Zhen Li

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Phone: (+39) 3495322990   **LinkedIn**: www.linkedin.com/in/zhen-li-robotics

Research interests

Medical robotics, artificial intelligence, path planning, continuum robots, augmented reality

Education

Politecnico di Milano (POLIMI)   Milan, Italy
Ph.D. in Bioengineering   NOV 2019 – Present
Mentors: Prof. Elena De Momi

Delft University of Technology (TUD)   Delft, Netherlands
Ph.D. in BioMechanical Engineering   NOV 2019 – Present
Mentors: Prof. Jenny Dankelman

Ecole Centrale de Nantes (ECN)   Nantes, France
M.Sc. in Advanced Robotics   SEP 2017 – AUG 2019
Mentors: Prof. Stéphane Caro and Prof. Chriette Abdelhamid and Dr. Julian Erskine   *GPA: 3.75/4*

Warsaw University of Technology (WUT)   Warsaw, Poland
M.Sc. in Automatic Control and Robotics   SEP 2017 – AUG 2019
Mentors: Prof. Krzysztof Miaonowski   *GPA: Excellent 4.74/5*

Nankai University (NKU) (Top 10 in China)   Tianjin, China
B.Eng in Intelligent Science and Technology   SEP 2013 – JUL 2017
Mentors: Prof. Jingtai Liu   *GPA: 90.5/100 Ranking: 2/37*

Awards and scholarships

MSCA double Ph.D. Scholarship (ATLAS project)	2019 – 2022
Best poster award issued by SMIT 2021/22	2021
IDEA League Research Grant (POLIMI)	2020 – 2021
Third place winner of the 39th GNB Datathon	2020
Best project prize issued by Hamlyn Winter School	2019
EMARO+ full Scholarship (ECN, 1.4% awarded)	2017 – 2019
National Inspirational Scholarship (NKU, 2.5% awarded)	2016
National Second Prize of CUMCM	2015
First Level Comprehensive Scholarship (NKU, 5% awarded)	2015
Second Level Comprehensive Scholarship (NKU, 5% awarded)	2014

Publications

Robust Path Planning via Learning from Demonstrations for Robotic Catheters in Deformable Environments

Zhen Li, Chiara Lambranzi, Di Wu, Alice Segato, Federico De Marco, Emmanuel Vander Poorten, Jenny Dankelman, Elena De Momi.
IEEE Robotics and Automation Letters, 2022. (Under Review)

Autonomous Navigation for Robot-assisted Intraluminal and Endovascular Procedures: A Systematic Review
Ameya Pore*, Zhen Li*, Diego Dall'Alba, Albert Hernansanz, Elena De Momi, Arianna Menciassi, Alicia Casals, Jenny Dankelman, Paolo Fiorini and Emmanuel Vander Poorten.
IEEE Transactions on Robotics, 2022. (Under Review)

Position-based dynamics simulator of vessel deformations for path planning in robotic endovascular catheterization
Zhen Li, Enrico Manzionna, Giovanni Monizzi, Angelo Mastrangelo, Maria Elisabetta Mancini, Daniele Andreini, Jenny Dankelman, and Elena De Momi.
Medical Engineering & Physics, 2022.

Proof-of-Concept Medical Robotic Platform for Endovascular Catheterization
Mohammad Hasan Dad Ansari*, Beatriz Farola Barata*, Trauzettel Fabian*, Zhen Li*, Di Wu*, Diego DallÁlba, Gianni Borghesan, Mouloud Ourak, Veronica Iacovacci, Selene Tognarelli, Jenny Dankelman, Elena De Momi, Paul Breedveld, Paolo Fiorini, Jos Vander Sloten, Arianna Menciassi, Emmanuel Vander Poorten.
Proceedings of the 11th Conference on New Technologies for Computer and Robot Assisted Surgery, 2022.

Model-to-Image Registration via Deep Learning towards Image-Guided Endovascular Interventions
Zhen Li, Maria Elisabetta Mancini, Giovanni Monizzi, Daniele Andreini, Giancarlo Ferrigno, Jenny Dankelman, and Elena De Momi.
Proceedings of the IEEE International Symposium on Medical Robotics, 2021.

Path planning for endovascular catheterization under curvature constraints via two-phase searching approach
Zhen Li, Jenny Dankelman, and Elena De Momi.
International Journal of Computer Assisted Radiology and Surgery, 2021.

