Benjamin D. Killeen



Contact	Department of Computer Science Johns Hopkins University 3400 North Charles Street Baltimore, MD 21218	Cell: Office: Mail: Web:	+1 (314) 651-6809 Hackerman 137 killeen@jhu.edu benjamindkilleen.com
Summary	As a final-year Ph.D. candidate at Johns Hopki future of AI- and robot-assisted interventional h integration of sophisticated simulation environm build community in the classroom, in my local societies, with the ultimate goal of fostering an	ns Universit ealthcare th nents. Outs network, an n inclusive e	by, I am researching the arough the creation and ide of the lab, I work to ad through professional nvironment for all.
Education	Ph.D. in Computer Science08/2019 - nowJohns Hopkins University08/2019 - nowAffiliated with the Laboratory for Computational Sensing and Robotics.Primary advisor: Mathias UnberathSecondary advisor: Gregory D. Hager		
	 B.A. in Computer Science with Honors, Minor in Physics University of Chicago Honors thesis advisor: Gordon Kindlmann. 		09/2015 - 06/2019
Professional Employment	Computer Vision / AI Intern , Intuitive Su Applied Research With Omid Mohareri.	ırgical Inc.	06/2020 - 07/2020
	Software Development Intern , Epic System Center for Cognitive Computing	ns	06/2018 - 08/2018
	Research Intern , International Business Mac IBM Research - Almaden With Geoffrey Burr.	chines	06/2017 - 08/2017
Awards	Personal Awards		
	 4. Finalist for the WSE Excellence in Teaching, Advising, and Mentoring Award 2024 The Johns Hopkins Alumni Association, the Krieger School of Arts and Sciences, and the Whiting School of Engineering annually honor faculty and graduate students who excel in the arts of teaching, advising, and mentoring. 		
	3. DAAD AInet Fellow in the Postdoc-N Human-centered AI	NeT-AI No	etworking Week on 2023

Postdoctoral networking tour in Germany supported by the German Academic Exchange Service (Deutscher Akademischer Austauschdienst).

2.	Recipient of the Link Foundation Fellowship in Modeling, S	imula-
	tion, and Training	2023
	Two-year fellowship for Ph.D. students to fund their research.	
	Proposal: Interactive Digital Twins for Simulating the Future of W	Vork in
	AI- and Robot-assisted Operating Rooms	

1. LCSR Fellowship for Outstanding Incoming Ph.D. Students 2019

Publication Awards

	4. Honorable Mention, Bench-to-Bedside Award For paper [J-5] at IPCAI 2023.	2023
	3. Runner Up, Best Paper Award, Physics of Medical Imaging For paper [C-5] at SPIE Medical Imaging 2022.	2022
	2. Best Paper Award in Bioengineering For paper [C-4] at IEEE BIBE 2021.	2021
	1. Kaggle COVID-19 Dataset Award For our US county-level dataset described in [M-1].	2020
	Reviewer Awards	
	1. Honorable Mention, MICCAI Outstanding Reviewer Award	2023
	Coursework Awards	
	3. Best Presentation Award Reviewing IronFleet: Proving Practical Distributed Systems Correct Reliable Software Systems, Johns Hopkins University.	2021
	2. Best Graduate Project Award Resulted in our US county-level dataset described in [M-1]. Computer Integrated Surgery II, Johns Hopkins University.	2020
	1. Intuitive Surgical Best Project Award Enriching Unsupervised Feature Learning via Intermediate Subtasks Deep Learning, Johns Hopkins University.	2019
Service and Leadership	Societies	
	- Social Events Officer, MICCAI Student Board 10/2023	– now
	 President, LCSR Graduate Student Association 08/2022 - 12 Established an executive board managing \$8,000/yr in student resource 	/2023 rces.
	- Sports Officer , MICCAI Student Board 12/2021 – 09 Organizer for athletic events at the MICCAI conference.	/2023

On-site representative and MICCAI Educational Challenge reviewer.

