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Andrew S. Morgan

Department of Mechanical Engineering and Material Science | Yale University
9 Hillhouse Ave. | New Haven, Connecticut, USA 06511 | +1 (330) 442-7556 | Andrew.Morgan@yale.edu
https://asmorgan24.github.io

EDUCATION

Yale University, New Haven, CT — Expected Graduation March 2023
PhD in Engineering & Applied Science (Robotics)
Thesis Title: "Learning Variant-Agnostic Models for Dexterous Manipulation with Underactuated Robotic Hands"
Advisor: Professor Aaron Dollar

Yale University, New Haven, CT — August 2017-May 2019
MS in Engineering & Applied Science (Robotics), MPhil in Engineering & Applied Science (Robotics)
GPA: Received *Honors* (equivalent of an A) in all ten graduate courses

Youngstown State University, Youngstown, OH — August 2013-May 2017
BE in Electrical Engineering, BS in Computer Science, Minor in Mathematics
GPA: 3.98/4.0 (summa cum laude from Honors College)

RESEARCH INTERESTS

Robot Manipulation, Dexterous Manipulation, Robot Grasping, Compliant Mechanisms
Machine Learning, Deep Learning (DL), Reinforcement Learning (RL), Self-Supervised Learning
Optimal Control, Adaptive Control, Motion Planning, State Estimation

WORK EXPERIENCE

Amazon Robotics, *Applied Scientist Intern,* Berlin, Germany — September 2022-March 2023
- Robot Pick Team working on retrieving objects from pods in high clutter situations
- Facilitated the development of a mechanism for clearing the view of perception with the pod

Technische Universität Darmstadt, *Visiting Research Intern (Virtual)*, Darmstadt, Germany — March 2020-March 2021
- Intelligent Autonomous Systems (IAS) Group led by Professor Jan Peters. Collaborators: Georgia Chalvatzaki, PhD, Daljeet Nandha, and Carlo D'Eramo, PhD
- Developed a Hybrid Model-based/Model-free RL method to accelerate policy acquisition (Model Predictive Actor-Critic)
- Explored optimal control formulations (LQR, MPC, MPPI, MBRL) in OpenAI gym environments

Youngstown Business Incubator, *Biz3D Instructor,* Youngstown, OH — June 2016-August 2017 (Summers)
- Taught five different groups of students (~80 total) ranging from late middle school to high school
- Developed a curriculum focused on entrepreneurship and FDM additive manufacturing (3D printing)
- Constructed memorable and practical real-life examples for 3D Printing practices in the workplace

Auburn University, *Research Experience for Undergraduates,* Auburn, AL — May 2016-August 2016
- Department of Computer Science and Software Engineering, advised by Prof. Richard Chapman
- Constructed a collision avoidance simulator in OpenGL for UAV see-and-avoid algorithm development
- Designed an independent UAV parachute recovery system as to adhere to recent FAA regulations

ABB Inc., *Research and Development Engineering Intern,* Wickliffe, OH — May 2015-August 2015
- Tested ABB Power Systems and Power Generation (PSPG) controllers and peripherals for corresponding tasks of implementation in the R&D group
- Organized intern fundraising efforts for the selected charity organizations

AWARDS AND HONORS

Research Articles:

- **Editors' Top (5) Picks of 2021:** *Science Robotics.* "Manipulation for Self-Identification, and Self-Identification for Better Manipulation" Winter 2021
- **Cover Article:** *Science Robotics*. "Siding, rolling, and breaking contact: complex manipulation with a simple robotic hand" Summer 2021
- Nominated for Best Paper in Manipulation (ICRA 2019) Summer 2019
- Nominated for Best Paper in Manipulation (ICRA 2018) Summer 2018
- Second Place winner in Computer Science Category – NSF ERN Conference Spring 2017
- Best Honors College Undergraduate Research Project – Youngstown State University Spring 2017

Fellowships and Scholarships:

- Robotics: Science and Systems Pioneer Spring 2022
  1 of 30 selected as "the world's top early career researchers" in Robotics
- Nominee for the Yale SEAS Henry Prentiss Becton Graduate Prize for Exceptional Research Achievement – greatest contributions to engineering during a PhD Spring 2022
- National Science Foundation Graduate Fellow (NSF GRFP) Spring 2019
- Robert E. Apfel Graduate Fellowship Fall 2017
- Tau Beta Pi (ΤΒΠ) Fellow Spring 2017
- National Science Foundation GRFP Honorable Mention Spring 2017
- Youngstown State University Scholars Program USXXI Fall 2013
  (4-year) Full-Funding Academic Merit Scholarship

