

# Miao Li

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Founder, [COBOT Technology](#)

## Research Interests

My research interests are in robotics, machine learning and applied nonlinear control. They encompass **robot learning and control, object grasping and manipulation, human-robot interaction, robotic hands and tactile sensing, and neuroscience**. I am particularly interested in finding the deep connections between the dynamics of intelligent systems and the advanced learning algorithms, which enables adaptive, efficient and robust control design for complex systems. The goal of my research is to enable robots to perform skills with the level of dexterity and flexibility that human demonstrates in similar tasks.

## Education

- 2011-2015.12 Ph.D Student, [École Polytechnique Fédérale de Lausanne \(EPFL\)](#), Switzerland.  
*Thesis: **Dynamic grasp adaptation – from humans to robots.** (**ABB Award, EPFL PhD Thesis Award**)*  
Supervisor: Prof. Aude Billard  
Jury member: Alberto Rodriguez (MIT), Kenji Tahara (Kyushu University), Jose del R. Millan (EPFL), Jamie Paik (EPFL).
- 2008-2011 M.S. ME, [Huazhong University of Science and Technology](#), China  
*Thesis: Grasp force distribution and its uncertainty analysis.*
- 2004-2008 B.S. ME, [Huazhong University of Science and Technology](#), China  
*Thesis: A compliant end-effector for robot polishing.*

## Research Experience

- 2021 - 2025 Academia Professor, [HONG YI HONOR COLLEGE](#) of [Wuhan University](#), China
- Jan 2021 - now Associate Professor, [Wuhan University](#), [School of Power and Mechanical Engineering](#), China
- 2017-2020 Assistant Professor, [Wuhan University](#), [School of Power and Mechanical Engineering](#), China
- Jan 2017 Visiting Researcher [Human-Centered Robotics Laboratory](#) (Prof. Kenji Tahara), [Kyushu University](#), Japan
- 2016 Postdoctoral fellow at [LASA, EPFL](#)
- 2013-2015 Lecturer for [Robotic Practicals](#) (Master Course), EPFL  
*Topic: Teaching robots to accomplish a manipulation task*

2011-2015 Research Assistant at LASA, EPFL, working on EU project RoboHow  
*Topic:* Planning, control and learning on grasping and manipulation  
 \* Developed an optimization-based grasp synthesis method  
 \* Development of a learning-based adaptive control strategy for robust grasping

## Award

2021 Robot Innovation Design Competition for Chinese Graduate, Second Prize. (Ultrasound Robots)

2020 Innovation and Entrepreneurship Talents Award, China. (10 persons in China per year)

2020 Hundred-Talent Program Award, Hubei Province.

2019 Hubei May 1st labor medal, Hubei Province.

2018 Best Paper Award, The 11th International Workshop on Human-Friendly Robotics.

2018 Internet Innovation and Entrepreneurship Competition, Gold Award, China.

2018 ABB Award 2018, EPFL, Switzerland. (One person every two years)

2016 IROS Competition on Grasping and Manipulation, Team: Dorabot & Cobot, Autonomous Track: 2nd, Simulation Track: 2nd.

2016 3551 Talent Program Award, Wuhan, China.

2015 PhD thesis, nominated for EPFL thesis prize and ABB automation award.

2010 Excellent Master Paper Award, HUST.

2008 Scholarship for Distinguished Graduate Student, HUST.

2008 Outstanding Graduation of HUST.

2005, 2006 Scholarship for Distinguished Students.

## Publications([Google Scholar](#))

### *Journal Articles*

- 1 X. Gao, **M. Li** and X. Xiao, Learning Coupled Dynamical System Based on Diffeomorphisms, submitted to *Robots and Automation Letter*, 2021.
- 2 Z. Fu, Z. Lei, X. Deng, D. Zhang, Dong Han and **M. Li**, Design and Implementation of Parallel Wrist for Master-slave Control in Ultrasound Scanning, submitted to *Journal of Mechanisms and Robotics*, 2021.
- 3 Z. Lu, N. Wang, **M. Li** and C. Yang, Incremental Motor Skill Learning and Generalization from Human Dynamic Reactions based on Dynamic Movement Primitives and Fuzzy Logic System, submitted to *Transactions on Fuzzy Systems*, 2021.
- 4 S. Lin, **M. Li** and C. Yang, Robot Grasping based on Object Shape Approximation and LightGBM, submitted to *Computers & Industrial Engineering*, 2021.
- 5 X. Gao, J. Silvrio, S. Calinon, **M. Li** and X. Xiao, Bilateral teleoperation with object-adaptive mapping, submitted to *Complex & Intelligent Systems*, 2021.