	 Head of Student Resources 09/2020 - 08/2022 LCSR Graduate Student Committee
	Academic Services
	 Seminar Course Assistant 2023 Future Faculty: Preparing a New Generation of PIs for the Academic Job Search Department of Computer Science, Johns Hopkins University
	 Organizer 2023 Focus Group on Graduate Student Space Laboratory for Computational Sensing and Robotics, Johns Hopkins Univ.
	 Brainlab Loop-X Trainer and Coordinator 2022 – now Laboratory for Computational Sensing and Robotics, Johns Hopkins Univ.
	 Robotorium and Mock OR Tours 2022, 2023 Laboratory for Computational Sensing and Robotics, Johns Hopkins Univ.
	 Journal Reviewer Nature Communications IEEE Transactions on Medical Imaging (TMI) Journal of Machine Learning Research (JMLR) Quantitative Imaging in Medicine and Surgery (QIMS) Journal of Visualized Surgery (JOVS) IEEE Robotics and Automation Letters (RA-L) Computer Assisted Surgery (CAI) Nature Scientific Data Medical Image Analysis (MedIA)
	 Conference Reviewer Medical Image Computing and Computer Assisted Interventions (MICCAI) International Conference on Information Processing in Computer-Assisted Interventions (IPCAI) International Symposium on Medical Robotics (ISMR) IEEE International Conference on Computer Vision (ICCV) IEEE/CVF Computer Vision and Pattern Recognition (CVPR)
Talks and	Invited Talks and Demos
Press	7. Malone Center Trainee Mix and Mingle04/2024Malone Center for Engineering in Healthcare, Baltimore, USA "The Future of Simulation-Driven Interventional Healthcare" Runner up, Audience Choice for Best Presentation.04/2024
	6. IHU Seminar Series 03/2024 IHU, Strasbourg, France "Advancing Interventional Healthcare One Simulation at a Time"
	5. CAMP Seminar Series 03/2024 In the Postdoc-NeT-AI Networking Week on Human-centered AI

	TUM, Munich, Germany "Advancing Interventional Healthcare One Simulation at a Time"	
4.	medPhoton Invited Talk Series medPhoton, Salzburg, Austria "Robotic X-ray Imaging Interfaces"	06/2023
3.	FDA DIDSR Seminar Series Food and Drug Administration, Silver Spring, MD "Simulating Image-guided Interventions: Interactive Digital Twins	05/2023 to Usher
	in Next-generation Surgical Suites"	
2.	The Artificial Intelligence Society (HopAI) Johns Hopkins University, Baltimore, MD "Yet Another Deep Learning Introduction for Everyone"	04/2023
1.	LCSR Seminar Series Johns Hopkins University, Baltimore, MD	04/2023
	"An Autonomous X-ray Image Acquisition and Interpretation Sy Assisting Percutaneous Pelvic Fracture Fixation"	stem for

Selected Press

- 4. Our work [C-6] presenting the first approach to surgical phase recognition in X-ray guided surgery with dynamic simulation was featured in the JHU Hub and Surgery International.
- 3. Our work [J-4] demonstrating the utility of synthetic data for training novel X-ray image analysis algorithms was featured in the JHU Engineering magazine, the JHU Hub, and Medical Xpress.
- 2. My proposal to the Link Fellowship on Simulation, Modeling, and Training was featured on JHU Computer Science News.
- 1. Our work [J-2] demonstrating efficient strategies for training robots using reinforcement learning was featured in the JHU Hub, TechCrunch, Psychology Today, BBC News, and Voice of America.

