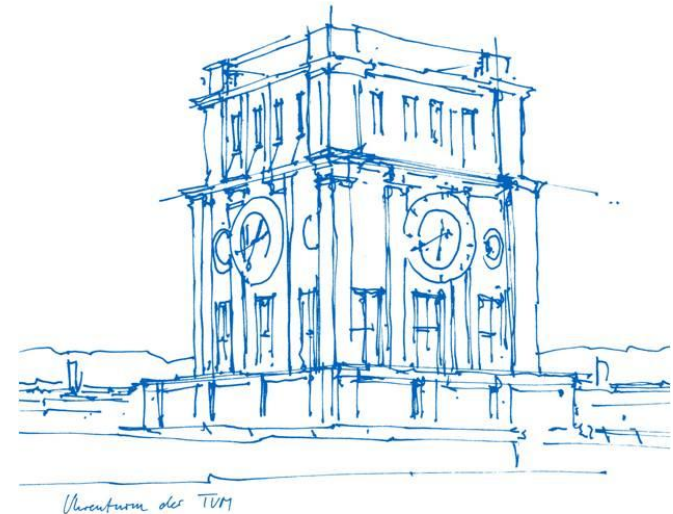
Practical Course

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Summer Semester 2022

Course webpage:

https://vision.in.tum.de/teaching/ss2022/intellisys_ss2022



Structure

- Masters practical course
- Data modalities: images, GNSS, IMU, point clouds, sets, graphs etc.
- Programming assignments in the initial weeks
- Research oriented projects
- max. 2 persons per each group
- Dynamic research goals
- One-on-one meetings with supervisors for updates and resolving issues
- Final Presentations
- Weekly summaries of the work progress
- Tuesday, 11 am - 1 pm [Online | Onsite]
- You will be provided remote access to compute resources via ssh for this course.
- Final Evaluation will be a combination of the programming assignments, weekly/final reports, presentation, viva, project code and results etc.

Prerequisites

- Proficient in python programming
- Familiar with version control (git)
- Comfortable with DL frameworks: PyTorch, Tensorflow etc.
- Good knowledge of basic mathematics, linear algebra, probability, numerics, analysis etc.
- Participation in at least one of the offered **deep learning** lectures at TUM, e.g. [[1](#),[2](#),[3](#) ...]
- Or participation in at least one of **Multi-View Geometry** courses / labs, e.g. [[1](#), [2](#), [3](#)...]
- We may consider other courses offered outside of TUM if the contents match with the example courses referenced above. Please highlight the content of those courses in your application.

Application

- Assignment to the course done via the matching system: <https://matching.in.tum.de/>
- Select your preference of the lab course between 10 to 15 February on the system
- Application documents to be sent separately
- **Send your CV and Transcripts by 16 February 2022 to:** intellisys-ss22@vision.in.tum.de

Please see the email format on the next slide

- We can only consider candidates who applied to the matching system **AND** sent their application documents

Application Email Format

In order to easily evaluate your profile for matching, we ask you to follow the format below:

Subject: Application [Your Matriculation Number]

In the body please give at least the following details:

- *Matriculation #:*
- *Name:*
- *Name of Degree:*
- *Masters Semester #:*
- *Average Grade:*
 - *Bachelor:*
 - *Master (For the previous semester, if available)*
- *List of Relevant courses taken with grade*

Please remember to also attach your CV and transcripts(Bachelor + Master) with the email.