Design and control of a variable aerial cable towed system
Zhen Li, Julian Erskine, Stéphane Caro, and Abdelhamid Chriette.
IEEE Robotics and Automation Letters, 2020.

TAuTonomous intraLuminAl Surgery (ATLAS) – Path planning and real-time re-planning

Mentors: Prof. Elena De Momi (NearLab, POLIMI) and Prof. Jenny Dankelman (MISIT Lab, TUD)   NOV 2019 – Present

Steerable robotic catheters and real-time navigation guidance can mitigate the skill and experience requirements for percutaneous treatment. This work aims to develop a safe, accurate, and efficient path planner for catheters. This PhD work developed (i) a fast path planner that can compute obstacle-free trajectories suited to the patient's vasculature, incorporating knowledge of the catheter limitations (e.g., maximal curvature); (ii) a virtual training system that can predict the interaction between catheters and vessel walls and the deformable property of vessels; (iii) a more accurate intra-operative path planner for steerable catheters, respecting the deformable property of vessels and the steering capability of the catheter; (iv) an intra-operative reconstruction of vessel tree structures from medical images, respecting deformations. Summary of findings available here.

Modeling, control and optimization configuration of a novel aerial cable towed system

Mentors: Prof. Stéphane Caro and Prof. Chriette Abdelhamid and Dr. Julian Erskine (LS2N, ECN)   SEP 2018 – AUG 2019

This master thesis project is about modeling, control, and optimization configuration of a parallel robotic system – a novel aerial cable towed system (ACTS) with actuated cable lengths. This thesis scored 93/100 at ECN and 5/5 at WUT. This research work has been published in the IEEE RA-L journal.

Teaching assistant, Department of Electronics, Information and Bio-engineering, POLIMI   2019 – 2022

Activity: Supervising BSc/MSc students' thesis projects

During my PhD study, I proposed and supervised two groups of BSc students' thesis projects and two MSc students' thesis projects. The research topics include image segmentation, path planning, and interventional training systems.

Teaching assistant, Department of Electronics, Information and Bio-engineering, POLIMI   SEP 2020 – MAR 2021

Activity: Assisting in laboratory lectures of the course "Medical Robotics and Technologies for Computer Assisted Surgery" for MSc students

In this course, I assisted with laboratory lectures, exam preparation and corrections, and proposed and supervised student projects. Moreover, I gave a talk on introducing the Robotic Operating System (ROS), which students found interactive, interesting and practical.

Teaching assistant, Department of Electronics, Information and Bio-engineering, POLIMI   Summer 2021

Activity: Supervising BSc/MSc students' internships
Two BSc/MSc students' internships on image registration and path planning were proposed and supervised.

Teaching assistant, Department of Mathematics and Computer Science, Università della Calabria   May 2020
Activity: Assisting in the online course "Embodiment of AI" for PhD students
This course discusses how robots can interpret environmental information and act consequently. In this course, I gave a talk on introducing the Robotic Operating System (ROS).

Clinical experience

Researcher, the Cardiovascular CT Operating Unit, Centro Cardiologico Monzino, Milan, Italy   Feb-JUL 2021
I carried out my research project, developed in the framework of the ATLAS Research project, at the secondment institution – Centro Cardiologico Monzino. The research topics are (i) developing a virtual training system that can predict intra-operative vessel deformations; (ii) reconstructing pre-operative and intra-operative vessel tree structures from medical images. The data collection followed the ethical protocol approved by the secondment institution under the assigned code of "02_21 PA".

Talks and tutorials

Simulation of deformable vasculature for robot-assisted endovascular catheterization (Best Poster Award)   MAY 2022
The 33rd Conference of the International Society for Medical Innovation and Technology (iSMIT) in Oslo, Norway.

Demonstration of a Proof-of-Concept Medical Robotic Platform for Endovascular Catheterization   APR 2022
The 11th Conference on New Technologies for Computer and Robot Assisted Surgery (CRAS) and its the workshop in Napoli, Italy.

Model-to-Image Registration via Deep Learning towards Image-Guided Endovascular Interventions   NOV 2021
The IEEE International Symposium on Medical Robotics (ISMR) in Atlanta, United States.

Programming

Proficient in: C++/C#/Python
Skillful with: ROS, Unity3D, 3DSlicer, MATLAB, CATIA, Cero parametric, ADAMS, Gazebo.

Professional memberships

IEEE, student member   AUG 2022 – Present