TEACHING Computer Integrated Surgery II EN.601.456/656, Project Mentor Johns Hopkins University

- A Cannula Marker Body for Tracker-free Surgical Navigation during Kirschner Wire Placement
 Spring 2024
- Bringing View-invariant X-ray Image Analysis into the Operating Room Spring 2024
- Measuring Variability of Pelvic Standard Views in Virtual Reality Spring 2024
- Recreating Pelvic Trauma Surgery in Virtual Reality for the Development of Novel C-arm Interfaces
 Spring 2023

Voted to receive the **Best Project Award**

	 Making 2D/3D Registration Accessible 3D Segmentation of Hard and Soft Tissue for Simulating tion with Deep Learning 2022 	Spring 2023 X-ray Image Forma- Spring		
	Computer Integrated Surgery I EN.601.455/655, Teaching Assistant			
	TA quality: 4.32/5.00 (sample size: 86) TA quality: 4.13/5.00 (sample size: 63)	Fall 2022 Fall 2021		
	Introduction to Computer Science CMSC 14100/142 Department of Computer Science, University of Chicago	200, Course Assistant		
		Summer 2019		
	 Machine Learning and Large Scale Data Analysis S' 25025, Teaching Assistant University of Chicago 	TAT 37601/CMSC		
		Spring 2019		
	Scientific Visualization CMSC 23710, Course Assistan	ıt		
	Department of Computer Science, University of Chicago	Winter 2019		
SUPERVISION	As a member of the ARCADE Lab with Mathias Unberath, contributions to research. Where known, career steps after search effort are provided.	, I supervise students' completing their re-		
	Graduate			
	10. Xu "Lance" Lian, Johns Hopkins University	09/2023 - 12/2023		
	9. Bohua Wan, Johns Hopkins University	06/2023 - now		
	8. Hengyu Cao, Johns Hopkins University	08/2023 - 12/2023		
	7. Shreayan Chaudhary, Johns Hopkins University 05/2024 Shreayan joined Seagate Technology as a Engineer	05/2023 – Machine Learning		
	6. Han Zhang, Johns Hopkins University Han joined Johns Hopkins University as a Ph.D	01/2023 - 12/2023 • Student.		
	5. Zixuan Liu, Johns Hopkins University	01/2023 - 09/2023		
	4. Aditya Kulkarni, Johns Hopkins University	$09/2022 - \mathrm{now}$		
	3. Qiyuan Wu, Johns Hopkins University Qiyuan joined Cornell University as a Ph.D. Stu	08/2022 - 06/2023		
	2. Zidi Tao, Johns Hopkins University Zidi joined Rensselaer Polytechnic Institute as a	10/2021 – 06/2022 Ph.D. Student .		
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1. Shreaya Chakraborty, Johns Hopkins University 08/2020 – 09/2021 Shreya joined PathAI as a Machine Learning Engineer.

Undergraduates

9. Janya Budaraju, Johns Hopkins University Janya is a recipient of the Pistritto Fellowship for under	02/2024 - now ergraduate research.
8. Samhith Bhrugubanda, Johns Hopkins University,	$02/2024 - \mathrm{now}$
7. Asmitha Sathya, Johns Hopkins University,	09/2023 - 12/2023
6. Darren Shih, Johns Hopkins University	09/2023 - 12/2023
 William "Liam" Wang, Johns Hopkins University Liam joined the University of Michigan as an NSF- dent. 	01/2023 – now GRFP Ph.D. Stu-
4. Sambhav Chordia, Johns Hopkins University	06/2022 - 12/2022
3. Sean Sebastian Darcy, Johns Hopkins Univ Sean joined the California Institute of Technology dent.	10/2021 - 10/2022 y as a Ph.D. Stu-
2. Nethra Venkatayogi, Johns Hopkins University Visiting from the University of Texas at Austin Nethra joined Johns Hopkins University as a Ph.J	05/2021 - 10/2021 D. Student .
1. Max Judish, Johns Hopkins University Visiting from Brown University.	01/2021 - 08/2021

PUBLICATIONS I have (first/co)-authored 5/4 journal articles, 4/2 conference papers, and 3/0 preprints, and I am an inventor on 4 patents or patent applications in process. My publication list is also available on Google Scholar.

