

# Nadia Figueroa

Curriculum Vitae

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## EDUCATION

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<b>Swiss Federal Institute of Technology Lausanne (EPFL)</b> <i>Ph.D. Robotics, Control and Intelligent Systems</i>	Oct. 2013 – Dec. 2019 <i>Lausanne, Switzerland</i>
<b>TU Dortmund University</b> <i>M.Sc. Automation and Robotics (Robotics Major)</i> *Thesis conducted at the German Aerospace Center (DLR)	Oct. 2009 – May 2012 <i>Dortmund, Germany</i>
<b>Monterrey Institute of Technology (ITESM)</b> <i>B.Sc. Mechatronics (Robotics Minor)</i>	Oct. 2002 – Dec. 2007 <i>Monterrey, Mexico</i>

## ACADEMIC POSITIONS

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<b>University of Pennsylvania</b> <i>Shalini and Rajeev Misra Presidential Assistant Professor</i> Mechanical Engineering and Applied Mechanics (Primary) Computer and Information Science (Secondary) GRASP Laboratory	Jan. 2022–present <i>Philadelphia, USA</i>
<b>Massachusetts Institute of Technology</b> <i>Postdoctoral Associate</i> Computer Science and Artificial Intelligence Lab (CSAIL) Department of Aeronautics and Astronautics	Jan. 2020–Dec. 2021 <i>Cambridge, USA</i>

## AWARDS AND HONORS

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- **Finalist for the 2022 Agilent Early Career Professor Award** May 2022  
For early career professors with significant original research contributions and outstanding potential for future research enabling technologies of importance to *Agilent Technologies* and the world.
- **IEEE RA-L Outstanding Associate Editor** May 2022  
The IEEE Robotics and Automation Letters (RA-L) annually recognizes Associate Editors for their distinguished service. Candidates are nominated by the Editor-in-Chief and Senior Editors.
- **Finalist for the euRobotics Georges Giralt PhD Award** March 2020  
Sponsored by *euRobotics*. This award is a European scientific prize for extraordinary contributions in robotics. It is yearly awarded at the European Robotics Forum.
- **Finalist for the EPFL Doctoral Program Distinction Award** June 2019  
Each year, a distinction is granted to a selection of very high quality theses, in order to highlight the doctoral candidates' research work and their scientific merit.

- **Nominated for the ABB (Asea Brown Boveri) PhD Award** June 2019  
The prize is awarded, every two years, for particularly excellent doctoral work in the fields of energy and information technology and automation technology.
- **Finalist for the KUKA Innovation Award** April 2017  
Sponsored by *KUKA*. This award is given to the top 5 finalists in a world-wide robotics innovation competition. Our team developed an application of multiple robot arms in collaboration with a human, spotlight video [here](#).
- **Best Student Paper Award at Robotics: Science and Systems** June 2016  
Sponsored by *Springer*. Our work on coordinated multi-arm motion planning was also selected as finalist for Best Conference Paper Award and Best Systems Award. Spotlight video [here](#).
- **Human-Robot Interaction (HRI) Pioneer** March 2016  
HRI Pioneers identifies and empowers the world's top student researchers early in their careers.

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## PUBLICATIONS UNDER REVIEW OR IN PREPARATION

- [U5] Jin, L., Yang, Y., Torres, B.O., Lee, S.D., **Figueroa, N.**, Full, R.J. and Yang, S. "Ultra-fast, programmable, and electronics-free soft robots enabled by snapping metacaps". *Under Review*.
- [U2] Fourie, C., **Figueroa, N.** and Shah, J. "On-Manifold Strategies for Reactive Dynamical System Modulation with Non-Convex Obstacles". *Under Review at IEEE TRO*.

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## BOOKS/CHAPTERS IN BOOKS

- [B1] Billard, A., Mirrazavi Salehian, S. S. and **Figueroa, N.** "Learning for Adaptive and Reactive Robot Control: A Dynamical Systems Approach." *Intelligent Robotics and Autonomous Agents Series*, MIT Press, 2022.

