Multi-Modal Perception for Mobile Robotics

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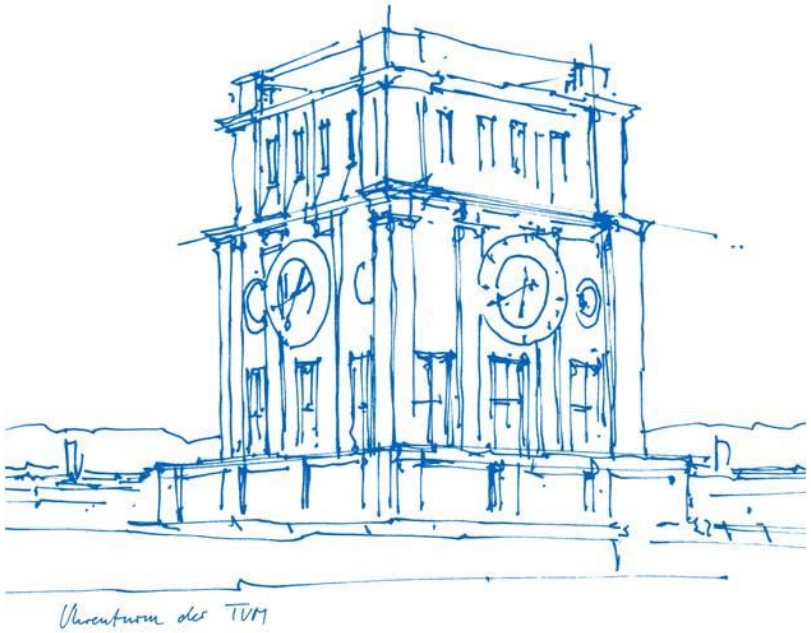
Smart Robotics Lab

Technical University of Munich

SS 2022



Outline

- General Information
  - About the seminar
  - Registration
- Papers
- Questions

How is the seminar organized?

- Slides / Material: seminar webpage
  - https://mlr.in.tum.de/teaching/s22/seminar_mmpmr
  - Password: mmpmr_22 − Material page will soon go online

- Questions / Meeting arrangement: contact organizers
  - mmpmr-ss22@vision.in.tum.de

How is the seminar organized?

- Seminar meetings: talks and discussion
  - Time: Tuesdays, 10:00-12:00
  - Room: MI 02.09.023
  - Starting date: TBA (web page)
  - Number of meetings: TBA
  - **Attendance is mandatory!**

- Talk preparation / contact with supervisor
  - Read through your paper and write down what you don’t understand
  - Approx. **one month before talk**(optional, but recommended): meet supervisor for questions
  - **One week before talk** (optional, but recommended) talk: meet supervisor to go through slides
  - **One week before talk** (mandatory) talk: send slides to your supervisor
  - **Two weeks after** talk: submit your report via email

What about the presentation?

- General setup:
  - Duration: 20-25 minutes talk + 10-15 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
  - Overview / Outline
  - Method description
  - Experiments and results
  - Personal comments
  - 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 mmpmr-ss22@vision.in.tum.de
  - Submission deadline: **two weeks after talk**

- Recommended structure (main text only):
  - Introduction
  - Related work
  - Method description
  - Experiments and results
  - Discussion of results
  - 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 “Multi-Modal Perception for Mobile Robotics”

- Step 2: Personal registration via email
  - In the list of papers on the web page, select your **three** favorites
  - Write an email ranking these three favorites to mmpmr-ss22@vision.in.tum.de
  - Email subject: “MMPMR seminar application [your name]”
  - Include information about related lectures / courses you have taken so far.
  - We do **not** need a CV or a motivation letter!
  - **Registrations without email / emails with missing information will be ignored**!

- Deadline for both registrations: February 15, 2022

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 (XXX)

- Paper assignment
  - Papers are assigned after the participant list is finalized
  - We give our best to accommodate your preference list in the assignment