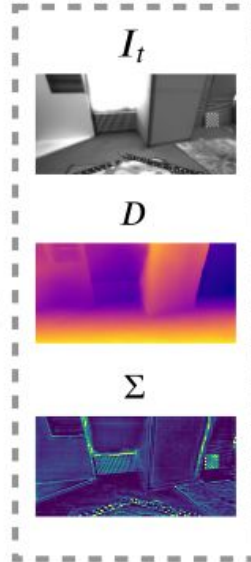
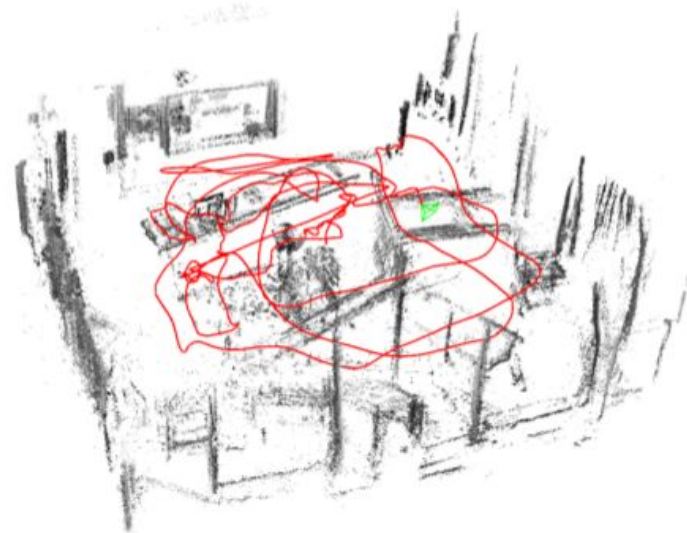
Feel free to share any additional documents, information (for eg. link to git, past research projects) that could support your application. *Optional:* If you also have a project suggestion matching the theme of the lab course, please briefly describe.

Projects

- Practical project experience with real-world problems
- Novel application-oriented research challenges
- Project Assignment to be done after the initial weeks of programming tasks
- Projects specifics will be decided later
- However, if you have project proposals prior to beginning of the semester. It may be considered
- Nevertheless, some general research areas can be found in the next slides

Projects

- SLAM
 - Deep depth \mathbf{D} , deep pose and deep uncertainty Σ based on a single view I_t [1]
- 3D reconstruction
 - Dense reconstruction using a deep neural network [2]



Reference (top):

<https://vision.in.tum.de/research/vslam/d3vo>

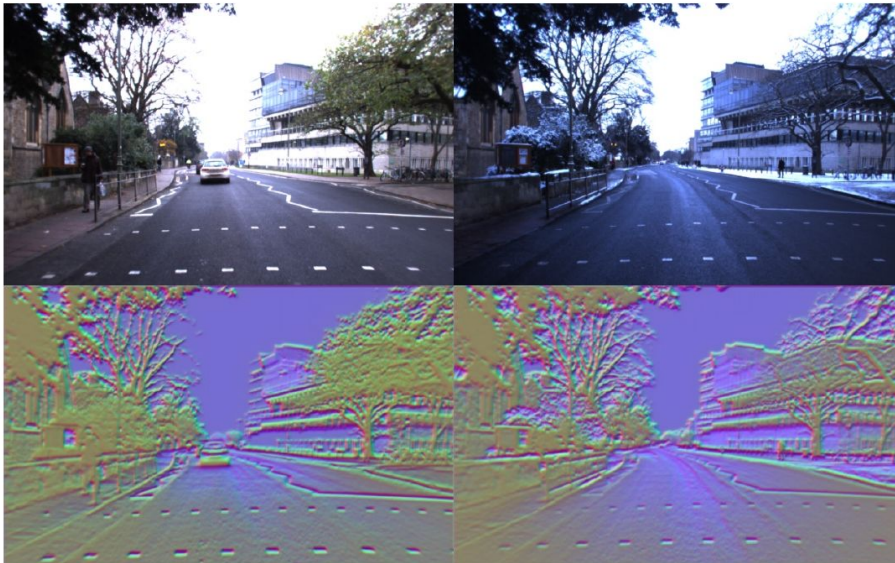
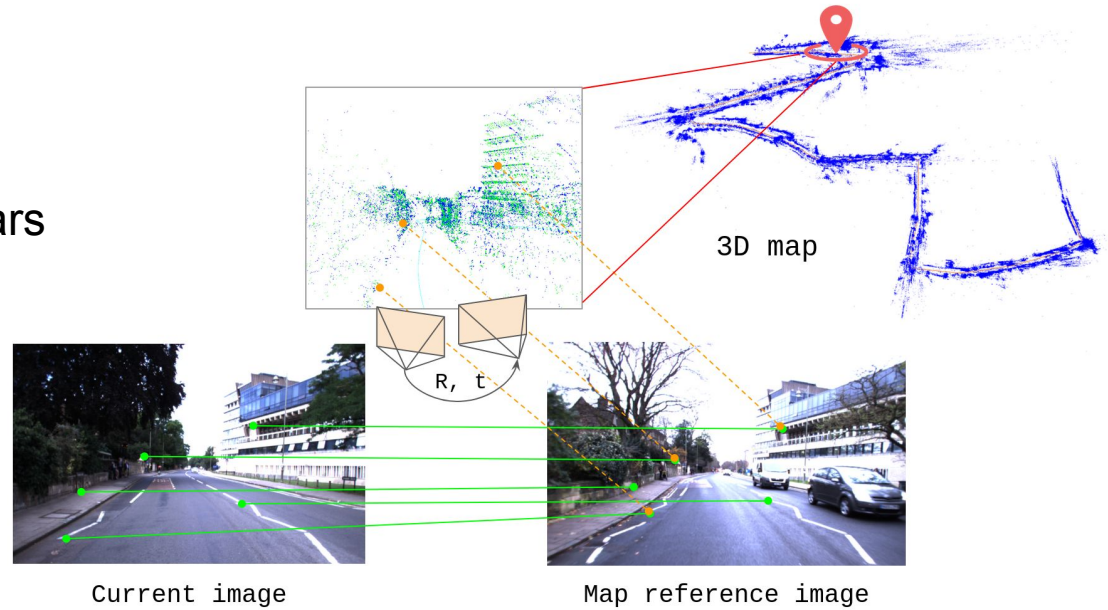
Reference (left):

