Matías Mattamala

Postdoctoral Researcher

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Research interests

Robotic Systems — Navigation — Field Robotics — Perception — Computer Vision — State Estimation — Inference Optimization — Machine Learning

Education

University of Oxford

- DPhil in Engineering Science — Nov 2023
  Thesis: *Vision-based Legged Robot Navigation: Localisation, Local Planning, Learning*
  Supervisor: Prof. Maurice Fallon

Universidad de Chile

- M.Sc in Electrical Engineering — Aug 2018
  Thesis: *Visual Localization for Resource-constrained Robots*
  Supervisor: Prof. Javier Ruiz-del-Solar
- Ingeniería Civil Eléctrica — Aug 2018
- B.Sc in Electrical Engineering — Mar 2014

Research Experience

Oxford Robotics Institute, Oxford, UK — Sep 2023 - to date
Postdoctoral Researcher

- Topic: Robot navigation in natural environments.
- Supporting research on navigation, mapping, and monitoring using vision, geometry, and language.

Oxford Robotics Institute, Oxford, UK — Oct 2019 - Nov 2023
Doctoral Researcher

- Topic: Vision-based legged robot navigation in industrial, underground, and natural environments.
- Contributed to research projects on SLAM, robust estimation, and reconstruction.

Robotic Systems Lab, ETH Zürich, Zürich, Switzerland — Apr 2022 - Sep 2022
Visiting Researcher

- Topic: Learned visual traversability estimation for natural environments.
- Supervisor: Prof. Marco Hutter.
- Co-supervision of semester and master's thesis projects.

Universidad de Chile, Santiago, Chile — Mar 2012 - Aug 2018
Undergraduate and M.Sc. researcher

- Topic (undergraduate): perception lead of the UChile Robotics RoboCup Soccer team, attending competitions in Mexico (2012), The Netherlands (2013), Brazil (2014), and China (2015).
- Topic (M.Sc.): Visual-proprioceptive SLAM for humanoid robots.

Teaching Experience

University of Oxford, Oxford, UK — Mar 2021
Teaching Assistant

- Lead TA of the AIMS CDT course on autonomous exploration. I co-designed a new virtual challenge (due to Covid restrictions) to introduce advanced robotics methods and C++ programming.

Universidad de Chile, Santiago, Chile Mar 2017 - Sep 2019
Instructor
- Designed and taught courses on mobile robotics (based on the Duckietown project), tech project development, battlebots, and data science for astronomy. Over 300 students taught.

Mustakis Foundation, Santiago, Chile Apr 2014 - Jun 2018
Mentor
- Introductory robotics and programming courses for high school students using LEGO Mindstorms and Arduino. Over 200 high-school students taught.

Universidad de Chile, Santiago, Chile Mar 2012 - Dec 2016
Teaching Assistant
- TA for mobile robotics, image processing, computational methods for science and engineering, introduction to engineering, and electromagnetism. Over 200 students taught.

Other Positions

Beauchef Proyecta, Universidad de Chile, Santiago, Chile Jun 2018 - Aug 2019
Project Engineer
- Coordinator of the 'Beauchef Proyecta' unit to foster multidisciplinary activities across engineering degrees. Managed funds associated to the project (∼£90,000)

Knight Robotics, Santiago, Chile Jan 2015 - Mar 2018
Part-time Developer
- Assembly of educational robot kits, graphic design tasks, training for school teachers.

ALMA Observatory, San Pedro de Atacama, Chile Jan 2013 - Mar 2013
Engineering Intern
- Implemented a Python-based graphical user interface for monitoring the radiotelescope's antennas.

Awards and Grants

- PhD Exchange Fellowship (2022). *NCCR Robotics, Swiss National Science Foundation (SNSF)*. 9,000 CHF to partially support research exchange at ETH Zurich.
- ANID Becas Chile Scholarship (2019-2023). *Government of Chile*. For PhD studies at the University of Oxford.
- Graduate Students Projects Grant (2016). *Universidad de Chile*. £2,500 to implement Duckietown-based course.

Pre-prints

- **Mattamala, M.***, Frey, J., Libera, P., Chebrolu, N., Martius, G., Hutter, M., Fallon, M. (2024). Wild Visual Navigation: Fast Traversability Learning via Pre-Trained Models and Online Self-Supervision. *(Under review)*.
- Wang, J., **Mattamala, M.**, Kassab, K., Zhang, L., Fallon, M. (2024). Exosense: A Vision-Centric Scene Understanding System For Safe Exoskeleton Navigation. *(Under review)*.
- Oh, H., Chebrolu, N., **Mattamala, M.**, Freißmuth, L., Fallon, M. (2024). Evaluation and Deployment of LiDAR-based Place Recognition in Dense Forests. *(Under review)*.
- Freißmuth, L., **Mattamala, M.**, Chebrolu, N., Schaefer, S., Leutenegger, S., Fallon, M. (2024). Online Tree Reconstruction and Forest Inventory on a Mobile Robotic System. *(Under review)*.
- Casseau, B., Chebrolu, N., **Mattamala, M.**, Freißmuth, L., Fallon, M. (2024). Markerless Aerial-Terrestrial Co-Registration of Forest Point Clouds using a Deformable Pose Graph. *(Under review)*.
- Schönegg, T., Tuna, T., Yang, F., Waibel, G., **Mattamala, M.**, Hutter, M. (2024). Global Path Planning for Autonomous Vehicles in Orchards and Vineyards. *(Under review)*.