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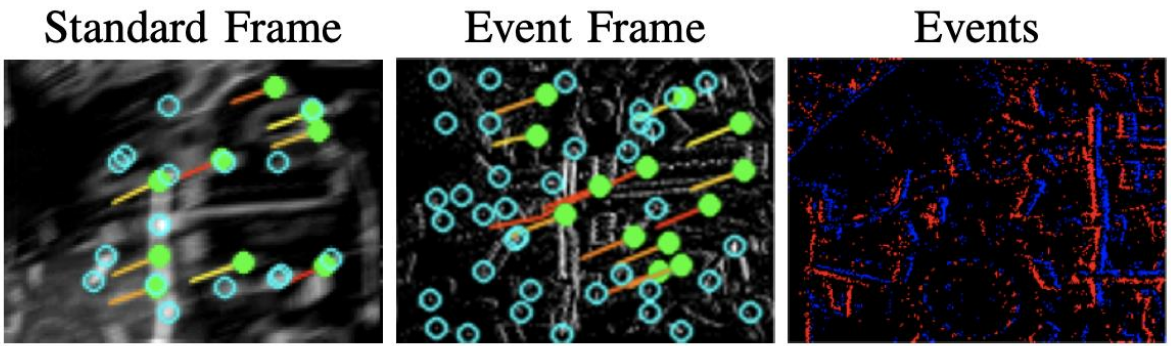
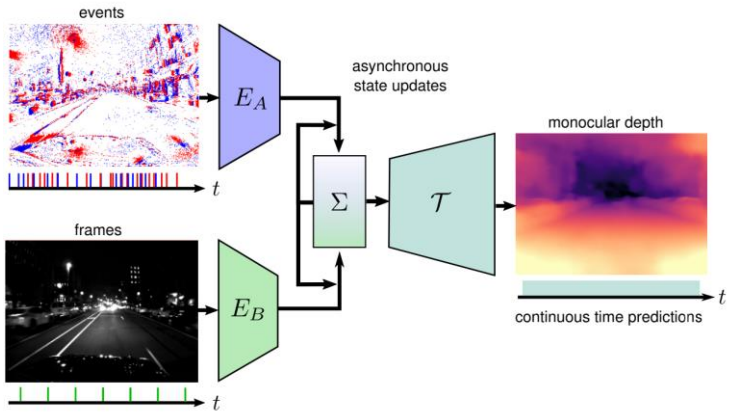
Ultimate SLAM? Combining Events, Images, and IMU for Robust Visual SLAM in HDR and High Speed Scenarios



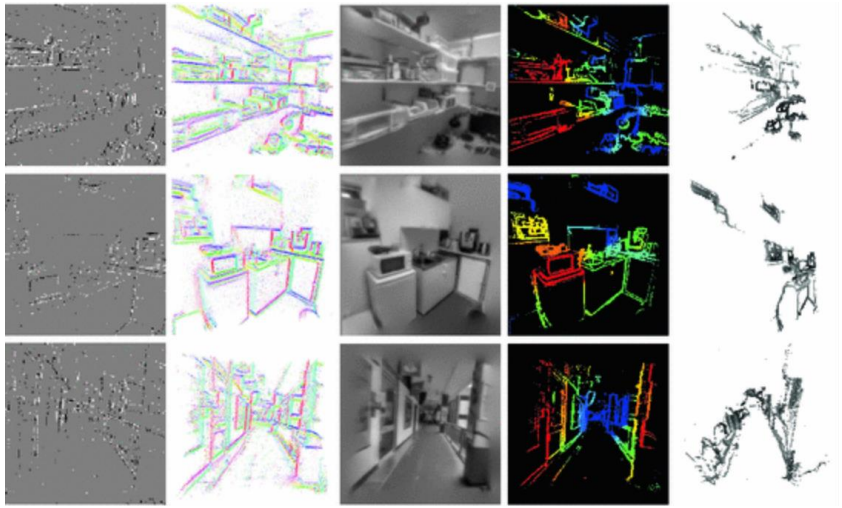
Antoni Rosinol Vida, Henri Rebecq, Timo Horstschaefer and Davide Scaramuzza (RAL 2018)

Combining Events and Frames using Recurrent Asynchronous Multimodal Networks for Monocular Depth Prediction