Honor Societies and Other:

- Barry M. Goldwater Scholar Spring 2016
- Tau Beta Pi (ΤΒΠ) Scholar Summer 2016
- Ohio State Senate Recognition Award Summer 2016
- Ohio State House of Reps. Recognition Award Summer 2016
- ΤΒΠ National Engineering Society Fall 2015
- ΦΚΦ National Honor Society Spring 2015
- ΠΜΕ National Math Honor Society Spring 2015

SKILLS AND INTERESTS

- *Computer Skills:* Advanced programming capabilities in ROS, C, C++, Java, Matlab, Python, R, Arduino
  Operating Systems: Windows, MacOS, Linux (Ubuntu, Red Hat)
  Deep Learning Frameworks: PyTorch, Tensorflow, Keras
  Simulation Environments: PyBullet, Gazebo, MuJoCo
  Others: Slurm, Moveit!, Docker, Anaconda, RViz
- *Language Skills:* Intermediate reading capabilities in German, Spanish, and Greek (in that order)

PUBLICATIONS

Refereed Journal Articles:

J14. Bircher, W.B., Morgan, A.S., Kopits, L., and Dollar, A.M., "Robust Whole-Hand Spatial Manipulation via Energy Maps with Caging, Rolling, and Sliding", *IEEE Transactions on Robotics*, 2022. (Revise and Resubmit)

J13. Bimbo, J., Morgan, A.S., and Dollar, A.M., "Force-based Simultaneous Mapping and Object Reconstruction for Robotic Manipulation", *IEEE Robotics and Automation Letters* (with ICRA option),Vol. 7, No. 2, 2022.

J12. Morgan, A.S.*, Hang, K.*, Wen, B., Bekris, K., and Dollar, A.M., "Complex In-Hand Manipulation via Compliance-enabled Finger Gaiting and Multi-Modal Planning*", IEEE Robotics and Automation Letters* (with ICRA option), Vol. 7, No. 2, 2022.

J11. Hang, K., Bircher, W. B., Morgan, A. S., and Dollar, A. M., "Manipulation for Self-Identification, and Self-Identification for Better Manipulation", *Science Robotics*, Vol. 6, No. 54, eabe1321, May 2021.
Awarded in Science Editors' Top Picks of 2021.

J10. Bircher, W. B., Morgan, A. S. , and Dollar, A. M., "Sliding, rolling, and breaking contact: complex manipulation with a simple robotic hand", *Science Robotics*, Vol. 6, No. 54, eabd2666, May 2021. **Cover Article.**

J9. Morgan, A. S., Bircher, W. G., and Dollar, A. M., "Towards Generalized Manipulation Learning through Grasp Mechanics-based Features and Self-Supervision", *IEEE Transactions on Robotics*, Vol. 37, No. 5, pp. 1553-1569, 2021.

J8. Morgan, A.S., Hang, K., and Dollar, A. M., "Object-Agnostic Dexterous Manipulation of Partially Constrained Trajectories", *Robotics and Automation Letters* (with IROS option), Vol. 5, No. 4, pp. 5494-5501, 2020.

J7. Spiers, A., Morgan, A. S., Srinivasan, K., Calli, B., and Dollar, A. M., "Using Variable-Friction Finger Surfaces and Proprioceptive Sensing to Classify Objects during Robotic Within-Hand Manipulation", *Transactions on Haptics*, Vol. 13, No. 3, pp. 600-610, 2020

J6. Morgan, A.S., Hang, K., Bircher, W. G., Alladkani, F.M., Gandhi, A., Calli, B., and Dollar, A.M., "Benchmarking Pick-and-Place Manipulation with the Box and Blocks Test", *Special Issue on Benchmarking Robot Manipulation: Robotics and Automation Letters,* Vol. 5, No. 2, pp. 454-461, 2019.

J5. Hang, K.*, Bircher, W. G.*, Morgan, A. S., and Dollar, A.M., "Hand-Object Configuration Estimation using Particle Filters for Dexterous In-Hand Manipulation", *Special Issue on Soft Manipulation: International Journal of Robotics Research*, Vol. 37, No. 14, pp. 1760-1774, 2019 .