- 6 X. Deng, Z. Lei, Y. Wang, W. Cheng, C. Yang and **M. Li**, Learning Ultrasound Scanning Skills from Human Demonstrations, *Science China Information Sciences*, accepted, 2021.
- 7 Y. Zhang, **M. Li** and C. Yang, Robot learning system based on Dynamic Movement Primitives and Neural Network, *Neurocomputing*, 2021.
- 8 X. Gao, J. Silvrio, E. Pignat, S. Calinon, **M. Li** and X. Xiao, Motion Mappings for Continuous Bilateral Teleoperation, *Robots and Automation Letter*, 2021.
- 9 Z. Deng, **M. Li**, Learning Optimal Fin-ray Finger Design for Soft Grasping, *Frontier in Robotics and AI*, 2021.
- 10 Z. Fu, J. Pan, Emmanouil Spyarakos-Papastavridis, X. Chen and **M. Li**, A Dual Quaternion-based Approach for Coordinate Calibration of Dual Robots in Collaborative Motion, *Robots and Automation Letter*, 2020.
- 11 Y. Lee, S. Zhang, **M. Li**, Harold Soh, and X. He, Blind Inverse Gamma Correction with Maximized Differential Entropy, *IEEE Transactions on Image Processing*, under review, 2020.
- 12 J. Zhang, **M. Li**, Y. Feng, and C. Yang, Robotic Grasp Detection based on Image Processing and Random Forest, *Multimedia Tools and Applications*, 2020.
- 13 X. Gao, J. Ling, X. Xiao and **M. Li**, Learning Force-relevant Skills from Human Demonstration, *Complexity*, 2019. <https://doi.org/10.1155/2019/5262859>
- 14 C. Yang, J. Luo, C. Lin, **M. Li** and S. Dai, A Haptics-Electromyography Perception and Learning Enhanced Intelligence for Teleoperated Robot, *IEEE Transactions on Automation Science and Engineering*, 2018.
- 15 Andrea Maria Zanchettin, Elizabeth Croft, Hao Ding, and **Miao Li**, Collaborative robots in the workplace, *IEEE Robotics and Automation Magazine*, 2018.
- 16 **M. Li**, K. Tahara and A. Billard, Learning task manifold for constrained object manipulation, *Autonomous Robots*, 2017, DOI: 10.1007/s10514-017-9643-z.
- 17 K. Hang **M. Li**, J. A. Stork, Y. Bekiroglu, F. T. Pokorny, A. Billard and D. Kragic. Hierarchical fingertip space: a unified framework for grasp planning and in-hand grasp adaptation. *IEEE Transactions on Robotics*, 32(4), 960-972, 2016. **Selected for oral presentation (15 papers per year) at IEEE ICRA, Singapore, 2017**
- 18 **M. Li**, K. Hang, D. Kragic, A. Billard. Dexterous grasping under shape uncertainty. *Robotics and Autonomous Systems*, 2015.
- 19 B. Huang, **M. Li**, R. D. Souza, J. J. Bryson and A. Billard. A modular approach to learning manipulation strategies from human demonstration. *Autonomous Robots*, 2015.
- 20 S. El-Khoury, **M. Li**, A. Billard. On the generation of a variety of grasps. *Robotics and Autonomous Systems*, 61(12), 1335-1349, 2013.
- 21 **M. Li**, W. Yang, X. Zhang. Robust actuator force analysis of a heavy-duty manipulator using GMM/GMR. *International Journal of Robotics and Automation*, 28(4), 349-356, 2013.