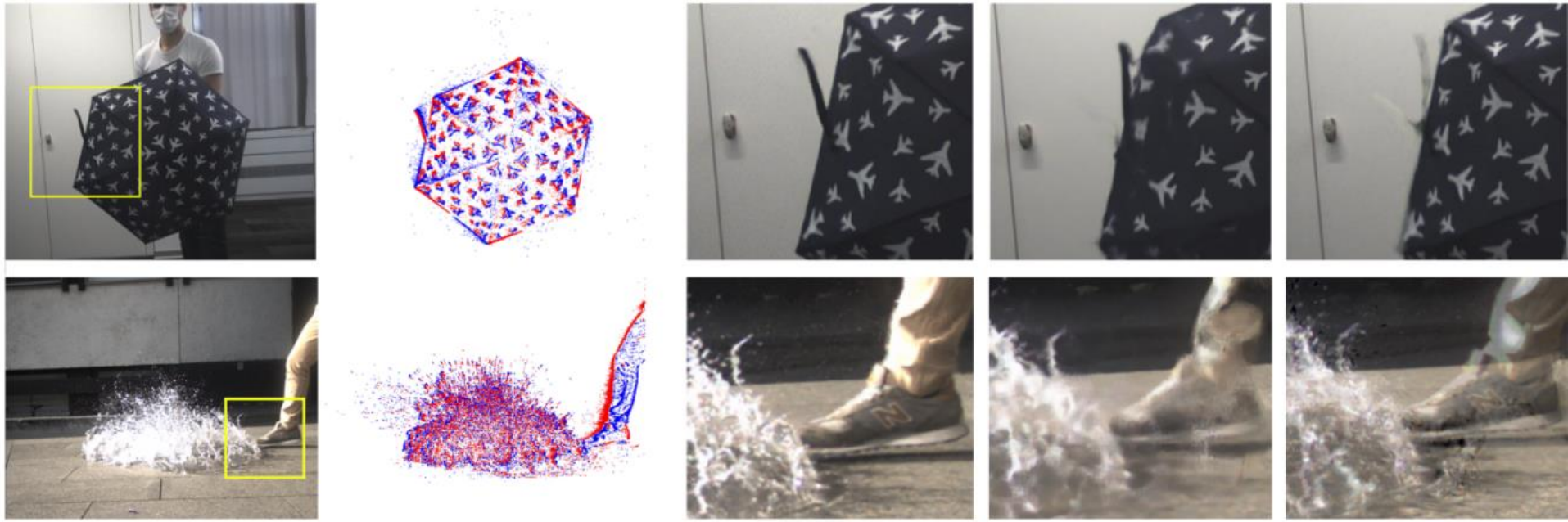
Daniel Gehrig, Michelle Rüegg, Matthias Gehrig, Javier Hidalgo-Carrio and Davide Scaramuzza (RAL 2021)

Real-Time 3D Reconstruction and 6-DoF Tracking with an Event Camera



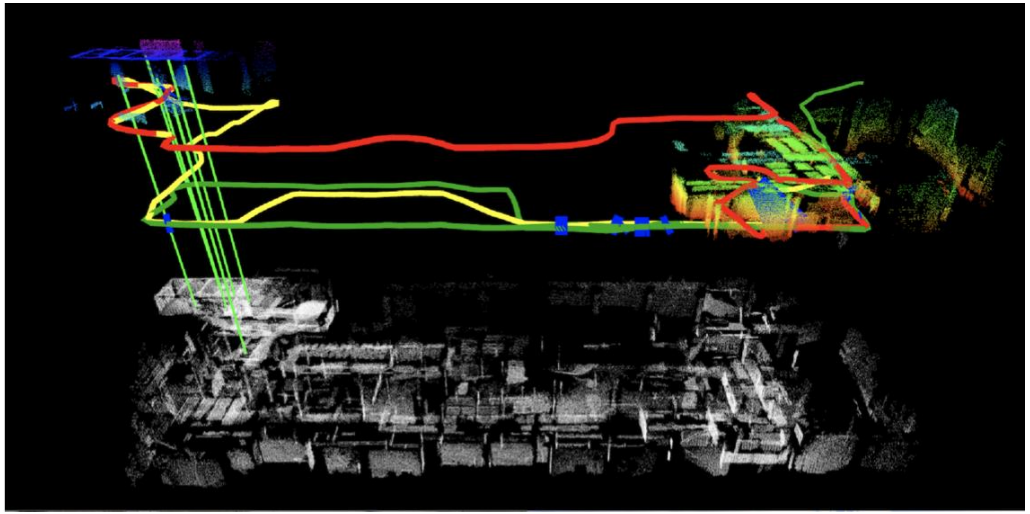
Hanme Kim, Stefan Leutenegger and Andrew J. Davison (ECCV 2016)

