Frederike Dümbgen

Postdoctoral researcher

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Education

École Polytechnique Fédérale de Lausanne (EPFL) *Lausanne, Switzerland*

PhD in Computer and Communication Sciences (EDIC) *Sep 2016 – Nov 2021*

- Advisors: Prof. Martin Vetterli, Dr. Adam Scholefield, Laboratory of Audiovisual Communications (LCAV)
- Thesis title: *Blind as a Bat: Spatial Perception without Sight*
- Thesis nominated for EPFL Doctorate Award

École Polytechnique Fédérale de Lausanne (EPFL) *Lausanne, Switzerland*

M.Sc. in Mechanical Engineering *Sep 2014 – Nov 2016*

- Specialization in Control and Mechatronics
- Minor (20%) in Computational Science and Engineering

Eidgenössische Technische Hochschule Zürich (ETHZ) *Zürich, Switzerland*

Master's Thesis at Autonomous Systems Lab (Prof. Roland Siegwart) *Feb 2016 – Jun 2016*

- Advisors: Alireza Karimi (EPFL), Philipp Krüsi (ETHZ), Michael Blösch (ETHZ), Dominik Schindler (ETHZ)
- Thesis title: *Local Spline-Based Dense Stereo Reconstruction and Pose Estimation*

École Polytechnique Fédérale de Lausanne (EPFL) *Lausanne, Switzerland*

B.Sc. in Mechanical Engineering *Sep 2010 – Jun 2014*

- Exchange year: Heriot Watt University, Edinburgh, UK

Professional Experience

Apr 2022 – Present	**Postdoctoral Researcher**, Robotics Institute (RI), University of Toronto
Feb 2018 – Nov 2018	**Lab Associate**, Disney Research Los Angeles, California, United States
Sep 2011 – Sep 2021	**Teaching Assistant**, EPFL, Switzerland
Jun 2015 – Aug 2015	**Summer Research Assistant**, LCAV, EPFL, Switzerland
Apr 2014 – Sep 2014	**Product Management Intern**, Bystronic Laser AG, Berne, Switzerland
Sep 2013 – Mar 2014	**Technical Training Intern**, ABB High Voltage Products, Zürich, Switzerland

Publications

In Review

F. Dümbgen, C. Holmes, B. Agro, and T. D. Barfoot. "Toward Globally Optimal State Estimation Using Automatically Tightened Semidefinite Relaxations". In: *arXiv:2308.05783 [cs]* (2023). link

T. D. Barfoot, C. Holmes, and F. Dümbgen. "Certifiably Optimal Rotation and Pose Estimation Based on the Cayley Map". In: *arXiv:2308.12418 [cs]* (2023). link

C. Holmes, F. Dümbgen, and T. D. Barfoot. "On Semidefinite Relaxations for Matrix-Weighted State-Estimation Problems in Robotics". In: *arXiv:2308.07275 [cs, math]* (2023). link

Z. C. Guo, F. Dümbgen, J. R. Forbes, and T. D. Barfoot. "Data-Driven Batch Localization and SLAM Using Koopman Linearization". In: *arXiv:2309.04375 [cs]* (2023). link

Journal Papers

F. Dümbgen, C. Holmes, and T. D. Barfoot. "Safe and Smooth: Certified Continuous-Time Range-Only Localization". In: *IEEE Robotics and Automation Letters* 8.2 (2023), pp. 1117–1124. Presented at IROS 2023, link

F. Dümbgen, A. Hoffet, M. Kolundžija, A. Scholefield, and M. Vetterli. "Blind as Bat: Audible Echolocation on Small Robots". In: *IEEE Robotics and Automation Letters*. Vol. 8. 2022. Presented at IROS 2022, Kyoto. link

M. Pacholska*, F. Dümbgen*, and A. Scholefield. "Relax and Recover: Guaranteed Range-Only Continuous Localization". In: *IEEE Robotics and Automation Letters* 5.2 (2020), pp. 2248–2255. Presented at ICRA 2020, link

G. Baechler*, F. Dümbgen*, G. Elhami*, M. Kreković*, and M. Vetterli. "Coordinate Difference Matrices". In: *SIAM Journal on Matrix Analysis and Applications* (2020). link