Publications

- Kassab, C., **Mattamala, M.**, Zhang, L., Fallon, M. (2024). Language-EXtended Indoor SLAM (LEXIS): A Versatile System for Real-time Visual Scene Understanding. *IEEE International Conference on Robotics and Automation*.
- Tao, Y., Balgat, Y., Fu, L.F.T, **Mattamala, M.**, Chebrolu, N., Fallon, M. (2024). SiLVR: Scalable Lidar-Visual Reconstruction with Neural Radiance Fields for Robotic Inspection. *IEEE International Conference on Robotics and Automation*.
- Malladi, M., Guadagnino, T., Lobefaro, L., **Mattamala, M.**, Griess, H., Schweier, J., Chebrolu, N., Fallon, M., Behley, J., Stachniss, C. (2024). Tree Instance Segmentation and Traits Estimation for Forestry Environments Exploiting LiDAR Data Collected by Mobile Robots. *IEEE International Conference on Robotics and Automation*.
- Jin, J., Zhang, C., Frey, J., Rudin, N., **Mattamala, M.**, Cadena, C., Hutter, M. (2024). Resilient Legged Local Navigation: Learning to Traverse with Compromised Perception End-to-End. *IEEE International Conference on Robotics and Automation*.
- Erni, G., Frey, J., Miki, T., **Mattamala, M.**, Hutter, M. (2023). MEM: Multi-Modal Elevation Mapping for Robotics and Learning. *IEEE/RSJ International Conference on Intelligent Robots and Systems)*.
- Frey, J.*, **Mattamala, M.***, Chebrolu, N., Cadena, C., Fallon, M., Hutter, M. (2023). Fast Traversability Estimation for Wild Visual Navigation. *Robotics: Science and Systems*. (* Equal contribution)
- Tranzatto, M., Dharmadhikari, M., Bernreiter, *et al.*, including **Mattamala, M.** (2023). Team CERBERUS Wins the DARPA Subterranean Challenge: Technical Overview and Lessons Learned. *Field Robotics*.
- Wang, Y., Ramezani, M., **Mattamala, M.**, Digumarti, T., Fallon, M. (2022). Strategies for Large Scale Elastic and Semantic LiDAR Reconstruction. *Robotics and Autonomous Systems*.
- Ramezani, M., **Mattamala, M.**, Fallon, M. (2022). AEROS: Adaptive RObust least-Squares for Graph-Based SLAM. *Frontiers in Robotics and AI*.
- **Mattamala, M.**, Chebrolu, N., Fallon, M. (2022). An Efficient Locally Reactive Controller for Safe Navigation in Visual Teach and Repeat Missions. *IEEE Robotics and Automation Letters*.
- Wang, Y., Ramezani, M., **Mattamala, M.**, Fallon, M. (2021). Scalable and Elastic LiDAR Reconstruction in Complex Environments Through Spatial Analysis. *European Conference on Mobile Robots*.
- **Mattamala, M.**, Ramezani, Camurri, M., Fallon, M. (2021). Learning Camera Performance Models for Active Multi-Camera Visual Teach and Repeat. *IEEE International Conference on Robotics and Automation*.
- Ramezani, M., Wang, Y., Camurri, M., Wisth, D., **Mattamala, M.**, Fallon, M. (2020). The Newer College Dataset: Handheld LiDAR, Inertial and Vision with Ground Truth. *IEEE/RSJ International Conference on Intelligent Robots and Systems*.
- Gómez, C.*, **Mattamala, M.***, Resink, T.*, Ruiz-del-Solar, J. (2018). Visual SLAM-based Localization and Navigation for Service Robots: The Pepper Case. *RoboCup Symposium 2018*. (* Equal contribution)
- **Mattamala, M.**, Olave, G., González, C., Hasbún, N., Ruiz-del-Solar, J. (2017). The NAO Backpack: An Open-hardware Add-on for Fast Software Development with the NAO Robot. *RoboCup Symposium 2017*.
- **Mattamala, M.**, Villegas, C., Yáñez, J.M, Cano, P., Ruiz-Del-Solar, J., A Dynamic and Efficient Active Vision System for Humanoid Soccer Robots. *RoboCup Symposium 2015*.