Timelens: Event-based Video Frame Interpolation



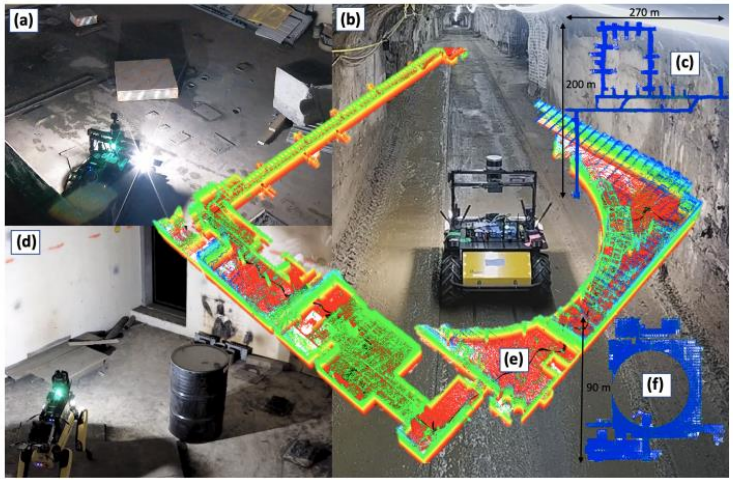
Stephan Tulyakov, Daniel Gehrig, Stamatios Georgoulis, Julius Erbach, Mathias Gehrig, Yuanyou Li, and Davide Scaramuzza (CVPR 2021)

An online multi-robot SLAM system for 3D LiDARs



Renaud Dubé, Abel Gawel, Hannes Sommer, Juan Nieto, Roland Siegwart, Cesar Cadena (IROS 2017)

LOCUS: A Multi-Sensor Lidar-Centric Solution for High-Precision Odometry and 3D Mapping in Real-Time

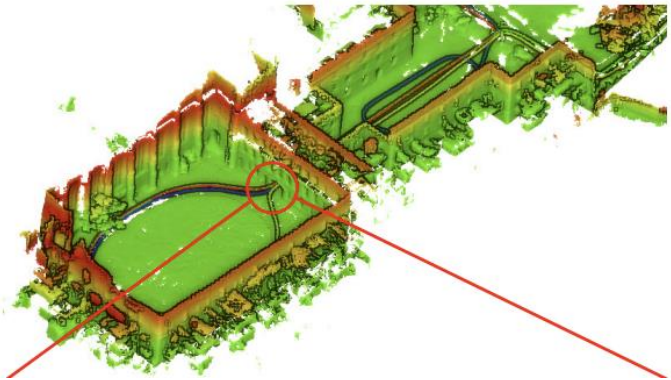


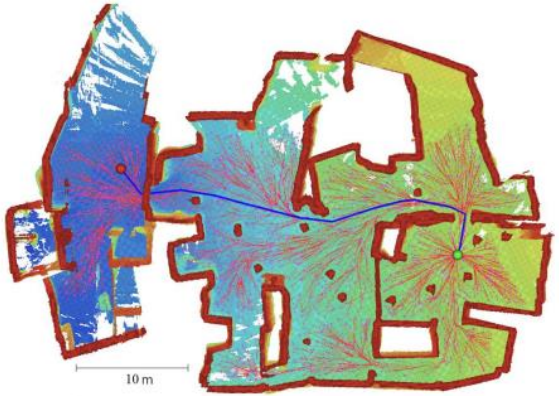
Matteo Palieri, Benjamin Morrell, Abhishek Thakur, Kamak Ebadi, Jeremy Nash, Arghya Chatterjee, Christoforos Kanellakis, Luca Carlone, Cataldo Guaragnella, Ali-akbar Agha-mohammadi (RA-L 2020)

Self-supervised Learning of LiDAR Odometry for Robotic Applications

Julian Nubert, Shehryar Khattak and Marco Hutter (IROS 2021)