*Conference Proceedings*

- 1 Yi Wang, Yuyang Tu, Yuchen He, Xutian Deng, Ziwei Lei, Jianwei Zhang and **M. Li**, Learning Friction Model for Magnet-actuated Tethered Capsule Robot, submitted to ICRA 2022.
- 2 Z. Lu, N. Wang, **M. Li**, C. Yang, A Novel Approach to Dynamic Movement Primitives-based Multi-tools Using Skills Learning, submitted to ICRA 2022.
- 3 Xutian Deng, Yiting Chen, Fei Chen and **M. Li**, Learning Robotic Ultrasound Scanning Skills via Human Demonstration and Guided Exploration, submitted to ROBIO 2021.
- 4 Zhaoxing Deng, Xutian Deng and **M. Li**, Learning Based Adaptive Force Control of Robotic Manipulation Based on Real Time Object Stiffness Estimation, submitted to ROBIO 2021.
- 5 Yi Wang, Yuchen He, Xutian Deng, Ziwei Lei, Yiting Chen and **M. Li**, Learning Friction Model for Tethered Capsule Robot, accepted to ICRAE 2021.
- 6 Y. Chen, C. Yang, **M. Li** and S. Dai, Learning to Predict Action Based on B-ultrasound Image Information, The 6th IEEE International Conference on Advanced Robotics and Mechatronics (ICARM), 2021.
- 7 Y. Chen, C. Yang and **M. Li**, Sim-to-Real:Unknown Object Segmentation by Domain Adaptation in a Bin-picking Scenario, ICoIAS 2021.
- 8 J. Xiong, Z. Fu, **M. Li**, Z. Gao, X. Zhang and X. Chen, Trajectory-Smooth Optimization and Simulation of Dual-Robot Collaborative Welding, In *International conference on Intelligent Robotics and Applications (ICIRA)*, 2021.
- 9 J. Zhang, **M. Li** and C. Yang, Robotic grasp detection using effective graspable feature selection and precise classification, In *International Joint Conference on Neural Networks (IJCNN)*, 2020.
- 10 D. Carter-Davies, J. Chen, F. Chen, **M. Li** and C. Yang, Mechatronic design and control of a 3D printed low cost robotic upper limb, In *The 11th International Workshop on Human-Friendly Robotics*, 2018. **Best Paper Award**
- 11 J. Zhang, C. Yang, **M. Li** and Y. Feng, Grasping novel objects with real-time obstacle avoidance, In *International Conference on Social Robotics (ICSR)*, 2018.
- 12 Y. Liu, S. Zhang, X. Xiao, and **M. Li**, A Robotized data collection approach for convolutional neural networks. In *International conference on Intelligent Robotics and Applications (ICIRA)*, 2017.
- 13 **M. Li**, Learning partial power grasp with task-specific contact, *IEEE International Conference on Robotics and Biomimetics (ROBIO)*, 2016. **Finalist of T. J. Tarn Best Paper**
- 14 K. Hang, J.A. Haustein, **M. Li**, A. Billard, C. Smith and D. Kragic, On the evolution of fingertip grasping manifolds, In *IEEE International Conference on Robotics and Automation (ICRA)*, 2016.
- 15 **M. Li**, Y. Bekiroglu, D. Kragic, A. Billard. Learning of grasp adaptation through experience and tactile sensing. In *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2014.
- 16 **M. Li**, H. Yin, K. Tahara, A. Billard. Learning object-level impedance control for robust grasping and dexterous manipulation. In *IEEE International Conference on Robotics and Automation (ICRA)*, 2014.
- 17 N. Sommer, **M. Li**, A. Billard. Bimanual compliant tactile exploration for grasping unknown objects. In *IEEE International Conference on Robotics and Automation (ICRA)*, 2014.

- 18 B. Huang, S. El-Khoury, **M. Li**, J. J Bryson, A. Billard. Learning a real time grasping strategy. In *IEEE International Conference on Robotics and Automation (ICRA)*, 2013.
- 19 S. El Khoury, **M. Li**, A. Billard. Bridging the gap: one shot grasp synthesis approach. In *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2012.
- 20 **M. Li**, W. Yang, X. Zhang. Analysis of indeterminate force in multi-contact friction grasp based on potential energy minimization. In *International Conference on Modelling, Identification and Control (ICMIC)*, 2010.
- 21 W. Yang, **M. Li**, X. Zhang. Robust robotic grasping force optimization with uncertainty. In *International conference on Intelligent Robotics and Applications (ICIRA)*, 2010.
- 22 **M. Li**, W. Yang, X. Zhang. Projection on convex set and its application in testing force closure properties of robotic grasping. In *International conference on Intelligent Robotics and Applications (ICIRA)*, 2010.
- 23 X. Zhang, W. Yang, **M. Li**. An uncertainty approach for fixture layout optimization using Monte Carlo method. In *International conference on Intelligent Robotics and Applications (ICIRA)*, 2010.
- 24 X. Zhang, W. Yang, **M. Li**. Fixture layout and clamping force optimization for large-scale workpiece using augmented Lagrangian method. *Applied Mechanics and Materials*, page 560-565, 2010.

### Workshop

- 1 Y. Zhou, **M. Li**, A. Billard, Learning to organise objects in cluttered environments, Workshop on Dynamic Locomotion and Manipulation With Complex Robotic Systems in the Real World, 2016.
- 2 K. Hang, **M. Li**, J. A Stork, Y. Bekiroglu, A. Billard, D. Kragic. Hierarchical fingertip space for synthesizing adaptable fingertip grasps. *Autonomous Grasping and Manipulation: An Open Challenge*. ICRA, 2014.
- 3 **M. Li**, S. El Khoury, A. Billard. Synergy-level grasp synthesis learning. *Hand synergies - how to tame the complexity of grasping*. ICRA, 2013.

