Sergio A. Machaca

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Citizenship: United States of America

Education

Ph.D. Mechanical Engineering *(December 2024)*
Johns Hopkins University Baltimore, MD, USA
Advisor: Jeremy D. Brown, Ph.D.

M.S.E. Robotics December 2022
Johns Hopkins University Baltimore, MD, USA
Advisor: Jeremy D. Brown, Ph.D.

B.S. Mechanical Engineering June 2018
Drexel University Philadelphia, PA, USA
Honors: Distinction, Magna cum Laude. GPA: 3.87/4.00

B.S. Biomedical Engineering (transferred) *2013-2014*
University of Rochester Rochester, NY, USA

Positions Held

Graduate Research Assistant July 2018 - Present
Haptics and Medical Robotics Laboratory, Johns Hopkins University Baltimore, MD, USA
PI: Jeremy D. Brown, Ph.D.

Teaching Assistant January - May 2020
EN.530.421 Mechatronics Baltimore, MD, USA
Professor: Jeremy D. Brown, Ph.D.

Teaching Assistant August - December 2019
EN.530.691 Haptic Interface Design for Human-Robot Interaction Baltimore, MD, USA
Professor: Jeremy D. Brown, Ph.D.

Robotic Design Intern April - September 2017
Siemens Corporate Technology, Siemens AG Munich, Germany
Mentor: Iason Vittorias, Ph.D., PI: Georg Bachmaier, Ph.D.

Computational Biomechanics Intern March - September 2016
Research and Exploratory Development, JHU Applied Physics Laboratory Laurel, MD, USA
Mentor: Connor Pyles, PI: Robert Armiger

NSF REU Student June - August 2015
LRSM, University of Pennsylvania Philadelphia, PA, USA
Mentor: Somayeh Farhadi, Ph.D., PIs: Paulo E. Arratia, Ph.D., Douglas J. Durian, Ph.D.

Student Researcher September 2015 - June 2018
Biomechanics Laboratory, Drexel University Philadelphia, PA, USA
PI: Sorin Siegler, Ph.D.

Fellowships

Modeling, Simulation, and Training (MS&T) Fellowship 2022-2024
Grantor: Link Foundation
Duration: 2 years

Graduate Research Fellowship Program (GRFP) 2019-2021
Grantor: National Science Foundation
Duration: 3 years (within a 5-year fellowship period)

Payback Fellowship 2018-2019
Grantor: Johns Hopkins University
Duration: 1 year

Journal Publications

J1 **S. Machaca**, G. Ung, J.D. Brown, "Towards an Understanding of the Utility of Dual-Modality Haptic Feedback in Teleoperated Medical Devices," *IEEE Transactions on Medical Robotics and Bionics*, vol. 2, no. 4, pp. 574-577, Oct. 27, 2020. doi: 10.1109/TMRB.2020.3034254

J2 S. Farhadi, **S. Machaca**, J. Aird, B.O. Torres Maldonado, S. Davis, P.E. Arratia, D.J. Durian, "Dynamics and Thermodynamics of Air-Driven Active Spinners," *Soft Matter*, vol. 14, no. 27, pp. 5588-5594, May 24, 2018. doi: 10.1039/C8SM00403J

Peer-Reviewed Conference Publications

C1 **S. Machaca**, E. Cao, A. Chi, G. Adrales, K. J. Kuchenbecker and J. D. Brown, "Wrist-Squeezing Force Feedback Improves Accuracy and Speed in Robotic Surgery Training," 2022 9th IEEE RAS/EMBS International Conference for Biomedical Robotics and Biomechatronics (BioRob), Seoul, Republic of Korea, Aug. 21-24, 2022, pp. 1-8, doi: 10.1109/BioRob52689.2022.9925306

C2 **S. Machaca**, Z. Karachiwalla, N. D. Riaziat and J. D. Brown, "Towards a ROS-based Modular Multi-Modality Haptic Feedback System for Robotic Minimally Invasive Surgery Training Assessments," 2022 International Symposium on Medical Robotics (ISMR), Atlanta, GA, USA, Apr. 13-15, 2022, pp. 1-7, doi: 10.1109/ISMR48347.2022.9807479

Short Peer-Reviewed Conference Articles and Abstracts

S1 **S. Machaca** and J.D. Brown, "A Multimodality Haptic Feedback Device for Visual-Haptic Acuity Development in Robotic Minimally Invasive Surgery Training," 2024 IEEE Haptics Symposium (Works in Progress Session), Long Beach, CA, USA, Apr. 7-10, 2024 *(accepted)*

S2 **S. Machaca** and J.D. Brown, "Towards a robotic minimally invasive surgery assessment and augmentation platform for visual-haptic acuity development," In Proc. 15th Hamlyn Symposium on Medical Robotics, London, England, June 26-29, 2023

S3 E. Cao, **S. Machaca**, T. Bernard, B. Wolfinger, Z. Patterson, A. Chi, G. Adrales, K.J. Kuchenbecker, J.D. Brown, "Bimanual Wrist-Squeezing Haptic Feedback Changes Speed-Force Tradeoff in Robotic Surgery Training," Annual Meeting of the Society of American Gastrointestinal and Endoscopic Surgeons, Baltimore, MD, USA, Apr. 3-6, 2019