Conference Papers

Y. Chen, B. Xu, F. Dümbgen, and T. D. Barfoot. "What to Learn: Features, Image Transformations, or Both?" In: *IEEE International Conference on Intelligent Robots and Systems*. 2023. link

F. Dümbgen, M. E. Helou, and A. Scholefield. "Realizability of Planar Point Embeddings from Angle Measurements". In: *IEEE International Conference on Acoustics, Speech and Signal Processing*. 2020. link

F. Dümbgen, C. Oeschger, M. Kolundžija, A. Scholefield, E. Girardin, J. Leuenberger, and S. Ayer. "Multi-Modal Probabilistic Indoor Localization on a Smartphone". In: *IEEE International Conference on Indoor Positioning and Indoor Navigation*. 2019, pp. 1–8. link

F. Dümbgen, C. Schroers, and K. Mitchell. "Light Field Synthesis Using Inexpensive Surveillance Camera Systems". In: *IEEE International Conference on Image Processing*. 2019, pp. 744–748. link

M. E. Helou, F. Dümbgen, and S. Süsstrunk. "AL2: Progressive Activation Loss for Learning General Representations in Classification Neural Networks". In: *IEEE International Conference on Acoustics, Speech and Signal Processing*. 2020. link

M. E. Helou, F. Dümbgen, and S. Süsstrunk. "AAM: An Assessment Metric of Axial Chromatic Aberration". In: *IEEE International Conference on Image Processing*. 2018, pp. 2486–2490. link

G. Baechler*, F. Dümbgen*, G. Elhami*, M. Kreković*, R. Scheibler, A. Scholefield, and M. Vetterli. "Combining Range and Direction for Improved Localization". In: *IEEE International Conference on Acoustics, Speech and Signal Processing*. 2018, pp. 3484–3488. link

F. Dümbgen*, M. E. Helou*, N. Gucevska, and S. Süsstrunk. "Near-Infrared Fusion for Photorealistic Image Dehazing". In: *IS&T EI Proceedings* (2018). link

Reports and Tutorials

F. Dümbgen*, M. A. Shalaby*, C. Holmes*, C. C. Cossette*, J. R. Forbes, J. L. Ny, and T. D. Barfoot. "STAR-loc: Dataset for STereo And Range-based Localization". In: *arXiv:2309.05518 [cs.RO]* (2023)

T. D. Barfoot, C. Holmes, and F. Dümbgen. "A Fine Line: Total Least-Squares Line Fitting as QCQP Optimization". In: *arXiv:2206.05082 [cs]* (2022). link

M. E. Helou, F. Dümbgen, R. Achanta, and S. Süsstrunk. *Fourier-Domain Optimization for Image Processing*. 2018. arXiv: 1809.04187 [cs]. link

Thesis

F. Dümbgen. "Blind as a Bat: Spatial Perception without Sight". PhD thesis. École Polytechnique Fédérale de Lausanne (EPFL), 2021. link

F. Dümbgen. "Local Spline-Based Dense Stereo Reconstruction and Pose Estimation". Master's Thesis. Eidgenössische Technische Hochschule Zürich (ETHZ), 2016

Awards, Fellowships, & Grants

2022	**Postdoc Mobility Grant**, Swiss National Science Foundation	*CHF 105,250*
2020	**Google Women Techmaker Scholarship**, Google	*EUR 7,000*
2018	**Distinguished Service Award EDIC**, EPFL	
2016	**EDIC Fellowship (given to <7% of applicants)**, EDIC, EPFL	
2016	**NCCR Robotics – Master Scholarship for Women**, Swiss National Science Foundation	*CHF 12,000*
2011	**Admission as Fellow**, Swiss Study Foundation	

Talks

November 2023 (scheduled). *Toward plug-and-play global optimality for robotics*. Presentations at M.I.T., Northeastern University and Tufts University.

August 2023. *Toward Globally Optimal Solvers for Robotics and Beyond*. Invited talk at *Signal Processing and Friends* conference, EPFL. Also presented at LASA (Prof. Aude Billard), EPFL. Description and slides available online.

