Trevor W. Exley

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Personal Statement

Dedicated and diligent researcher with background in biomechanics, machine learning, and compliant robotics. Confident presenter in classroom and professional settings. Interested in converging my knowledge on rehabilitation applications.

Education

Ph.D. Biomedical Engineering **August 2021 – Present**
University of North Texas
- Supervisor: Dr. Amir Jafari
- 4.00/4.00 cumulative GPA

M.S. Biomedical Engineering **June 2020 – May 2021**
University of North Texas
- Thesis: Parkinson's Disease and UPDRS-III Prediction Using Quiet Standing Data and Applied Machine Learning
  Committee: Rita M. Patterson, Mark V. Albert, Vijay Vaidyanathan
- 4.00/4.00 cumulative GPA

B.S. Biomedical Engineering, summa cum laude **August 2017 – May 2020**
University of North Texas
- Minors in Mathematics and Mechanical Engineering
- 3.94/4.00 cumulative GPA, rank (295/3883)

Teaching Experience

Teaching Fellow **June 2021 – August 2021**
Department of Biomedical Engineering, University of North Texas
- Refine curriculum to accommodate for a hybrid setting
- Demonstrate acquired knowledge for biomedical instrumentation

Teaching Assistant **August 2020 – August 2021**
Department of Biomedical Engineering, University of North Texas
- Create lab curriculum for course with 80 students
- Grade all assignments and exams independently

Academic Tutor **February 2020 – August 2021**
Pam H. Weber, PhD & Associates
- Tutor high-school students in STEM courses
- Construct lesson plans in preparation for AP exams

Research Experience

PhD Candidate and researcher, Advanced Robotic Manipulators Lab, *University of North Texas* **August 2021 – Present**

Lab affiliated, Biomedical AI Lab, *University of North Texas* **May 2020 – Present**

Poster Presentations, external

1. Exley T, Johnson D, Jafari A. "Enhancing Bandwidth in Thermoactive Soft Actuators: Utilizing the Peltier Effect for Symmetrical Actuation and Active Cooling" *Biomedical Engineering Society Conference (BMES 2023)* October 11-15, 2023
2. Exley T, Johnson D, Jafari A. "Polycaprolactone-Based Thermoresponsive Variable Impedance Actuators: Prioritizing Active Heating/Cooling for Effective Offline Impedance Control" *Biomedical Engineering Society Conference (BMES 2023)* October 11-15, 2023
3. Torres, M, Exley T, Johnson D, Jafari A, Ecker M. "Silicone Elastomers for Soft Robotics: Controlling Strain-Limiting Functionality" *Biomedical Engineering Society Conference (BMES 2023)* October 11-15, 2023
4. Exley T, Porter L, Vaidyanathan V. "Component Reduction of Bioinstrumentation Using Programmable System on Chip." *Biomedical Engineering Society Conference (BMES 2020)* October 14-17, 2020

Oral Presentations, select external

1. Exley, T. Global Ethicon RD, (Feb. 15, 2023) in 'Robotics and Digital Surgery' session 'Thermo-Reversible Phase-Change Actuators for physical Human-Robot Interactions'
2. Exley, T. University of Texas San Antonio (June 17, 2022) in 'Robotics in Industry 4.0' session 'Soft Robotics for Industry 4.0'

Patents

1. 63/480,649 Thermoactivate Modular Soft Actuator based on Phase Transition United States Provisional Patent Filed 1/19/2023
2. 63/498,739 Hydraulic-actuated soft robotic glove United States Provisional Patent Filed 4/27/2023
3. 63/480,645 Thermal-Based Variable Impedance Actuator (VIA - PCL) United States Provisional Patent Filed 1/19/2023
4. 63/499,128 Peltier-Integrated Therapeutic Wrap United States Provisional Patent Filed 4/28/2023

Grants, Fellowships, and other Funding

NIH Graduate Research Training Initiative for Student Enhancement (G-RISE) funding under NIH T32GM136501 for research during my PhD. **August 2021 – August 2024**

Peer-reviewed publications

In press, submitted, or under revision:

1. **Exley, T.,** Wijesundara, R., Tan, N., Sunkara, A., He, X., Wang, S., Chan, B., Jain, A., Espinosa, L., Loza, S., Jafari, A. (submitted) Agonist-Antagonist Pouch Motors: Bidirectional Soft Actuators Enhanced by Thermally Responsive Peltier Elements, *2024 International Conference on Intelligent Robots and Systems*

2. **Exley, T.,** Wijesundara, R., Wang, S., Jafari, A. (submitted) Evaluating Shear-Mode Capabilities of *Polycaprolactone* for Variable Impedance Modules, *2024 International Conference on Intelligent Robots and Systems*
3. **Exley, T**., Johnson, D., Jafari, A. (Under Revision) A Novel Thermo-Responsive Soft Actuation Technology based on Phase-Change Material. *Journal of Medical Robotics Research*

Published:

