Wenda Zhao

Postdoctoral Fellow, University of Toronto Institute for Aerospace Studies (UTIAS)
Email: wenda.zhao@robotics.utias.utoronto.ca
Homepage: williamwenda.github.io
Google Scholar: scholar.google.com

Research Interests

I am a researcher in artificial intelligence and robotics dedicated to developing resilient autonomy for the most challenging environments on Earth and beyond. I hold a Ph.D. in Artificial Intelligence and Robotics from the University of Toronto Institute for Aerospace Studies (UTIAS), where I was advised by Professor Angela P. Schoellig, and I am currently a Postdoctoral Fellow with Professor Tim Barfoot, focusing on lidar-based continuous-time state estimation in geometry-degenerated environments. I am also affiliated with the University of Toronto Robotics Institute and the Vector Institute.

My research spans state estimation, reinforcement learning, and autonomous navigation, with a consistent emphasis on deploying systems in real-world, challenging conditions. My broader vision is to create fully autonomous systems that thrive where human access is limited: planetary exploration, underground mining, disaster response, and deep-ocean operations. By uniting advanced sensing, robust estimation, and AI reasoning, my research takes an interdisciplinary step toward resilient autonomy with broad scientific, industrial, and societal impact.

Education

- **University of Toronto** *2018 – 2024*
  Ph.D. in Aerospace Science and Engineering Toronto, ON
  - –Supervisor: Prof. Angela P. Schoellig
  - –Thesis: Robust and accurate localization for heterogeneous agents using ultra-wideband (UWB) radio technology
  - –Affiliations: Vector Institute, UofT Robotics Institute
- **Tongji University** *2015 – 2018*
  M.Eng. in Control Science and Engineering Shanghai, China
  - –Supervisor: Prof. Yongqing Su
  - –Research: Fault and defect inspection of power systems

Experience

- **Postdoctoral Fellow** *2025 – Present*
  University of Toronto, UTIAS Toronto, ON
  - –Working with Prof. Timothy D. Barfoot on lidar-based continuous-time state estimation in geometry-degenerated environments.
- **Researcher** *2024 – Present*
  UofT Autonomous Drone Racing (ADR) Team Toronto, ON
  - –Lead localization research for AI-enabled autonomous drone racing.
  - –Developed visual-inertial localization pipelines for high-speed, agile flight.
- **Researcher** *2020 – Present*
  Vector Institute & UofT Robotics Institute Toronto, ON
  - –Explored reinforcement learning and optimal control for robotic decision-making.
  - –Developed robust UWB-based localization systems with learning-based methods for non-Gaussian noise modeling.
- **Research Assistant** *2024*
  Technical University of Munich Munich, Germany
  - –Worked on AI-enabled autonomous drone racing with the Learning Systems and Robotics Lab.

