Duke UNIVERSITY

Sarah Sangjun Eom

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EDUCATION

DUKE UNIVERSITY, Durham, NC — Ph.D. in Electrical and Computer Engineering — 2021 – present
- Research Interests**:** IoT, HCI, AR, Medical Applications — **Advisor:** Dr. Maria Gorlatova
- Intelligent Interactive Internet of Things (I^3T) Lab

PURDUE UNIVERSITY, West Lafayette, IN — M.S. in Engineering Technology — 2017 – 2020
- M.S. Thesis**:** TupperwareEarth: Knowledge-Based Ontological System for the Internet of "Kitchen Things"
- Collaborative Robotics Lab (CRL) — **Advisor:** Dr. Richard M. Voyles

PURDUE UNIVERSITY, West Lafayette, IN — B.S. in Electrical and Computer Engineering Technology — 2014 – 2017
- Graduated with *Distinction* — GPA: 3.89
- Minor in Electronic and Time-Based Art

SELECTED EXPERIENCE

BOSCH RESEARCH AND TECHNOLOGY CENTER, Pittsburgh, PA — Summer 2023

IoT Edge and Cloud Integration Intern
- Developed an ontology-based digital twin for industrial applications using Ontology Web Language (OWL). Worked with Bosch's Reliable Distributed Systems group and Professor Anthony Rowe's group at Carnegie Mellon University.
- Created a proof-of-concept demo of a virtual pendulum that automatically detects and maps the IoT sensors and actuators for synchronization of a physical pendulum swinging behaviors in real time using ARENA WebXR and NVIDIA Omniverse.

DUKE UNIVERSITY, Durham, NC — 2021 – present

Graduate Research Assistant, Pratt School of Engineering

Member and lab manager of I^3T Lab led by Prof. Maria Gorlatova. Leading multiple interdisciplinary medical AR research projects in collaboration with multiple departments in the School of Medicine at Duke University.
- Designing and developing an augmented reality-based guidance system for neurosurgery using Microsoft HoloLens 2 and OptiTrack cameras for high precision image registration with a custom-designed patient-specific phantom model, and evaluated with 80+ medical students and 9 neurosurgeons (collaborated with the Department of Neurosurgery, School of Medicine, Duke University).
- Developing an edge-based augmented reality system for retinal laser therapy, running real-time image processing with OpenCV and optimizing the latency using Microsoft HoloLens 2 (collaborated with the Department of Ophthalmology, School of Medicine, Duke University).
- Exploring the use of digital biomarkers including ECG, EEG, heart rate, and temperature sensors with AR in enhancing mental health training sessions. Leading a multi-departmental team in analyzing physiological data, designing realistic AR environment for emotion regulation, and conducting user studies (collaborated with the Department of Biomedical Engineering and Department of Psychiatry and Behavioral Science, Duke University).

PURDUE UNIVERSITY, West Lafayette, IN — 2015 – 2020

Graduate Research Assistant, School of Engineering Technology (2017-2020)

Undergraduate Research Assistant, School of Engineering Technology (2015-2017)

Member and lab manager of Collaborative Robotics Lab (CRL) led by Prof. Richard M. Voyles.
- Designed, developed and integrated an embedded system (MSP430 and nRF microcontrollers) with various IoT sensors and actuators (light, proximity, VOC, humidity sensors, E-ink display) built on a flexible PCB for the prototype of a smart food container that provides user convenience in recipe recommendation, food expiration alerts, and displaying information through an ontological system based on AWS Lambda, IoT Core, and EC2.
- Collaborated with Tupperware Brands' Vice President for Research on technology commercialization of Smart Tupperware. Completed NSF Innovation Corp (I-Corp) program as an entrepreneurial lead (with an industrial lead, Dr. Shoumen Datta from MIT AutoID Lab).

SELECTED AWARDS AND HONORS

Research to Prevent Blindness Grant (Funding: $3k)	Duke Eye Center	Spring 2023
CRA-WP Grad Cohort for Women Invitation	CRA-WP	Spring 2022
NSF Innovation Corp Program (Funding: $50k)	National Science Foundation	Summer 2020
Midwest I-Corps ICD (Funding: $2k)	Purdue University	Spring 2020

PUBLICATIONS

https://scholar.google.com/citations?user=4CRAKIkAAAAJ&hl=en

Names of the students I advised are underlined.