## Organized Workshops

- 1 Bimanual Manipulation: Addressing Real-World Challenges, workshop at ICRA 2022, submitted (Fei Chen, **Miao Li**, Sylvain Calinon, Nadia Figueroa and Jihong Zhu)
- 2 Bridging the Gap between Data-driven and Analytical Physics-based Grasping and Manipulation II, workshop at ICRA, China, 2021 (Yasemin Bekiroglu, Naresh Marturi, Marc Peter Deisenroth, Yiannis Karayiannidis, **Miao Li**, Florian T. Pokorny, Robert Platt)
- 3 Bimanual manipulation: learning, planning and control, workshop at ICRA, China, 2021 (Fei Chen, **Miao Li**, Sylvain Calinon, Huan Tan, Yasuhisa Hasegawa, Yunhui Liu)
- 4 Examining Sensing Modalities for Robust and Dexterous Object Manipulation, workshop at IROS, Spain, 2018 (Kaiyu Hang, Hao Ding, **Miao Li**, Danica Kragic, Aaron Dollar)
- 5 Sensor-Based Object Manipulation for Collaborative Assembly, workshop at ICRA, Singapore, 2017 (**Miao Li**, Hao Ding, Qiang Li, Zhaopeng Chen).
- 6 Closed-loop Grasping and Manipulation: Challenges and Progress, workshop at IROS, Korea, 2016 (Yasemin Bekiroglu, **Miao Li**, Robert Krug, Florian Pokorny, Aude Billard ).
- 7 The 1st Collaborative Robots Workshop, Guangzhou, China, August, 2016.

## Invited Talks

- 1 Lesson Learned from Robotic Grasping - More is Different, Workshop of Manipulation through Contact, Macau, IROS, 2019.
- 2 Robotic Vision - From Research to Application, Hubei University of Arts and Science, Hubei, Hosted by Prof. Zhongren Wang, 2019.
- 3 Lesson Learned from Robotic Grasping - More is Different, Southern University of Science and Technology, Shenzhen, May, 2019.
- 4 Collaborative Robots - From Hand, Arm to Brain, Tsinghua University, Beijing, Nov. 2018.
- 5 Robotics and AI: Opportunities and Challenges, Wuhan University of Technology, Wuhan, Hosted by Prof. Kui Xiang, Oct. 2018.
- 6 Future Challenges of Robotic Grasping - More is Different!, LASA, EPFL, Lausanne, Switzerland, 2018.
- 7 Collaborative Robots - From Hand, Arm to Brain, China Mechanical Engineering Forum, Xiangtan, 2018.
- 8 Collaborative Automation for Flexible Manufacturing, Siemens-Tsinghua Qingdao Innovation Forum, Qingdao, 2018.
- 9 Machine Intelligence in Manufacturing, China University of Geosciences, Wuhan, 2018.
- 10 Learning Force-dominant Skills from Human Demonstrations, South China University of Technology, Hosted by Prof. Chenguang Yang, 2018.
- 11 Close the Loop for Robotic Grasping with Learning-based Approach, Cross Modal Learning summer school at Hamburg University, Germany, Aug. 2017.
- 12 Bridge The Gap - From Humans To Robots, **keynote speaker** at the 49th International Symposium on Robotics (ISR), Shanghai, 2017
- 13 Dynamic Grasp Adaptation - From Humans To Robots, Tsinghua University, Beijing, Oct. 2016
- 14 Machine Intelligence in Manufacturing, Wuhan University of Science and Technology, Host by Huasong Min, Wuhan, Oct. 2016
- 15 Sensor-Based Object Manipulation for Collaborative Applications, workshop of Safety-Related Sensing for Collaborative Applications, Korea, IROS 2016
- 16 Dynamic Grasp Adaptation - From Humans To Robots, Hebei University of Technology, Tianjin, Oct. 2016
- 17 Next Generation Robots - Advance and Challenges, Hubei Robot Innovation Forum, Wuhan, Sept. 2016
- 18 Dynamic Grasp Adaptation - From Humans To Robots, Wuhan University, Wuhan, Sept. 2016
- 19 Collaborative Robots and Flexible Manufacturing, Huawei Automation Department, Dongguan, August 2016
- 20 A Learning-Based Approach for Dynamic Grasp Adaptation, workshop on Robotic Hand Technologies and Performance Benchmarking, organized by NIST, CASE, USA, August 2016