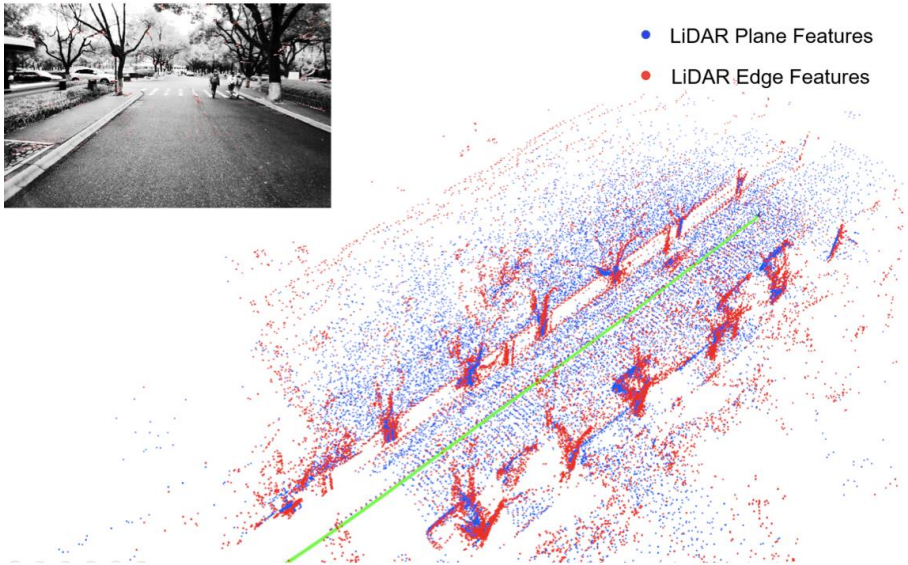
Elastic and Efficient LiDAR Reconstruction for Large-Scale Exploration Tasks





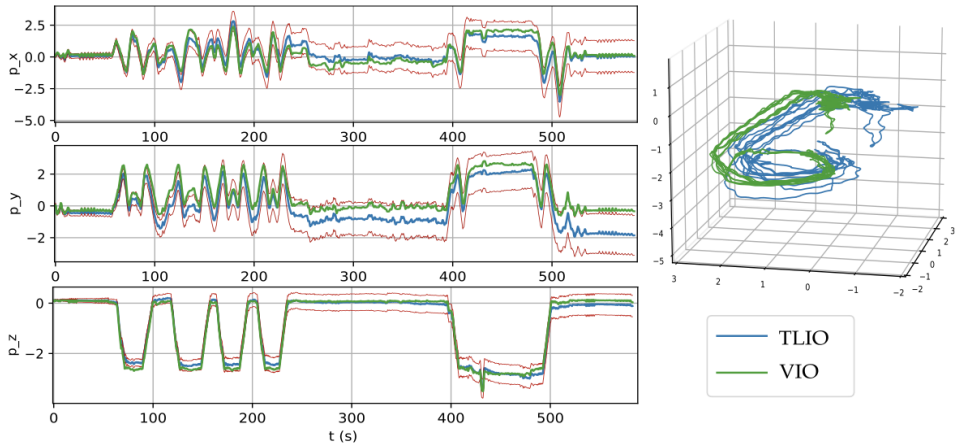
Yiduo Wang, Nils Funk, Milad Ramezani, Sotiris Papatheodorou, Marija Popovic, Marco Camurri, Stefan Leutenegger and Maurice Fallon (ICRA 2021)

LIC-Fusion: LiDAR-Inertial-Camera Odometry



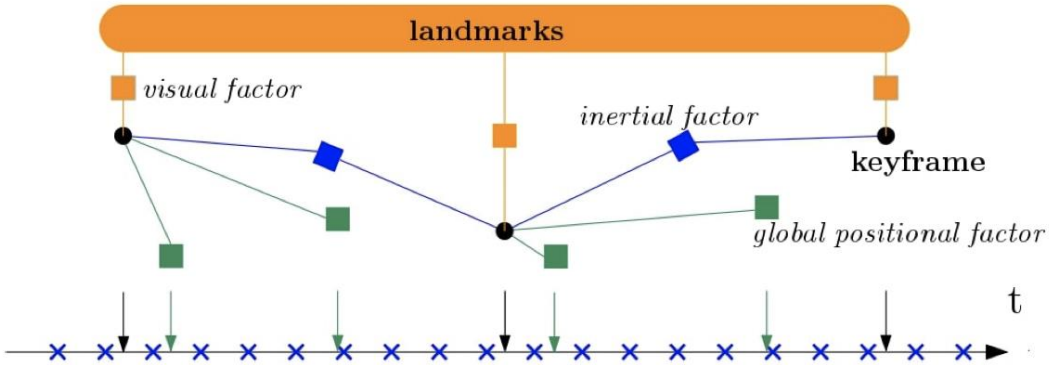
Xingxing Zuo, Patrick Geneva, Woosik Lee, Yong Liu, and Guoquan Huang (IROS 2019)

