DEMIANA R BARSOUM

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EDUCATION

PhD in Mechanical Engineering, Northwestern University, Evanston, IL — Sep 2022 - Present

- **Research Areas & Interests:** Robot Learning, Teleoperation, Control Interfaces, Human-Robot Interaction, Assistive Robotics, User-centered Design
- **Awards:** Dr. L. Lewin Graduate Fellow, 2024 ROSCon Diversity Scholar, Walter P. Murphy Fellowship (2022-2023)
- **Teaching Assistant:** ME/CS 301: Introduction to Robotics (Winter 2025)
- **Relevant Coursework:** Robotic Manipulation, Embedded Systems (ROS 2), Machine Learning and Artificial Intelligence for Robotics, Active Learning for Robotics, Deep Learning, SLAM (ROS 2), Additive Manufacturing, Design: Learning to See People and Their Patterns
- **Severed as Reviewer:** HRI, ICORR, CoRL

BS in Mechanical Engineering, University of Tennessee, Knoxville, TN — Aug 2018 - May 2022

- **Minor:** Mathematics
- **GPA:** 3.82/4.0 (Magna Cum Laude)
- **Leadership:** President of Orthodox Christian Campus Ministries (OCCM)
- **Awards:** Carlos and Winnie Simpson Scholarship, Dean's List (2018 - 2022)

RESEARCH EXPERIENCE

PhD Student, Argallab, Northwestern University — Jan 2023 - Present
Advisor: Dr. Brenna D. Argall
Main Focus: Teleoperation of robotic arms via low-dimensional control interfaces for the purpose of robot learning from motor impaired teachers.

- Robot Learning & Accessible Control
  - Designing and implementing learning algorithms and pipelines for motor-impaired teachers to improve accessibility in robot learning (Current work).
  - Developed and evaluated a reconstruction algorithm designed to lift low-dimensional demonstrations (e.g., 1-D ip/puff or 2-D joystick) into higher-dimensional trajectories, enabling unconstrained robot learning and end-users to teach robots using interfaces accessible to them (Manuscript under review).
  - Designed and implemented a user-defined mapping framework where participants assigned control interface actions to observed robot behaviors, resulting in personalized teleoperation maps for assistive robots (Published at ICORR).
  - Collaborated on designing and executing a user study in which participants teleoperated a robotic arm using a novel body-machine interface; analyzed learning patterns across multiple sessions (Published at HRI and ICORR).
- User Studies & Data Analysis
  - Led and managed human-robot interaction studies, including participant recruitment (control and motor-impaired), study and task design, and IRB modifications for ethical compliance.
  - Directed full research cycles, integrating algorithm development, user study execution, and quantitative analysis.
  - Developed and applied analysis tools to evaluate robot learning policies from raw and reconstructed demonstrations, validating the performance of the reconstruction algorithm (Manuscript in preparation).
  - Conducted user studies to evaluate the customization of control interface mappings for robotic arms and powered wheelchairs during robot teleoperation.
  - Analyzed physiological metrics (ECG, heart rate variability) to assess mental workload during studies involving eye-gaze interfaces for assistive device control (Published as Wearables Journal paper).
  - Developed data processing pipelines for filtering, analyzing, and visualizing large multimodal datasets from user studies.
- Robotic Systems Development & Maintenance
  - Contributed to open-source repository on GitHub that Pinocchio depends on (repo: Gepetto/example_robot_data).
  - Manage and maintain the hardware and software for lab robots: Kinova JACO, Kinova MICO, & UFactory xArm 7.
  - Implemented and tested an open-source singularities avoidance algorithm (Stanford University, Dr. Monroe Kennedy's group) and developed teleoperation infrastructure for the xArm 7 supporting multiple interfaces (sip/puff, joystick, keyboard); Ported the system to ROS 2 using the Pinocchio library.
  - Led software migration efforts, including porting the Kinova MICO workspace from Python 2/ROS Kinetic to Python 3/ROS Noetic, and migrating the Kinova JACO from ROS to ROS 2.

Undergraduate Researcher, Advincula Group, UTK — Jan 2018 - Apr 2018
Advisor: Dr. Rigoberto Advincula

- Fabricated high-precision tensile bars and sandwich structures with custom epoxy-based materials using Direct Ink Writing (DIW) 3D printers.

- Spearheaded research initiatives to enhance 3D printing formulas, improving material performance and print quality.
- Performed comprehensive mechanical testing on printed tensile bars and sandwich structures, ensuring material integrity and performance.
- Configured and optimized a Dobot Magician robotic arm for precise, reliable PLA-based prints.
- Communicated research findings to lab members and advisor by leading technical discussions.

WORK EXPERIENCE

Manufacturing Engineer Intern, HBD Industries: Thermoid Inc., Oneida, TN May 2021 - Aug 2021
Supervisor: Mr. Keith Taylor

- Responsibilities included working with the plant staff on the implementation of Lean Manufacturing principles, troubleshooting production issues, and material testing.
- Worked closely with Manufacturing and Quality teams to resolve production issues with machinery, tooling, and material.
- Worked with Quality and Technical Departments on product testing. Experience in rubber testing (Rheometer) and product testing (burst & tensile testing).
- Created the process flow map for the Hose production line. Worked with the Continuous Improvement leader to develop product families.
- Updated old and wrote new procedures within the cells to reflect current state operations (used by workers until today).
- Reported updates on project status in the Daily Visual Management meetings.

Nissan Summer Engineering Program Participant, Smyrna, TN May 2017 - Jun 2017
Location: Smyrna Nissan Plant

- Developed skills for research and development of manufactured products by performing tests to figure out problems and solutions for future designs.
- Collaborated with a team to determine a problem in a 2017 Nissan Altima and come up with solutions to fix it.
- Presented research in front of bosses (including VP of Nissan), co-workers, and mentors.