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## JOURNAL PUBLICATIONS

- [J13] M. Koptev, **Figueroa, N.**, Billard, A. "Neural Joint-Space Implicit Distance Functions for Reactive Robot Manipulator Control". *IEEE Robotics and Automation Letters (RA-L)*, Dec. 2022.
- [J12] **Figueroa, N.** and Billard, A. "Locally Active Globally Stable Dynamical Systems: Theory, Learning and Experiments." *The International Journal of Robotics Research (IJRR)*, January 2022.
- [J11] Koptev, M., **Figueroa, N.** and Billard, A. "Real-Time Self-Collision Avoidance in Joint Space for Humanoid Robots." *IEEE Robotics and Automation Letters (RA-L)*, 6(2): 1240-1247. 2021.
- [J10] Shavit, Y., **Figueroa, N.**, et al. "Learning Augmented Joint-Space Task-Oriented Dynamical Systems: A Linear Parameter Varying and Synergetic Control Approach". *IEEE RA-L*. 2018.
- [J9] Mirrazavi Salehian, S. S., **Figueroa, N.** and Billard, A. "A Unified Framework for Coordinated Multi-Arm Motion Planning". *IJRR*, 37(10), 1205-1232, 2018.
- [J8] **Figueroa, N.**, et al. "A Combined Approach Toward Consistent Reconstructions of Indoor Spaces Based on 6D RGB-D Odometry and KinectFusion". *ACM TIST*, 6(2):14, 2015.
- [J7] Dong, H., **Figueroa, N.** and El Saddik, A. "Elicitation Study on Gesture Preferences and Memorability Towards a Practical Hand-Gesture Vocabulary for Smart TVs". *IEEE Access*, 2015.
- [J6] Dong, H., **Figueroa, N.** and El Saddik, A. "Load balance control for a humanoid musculoskeletal arm in table tennis movement". *Intl. Journal of Control, Automation and Systems*, 4:887-896, 2015.
- [J5] Dong, H., **Figueroa, N.**, El Saddik, A. "Adaptive load-distributed muscle coordination method for kinematically redundant musculoskeletal humanoid systems". *RAS*, 64:56-69, 2015.
- [J4] Dong, H., Ugalde, I., **Figueroa, N.** and El Saddik, A. "Towards whole body fatigue assessment of human movement". *Sensors*, 14(2):2052-2070, 2014.

- [J3] Ali, H., Shafait, H., Giannakidou, E., Vakali, A., **Figueroa, N.**, Varvadoukas, T. and Mavridis, N. “Contextual object category recognition for RGB-D scene labeling”. *RAS*, 62(2):241-256, 2014.
- [J2] Dong, H., Giakoumidis, N., **Figueroa, N.** and Mavridis, N. “Approaching Behaviour Monitor and Vibration Indication in Developing a General Moving Object Alarm System”. *JARS*, 10, 2013.
- [J1] **Figueroa, N.**, Schmidt, F., et al. “Joint origin identification of articulated robots with marker-based multi-camera optical tracking systems”. *Robotics and Autonomous Systems*, 61(6):580-592, 2013.