TLIO: Tight Learned Inertial Odometry



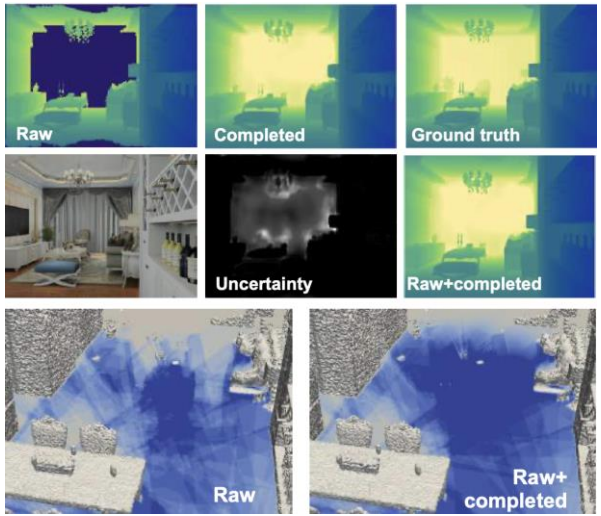
Wenxin Liu, David Caruso, Eddy Ilg, Jing Dong, Anastasios I. Mourikis, Kostas Daniilidis, Vijay Kumar, and Jakob Engel (IEEE RAL 2020)

Tightly-coupled Fusion of Global Positional Measurements in Optimization-based Visual-Inertial Odometry



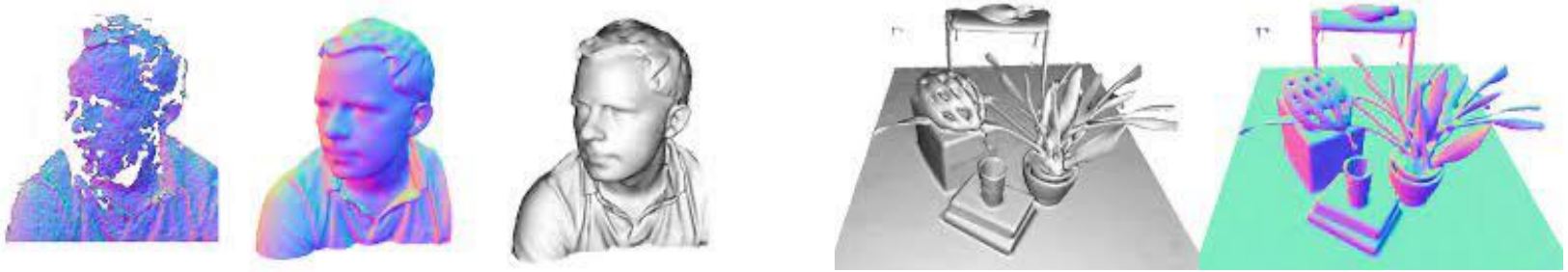
Giovanni Cioffi, Davide Scaramuzza (ICRA 2021)

Volumetric Occupancy Mapping With Probabilistic Depth Completion for Robotic Navigation



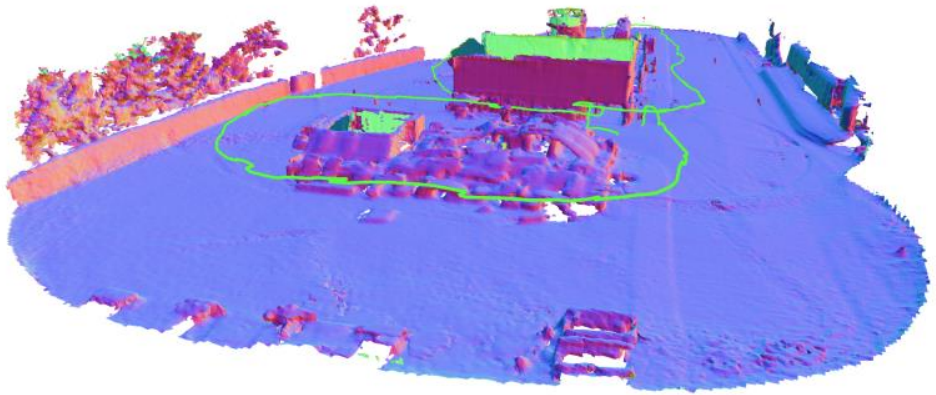
Marija Popović, Florian Thomas, Sotiris Papatheodorou, Nils Funk, Teresa Vidal-Calleja, Stefan Leutenegger (IEEE Automation Letters 2021)