March 2023. *Towards Globally Optimal State Estimation*. Invited talk at *Toronto AIR Seminar*, University of Toronto. Description and video available online

May 2021. *From Autonomous Lawn Mowers to Bat Drones: Dynamical Distance Geometry in the Wild*. Invited talk at *Minisymposium on Sensor Network Localization and Dynamical Distance Geometry*, Fields Institute, Toronto (online). Description and video available online.

January 2020. *Guaranteed Distance-based Trajectory Estimation*. Talk during lab visit of RPG (Prof. Davide Scaramuzza), University of Zürich. Slides available online.

June 2019. *Towards Multimodal Indoor Localization*. Invited talk at *DIMACS Workshop on Distance Geometry: Theory and Applications* at Rutger's University. Description and video available online.

Teaching Experience

Instructor

2022 — **Mathematics for Robotics (ROB310)**, Instructor of 3rd year Engineering Science class — *UofT*
- Probability and Statistics (Bayesian statistics, MAP estimation, Kalman filter)
- Numerical Methods (numerical integration and differentiation, conditioning)
- Optimization (root finding, convex and non-convex optimization)

Teaching Assistant

2020	**Signal Processing for Communications**, Teaching Assistant	*EPFL*
2019	**Mathematical Foundations of Signal Processing**, Teaching Assistant for FRI lab	*EPFL*
2016	**Physics I**, Teaching Assistant	*EPFL*
2016	**Digital Signal Processing**, Teaching Assistant for DSP lab	*EPFL*
2015	**Probability and Statistics**, Teaching Assistant	*EPFL*
2014	**Linear Algebra I**, Teaching Assistant	*EPFL*

Project Supervisor

2023	**Demo for Certifiably Optimal Drone Localization**, Summer research project	*UofT*
2021	**Droning drones: melodies on the fly**, Master's semester project	*EPFL*
2021	**Audio-based algorithms for the e-puck robot**, Master's semester project	*EPFL*
2020	**Simulation framework for audible echolocation**, Summer research project (remote)	*EPFL*
2020	**Learning acoustics-based localization of a blind drone**, Master's semester project/internship	*EPFL*
2019	**Learning-based approaches for indoor localization**, Master's semester projects/internships	*EPFL*
2019	**Modular mobile robot for localization experiments**, Master's semester project	*EPFL*
2019	**Bring voice user-interfaces to our offices**, Master's semester project	*EPFL*
2018	**Python package for localization with angular measurements**, Master's semester project	*EPFL*

Other Teaching Experience

2023	**Presentation on Python best practices**, Student-run tutorial series	*RI, UofT*
2017–2019	**Head of app development team, teaching volunteers**, voCHabular (non-for-profit)	*Zürich, CH*
2017	**Organizer of Python workshop for young professionals**, Powercoders (non-for-profit)	*Berne, CH*

Outreach & Professional Development

Service and Outreach

2023 **Session Chair at IEEE IROS conference**, Detroit, U.S.
2023 **Presentation at outreach event for high school students**, RI, UofT
2019 **Co-organizer of Eurotech summer school *Open Science in Practice***, EPFL
2019 **Presentation of LCAV for visiting Swiss-German high school students (2 events)**, EPFL
2018 **Co-organizer of EPFL & ETHZ summer school *Reproducibility in Computational Sciences***, Ticino, CH
2016-2018 **Elected PhD student representative for EDIC committee**, EPFL
2016-2017 **Organizer of lunch talks of EDIC PhD student association**, EPFL

Peer Review

IEEE Transactions on Robotics
IEEE Transactions on Mobile Computing
IEEE Robotics and Automation Letters
IEEE Signal Processing Letters
IEEE/RSJ International Conference on Intelligent Robots and Systems
Discrete Applied Mathematics (Elsevier)

Professional Memberships

IEEE Member
RAS Member

References

Prof. Tim Barfoot (head of ASRL, UofT, postdoc advisor): tim.barfoot@utoronto.ca

Prof. Martin Vetterli (head of LCAV, EPFL, PhD advisor): martin.vetterli@epfl.ch

Dr. Adam Scholefield (former postdoc of LCAV, EPFL, PhD co-advisor): adamscholefield@yahoo.co.uk