Hands-On Demonstrations

D1 **S. Machaca** and J.D. Brown, "Demonstration of MODAL: A Wrist-Squeezing and Vibrotactile Feedback Device for Robotic Minimally Invasive Surgery Training," 2024 IEEE Haptics Symposium, Long Beach, CA, USA, Apr. 7-10, 2024 *(accepted)*

D2 **S. Machaca**, G. Ung, J.D. Brown, "Virtual Grasp-and-Hold Task Using Continuous Vibrotactile and Squeezing Cues," 2020 IEEE Haptics Symposium, Washington, D.C., USA, Mar. 28-30, 2020 *(conference cancelled due to COVID-19 pandemic)*

Non-refereed/Short Conference Articles and Abstracts

A1 **S. Machaca**, R.M. Haupt, A. Malpani, J.D. Brown, "Kinematic and kinetic task performance data for holistic assessment of skill at robot-assisted minimally invasive surgery," ACS Surgeons and Engineers: A Dialogue on Surgical Simulation (virtual), Mar. 10, 2021

A2 E. Cao, **S. Machaca**, A. Chi, G.L. Adrales, K.J. Kuchenbecker, J.D. Brown, "Bimanual Wrist-Squeezing Haptic Feedback Changes Speed-Force Tradeoff in Robotic Surgery Training," ACS Surgeons and Engineers: A Dialogue on Surgical Simulation (virtual), Mar. 10, 2021

A3 E. Cao, **S. Machaca**, T. Bernard, B. Wolfinger, Z. Patterson, A. Chi, G.L. Adrales, K.J. Kuchenbecker, J.D. Brown, "Bimanual Wrist-Squeezing Haptic Feedback Changes Speed-Force Tradeoff in Robotic Surgery Training," Johns Hopkins University Malone Center for Engineering in Healthcare Symposium, Baltimore, MD, USA, Nov. 19, 2018

Presentations

T1 **S. Machaca**, E. Cao, A. Chi, G. Adrales, K. J. Kuchenbecker and J. D. Brown, "Wrist-Squeezing Force Feedback Improves Accuracy and Speed in Robotic Surgery Training," 9th IEEE RAS/EMBS International Conference on Biomedical Robotics and Biomechatronics (BioRob), Seoul, Republic of Korea, August 21-24, 2022

T2 **S. Machaca**, Z. Karachiwalla, N. D. Riaziat and J. D. Brown, "Towards a ROS-based Modular Multi-Modality Haptic Feedback System for Robotic Minimally Invasive Surgery Training Assessments," 2022 International Symposium on Medical Robotics (ISMR), Atlanta, GA, USA, Apr. 13-15, 2022

T3 **S. Machaca** and J.D. Brown, "Understanding the role of haptic feedback in robotic surgery training," Johns Hopkins University Laboratory for Computational Sensing and Robotics (LCSR) Seminar (virtual), February 28, 2022

Media Highlights

May 2023 My work was featured in a Johns Hopkins Medicine article about haptic feedback in robotic minimally invasive surgery training: `https://www.hopkinsmedicine.org/news/articles/2023/05/johns-hopkins-surgeons-seek-to-improve-tactile-sensitivity-during-robotic-surgery/`

July 2019 The Johns Hopkins University Department of Mechanical Engineering recognized me for receiving the NSF GRFP Fellowship: `https://me.jhu.edu/news/phd-student-sergio-machaca-awarded-nsf-graduate-research-fellowship/`

April 2019 Drexel University Pennoni Honors College created a student profile on me to recognize my fellowships and research: `https://drexel.edu/pennoni/urep/fellowships/studentprofiles/profiles/Sergio%20Machaca/`

Mentorship

Below are students I have mentored as part of the NSF-funded CSMR REU summer program hosted by JHU LCSR: `https://lcsr.jhu.edu/reu/`

2022 - Present	Delphine Tan, Johns Hopkins University
2021 - 2022	Zulekha Karachiwalla, B.S. Computer Engineering, University of Maryland Baltimore County
2019	Rachel Haupt, B.S. Biomedical Engineering, University of South Carolina

Doctoral Exams and Dissertation Defense

December 2024	Dissertation Defense (tentative date)
July 11, 2022	Graduate Board Oral (GBO) Exam - **Unconditional Pass**
September 12, 2019	Departmental Qualifying Exam (DQE) - **Unconditional Pass**

Professional Activities

Engineering Societies

Institute of Electrical and Electronics Engineers (IEEE) Student Member
American Society of Mechanical Engineers (ASME) Student Chapter, Drexel University
Biomedical Engineering Society (BMES) Student Chapter, University of Rochester

Departmental Organizations

2023 - 2024 Treasurer, JHU Mechanical Engineering Graduate Association (MEGA)
2022 - 2023 Vice President, JHU Mechanical Engineering Graduate Association (MEGA)
2016 - 2017 Secretary, Drexel University American Society of Mechanical Engineers (ASME)

University-wide Organizations

2022 - 2023 Mechanical Engineering Representative, JHU Graduate Representative Organization (GRO)

Honor Societies

Hess Engineering Scholars, Drexel University
Pennoni Honors College, Drexel University
Tau Beta Pi, Drexel University chapter

Languages Spoken

English, Spanish, Portuguese