<https://vision.in.tum.de/research/monorec>

Accessed on 03.02.2022

Projects

- Perception for self-driving cars
- Scene understanding
- Global localization



Reference (top):

<https://vision.in.tum.de/research/vslam/tirdso>

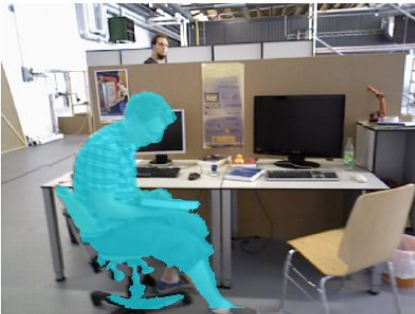
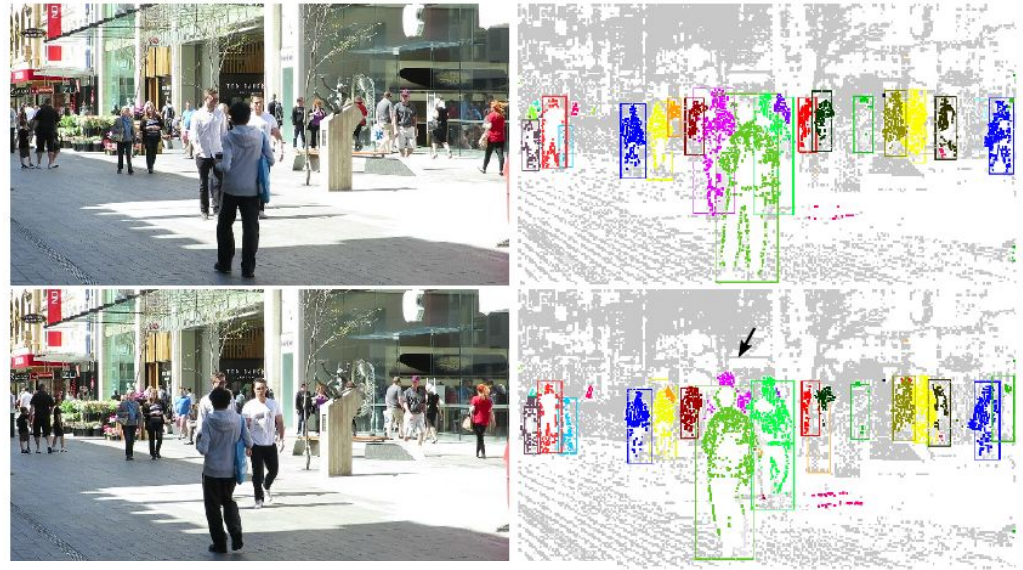
Reference (left):

<https://vision.in.tum.de/research/vslam/gn-net>

Accessed on: 03.02.2022

Projects

- Object detection & tracking
- Dynamic object segmentation



(a) Using Multi-view Geometry.