BOOK CHAPTERS

[SPRINGER23] T. Scargill, **S. Eom**, Y. Chen, M. Gorlatova, Ambient Intelligence for Next-Generation AR, in *Springer Handbook of the Metaverse* (invited book chapter), 2023.

JOURNAL PUBLICATIONS

(Under Review) **S. Eom**, S. Kim, J. Jackson, D. Sykes, S. Rahimpour, M. Gorlatova, Augmented Reality-based Contextual Guidance through Surgical Tool Tracking in Neurosurgery, submitted to *IEEE Transactions on Visualization and Computer Graphics (TVCG)*, 2023.

[NEUROSURG24] **S. Eom**, T. Ma, N. Vutakuri, T. Hu, A. P. Haskell-Mendoza, D. W. Sykes, M. Gorlatova, J. Jackson, Accuracy of routine external ventricular drain placement following a mixed reality-guided twist-drill craniostomy, to appear in *Neurosurgical Focus* (special issue for January 2024), 2024.

[IOTJ22] **S. Eom**, H. Zhou, U. Kaur, R. Voyles, D. Kusuma, TupperwareEarth: Bringing Intelligent User Assistance to the "Internet of Kitchen Things," in *IEEE Internet of Things Journal*, Vol. 9, No. 15, 2022.

[EDTECH19] L. Bosman, **S. Eom**, Using scaffold innovation-thinking frameworks to integrate food science and technology into the transdisciplinary engineering design classroom, in *Journal of Educational Technology in Higher Education*, 16(1), 35, 2019.

CONFERENCE PROCEEDINGS

[ISMAR22] **S. Eom**, D. Sykes, S. Rahimpour, M. Gorlatova, NeuroLens: Augmented Reality-based Contextual Guidance through Surgical Tool Tracking in Neurosurgery, in Proc. *IEEE International Symposium on Mixed and Augmented Reality (ISMAR)*, Oct. 2022 **(Acceptance Rate: 21%)**. [DEMO]

[ICRA21] **S. Eom**, P. Abbaraju, Y. Xu, B. Nair, R. Voyles, Optimized Neuromorphic Architecture Based on Printable Organic Semiconductors for *Form + Function 4-D Printing* of Robotic Materials for a Sensing Skin, in Proc. *IEEE Conference on Robotics and Automation (ICRA)*, May 2021.

[ANTEC19] **S. Eom**, R. Voyles, D. Kusuma, Embedding Intelligence into Smart Tupperware Brings Internet of Things Home, in *Society of Plastics Engineers Annual Technical Conference (SPE ANTEC)*, Mar. 2019.

[END18] T. M. Smith, A. Hammoud, **S. Eom**, Defining Transdisciplinarity, in *International Conference on Education and New Development (END)*, pp.204-208, 2018.

WORKSHOP PROCEEDINGS

(Accepted) **S. Eom**, T. Ma, N. Vutakuri, T. Hu, J. Jackson, M. Gorlatova, Did I Do Well? Personalized Assessment of Trainees' Performance in Augmented Reality-assisted Neurosurgical Training, to appear in Proc. *IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW)*, Mar. 2024.

[VR23HEALTH] **S. Eom**, S. Kim, Y. Jiang, R. J. Chen, A. R. Roghanizad, M. Z. Rosenthal, J. Dunn, M. Gorlatova, Investigation of Thermal Perception and Emotional Response in Augmented Reality using Digital Biomarkers: A Pilot Study, in Proc. *IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW)*, Mar. 2023.

[VR22HEALTH] **S. Eom**, S. Kim, S. Rahimpour, M. Gorlatova, AR-Assisted Surgical Guidance System for Ventriculostomy, in Proc. *IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW)*, Mar. 2022.

[VR22META] T. Scargill, Y. Chen, **S. Eom**, J. Dunn, M. Gorlatova, Environmental, User, and Social Context-Aware Augmented Reality for Supporting Personal Development and Change, in Proc. *IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW)*, Mar. 2022.