KinectFusion



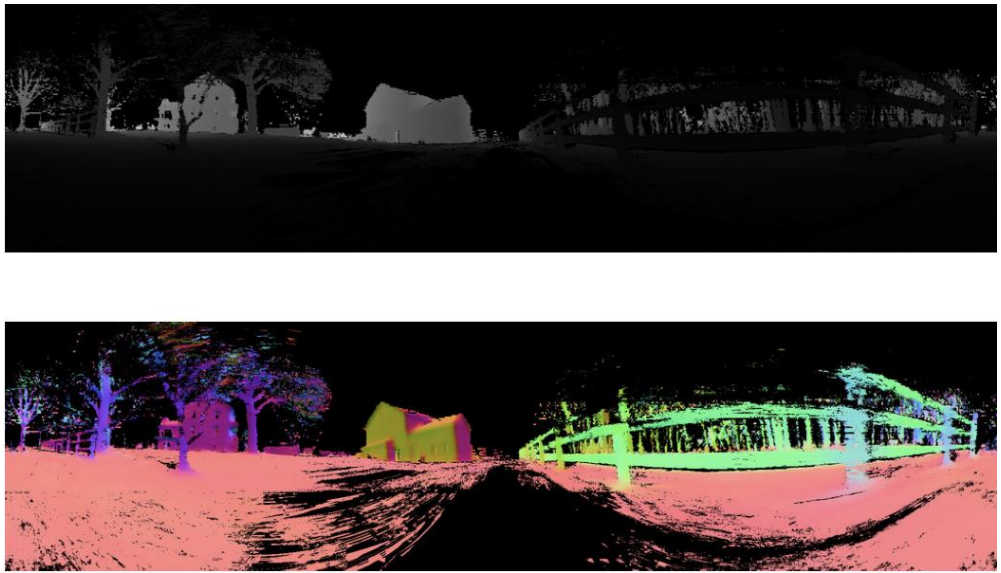
Richard A. Newcombe, Shahram Izadi, Otmar Hilliges, David Molyneaux, David Kim, Andrew J. Davison, Pushmeet Kohi, Jamie Shotton, Steve Hodges and Andrew Fitzgibbon (ISMAR 2011)

Voxgraph: Globally Consistent, Volumetric Mapping using Signed Distance Function Submaps



Victor Reijgwart, Alexander Millane, Helen Oleynikova, Roland Siegwart, Cesar Cadena, Juan Nieto (RA-L 2019)

UPSLAM: Union of Panoramas SLAM

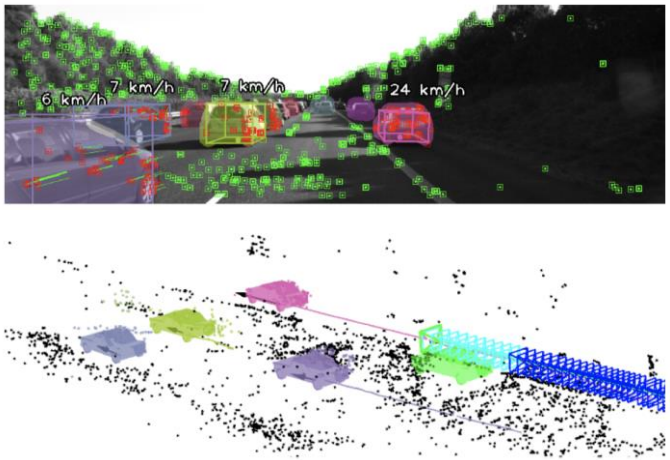


Anthony Cowley, Ian D. Miller and Camillo Jose Taylor (2021)

Redesigning SLAM for Arbitrary Multi-Camera Systems

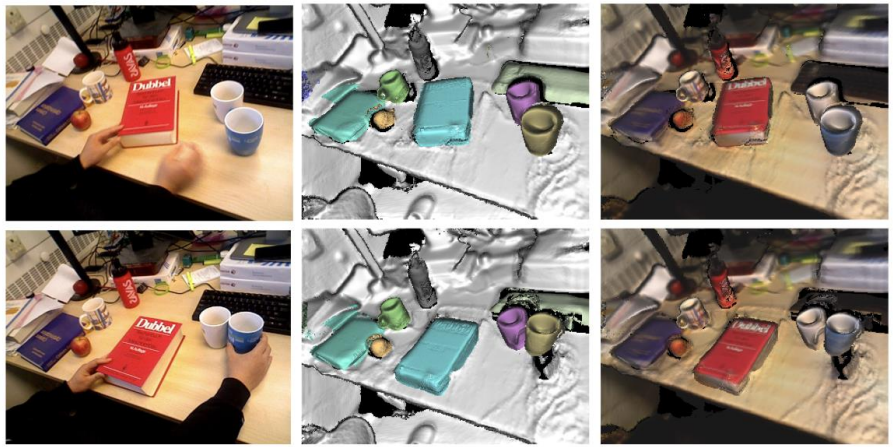
Juichung Kuo, Manasi Muglikar, Zichao Zhang, Davide Scaramuzza (ICRA 2021)