- 21 Dynamic Grasp Adaptation with Simulated Database and Human-guided Demonstration, The 1st China-Germany Robotics Forum, Bad Herrenalb, Germany, 2016
- 22 Sensor-based Object Manipulation for Collaborative Tasks – Design, Control and Learning, The 1st Collaborative Robots Workshop, Guangzhou, China, August 2016.
- 23 Robotic Grasping and Manipulation in Human-centered Environments, Huazhong University of Science and Technology, China, December, 2015.
- 24 Vision and Haptic-Guided Fine Manipulation of Objects, Bath University, UK, July, 2014.
- 25 Vision and Haptic-Guided Fine Manipulation of Objects, workshop of the British Machine Vision Association (BMVA) on Vision for Language and Manipulation, UK, July, 2014.

## Grant Selected

- 1 Intelligent Robotic Grasping System for Warehouse Logistics, Wuhan Research Program, 2018-2020, 0.5M RMB, PI.
- 2 Research on Imitation Learning-based Compliant Interaction Control for Soft Manipulation, National Scientific Founding, 2018-2020, 0.22M RMB, PI.
- 3 Intelligent Industrial Operation System, Hubei Innovation Program, 2017-2019, 1M RMB, PI.
- 4 Force Control for the Application of Robotic Polishing and Assembly, National Key Research Program, 2019-2020, 1.05M RMB, PI.
- 5 Flexible Robotic Grasping System for Logistics with Robust Vision and Force Perception, Hubei Key Research Program, 2018-2020, 2M RMB, PI.
- 6 Flexible Manufacturing with Collaborative Robots, Wuhan 3551 Program, 2016-2019, 0.6M RMB, PI.
- 7 Robotic Soft Manipulation based on Learning Approach, Wuhan University Talent Program, 2017-2020, 0.5M RMB, PI.

## Professional Service

Technical Program Committee of IEEE [ROBIO](#) 2021.

**Co-Chair** of Technical Program Committee - [ICRAE & ICRAI](#) 2021.

**Founding Co-Chair** of IEEE Technical Committee - Collaborative Automation for Flexible Manufacturing. (Hao Ding, Andrea Maria Zanchettin, **Miao Li**, Julie Shah)

### Editor

- 1 Guest Editor for Special Issue on Robotics and Automation Letter (Learning and Control for Robot Compliant Manipulation with Human in the Loop), 2021.
- 2 Associate Editor for Ubiquitous Robots (UR 2020, 2021)
- 3 Associate Editor for ICRA 2020, 2021
- 4 Topic Editor for Research Topic on Bridging the Gap Between Data-Driven and Analytical Physics-Based Grasping and Manipulation, *Frontiers in Robotics and AI*, 2021.
- 5 Guest Editor for Special Issue on [Robotics & Automation Magazine](#), 2017.

6 Guest Editor for International Journal of Robotics, 2017.

#### **Reviewer and Program Committee**

IEEE Transactions on Robotics, IEEE Transactions on Automation Science and Engineering, IEEE Transactions on Systems, Man and Cybernetics: SystemsAutonomous Robots, Robotics and Autonomous Systems, Journal of Mechanisms and Robotics, Industrial Robot, Robotica, International Journal of Intelligent Robotics and Applications, RSS, ICRA, RAL, IROS, CoRL, ISRR, Humanoids, Ubiquitous Robot, International Journal of Humanoid Robots, IEEE Sensors Journal, Journal of Intelligent and Robotic Systems, International Journal of Advanced Robotic Systems, Journal of Robotics, Information Science, Elsevier Book on Safe Sensing, Advances in Mechanical Engineering, Electronics.

#### **Teaching Courses**

Introduction to Robotics, Mechatronics, Advanced Robotics, Robotic Practicals.

#### **Membership**

IEEE Member, IEEE RAS Technical Committee of Robot Hand, Grasping and Manipulation, Committee of Robots in China (CMES), China Computer Federation (CCF).

## References

Aude Billard, professor at EPFL, Switzerland, Email: aude.billard@epfl.ch

—Supervisor of my PhD thesis

Jianwei Zhang, professor at Department of Informatics, University of Hamburg, Email: zhang@informatik.uni-hamburg.de

—Supervisor on transferring robotics technology from academia to real-world problems

Kenji Tahara, professor at Kyushu University, Japan, Email: tahara@mech.kyushu-u.ac.jp

— Long-term collaboration on design and control of robotic hands

Danica Kragic Jensfelt, professor at KTH, Sweden, Email: dani@kth.se

— Collaboration on several joint papers under EU project RoboHow

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