CONFERENCE DEMONSTRATIONS

(Accepted) **S. Eom**, T. Ma, N. Vutakuri, A. Du, Z. Qu, J. Jackson, M. Gorlatova, Did You Do Well? Real-time Personalized Feedback on Catheter Placement in Augmented Reality-assisted Neurosurgical Training, to appear in Proc. *IEEE Conference on Virtual Reality and 3D (VR)*, Mar. 2024.

[IPSN23D] **S. Eom**, R. Janamsetty, M. Hadziahmetovic, M. Pajic, M. Gorlatova, Demo Abstract: Edge-based Augmented Reality Guidance System for Retinal Laser Therapy via Feature Matching, in Proc. IEEE/*ACM International Conference on Information Processing in Sensor Networks (IPSN, co-located with CPS-IoT Week)*, May 2023. [DEMO]

[SENSYS22D] **S. Eom**, M. Hadziahmetovic, M. Pajic, M. Gorlatova, Demo Abstract: Through an AR Lens: Augmented Reality Magnification through Feature Detection and Matching, in Proc. *ACM Conference on Embedded Networked Sensor Systems (SenSys)*, Nov. 2022. [DEMO]

[END18D] T. M. Smith, A. Hammoud, **S. Eom**, Transdisciplinary Writing: An Exercise In Explaining Visual Design Programs, in *International Conference on Education and New Development (END)*, pp.675-677, 2018.

INVITED TALKS

Augmented Reality in Surgical Applications:

- *Carnegie Mellon University Wireless Sensing and Embedded Systems (WiSE) Lab*, Pittsburgh, PA, June 2023.
- *Duke University REU Seminar*, Durham, NC, June 2023.

Augmented Reality for Retinal Laser Therapy:

- *Duke Ophthalmology Trainee Day Scientific Session*, Durham, NC, June 2022.

MEDIA COVERAGE

NeuroLens: AR-assisted Neurosurgery:

- The Dawning of the Age of the Metaverse, *2022 Duke ECE Magazine*, Oct. 2022 [Link]
- NSF Athena AI Institute's Demo at Capitol Hill, Sep. 2023 [Link1][Link2]

Augmented Reality for Retinal Laser Therapy:

- Duke PhD Student Presents Research on Utilizing AR Guidance System in Retinal Laser Therapy, *Duke Eye Center News*, May 2023 [Link]
- 2023 VISION Magazine, *Duke Eye Center News*, July 2023 [Link]

POSTER PRESENTATIONS

(Accepted) **S. Eom,** M. Pajic, M. Gorlatova, M. Hadziahmetovic, Improving Laser Targeting Accuracy with Augmented Reality Guidance in Retinal Laser Therapy, to appear in *Investigative Ophthalmology & Visual Science*, 2024.

(Accepted) R. Byrne, Z. Qu, C. Fronk, **S. Eom,** T. Scargill, M. Gorlatova, AR Simulations in VR: The Case for Environmental Awareness, to appear in Proc. *IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW)*, 2024.

[ARVO23] **S. Eom**, M. Pajic, M. Gorlatova, M. Hadziahmetovic, Augmented Reality for Retinal Laser Therapy in *Investigative Ophthalmology & Visual Science*, Vol. 64, No. 8, Apr. 2023.

[CRAW22] **S. Eom**, S. Rahimpour, M. Gorlatova, NeuroLens: Augmented Reality-based Contextual Guidance for Assisting Neurosurgeons in Ventriculostomy, in *CRA-WP Grad Cohort for Women*, Apr. 2022.

[PURE19] Q. Wu, **S. Eom**, M. Balakuntala, Enhancing Sustenance with Food Quality Monitoring via Smart Tupperware, in *Purdue Undergraduate Research Expo*, Apr. 2019.

[TESS19] **S. Eom**, A. Hammoud, T. Smith, L. Bosman, Transdisciplinary Studies in Technology Program, in *Transforming Education for Student Success (TESS)*, 2019.

[NSF18] **S. Eom**, R. Voyles, Smart Tupperware: From Raw Data to Customer Convenience through IoT, in *NSF Center on Robots and Sensors for the Human Well-being (ROSE-HUB)*, 2018.