## PEER-REVIEWED CONFERENCE PAPERS

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- [C15] Wang, Y., **Figueroa, N.**, Li, S., Shah, A. and Shah, J. “Temporal Logic Imitation: Learning Plan-Satisficing Motion Policies from Demonstrations.” To appear *In Proc. of 6th CoRL*, Dec 2022.
- [C14] Zhou, Y., Booth, S., **Figueroa, N.** and Shah, J. “RoCUS: Robot Controller Understanding via Sampling.” *In proceedings of the 5th CoRL*, volume 164, of PMRL, pages 850–860, 08–11 Nov 2021.
- [C13] Li, S., **Figueroa, N.**, Shah, A. and Shah, J. “Provably Safe and Efficient Motion Planning under Uncertainty for Human-Robot Collaboration.” In *Proceedings of RSS*, Virtual, July 2021.
- [C12] **Figueroa, N.**, Faraji, S., et al. “A Dynamical System Approach for Adaptive Grasping, Navigation and Co-Manipulation with Humanoid Robots.” In *Proc. of the IEEE ICRA*, 2020
- [C11] **Figueroa, N.** and Billard, A. “A Physically-Consistent Bayesian Non-Parametric Mixture Model for Dynamical System Learning”. In *Proc. of the 2nd CORL*. Zürich, Switzerland. October 2018.
- [C10] Mirrazavi Salehian, S. S., **Figueroa, N.** and Billard, A. “Dynamical System-based Motion Planning for Multi-Arm Systems: Reaching for Moving Objects” In *Proc. of the 2017 IJCAI*. Australia.
- [C9] Mirrazavi Salehian, S. S., **Figueroa, N.** and Billard, A. “Coordinated multi-arm motion planning: Reaching for moving objects in the face of uncertainty.” In *Proc. of RSS XVI*, Michigan, USA, 2016.
- [C8] Beetz, M., Bessler, D., Winkler, J., Bartels, G., Billard, A., **Figueroa, N.**, et al. “Open Robotics Research Using Web-based Knowledge Services.” In *Proc. of the IEEE ICRA*, Sweden, 2016.
- [C7] Dong, H., **Figueroa, N.** and El Saddik, A. “An Elicitation Study on Gesture Attitudes and Preferences Towards an Interactive Hand-Gesture Vocabulary”. In *MM '15 Proceed.*, 2015.
- [C6] Dong, H., **Figueroa, N.** and El Saddik, A. “Towards consistent reconstructions of indoor spaces based on 6D RGB-D odometry and KinectFusion”. In *IEEE IROS*, pages 1796-1803, 2014.
- [C5] Dong, H., Yazdkhasti, S., **Figueroa, N.** and El Saddik, A. “Anti-fatigue control for over-actuated bionic arm with muscle force constraints”. In *IEEE IROS*, pages 335-342, 2013.
- [C4] **Figueroa, N.**, Dong, H. and El Saddik, A. “From Sense to Print: Towards Automatic 3D Printing from 3D Sensing Devices”. In *IEEE SMC*, pages 4897-4904, 2013.
- [C3] Dong, H., **Figueroa, N.** and El Saddik, A. “Muscle Force Control of a Kinematically Redundant Bionic Arm with Real-Time Parameter Update”. In *IEEE SMC*, pages 1640-1647, 2013.
- [C2] Ali, H. and **Figueroa, N.** “Segmentation and Pose Estimation of Planar Metallic Objects”. In *Ninth Conf. on Computer and Robot Vision (CRV)*, pages 376-382, 2012.
- [C1] **Figueroa, N.**, Ali, H. and Schmidt, F. “3D registration for verification of humanoid Justin’s upper body kinematics”. In *Ninth Conference on CRV*, pages 276-283, 2012.

## WORKSHOP PAPERS AND ABSTRACTS

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- [W7] Wang, F., **Figueroa, N.**, Li, S., Shah, A. and Shah, J. “Temporal Logic Imitation: Learning LTL-Satisficing Dynamical Systems from Demonstration”. In *Proc. of the RSS 2022 Workshop on Overlooked Aspects of Imitation Learning: Systems, Data, Tasks, and Beyond*.

- [W6] M. Koptev, **Figueroa, N.**, Billard, A. “Implicit Distance Functions: Learning and Applications in Control.” In Proc. of the *2022 IEEE ICRA* Workshop on Motion Planning with Implicit Neural Representations of Geometry.
- [W5] Mirrazavi Salehian, S. S., Lin, H.C., **Figueroa, N.**, Smith, J., Mistry, M. and Billard, A. “Transitioning with confidence during contact/non-contact scenarios.” In Proc. of the *2018 IEEE IROS* Workshop on Human-Robot Cooperation and Collaboration in Manipulation.
- [W4] **Figueroa, N.** and Billard, A. “Modeling Compositions of Impedance-based Primitives via Dynamical Systems.” In Proc. of the *2018 IEEE ICRA* Workshop on Cognitive Whole-Body Control for Compliant Robot Manipulation (COWB-COMP).
- [W3] **Figueroa, N.** and Billard, A. “Multi-Arm Self-Collision Avoidance: A Sparse Solution for a Big Data Problem.” In Proc. of the 2018 Third Machine Learning in Planning and Control of Robot Motion (MLPC) Workshop at *2018 IEEE ICRA*.
- [W2] **Figueroa, N.** and Billard, A. “Learning Complex Manipulation Tasks from Heterogeneous and Unstructured Demonstrations.” In Proc. of the *2017 IEEE/RSJ IROS* Workshop on Synergies between Interaction and Learning.
- [W1] **Figueroa, N.**, Pais, A. L. and Billard, A. “Learning Complex Sequential Tasks from Demonstration: A Pizza Dough Rolling Case Study.” In Proc. of the *2016 ACM/IEEE Intl. Conf. on Human-Robot Interaction (HRI)*. HRI 2016 Pioneers.