Peer-reviewed Journal Articles

- [J-9]. B.D. Killeen*, H. Zhang*, L. Wang, Z. Liu, C. Kleinbeck, M. Rosen, R.H. Taylor, M. Unberath. "Stand in Surgeon's Shoes: Virtual Reality Crosstraining to Enhance Teamwork in Surgery," to appear in *Information Pro*cessing in Computer-assisted Interventions (IPCAI), 2024.
- [J-8]. B.D. Killeen, S. Chaudhary, G. Osgood, M. Unberath. "Take a Shot! Natural Language Control of Robotic X-ray Systems for Image-guided Surgery," to appear in International Journal of Computer Assisted Radiology and Surgery, 2024.
 Special Issue: Information Processing in Computer-Assisted Interventions (IPCAI) 2024
- [J-7]. C. Kleinbeck, H. Zhang, B.D. Killeen, D. Roth, M. Unberath. "Neural Digital Twins: Reconstructing Complex Medical Environments for Spatial Planning in Virtual Reality," to appear in *Information Processing in Computer-assisted Interventions (IPCAI)*, 2024.

[J-6]. B.D. Killeen, S.M. Cho, M. Armand, R.H. Taylor, M. Unberath. "In Silico Simulation: A Key Enabling Technology for Next-generation Intelligent Surgical Systems," *Progress in Biomedical Engineering*, 2023, vol. 5, no. 3, pp. 032001.

Invited submission to the Special Issue on In Silico Trials.

- [J-5]. B.D. Killeen, C. Gao, K. Oguine, S. Darcy, M. Armand, R.H. Taylor, G. Osgood, M. Unberath. "An Autonomous X-ray Image Acquisition and Interpretation System for Assisting Percutaneous Pelvic Fracture Fixation," *International Journal of Computer Assisted Radiology and Surgery*, 2023. Special Issue: *Information Processing in Computer-Assisted Interventions* (IPCAI) 2023 Audience vote for long oral presentation at IPCAI'23. Awarded Honorable Mention, Bench-to-Bedside Award at IPCAI'23.
- [J-4]. C. Gao, B.D. Killeen, Y. Hu, R. Grupp, R.H. Taylor, M. Armand, M. Unberath. "Synthetic Data Accelerates the Development of Generalizable Learning-based Algorithms for X-ray Image Analysis," *Nature Machine Intelligence*, 2023, vol. 5, no. 3, pp. 294-308.
 Featured in the JHU Hub, the JHU News Letter, and the Nature Robotics and AI collection.
- [J-3]. B.D. Killeen, J. Winter, W. Gu, A. Martin-Gomez, R.H. Taylor, G. Osgood, M. Unberath. "Mixed Reality Interfaces for Achieving Desired Views with Robotic X-ray Systems," Computer Methods in Biomechanics and Biomedical Engineering: Imaging & Visualization, 2022.
 Special Issue: Augmented Environments for Computer Assisted Interventions (AE-CAI) 2020
- [J-2]. A. Hundt, B.D. Killeen, H. Kwon, C. Paxton, G.D. Hager. "Good Robot!': Efficient Reinforcement Learning for Multi-Step Visual Tasks with Sim to Real Transfer," *IEEE Robotics and Automation Letters*, 2020, vol. 5, no. 4, pp. 6724-6731.
 Featured in the JHU Hub, Psychology Today, BBC News, and Voice of America.
- [J-1]. S. Ambrogio, P. Narayanan, H. Tsai, R. M. Shelby, I. Boybat, C. di Nolfo, S. Sidler, M. Giordano, M. Bodini, N. Farinha, B.D. Killeen, C. Cheng, Y. Jaoudi, G. W. Burr. "Equivalent-accuracy accelerated neural-network training using analogue memory," *Nature*, 2018, vol. 558, no. 7708, p. 60.