J4. Sintov, A., Morgan, A. S., Kimmel, A., Dollar, A. M., Bekris, K. E., and Boularias, A., "Learning a State Transition Model of an Underactuated Adaptive Hand", *IEEE Robotics and Automation Letters,* Vol. 4, No. 2, pp. 1287-1294, 2019.

J3. Hang, K., Morgan, A. S., and Dollar, A. M., "Pre-Grasp Sliding Manipulation of Thin Objects Using Soft, Compliant, or Underactuated Hands", *IEEE Robotics and Automation Letters,* Vol. 4, No. 2, pp. 662-669, 2019.
Nominated for best paper in robot manipulation (ICRA 2019).

J2. Morgan, A. S., Jones, Z., Chapman, R., and Biaz, S., "An Unmanned Aircraft "See and Avoid" Algorithm Development Platform using OpenGL and OpenCV", *Journal of Computing Sciences in Colleges*, Consortium for Computing in Colleges, Vol. 33, No. 2, pp. 229-236, 2017.

J1. Meyers, K., Morgan, A. S., and Conner, B. "3D printing to introduce design in a cornerstone project". *Global Journal of Engineering Education*, Vol. 18, Issue 1, 2016.

Refereed Conference Papers (full manuscripts):

C12. Morgan, A.S., Bateux, Q., Hao, M., and Dollar, A.M., "Towards Generalized Robot Assembly through Compliance-Enabled Contact Formations", *IEEE International Conference on Robotics and Automation (ICRA),* 2023. (Submitted)

C11. Wang, W., Morgan, A.S., Dollar, A.M., and Hager, G., "Dynamical Scene Representation and Control with Keypoint-Conditioned Neural Radiance Field ", *IEEE International Conference on Automation Control Science and Engineering (CASE)*, 2022.

C10. Morgan, A.S.*, Wen, B., Liang, J., Boularias, A., Dollar, A.M., and Bekris, K., "Vision-driven Compliant Manipulation for Reliable, High-Precision Assembly Tasks", *Robotics: Science and Systems (RSS)*, 2021.

C9. Morgan, A.S.*, Nandha, D.*, Chalvatzaki, G., D'Eramo, C., Dollar, A.M., and Peters, J., "Model Predictive Actor-Critic: Accelerating Robot Skill Acquisition with Deep Reinforcement Learning", *IEEE International Conference on Robotics and Automation (ICRA),* Xi'an, China, 2021.

C8. Patel, V. V., Morgan, A. S., and Dollar, A. M., "Highly Underactuated Radial Gripper for Automated Planar Grasping and Part Fixturing", *IEEE International Conference on Intelligent Robots and Systems (IROS),* Las Vegas, USA, 2020.

C7. Morgan, A. S., Hang, K., Bircher, W. G., and Dollar, A. M., "A Data-Driven Framework for Learning Spatial, Object-Agnostic Underactuated Dexterous Manipulation", IEEE *International Conference on Intelligent Robots and Systems (IROS)*, Macao, China, 2019.

C6. Morgan, A. S. *, Baines, R. L.*, McClintock, H., and Scassellati, B., "Unstructured Terrain Navigation and Topographic Mapping with a Low-cost Mobile Cuboid Robot", *IEEE International Conference on Intelligent Robots and Systems (IROS),* Macao, China, 2019.

C5. Morgan, A. S., Bircher, W. G., Calli, B., and Dollar, A. M., "Learning from Transferable Mechanics Models: Generalizable Online Mode Detection in Underactuated Dexterous Manipulation", *IEEE International Conference on Robotics and Automation (ICRA),* 2019.

C4. Bircher, W. G., Morgan, A. S., Hang, K., and Dollar, A. M., "Energy Gradient-Based Graphs for Planning Within-Hand Caging Manipulation", *IEEE International Conference on Robotics and Automation (ICRA),* 2019.

C3. Calli, B., Srinivasan, K., Morgan, A. S., and Dollar, A. M., "Learning Modes of Within-hand Manipulation." *IEEE International Conference on Robotics and Automation (ICRA),* Brisbane, Australia, 2018.
Nominated for best paper in robot manipulation (ICRA 2018).

C2. Meyers, K., Morgan, A. S., and Conner, B. "3D Printing in a First-Year Engineering Design Project", *American Society for Engineering Education National Conference*, New Orleans, Louisiana, 2016.

C1. Morgan, A. S., Sharif, B., and Crosby, M. "Understanding a Novice Programmer's Progression of Reading and Summarizing Source Code", Koli Workshop 2014, Koli, Finland, 2014.