## INVITED TALKS

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### **Collaborative Robots in the Wild: Challenges and Future Directions from a Human-Centric Perspective**

- Princeton Robotics Seminar Series, Princeton University Dec. 2022
- Illinois Robotics Virtual Seminar Series, University of Illinois Urbana-Champaign Nov. 2022
- Seminar at The Center for Cognition, Action, and Perception, University of Cincinnati Oct. 2022
- The International Symposium on Robotics Research (ISRR), Geneva, Switzerland Sept 2022

### **Multi-arm Robots and Human Cooperation**

- US-EU Workshop on Intelligent Manufacturing, Prague, Czech Republic June 2022

### **Towards Safe and Efficient Learning and Control for Physical Human Robot Interaction**

- ICLR 2022 Workshop on Generalizable Policy Learning in the Physical World. April 2022
- IROS 2021 Workshop on From Human-Robot Interaction to Collaborative Control: A Human Centered Perspective. Sept. 2021
- NYU Courant Computer Science Spring 2021 Colloquium. April 2021
- University of Pennsylvania GRASP/MEAM Department Seminar. Mar. 2021
- MIT EECS Department Special Seminar. Mar. 2021
- Yale MEMS Department Research Seminar. Feb. 2021

### **Efficient Learning and Adaptive Motion Planning for and from Physical Human Robot Interaction**

- MIT AeroAstro Humans interacting with Autonomy Virtual Workshop. Jan. 2021

### **From High-Level to Low-Level Robot Learning of Complex Tasks: Leveraging Priors, Metrics and Dynamical Systems**

- Robotics Research Seminar, University of Washington, Seattle, USA. Aug. 2019
- Robotics Research Seminar, MIT CSAIL, Cambridge, USA. July 2019

### **Teaching Robots Complex Manipulation Tasks from Demonstrations**

- Swiss AI Machine Learning Meetup, Lausanne, Switzerland Dec 2018

## A Physically-Consistent Bayesian Non-Parametric Mixture Model for Dynamical System Learning

- Swiss Machine Learning Day 2018, Lausanne Nov 2018
- **Invariant and Weakly-Parameterized Algorithms for Efficient Robot Learning: Tackling the Micro-Data Challenge**
- IROS'17 Workshop on Micro-Data: The Next Frontier in Robot Learning? Sept 2017
- **Discovering Primitive Motions from Unstructured Heterogeneous Demonstrations**
- Swiss Machine Learning Day 2014, Lausanne Oct 2014
- **3D Computer Vision and Applications in Robotics and Multimedia**
- Seminar for NYU AD Research Rounds: June 2013

## TEACHING EXPERIENCE

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- **University of Pennsylvania**, MEAM-520: Introduction to Robotics Spring 2022
- **École Polytechnique Fédérale de Lausanne (EPFL)** *Lausanne, Switzerland*
- MICRO-570: Advanced Machine Learning (Head TA) Spring 2016/2017
- MICRO 401: Machine Learning Programming (Head TA) Fall 2016/2017
- MICRO-455: Applied Machine Learning (TA) Fall 2015
- **TU Dortmund University** *Dortmund, Germany*
- Object Oriented Programming for Automation and Robotics (TA) Fall 2010

## STUDENT MENTORING

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- **Figuroa Robotics Lab @ University of Pennsylvania** 2022-present
- PhD students: Shafagh Keyvanian, Yifan Xue, Tianyu Li
- External PhD Collaborators: Farhad Nawaz (Penn ESE, advised by Nik Matni), Hadi Beik-Mohammadi (Bosch AI, advised by Leonel Rozo), Mikhail Koptev (EPFL, advised by Aude Billard [J13, J11, W6])
- MS students: Sicheng Tao, Raktimjyoti Parashar, Haihui Gao, Zijian An, Zeeshan Islam, Harshil Parekh, Sunan Sun, Bowen Sun, Jeff Huang, Shaoting Peng, Gene Lam, Ho Jin Choi
- *\*All listed students are currently doing research in my group under my direct supervision.*
- **Interactive Robotics Group @ Massachusetts Institute of Technology** 2020-2022
- PhD student collaborations: Shen Li [C13], Felix Wang [C15, W7], Chris Fourie [U2]
- MEng student: Dain Kim ([Thesis link](#))
- UG students: Maggie Wang, Shushu Fang and Brad Levine
- *\*All listed MS/UG students were under my direct supervision during my postdoctoral appointment at MIT. PhD student collaborators were advised and mentored during this time and are still on-going.*

## PROFESSIONAL MEMBERSHIPS

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- IEEE Member (since 2018)
- IEEE Robotics and Automation Society (RAS) Member (since 2018)
- IEEE-RAS Women in Engineering Committee Member (since 2022)

## ACADEMIC SERVICE

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### Reviewing

- IEEE: IROS, ICRA, Humanoids, RA-M, RA-L, TRO
- CORL, RSS, IJRR, THMS, IJSR, THRI, Frontiers in Robotics.