[PURS17] **S. Eom**, R. Voyles, Smart Tupperware: Shape Deposition Manufacturing of Zero-Power Displays, in *Purdue Undergraduate Research Symposium*, 2017.

[PURS16] **S. Eom**, R. Voyles, Smart Tupperware: Internet of Things Technology for Enhancing Kitchen Actuation, in *Purdue Undergraduate Research Symposium*, 2016.

TEACHING EXPERIENCE

ECE459: Intro to Embedded System	Grad. TA, Duke University	Fall 2023
ECE459: Intro to Embedded System	Grad. TA, Duke University	Fall 2022
ECE356: Computer Network Architecture	Grad. TA, Duke University	Fall 2021
PTEC108/208/308/408: Transdisciplinary Studies in Technology	Grad. TA, Purdue University	2017 – 2019
ECET229: Concurrent Digital Systems	Undergrad. TA, Purdue University	2015 – 2016

PROFESSIONAL ACTIVITIES

Association for Research in Vision and Ophthalmology (ARVO)	Student Member	2023 – present
ACM Member	Student Member	2022 – present
IEEE Member	Graduate Student Member	2021 – present
CRA Grad Cohort Workshop for Women	Invited Attendee	2022
ICDCS ’22, ICNP ’22, SenSys ’22, SenSys ’23, HotMobile ’23 MobiHoc ’23, MobiSys ’23	Reviewer	2021 – 2023

MENTORSHIP

Name of the students graduated with research distinctions under my mentorship are marked with *.

B.S. STUDENT		NEXT POSITION	
Ryan J. Chen, Duke University	Undergraduate Research Studies		2023 – present
Alex Meng, Duke University	Undergraduate Research Studies		2023 – present
Alexander Du, Duke University	Undergraduate Research Studies		2023 – present
Tiffany Ma, Duke University	Undergraduate Research Studies		2022 – present
Ritvik Janamsetty, Duke University	Undergraduate Research Studies		2022 – present
*Neha Vutakuri, Duke University	Undergraduate Research Studies		2022 – 2023
*Seijung Kim, Duke University	Undergraduate Research Studies	M.S. at Duke	2021 – 2023
Vineet Alaparthi, Duke University	Undergraduate Research Studies		2021 – 2022
Emily Eisele, Widener University	Summer REU Program at Duke	SeaSpine	Summer 2021
Haozhe Zhou, Purdue University	Undergraduate Research Studies	Ph.D. at CMU	2019 – 2020
Yuqing Xu, Purdue University	Undergraduate Research Studies	M.S. at UC Berkeley	2019 – 2020

HIGH SCHOOL STUDENT

Vanessa Tang, NCSSM	NCSSM Mentorship Program	2023 – present

OTHER EXPERIENCE

RESEARCH

PhD Research Intern	Bosch Research and Technology Center	Summer 2023
Graduate Research Assistant	Intelligent Interactive Internet of Things Lab, Duke University	2021 – present
Graduate Research Assistant	Collaborative Robotics Lab, Purdue University	2017 – 2020
Undergraduate Research Assistant	Collaborative Robotics Lab, Purdue University	2015 – 2017

LEADERSHIP

Lab Manager	Intelligent Interactive Internet of Things Lab, Duke University	2021 – present
Social Coordinator	Collaborative Robotics Lab, Purdue University	2018 – 2020
Lab Manager	Collaborative Robotics Lab, Purdue University	2017 – 2018
Undergraduate Student Ambassador	Polytechnic Institute, Purdue University	2015 – 2017

ACTIVITIES & SERVICES

Violinist, String Quartet	Purdue Chamber	2017 – 2020
Technical Assistant	Robert L. Ringel Art Gallery, Purdue University	2016 – 2016
Violinist, Orchestra	Purdue Symphony Orchestra	2014 – 2017
Polytechnic Transformation Team	Polytechnic Institute, Purdue University	2015 – 2016
Boiler OUT Volunteer Program	International Programs, Purdue University	2016 – 2016

Duke Energy Academy at Purdue	Discovery Park, Purdue University	2015
Junior Robotics Team Member	Purdue FIRST Robotics Program	2014 – 2015