Research Contributions

- **Journal Articles**
  - –**Wenda Zhao**†, Abhishek Goudar†, Mingliang Tang†, and Angela P. Schoellig, Ultra-wideband Time Difference of Arrival Indoor Localization: From Sensor Placement Analysis to System Evaluation – IEEE Robotics and Automation Magazine (RA-M), 2024. (Under review) [link]
  - –**Wenda Zhao**, Abhishek Goudar, Xinyuan Qiao, and Angela P. Schoellig, UTIL: An Ultra-wideband Time-difference-of-arrival Indoor Localization Dataset – International Journal of Robotics Research (IJRR), 2024. [link]
  - –**Wenda Zhao**, Abhishek Goudar, and Angela P. Schoellig, Finding the Right Place: Sensor Placement for UWB Time Difference of Arrival Localization in Cluttered Indoor Environments – IEEE Robotics and Automation Letters (RA-L), presented at ICRA 2023. [link]
  - –Abhishek Goudar, **Wenda Zhao**, and Angela P. Schoellig, Range-visual-inertial sensor fusion for micro aerial vehicle localization and navigation – IEEE Robotics and Automation Letters (RA-L), 2023. [link]
  - –Siqi Zhou, Karime Pereida, **Wenda Zhao**, and Angela P. Schoellig, Bridging the Model-Reality Gap with Lipschitz Network Adaptation – IEEE Robotics and Automation Letters (RA-L), presented at ICRA 2022. [link]
  - –Navid Kayhani, **Wenda Zhao**, Brenda McCabe, and Angela P. Schoellig, Tag-based Visual-inertial Localization of UAVs in Indoor Construction Environments using an On-manifold Extended Kalman Filter – Automation in Construction, 2022. [link]
  - –**Wenda Zhao**, Jacopo Panerati, and Angela P. Schoellig, Learning-based Bias Correction for Time Difference of Arrival Ultra-wideband Localization of Resource-constrained Mobile Robots – IEEE Robotics and Automation Letters (RA-L), presented at ICRA 2021. [link]
- **Conference Papers**
  - –**Wenda Zhao**, Abhishek Goudar, Mingliang Tang, Xinyuan Qiao, and Angela P. Schoellig, Uncertainty-aware Gaussian Mixture Model for UWB Time Difference of Arrival Localization in Cluttered Environments – IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2023. [link]
  - –Abhishek Goudar, **Wenda Zhao**, Timothy D. Barfoot, and Angela P. Schoellig, Gaussian Variational Inference with Covariance Constraints Applied to Range-only Localization – IROS, 2022. [link]
  - –**Wenda Zhao**, Marijan Vukosavljev, and Angela P. Schoellig, Optimal Geometry for Ultra-wideband Localization using Bayesian Optimization – IFAC World Congress, 2020. [link]
  - –Navid Kayhani, Adam Heins, **Wenda Zhao**, Mohammad Nahangi, Brenda McCabe, and Angela P. Schoellig, Improved tag-based indoor localization of UAVs using extended Kalman filter – ISARC, 2019. [link]
  - –**Wenda Zhao**, Yongqing Su, Jiguang Yue, Huihua Mu, and Xuejiao Liu, Fragility Analysis and Weak Point Identification of Power Systems – AOPC, 2017. [link]

Student Supervision

- **Xinyuan Sam Qiao** *2021 – 2022*

  Undergraduate Thesis, Engineering Science, University of Toronto

  –Supervised thesis on multi-quadrotor cooperative flight with UWB-aided relative state estimation and control. Guided platform building, algorithm design, and implementation.

Teaching Experience

- **Teaching Assistant** *2019 – 2023*

  University of Toronto Institute for Aerospace Studies

  –Graduate course: AER1217 Development of Autonomous Unmanned Aerial Systems.

  –Designed materials, delivered lectures, and supervised labs on quadrotor control, vision-based georeferencing, stereo VO, and path planning.

Technical Skills

Languages: English, Mandarin
Programming: Python, C/C++, MATLAB
Frameworks: ROS, Docker, PyTorch
Software: Altium Designer, FreeCAD
Research Areas: State Estimation, Localization, Perception, Reinforcement Learning, Autonomy

References

- **Prof. Angela P. Schoellig** | https://www.dynsyslab.org/prof-angela-schoellig/

  Alexander von Humboldt Professor, Technical University of Munich
  Faculty Member, Vector Institute; University of Toronto Robotics Institute
  Board of Directors, Munich Institute of Robotics and Machine Intelligence

- **Prof. Timothy D. Barfoot** | http://asrl.utias.utoronto.ca/ tdb/

  Professor, University of Toronto Institute for Aerospace Studies
  Associate Director, University of Toronto Robotics Institute
  Canada Research Chair (Tier II), Canada Research Chairs Program

- **Prof. Steven L. Waslander** | https://www.trailab.utias.utoronto.ca/stevenwaslander

  Professor, University of Toronto Institute for Aerospace Studies
  Affiliated Professor, Vector Institute; University of Toronto Robotics Institute