### Editorial Boards

- Technical Theme **Area Chair** for the 2023 ACM/IEEE International Conference on Human Robot Interaction (HRI) held from March 13-16, 2023 in Stockholm, Sweden
- **Associate Editor** for the The International Symposium on Robotics Research (ISRR) 2022 which will be held in Geneva, Switzerland on September 2022.
- **Associate Editor** for the “Robot Learning 2” Area of the IEEE *Robotics and Automation Letters (RA-L)*, appointed July 2021.

### Chairing Roles

- Inclusion@RSS **Co-chair** for the 19th edition of the Robotics: Science and Systems conference.
- **Co-Chair** of the IEEE RAS Technical Committee on Collaborative Automation for Flexible Manufacturing (since August 2021).
- **Chair** of ICRA 2022 Session on “Intention and Gesture Recognition”, Wednesday, May 25, 2022.

### Tutorial Organization

- **Co-organized** “Tutorial on Dynamical System-based Learning from Demonstration” at the *2019 International Conference on Robotics and Automation (ICRA)* in Montreal, Canada. Website [here](#).
- **Co-organized** “Tutorial on Dynamical System-based Learning from Demonstration” offered at the *2018 Robotics: Science and Systems Conference (RSS) conference*. [Tutorial cancelled due to US immigration policy. Materials presented at EPFL and available [here](#)]

### Workshop Organization

- **Co-organized** Workshop on “Geometry, Physics, and Human Knowledge as Inductive Bias in Robot Learning” at the *2022 Conference on Robot Learning (CORL)*. Auckland, New Zealand. Website [here](#)
- **Co-organized** “2nd Workshop on Bi-manual Manipulation: Addressing Real-world Challenges” at the *2022 IEEE International Conference on Robotics and Automation (ICRA)*. Philadelphia, USA. Website [here](#)
- **Co-organized** “Workshop on Collaborative Robots and the Work of the Future” at the *2022 IEEE International Conference on Robotics and Automation (ICRA)*. Philadelphia, USA. Website [here](#)
- **Co-organized** “Workshop on Joint Action, Adaptation and Entrainment” at the *Virtual 2022 ACM/IEEE International Conference on Human-Robot Interaction (HRI)*. Website [here](#).

## DEPARTMENTAL SERVICE

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- MEAM PhD Admissions Committee 2022, 2023
- Member of 3 MEAM PhD Qualifying Exam Committees (Math Examiner) 2022
- Member of 1 CIS WPE-II Exam Committee 2022

## COMMUNITY & OUTREACH SERVICE

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### Leadership

- **Treasurer, Community Development Co-Chair** (2020 FY) and **Innovation Co-Chair** (Fall 2021) for the Researchers and Postdocs Association of Aeronautics and Astronautics (RPA<sup>3</sup>) at MIT. Website: <https://rpa3.mit.edu>
- **Postdoc representative** in the CSAIL Postdoc and Graduate Student Council (CPGSC) at MIT CSAIL led by Prof. Daniela Rus. Website: <https://www.csail.mit.edu/cpgsc>
- **Postdoc representative** in the CSAIL Culture Committee led by Prof. Daniel Jackson focused on improving community and culture at CSAIL.

### Initiatives

- Part of the team of MIT postdocs that conducted and analyzed results on the “[Postdoc Hiring and Recruitment at MIT Survey](#)” with the initial goal of examining the impact hiring and recruiting has on the diversity of the postdoc population at MIT. The full report can be found [here](#).
- Organized and moderated the “Picture a Scientist” Virtual Film Screening and Panel Discussion in January 2021. Event details [here](#).

### Mentoring

- Mentor within the Minds Matter Boston (MMB) program for the Junior Class of 2020-2021.

## **PRESS COVERAGE**

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- “*Getting dressed with the help from robots,*” by Rachel Gordon. MIT News. July 12, 2021. Mentioned in IEEE Spectrum, TechCrunch, FastCompany, The Next Byte Podcast, etc.
- “*More transparency and understanding into machine behaviors,*” by Rachel Gordon. MIT News. March 22, 2021.