DynaSLAM II: Tightly-Coupled Multi-Object Tracking and SLAM



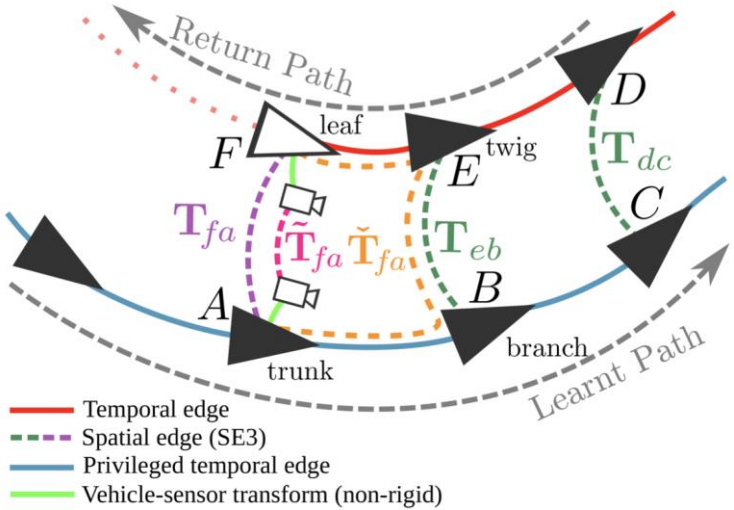
Berta Bescos, Carlos Campos, Juan D. Tardós and José Neira (RAL 2021)

MID-Fusion: Octree-based Object-Level Multi-Instance Dynamic SLAM



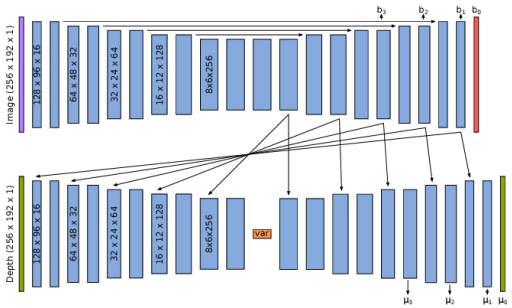
Binbin Xu, Wenbin Li, Dimos Tzoumanikas, Michael Bloesch, Andrew Davison, Stefan Leutenegger (ICRA 2019)

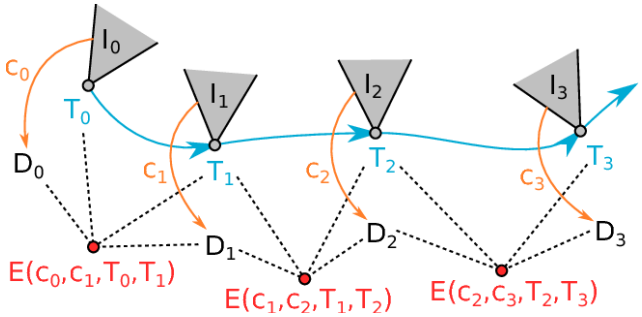
There's No Place Like Home: Visual Teach and Repeat for Emergency Return of Multirotor UAVs During GPS Failure



Michael Warren, Melissa Greeff, Bhavit Patel, Jack Collier, Angela P. Schoellig, Timothy D. Barfoot (IEEE Robotics and Automation Letters 2019)

CodeSLAM





Michael Bloesch, Jan Czarnowski, Ronald Clark, Stefan Leutenegger and Andrew J. Davison (CVPR 2018)

Where can I find the papers?

arxiv.org

IEEE Xplore

sign in with your TUM account

Questions?

- Web page: https://mlr.in.tum.de/teaching/s22/seminar_mmpmr
- Password: mmpmr_22
- Contact: mmpmr-ss22@vision.in.tum.de
- **Can I present another paper?** You can also suggest a paper that you are interested in! If you have a paper 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.