Liang Lu

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Research Topic

Robot motion planning, scene understanding, navigation and exploration

Work Experience

Apr 2023 - Present

The University of Hong Kong, Hong Kong SAR, China **Postdoc**

- Design algorithms for semantics-aware navigation and mapping using mobile robots and manipulators

Dec 2021 - Mar 2023

Istituto Italiano di Tecnologia, HHCM, Genova, Italy **Postdoc**

- Design perception algorithm for a wheel-legged robotic system to work in a dynamic environment

Education

Sep 2017 - Sep 2021

Universidad Politécnica de Madrid , Madrid, Spain **Automation and Robotics (Doctorate)**

- **PhD thesis:** UAV motion planning and exploration using onboard sensors
- **Supervisor:** Prof. Pascual Campoy
- **Cum Laude mention** for the PhD thesis and defence

Sep 2014 - May 2017

Hefei University of Technology, China **Mechatronic Engineering (Master)**

- **Master thesis:** research on path planning technology of 3D space mobile robot
- **Supervisor:** Prof. Ping Zhao
- 3rd class graduate scholarship (2016 - 2017)
- 2nd class graduate scholarship (2014 - 2016)

Sep 2010 - Jun 2014

Northeast Forestry University, China **Forestry Engineering (Intelligent Equipment Engineering) (Bachelor)**

Project experience

Apr 2023 - Present

Collaborative Solution for Garment HI-Cobot Navigation in Garment Manufacturing Plants **Researcher**

The project is supported by the "InnoHK" initiative of the Innovation and Technology Commission (ITC) of the Hong Kong SAR Government

- Mainly responsible for the algorithm development of the navigation and perception part of the mobile robot

Dec 2021 - Mar 2023

Configurable Collaborative Robot Technologies **Researcher**

Funded by the European Union's Horizon 2020 program (grant agreement No. 101016007)
Main responsibilities:

- Research and development of visual perception and motion planning algorithms for wheeled humanoid robots
- Presentation of the research results on perception and autonomous search at the 2022 International Conference on Humanoid Robots in Japan
- Design of a set of object perception and grasping strategies for wheeled humanoid robots to grasp and re-move objects

Dec 2021 - Mar 2023

RELAX: Robot Enable for Load Assistive Relaxation **Researcher**

Funded by the Italian Ministry of Economic Development (https://relax.comiteg.it/relax)
Main responsibilities:

- Environmental perception and occupancy map construction based on RGBD camera
- Hybrid search algorithm based on boundary point and best next step algorithm

Jan 2019 - Feb 2021

COMCISE: Coordinated Inspection and Security missions by UAVs in cooperation with UGV **Researcher**

Funded by the Spanish Ministry of Science, Innovation and Universities RTI2018-100847-B-C21, MCIU/AEI/FEDER, UE (2019-2021, Finished, 130680 euros)

Main responsibilities:

- Design cost-effective trajectory planning guided by a sampling-based best-next-step algorithm for autonomous UAV flight in cluttered environments
- Design trajectory planning algorithms for fast grasping of UAVs

Sep 2017 - Dec 2017

Visual Autonomy for UAV in Dynamic environments **Researcher**

Funded by the Spanish Ministry of Economy and Competitive DPI2014-60139-R (2015-2017, Finished, 183920 euros)

Main responsibilities:

- Construct unsigned distance field based on depth sensor and develop collision detection algorithm based on this distance field
- Design path planning algorithm and combine it with collision detection for reactive obstacle avoidance of drone

Academic Service

Competition Committee, 2019 International Micro Air Vehicle Competition and Conference (IMAV), 2019
Bachelor and Master Thesis Technical Supervisor, Universidad Politécnica de Madrid, 2020-2021
Reviewer, TRO, RAL, JFR, TIV, RSS, IROS, ICRA et al.
Associate Editor, ROBIO 2023.
IEEE member, IEEE Robotics and Automation Society member.

Honors & Awards

- **Third Place**, the grand challenge in the 2020 Mohamed Bin Zayed International Robotics Challenge, 2020
- **Third Place,** 2021 OPENCV AI Competition (Region Europe, Russia + Australasia), 2021
- **Editor Choice Article award**, Sensors(Basel), 2022
- **Winner Award**, Chinese Ministry of Education "Chunhui Cup" Chinese Overseas Students Innovation and Entrepreneurship Competition, 2022
- **Second Place**, ICRA 2024, 3rd Workshop on Future of Construction, Nothing Stands Still Challenge, 2024

Publication

Journal

Under Revision

- **Lu, L.**, Zhou, P., Du, Y., Zhang, Y., Qi, J., Li, C., Zheng, P., Pan, J. A Hierarchical Planning Scheme for Autonomous Object Exploration.