Other Publications (in Spanish)

- **Mattamala, M.** (2019) Inteligencia Artificial: Qué es y qué no es. In Brossi, L. *et al.* (eds), *Inteligencia Artificial y Bienestar de las Juventudes en América Latina*. Conectados al Sur.
- **Mattamala, M.**, Alfaro, M.J., Casado, F., Mesías, C., Holmberg, G., Higuera, F., Sanchirico, F., Palma, J., Insunza, R., Aguirre, L. (2019) Hackers, bandas y squads: Implementación de cursos flexibles para el desarrollo transversal de proyectos en la FCFM. *XXXII Congreso de la Sociedad Chilena de Educación en Ingeniería (SOCHEDI)*.
- **Mattamala, M.**, Lasen, M., Chi, R., Caba, A., Patiño, M., Larrondo, J., Meruane, V. (2018) Beauchef Proyecta: Implementación Curricular de Proyectos Multidisciplinarios. *XXXI Congreso de la Sociedad Chilena de Educación en Ingeniería (SOCHEDI)*.

- **Mattamala, M.**, Olave, G., Campusano, M., Gómez, C., Martínez, L., Estefó, P., Ugalde, J., Urrutia, J., San-Martín, F., Zúñiga, P., Carrasco, J, Villar, C., González, R. (2017). Aprendizaje Interdisciplinario en Robótica: La Experiencia Innovadora de Duckietown Chile. *XXX Congreso de la Sociedad Chilena de Educación en Ingeniería (SOCHEDI)*.

Invited Talks

- *Visual Navigation for Legged Robots in Challenging Environments*
  - (2023, in Spanish) *Qué hacemos en robótica?*, Universidad de Chile, Chile.
  - (2023, in Spanish) *Técnicas modernas de control y aprendizaje de máquina para robótica y locomoción*, Universidad Nacional de Colombia, Colombia.
  - (2022) *AIMS-WASP Event*, University of Oxford, UK.
- *On physical, algebraic, geometric, and probabilistic descriptions in robotics* (2021). *RPL Robotics Seminar*, University College London, UK.
- *Visual Navigation for Quadrupedal Robots* (2020, in Spanish). *Charlas en AI, Robótica, Tecnología y Aplicaciones*, Universidad de O'Higgins, Chile.
- *Visual Navigation for Mobile Robots* (2020, in Spanish). *IEEE UPAO Webinar*, Universidad Privada Antenor Orrego, Perú.
- *Robot Soccer* (2016, in Spanish). *V Congress of the Future*, National Congress of Chile, Chile.

Supervision

ETH Zurich, Zurich, Switzerland
- Piotr Libera, semester project (2023). Topic: Semantic Understanding of Outdoor Environments for Navigation.
- Giacomo Manzoni, semester project (2022). Topic: Motion-primitives Planning for Legged Robots.
- Pascal Lieberherr, M.Sc thesis (2022). Topic: Local Path Planning in Orchards and Vineyards.
- Timo Schönegg, M.Sc thesis (2022). Topic: Global Planning in Orchards and Vineyards.

Universidad de Chile, Santiago, Chile
- Andrés Astudillo, B.Sc thesis (2020). Topic: Design and Construction of a Multi-purpose SCARA robot.
- Matías Zamora, B.Sc thesis (2019). Topic: IoT-enabled Vermicompost System.

Professional Activities

Paper reviewing
- Autonomous Robots (AuRo)
- IEEE Robotics and Automation Letters (RA-L)
- IEEE Transaction on Robotics (T-RO)
- IEEE International Conference on Robotics and Automation (ICRA)
- IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
- IEEE International Conference on Robotics and Biomimetics (ROBIO)
- International Conference on Advanced Robotics (ICAR)
- Journal of Intelligent and Robotic Systems (JINT)
- Robotics: Science and Systems (RSS)
- Scientific Reports

Technical Memberships
- British Machine Vision Association (BMVA)
- Computer Vision Foundation (CVF)
- Institute of Electrical and Electronics Engineers (IEEE)

Advising
- Library of the Congress of Chile (2018-2021). Topic: Impact and State-of-development of Robotics in Chile.

- Universidad de Chile (2018-2019). Topic: Innovation in Engineering Courses.

Volunteering

- IEEE/RSJ International Conference on Intelligent Robots and Systems, Madrid, Spain (2018)
- International Symposium on Robotics Research 2017, Puerto Varas, Chile (2017)
- Singularity Summit Chile 2016, Santiago, Chile (2016)
- V Congress of the Future, National Congress of Chile, Santiago, Chile (2016)
- International Conference on Computer Vision, Santiago, Chile (2015)

Skills

- **Languages:** Spanish (Native), English (Advanced).
- **Programming:** C++, Python, Arduino, ROS.
- **Development:** Git, Docker.
- **Publishing and design:** LaTeX, Inkscape, GIMP, Kdenlive, Adobe Illustrator, Adobe Premiere.
- **Other software and technical skills:** Fusion 360, 3D printing.