PUBLICATIONS

- **Demiana R Barsoum**, Mahdieh Nejati Javaremi, Larisa YC Loke, and Brenna Argall. "Interface-Aware Trajectory Reconstruction for Robot Learning" (2025). *Under review.*
- **Demiana R Barsoum**, Michelle H Zhang, Larisa YC Loke, and Brenna Argall. "Curating Interface Maps for Robot Teleoperation" (2025). *In Proceedings of the International Conference on Rehabilitation Robotics (ICORR) 2025.*
- Joana Brito, Mayumi Mohan, Anouk Neerincx, **Demiana R Barsoum**, and Isabel Neto. "Workshop YOUR Study Design 2025! Participatory Critique and Refinement of Participants' Studies" (2025). *In Proceedings of the ACM/IEEE International Conference on Human Robot Interaction (HRI) 2025.*
- Larisa YC Loke, **Demiana R Barsoum**, Todd D Murphey, and Brenna Argall. "Characterizing Eye Gaze and Mental Workload for Assistive Device Control" (2024). *Wearable Technologies Journal.*
- **Demiana R Barsoum**, Mahdieh Nejati Javaremi, and Brenna Argall. "Learning from Limited Demonstrations Through Motor Impaired Teachers" (2024). *Workshop Paper for the ACM/IEEE International Conference on Human Robot Interaction (HRI) 2024.*
- Fiona A Neylon, Andrew Thompson, Fabio Rizzoglio, **Demiana R Barsoum**, Lucy E Ammon, Maximus N McCune, Lee Miller, and Brenna Argall. "Navigating Adaptive Design: Advancing the Body-Machine Interface for 6D Control in Assistive Applications" *Workshop Paper for the ACM/IEEE International Conference on Human Robot Interaction (HRI) 2024.*
- Andrew Thompson*, Fiona A Neylon*, Fabio Rizzoglio*, **Demiana R Barsoum**, Lucy E Ammon, Maximus N McCune, Lee Miller, and Brenna Argall. "An Evolution of Assistive Robot Control to Meet End-User Ability" (2024). *Proceedings of the ACM/IEEE International Conference on Human Robot Interaction (HRI) 2024.*
- Larisa YC Loke, **Demiana R Barsoum**, Todd D Murphey, and Brenna Argall. "Characterizing Eye Gaze for Assistive Device Control" (2023). *Proceedings of the IEEE International Conference on Rehabilitation Robotics (ICORR) 2023.*
- Zane J Smith, **Demiana R Barsoum**, Zahariah Arwood, Dayakar Penumadu, and Rigoberto C Advincula. "Characterization of micro-sandwich structures via direct ink writing epoxy based cores" (2023). *Journal of Sandwich Structures & Materials.*

PROJECTS

SLAM Implementation on TurtleBot3 using ROS 2 Iron and C++ Jan 2024 - Mar 2024

- Wrote libraries for geometry, SE2d, forward kinematics, inverse kinematics in preparation for controlling a turtlebot3.
- Implemented an Extended Kalman Filter (EKF) SLAM algorithm in C++ and ROS 2.

Painting Robot: BotROS in ROS 2 Iron Sep 2023 - Dec 2023

- Worked in a team of 4 to program Franka Emika Robotic arm to paint a given image.
- Worked on the control of the robot: Motion required to complete the task (Cartesian Path Planning) and pick-and-place of the paintbrush.

- Wrote a MoveIt2 Planning Library to coordinate the motion for this project.

A Star Implementation Sep 2023 - Dec 2023
- Implemented Online and Offline A* pathfinding on a 2D grid.
- Implemented path planning for autonomous navigation with obstacle avoidance in Python.
- Designed a PI controller for precise robot navigation.

GAN to Generate Super Mario Bros Levels Mar 2023 - Jun 2023
- Worked in a team of 4 to optimize an CDCGAN model to generate playable Super Mario levels.

Design & Development of a Shredder for Repurposing Plastics into 3-D Printing Filament Aug 2021 - May 2022
- Worked in a team of 4 to design and develop a plastic shredder for use aboard U.S. Navy Ships (project funded by the US Navy). Shredded plastics were to be used as filament for 3-D printing.

SKILLS

Programming Languages	Python, C/C++, Matlab, HTML, Lua
Operating Systems	Robot Operating System (ROS & ROS 2), Ubuntu Linux, Windows, WSL, macOS
Robots	Kinova JACO v2, UFactory xArm 7, Franka Emika, Kinova MICO, & LUCI powered wheelchair
Control Interfaces	Sip/Puff, Joysticks, Head Array, IMU sensors, Zed2i and Intel RealSense Depth Cameras
Tools	Git/GitHub, PyTorch and TensorFlow, Docker, sklearn/scikit-learn, LaTeX, &, Pinocchio
Software	3D Printing/Rapid Prototyping, SolidWorks, Onshape
Leadership	Mentoring Masters in Robotics (MSR) Project (2025)
Languages	Arabic and English (Native)

EXTRA-CURRICULAR ACTIVITIES

Museum of Science and Industry - Robotics Week, Chicago, IL Apr (Yearly since 2023)
Volunteer

- Volunteer to demo robotic platforms from our lab for robotics week to children.

STEM Outreach, UTK and Bowers Elementary School (Harriman, TN) Nov 2019 - Dec 2019
Mentor: Dr Stephanie TerMaath

- Volunteered to share engineering with underprivileged girls under the guidance of Dr. Stephanie TerMaath.
- Helped them operate tools like tinkerCAD, which allowed them to design airplanes and later 3D print them.