First or Corresponding Author

- Chen, C, **Lu, L.***, Yang, L., Zhang, Y., Chen, Y., Jia, R., & Pan, J. (2025). Signage-Aware Exploration in Open World using Venue Maps. ***IEEE Robotics and Automation Letters.***
- **Lu, L.**, Zhang, Y., Zhou, P., Qi, J., Pan, Y., Fu, C., & Pan, J. (2024). Semantics-Aware Receding Horizon Planner for Object-Centric Active Mapping. ***IEEE Robotics and Automation Letters***.
- **Lu, L.**, Fasano, G., Carrio, A., Lei, M., Bavle, H. & Campoy, P. (2023) A comprehensive survey onnon-cooperative collision avoidance for micro aerial vehicles: Sensing and obstacle detection. ***Journal of Field Robotics***, 40,1697–1720.
- **Lu, L**., Carrio, A., Sampedro, C., & Campoy, P. (2021). A Robust and Fast Collision-Avoidance Approach for Micro Aerial Vehicles Using a Depth Camera. ***Remote Sensing***, 13, 9, 1796.
- Novo, Á. Martínez , **Lu, L*** & Campoy, P. (2021). Fast RRT* 3D-Sliced Planner for Autonomous Exploration using MAVs. ***Unmanned Systems***.
- **Lu, L.**, Redondo, C., & Campoy, P. (2020). Optimal Frontier-Based Autonomous Exploration in Unconstructed Environment Using RGBD Sensor. ***Sensors***, 20 (22), 6507.
- **Lu, L**., Yunda, A., Carrio, A., & Campoy, P. (2020). Robust Autonomous Flight in Cluttered Environment using a Depth Sensor. ***International Journal of Micro Air Vehicles***. January 2020.

Other Author

- Zhang, Y., **Lu, L.**, Luo, X., Pan, J. (2024). Global BIM-Point Cloud Registration and Association for Construction Progress Monitoring. ***Automation in Construction.***
- Wang, Y., Yang, L., Zhou, P., Qi, J., **Lu, L.**, Zhu, J., Pan, J. (2024). Efficient Planar Fabric Repositioning: Deformation-Aware RRT* for Non-prehensile Fabric Manipulation. ***IEEE Robotics and Automation Letters.***
- Zhou, P., Zhen, P., Qi, J., Li, C., Li, H., Duan, A., **Lu, L.,** ... & Navarro-Alarcon, D. (2024). Reactive human–robot collaborative manipulation of deformable linear objects using a new topological latent control model. ***Robotics and Computer Integrated Manufacturing***.

- Rodriguez-Ramos, A., Alvarez-Fernandez, A., Bavle, H., RodriguezVazquez, J., **Lu, L**., Fernandez-Cortizas, M., Fernandez, R. A. S., Rodelgo, A., Santos, C., Molina, M., Merino, L., Caballero, F., & Campoy, P. (2022). Autonomous Aerial Robot for High-Speed Search and Intercept Applications. ***Field Robotics (IEEE Trans on Field Robotics)***, 2, 1320-1350.

Conference

First Author

- **Lu, L.**, Zuo, H., Liu, W., Fu, C. Autonomous Object Exploration with Semantics-Aware Routes-Enhanced Next-Best-View Planning, ***In 2024 IEEE International Conference on Advanced Robotics and Mechatronics (ICARM).***
- **Lu, L.**, De Luca, A., Muratore, L., & Tsagarakis, N. G. An Optimal Frontier Enhanced "Next Best View" Planner For Autonomous Exploration, In ***2022 IEEE-RAS 21st International Conference on Humanoid Robots (Humanoids)***, Ginowan, Japan, 2022, pp. 397-404.
- **Lu, L**., Rodriguez-Vazquez, J., Carrio, A.,& Campoy, P. (2019, October). Autonomous Navigation in Dynamic Environments using Monocular Vision. in ***2019 International Micro Air Vehicle Conference and Flight Competition (IMAV)***, Madrid, Spain,(pp. 132-137).
- **Lu, L**., Sampedro, C., Rodriguez-Vazquez, J., & Campoy, P. (2019, June). Laser-based Collision Avoidance and Reactive Navigation using RRT* and Signed Distance Field for Multirotor UAVs. In ***2019 International Conference on Unmanned Aircraft Systems (ICUAS)***, Atlanta, GA, USA, (pp. 1209-1217). IEEE.

Other Author

- Zuo, H., Fu, C., **Lu, L.,** Duan, R., Zhang, Y. EdgeSnake: A Lightweight Intelligent Modular Snake Robot. ***In 2024 IEEE International Conference on Advanced Robotics and Mechatronics (ICARM).***
- Lei, M.**, Lu, L.**, Laurenzi, A., Rossini, L., Romiti, E., Malzahn, J., & Tsagarakis, N. G. An MPC-Based Framework for Dynamic Trajectory Re-Planning in Uncertain Environments, In ***2022 IEEE-RAS 21st International Conference on Humanoid Robots (Humanoids)***, Ginowan, Japan, 2022, pp. 594-601.
- Suarez Fernandez, R., Rodríguez Ramos, A., Alvarez, A., Rodríguez-Vázquez, J., Bavle, H., **Lu, L.**, ... & Campoy, P. (2020, February). The SkyEye team participation in the 2020 Mohamed Bin Zayed International Robotics Challenge. In ***2020 Mohamed Bin Zayed International Robotics Competition (MBZIRC) Symposium***.

Book Chapter

- **Lu, L.** , Zong, C., Lei, X., Chen, B. & Zhao, P.(2016). Fixed-Wing UAV Path Planning In a Dynamic Environment Via Dynamic RRT Algorithm. ***Mechanism and Machine Science***, pp. 271-282.

Reference

1. Pascual Campoy (Ph.D. Supervisor), Full Professor, Universidad Politécnica de Madrid, pascual.campoy@upm.es
2. Ping Zhao (Master Supervisor), Full Professor, Hefei University of Technology, ping.zhao@hfut.edu.cn
3. Jia Pan (Postdoc Supervisor), Associate Professor, The University of Hong Kong, jpan@cs.hku.hk