Workshop Papers (peer reviewed):

W2. Morgan, A. S., "Learning to Visually Observe, Plan, and Control Compliant In-Hand Manipulation", *Robotics: Science and Systems Pioneers Workshop* , New York City, New York, USA, May 2022.

W1. Bimbo, J., Morgan, A. S., and Dollar, A. M., "Using Contacts During Robot Manipulation to Map and Reconstruct a Scene", *Robotics: Science and Systems Workshop on The Science of Bumping Into Things: Towards Robots That Aren't Afraid of Contact* , New York City, New York, USA, May 2022.

Magazine Articles:

M1. Morgan, A. S., Chapman, R., and Biaz, S., "DIY Drone Recovery Parachute", *Make Magazine,* Vol. 61, Feb/March Issue, pp. 42., 2018.

Patents:

P1. Morgan, A.S., and Kreatsoulas, N., Provisional Patent, April 2015, "IV Locking Device", Patent Application Number: 62/146,434.

PRESENTATIONS

Invited Seminar and Workshop Talks:

IP5. University of Chicago, Introduction to Robotics Course, Panel Discussion, Virtual — Spring 2022
Title: *"Perspectives of entering robotics research"*

IP4. Instituto Superior Técnico , Robotics Seminar Series, Lisbon, Portugal — Spring 2022
Title: *"Compliance-enabled in-hand manipulation"*

IP3. Yale University, CPSC559 Building Interactive Machines, New Haven, CT — Fall 2021
Title: "*On the utility of compliance for robot manipulation*"

IP2. TU Darmstadt Intelligent and Autonomous Systems (IAS) Seminar Series, Virtual — Fall 2021
Title: "*Challenges of In-Hand Manipulation*"

IP1. ICRA Workshop, "Benchmarks for Robotic Manipulation" Montreal, Canada — Summer 2019
Title: "*The Box and Blocks Test in Cluttered Robot Pick-and-Place Applications*"

Oral Conference Talks:

OP8. International Conference on Robotics and Automation (ICRA), Philadelphia, PA, USA — Summer 2022
Title: *"Complex In-Hand Manipulation via Compliance-Enabled Finger Gaiting and Multi-Modal Planning"*

OP7. International Conference on Robotics and Automation (ICRA), Virtual — Summer 2021
Title: "*Model Predictive Actor-Critic: Accelerating Robot Skill Acquisition with Deep Reinforcement Learning*"

OP6. International Conference on Intelligent Robots and Systems (IROS), Virtual — Fall 2020
Title: "*Object-Agnostic Dexterous Manipulation of Partially Constrained Trajectories*"

OP5. International Conference on Intelligent Robots and Systems (IROS), Macao, China — Fall 2019
Title: "*Data-Driven Framework for Learning Dexterous Manipulation of Unknown Objects*"

OP4. International Conference on Intelligent Robots and Systems (IROS), Macao, China — Fall 2019
Title: "*Unstructured Terrain Navigation and Topographic Mapping with a Low-cost Mobile Cuboid Robot*"

OP3. YSU's QUEST: a Forum for Undergraduate Research, Youngstown, OH — Spring 2017
Title: "*Digital Licensing Platform for Retro Games*"
Best University Honors College Project Award

OP2. NSF Emerging Researchers National Conference (ERN), Washington DC — Spring 2017
Title: "*Computer Vision 'See and Avoid' Simulation using OpenGL and OpenCV*"
Second Place winner in Computer Science and Information Management

OP1. Gulf Coast Undergraduate Research Symposium, Houston, TX — Fall 2016

Title: "*Computer Vision 'See and Avoid' Simulation using OpenGL and OpenCV*"

Poster Conference Presentations:

PP8. International Conference on Robotics and Automation (ICRA), Philadelphia, PA, USA Summer 2022
Title: *"Complex In-Hand Manipulation via Compliance-Enabled Finger Gaiting and Multi-Modal Planning"*

PP7. Robotics: Science and Systems (RSS) 2021, Virtual Summer 2021
Title: "*Vision-driven Compliant Manipulation for Reliable, High-Precision Assembly Tasks*"

PP6. Coalition for Life Sciences-Life Science Fair 2019. Capitol Hill, Washington D.C. Winter 2019
Title: "*Design Process Towards Robotic and Prosthetic Hands*"