(b) Using Deep Learning.



(c) Using Geometry and Deep Learning.

Reference (top):

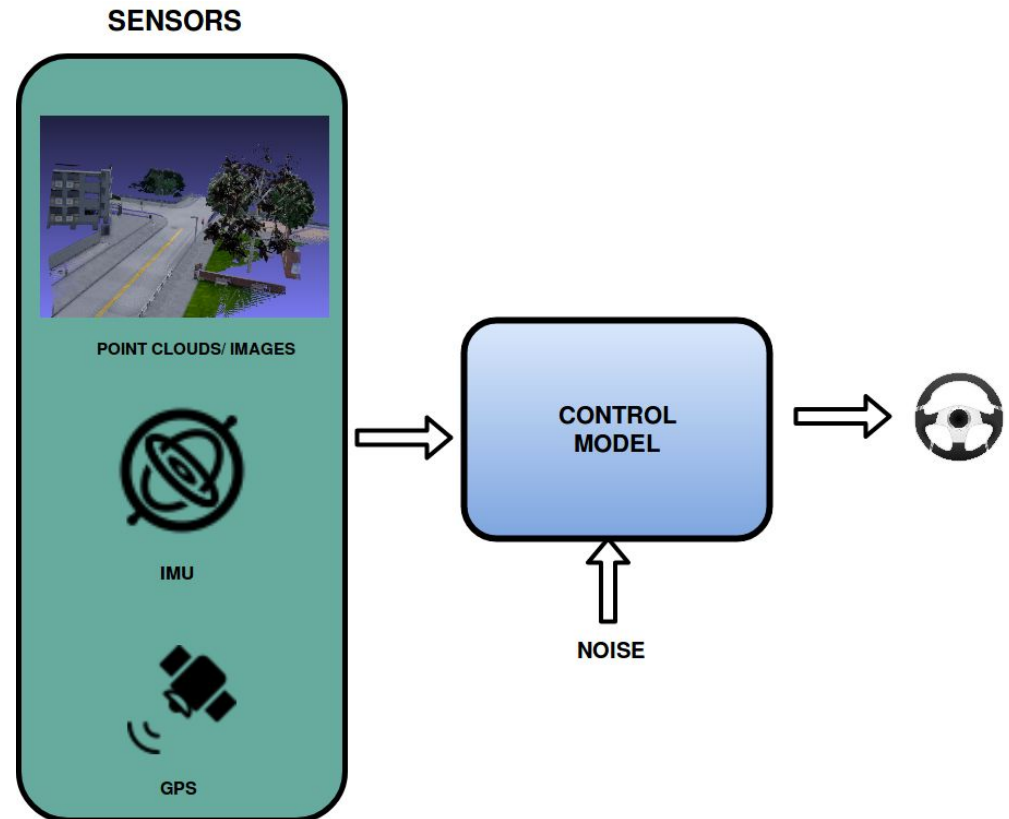
https://ps.is.mpg.de/uploads_file/attachment/attachment/468/motion_segmentation_tracking_clustering.pdf

Reference (bottom): <https://arxiv.org/abs/1806.05620>

Accessed on 03.02.2022

Projects

- Robot control
 - Embodied agents (Next slide)
 - Robustness to noisy data
 - Multiple Input Modalities



Projects

- Testing control algorithms on embodied agents
- Interaction with the environment
- Supervised, self-supervised, reinforcement learning