1. **Exley, T**., Hays, E., Johnson, D., Moridani, A., Motati, R., Jafari, A. (2024) Towards a Unified Naming Scheme for Thermo-Active Soft Actuators: A Review of Materials, Working Principles, and Applications. *Robotics Reports.*
2. **Exley, T**., Johnson, D., Jafari, A. (2023) A Novel Variable Impedance Actuator Utilizing Adjustable Viscoelastic Properties of Thermoresponsive Polycaprolactone. *Robotics Reports*.
3. **Exley, T.,** Johnson, D., Jafari, A. (2023). Towards a Novel Thermal-Based Variable Impedance Module through Adjusting Viscoelastic Properties of a Thermoresponsive Polymer. *IEEE Transactions on Medical Robotics and Bionics*, 1-1.
4. **Exley, T**., Johnson, D., Jafari, A. (2023). Utilizing the Peltier Effect for Actuation of Thermo-Active Soft Robots. *Smart Materials and Structures.*
5. Hays, E., Slayton, J., Tejeda-Godinez, G., Carney, E., Cruz, K., **Exley, T**., Jafari, A. (2023). A Review of Rehabilitative and Assistive Technologies for Upper-Body Exoskeletal Devices. *Actuators*, 12 (Soft Robotics in Biomedical Application), 178.
6. **Exley, T**., Moudy, S., Patterson, RM., Kim, J., & Albert, MV. (2022). Predicting UPDRS Motor Symptoms in Individuals with Parkinson's Diseases from Force Plates Using Machine Learning. *IEEE Journal of Biomedical and Health Informatics*
7. Liu, Z., **Exley, T.,** Meek, A., Yang, R., Zhao, H., Albert, MV. (2022). Predicting GPU Performance and System Parameter Configuration Using Machine Learning. *IEEE Computer Society Annual Symposium on VLSI*
8. **Exley, T**., & Jafari, A. (2022). Increasing robustness and output performance of Variable Stiffness Actuators in periodic motions. *Mechanism and Machine Theory*, *169*, 104645.
9. **Exley, T**., & Jafari, A. (2021). Maximizing energy efficiency of variable stiffness actuators through an interval-based optimization framework. *Sensors and Actuators. A, Physical*, *332*, 113123.

Teaching

Courses Taught

Traditional courses:

1. BMEN 2320: Biomedical Instrumentation

External courses, tutorials, and workshops

2. Soft Robotics in i4.0, Robotics in Industry 4.0: Challenges and Opportunities *University of San Antonio,* (Summer 2022)

Service

Editorial Positions

Co-guest editor Special Issue "Soft Robotics in Biomedical Application"

Academic Reviewer
(ordered by year of most recent review)

1. IEEE Robotics and Automation Letters, 2023
2. IEEE/RSJ International Conference on Intelligent Robots and Systems, 2023
3. IEEE International Consortium for Rehabilitation Robotics, 2022
4. IEEE International Conference on Intelligent Robots and Systems, 2022

Capstone Project **August 2019 – May 2020**
Department of Biomedical Engineering, University of North Texas

- Exley T, H Gomez A, Cruz M, Johnson H. "Low-cost trans-humeral prosthetic capable of power and precision grip controlled through foot and upper-body movement"
- Responsible for designing the control system for upper-limb prostheses using affordable and accessible methods

Independent Research **August 2018 – October 2020**
Department of Biomedical Engineering, University of North Texas

- Conducted cost and performance analyses for analog front-ends in bioinstrumentation using traditional and Programmable System on Chip ICs

Volunteer Experience

Director – Team Operations **October 2020 – July 2023**
The Shoulders of Giants Inc.

- Nonprofit organization that is dedicated to sharing the thrill of scientific discovery
- Organize and manage student project teams and coordinate between technical mentors.

Professional Experience

Chief Executive Officer **August 2023 –Present**
Robotics and STEM LLC

- Spearheaded innovative soft actuation technology development, transitioning groundbreaking concepts to market-ready products across various industries.
- Established partnerships with K-12 schools, implementing a robotics curriculum that emphasizes 3D printing, circuits, coding, and robotics design, nurturing future tech leaders.

Biomedical Internship **February 2019 – May 2019**
Bridging Biosciences LLC

- Research and development team for getting novel medical devices ready for patent

Awards/Honors

Outstanding M.S. Student University of North Texas (2021)

Outstanding Senior University of North Texas (2020)

Outstanding Senior Design One of three capstone projects that were recognized during commencement. "Low-cost trans-humeral prosthetic capable of power and precision grip controlled through foot and upper-body movement." University of North Texas (2020)

Distinguished Honors College Scholar Award University of North Texas Honors College (2020)

Esports Scholarship Awarded for being on the UNT Varsity League of Legends Team (2019-2020)

UNT Excellence Scholarship ($18,000) Funding for undergraduate study at University of North Texas - Awarded based on academic success (2017-2020)

CENG/DEAN Undergraduate Scholarship ($2000) Funding for first year at University of North Texas – Awarded to highest performing students (2017)

Skills

Computer: Solidworks, Autodesk, 3D Printing, FEA, C++, MATLAB, LabVIEW, Python, Machine Learning, ROS (Robot Operating System)

Relevant Certifications and Courses

Machine Learning, Coursera (2020)

Professional Memberships

Institute of Electrical and Electronics Engineers (IEEE)
Biomedical Engineering Society (BMES)

References

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