PP5. International Conference on Robotics and Automation (ICRA), Montreal, Canada Summer 2019
Title: "*Learning from Transferable Mechanics Models: Generalizable Online Mode Detection in Underactuated Dexterous Manipulation*"

PP4. International Conference on Robotics and Automation (ICRA), Montreal, Canada Summer 2019
Title: "*Energy Gradient-Based Graphs for Planning Within-Hand Caging Manipulation*"

PP3. New England Manipulation Symposium, (NEMS) New Haven, CT Summer 2018
Title: "*Data Driven Detection of Manipulation States*"

PP2. American Society for Engineering Education National Conference (ASEE), New Orleans, LA Summer 2016
Title: "*3D Printing in a First-Year Engineering Design Project*"

PP1. Koli Workshop, Koli, Finland Spring 2014
Title: "*Understanding a Novice Programmer's Progression of Reading and Summarizing Code*"

ORGANIZATIONS AND SERVICE

Over 110 community service hours logged annually during undergraduate career (2013-2017)

Pauli Murray College Graduate Affiliate	Aug. 2019 – Aug. 2022
Coordinator - Pauli Murray Mellon Forums	Aug. 2019 – Aug. 2022
Co-captain Yale SEAS Softball Intramural Team	June 2019 – Aug. 2022
Co-organizer Yale SEAS Friday Socials	May 2019 – Aug. 2022
Co-organizer Yale Graduate Engineering Community Organization (GECO)	June 2021 – Aug. 2022
Yale Flipped Science Fair (FSF) Presenter and Organizer	Aug. 2018 – Aug. 2022
Yale Science in the News Lecture Series Presenter	Aug. 2018 – March. 2020
Yale Openhand Workshop Co-coordinator	Summer 2018
Yale Engineering Day(s) Volunteer	Sept. 2017 – Sept. 2018
YSU STEM 3D Printing Outreach Coordinator	Dec. 2014 – July 2017
YSU Academic Senate STEM Representative	Aug. 2014 – July 2017
YSU Student Government Association Representative	Aug. 2014 – July 2017

Academic Service (previous or active reviewer for the following conferences and journals):

Co-Organizer: ICRA 2023 "*Second Workshop on Compliant Robot Manipulation: Challenges and New Opportunities"* (Submitted – In Review)
https://sites.google.com/yale.edu/icra2023-compliantmanipulation/home

Co-Organizer: Robotics: Science and Systems Pioneers Workshop 2023—Web Chair
(New website TBD) https://sites.google.com/view/rsspioneers2022/

Lead Organizer: ICRA 2022 workshop "*Compliant Robot Manipulation: Challenges and New Opportunities"*
https://sites.google.com/view/icra-2022-compliantmanip/home

Co-organizer: New England Manipulation Symposium (NEMS) 2018 workshop "*Yale Openhand Fabrication*"
https://github.com/grablab/Yale-OpenHand-Workshop-2018

IEEE International Conference on Robotics and Automation (ICRA)
IEEE Robotics and Automation Letters (RAL)
IEEE/RSJ International Conference on Intelligent Robotics and Systems (IROS)
ASME Journal on Mechanisms in Robotics (JMR)
IEEE Transactions on Robotics (TRO)
IEEE Transactions on Automation Science and Engineering (TASE)
IEEE Transactions on Haptics (ToH)
International Journal of Robotics Research (IJRR)

GRANT WRITING AND COURSE CONTENT CREATION

Writer/contributor to NSF Grant, "Learning Visual Manipulation for Forceful Contact with Compliant Systems"	May 2021
Problem Set and Lecture development for Yale Engineering Capstone I	October 2018
Writer/contributor to "Biz3D" curriculum creation, Youngstown Business Incubator	Summer 2016
Problem Set and Lecture development for YSU Engineering Concepts/Computing	Fall 2014 / Spring 2015

TEACHING FELLOWSHIPS/ASSISTANTSHIPS

Spring 2019 – Mechanical Engineering Capstone II	Yale University
Fall 2018 – Mechanical Engineering Capstone I	Yale University
Spring 2016 – Honors First Year Engineering Computing	Youngstown State University
Fall 2015 – Honors First Year Engineering Concepts	Youngstown State University
Spring 2015 – Honors First Year Engineering Computing	Youngstown State University
Fall 2014 – Honors First Year Engineering Concepts	Youngstown State University
Summer 2017 – Biz3D Course Instructor	Youngstown Business Incubator
Summer 2016 – Biz3D Course Creator and Instructor	Youngstown Business Incubator