Visual Odometry Trajectory



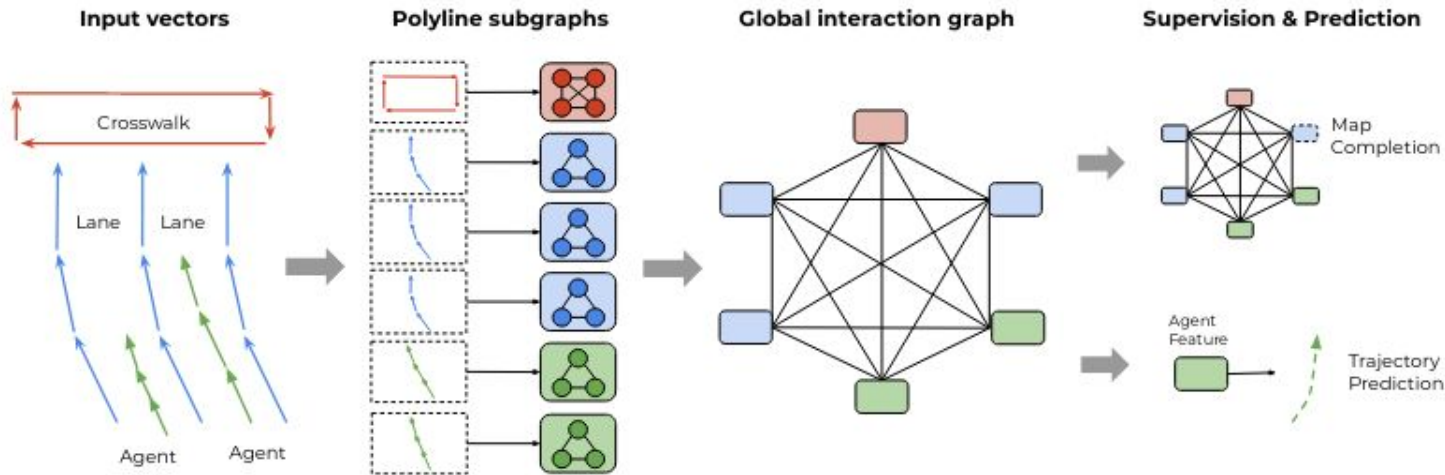
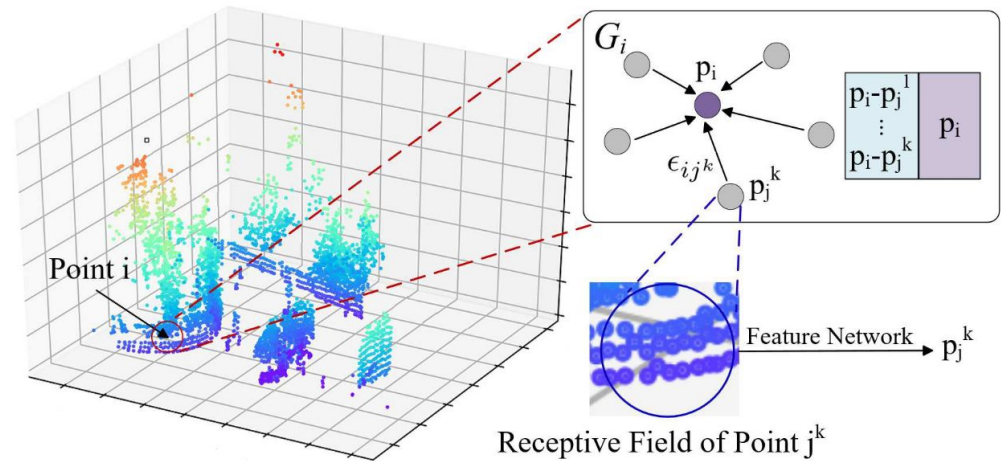
Online Evaluation



Reference: <https://arxiv.org/pdf/2103.11204.pdf>,
Accessed on 03.02.2022

Projects

- Learning on Graphical Neural Networks (GNNs)



Reference (top):

https://openaccess.thecvf.com/content_ICCV_2019/papers/Liu_LPD-Net_3D_Point_Cloud_Learning_for_Large-Scale_Place_Recognition_and_ICCV_2019_paper.pdf (accessed on 04.02.2022)

Reference (bottom): <https://arxiv.org/pdf/2005.04259.pdf> (accessed on 03.02.2022)

QUESTIONS