Peer-reviewed Conference Papers

- [C-6]. B.D. Killeen, H. Zhang, J.E. Mangulabnan, M. Armand, R. Taylor, G. Osgood, M. Unberath. "Pelphix: Surgical Phase Recognition from X-ray Images in Percutaneous Pelvis Fixation," *Medical Image Computing and Computer Assisted Intervention (MICCAI)*, 2023. Featured in the JHU Hub and Surgery International.
- [C-5]. B.D. Killeen, S. Chakraborty, G. Osgood, M. Unberath. "Toward Perception-based Anticipation of Cortical Breach During K-wire Fixation

of the Pelvis," *SPIE Medical Imaging*, 2022. Selected for **oral** presentation. Runner up, **Best Paper Award**, **Physics of Medical Imaging**

- [C-4]. J. Opfermann*, B.D. Killeen*, C. Bailey, M. Khan, A. Uneri, K. Suzuki, M. Armand, F. Hui, A. Krieger[†], M. Unberath[†]. "Feasibility of a Cannula-mounted Piezo Robot for Image-guided Vertebral Augmentation: Toward a Low Cost, Semi-autonomous Approach," *IEEE International Conference on BioInformatics and BioEngineering (BIBE)*, 2021.
 * Joint first authors; [†] joint last authors. Honored with a Best Paper Award in Bioengineering.
- [C-3]. X. Liu*, B.D. Killeen*, A. Sinha, M. Ishii, G. Hager, R. Taylor, M. Unberath. "Neighborhood Normalization for Robust Geometric Feature Learning," *IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, 2021, pp. 13049-13058.
 * Joint first authors.
- [C-2]. C. Gao, X. Liu, W. Gu, B.D. Killeen, M. Armand, R. Taylor, M. Unberath. "Generalizing Spatial Transformers to Projective Geometry with Applications to 2D/3D Registration," *Medical Image Computing and Computer Assisted Intervention*, 2020, pp. 329-339. Code available on GitHub here.
- [C-1]. X. Liu, Y. Zhang, B.D. Killeen, M. Ishii, G. Hager, R. Taylor, M. Unberath. "Extremely Dense Point Correspondences in Multi-view Stereo using a Learned Feature Descriptor," *IEEE Conference on Computer Vision* and Pattern Recognition, 2020, pp. 4847-4856. Code available on GitHub here.

Preprints

- [M-3]. B.D. Killeen, L.J. Wang, H. Zhang, M. Armand, R.H. Taylor, G. Osgood, M. Unberath. (2024). FluoroSAM: A Language-aligned Foundation Model for X-ray Image Segmentation. arXiv preprint, 2024, arXiv:2403.08059.
- [M-2]. J.Y. Wu*, B.D. Killeen*, P. Nikutta, M. Thies, A. Zapaishchykova, S. Chakraborty, M. Unberath. "Changes in Reproductive Rate of SARS-CoV-2 Due to Non-pharmaceutical Interventions in 1,417 U.S. Counties," medRxiv preprint, 2020.
- [M-1]. B.D. Killeen, J.Y. Wu, K. Shah, A. Zapaishchykova, P. Nikutta, A. Tamhane, S. Chakraborty, J. Wei, T. Gao, M. Thies, M. Unberath. "A County-level Dataset for Informing the United States' Response to COVID-19," arXiv preprint, 2020, arXiv:2004.00756.
 The data described herein received a Kaggle COVID-19 Dataset Award. Code available on GitHub here.

Patents

[P-1]. G.W. Burr, B.D. Killeen, "Efficient Processing of Convolutional Neural Network Layers Using Analog-memory-based Hardware." 20200117986, filed March 25, 2019, and issued April 16, 2020. METADATA This document was last updated on April 26, 2024. A complete, up-to-date version is available at https://benjamindkilleen.com/files/cv_killeen.pdf.