

Benjamin D. Killeen



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SUMMARY	A researcher in medical robotics, I strive to advance intelligent surgical systems to complement surgeons' technical knowledge with superhuman capabilities in image acquisition and surgical action. Outside of my research, I work to build community in my local network and professional societies, with the ultimate goal of fostering an inclusive environment for all.	
ACADEMIC EXPERIENCE	Research Assistant , Johns Hopkins University Department of Computer Science <i>Primary advisor:</i> Mathias Unberath <i>Secondary advisor:</i> Gregory D. Hager Research Assistant , Johns Hopkins University Laboratory for Computational Sensing and Robotics With Gregory D. Hager , Mathias Unberath , and Russell Taylor . Research Assistant , University of Chicago Department of Computer Science With Gordon Kindlmann .	08/2019 – now 08/2019 – 06/2020 03/2018 – 08/2019
PROFESSIONAL EXPERIENCE	Computer Vision / AI Intern , Intuitive Surgical Inc. Applied Research With Omid Mohareri . Software Development Intern , Epic Systems Center for Cognitive Computing Research Intern , International Business Machines IBM Research - Almaden With Geoffrey Burr .	06/2020 – 07/2020 06/2018 – 08/2018 06/2017 – 08/2017
EDUCATION	Ph.D. in Computer Science Johns Hopkins University B.A. in Computer Science with Honors Minor in Physics University of Chicago	08/2019 – now 09/2015 – 06/2019

AWARDS

Personal Awards

3. [DAAD AInet Fellow in the Postdoc-NeT-AI Networking Week on Human-centered AI](#) 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, Simulation, and Training](#) 2023
One year renewable fellowship for Ph.D. students to research full time.
Proposal: *Interactive Digital Twins for Simulating the Future of Work 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](#) 2023
For paper [J-5] at IPCAI 2023.
3. [Runner Up, Best Paper Award, Physics of Medical Imaging](#) 2022
For paper [C-5] at SPIE Medical Imaging 2022.
2. [Best Paper Award in Bioengineering](#) 2021
For paper [C-4] at IEEE BIBE 2021.
1. [Kaggle COVID-19 Dataset Award](#) 2020
For our US county-level dataset described in [M-1].

Reviewer Awards

1. [Honorable Mention, MICCAI Outstanding Reviewer Award](#) 2023

Coursework Awards

3. [Best Presentation Award](#) 2021
Reviewing [IronFleet: Proving Practical Distributed Systems Correct Reliable Software Systems](#), Johns Hopkins University.
2. [Best Graduate Project Award](#) 2020
Resulted in our US county-level dataset described in [M-1].
[Computer Integrated Surgery II](#), Johns Hopkins University.
1. [Intuitive Surgical Best Project Award](#) 2019
Enriching Unsupervised Feature Learning via Intermediate Subtasks Deep Learning, Johns Hopkins University.

SERVICE AND LEADERSHIP

Societies

- [President, LCSR Graduate Student Association](#) 08/2023 – now
Established an executive board managing \$8,000/yr in student resources.

- **Sports Officer, MICCAI Student Board** 12/2021 – now
Organizer for athletic events at the MICCAI conference.
On-site representative and MICCAI Educational Challenge reviewer.
- **Head of Student Resources** 09/2020 – 08/2022
[LCSR](#) Graduate Student Committee

Academic Services

- **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

- IEEE Transactions on Medical Imaging (TMI)
- Journal of Machine Learning Research (JMLR)
- Quantitative Imaging in Medicine and Surgery (QIMS)
- 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 PRESS

Invited Talks and Demos

4. Computer Science in Entrepreneurship
3. medPhoton Invited Talk Series 06/2023
medPhoton, Salzburg, Austria
“Robotic X-ray Imaging Interfaces”

2. FDA DIDSr Seminar Series 05/2023
Food and Drug Administration, Silver Spring, MD
“Simulating Image-guided Interventions: Interactive Digital Twins to Usher in Next-generation Surgical Suites”
1. [The Artificial Intelligence Society \(HopAI\)](#) 04/2023
Johns Hopkins University, Baltimore, MD
“Yet Another Deep Learning Introduction for Everyone”
0. LCSR Seminar Series 04/2023
Johns Hopkins University, Baltimore, MD
“An Autonomous X-ray Image Acquisition and Interpretation System for Assisting Percutaneous Pelvic Fracture Fixation”

Press

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

Spring 2023: *Recreating Pelvic Trauma Surgery in Virtual Reality for the Development of Novel C-arm Interfaces*

- **Voted to receive the Best Project Award**

Spring 2023: *Making 2D/3D Registration Accessible*

Spring 2022: *3D Segmentation of Hard and Soft Tissue for Simulating X-ray Image Formation with Deep Learning*

Computer Integrated Surgery I EN.601.455/655, Teaching Assistant

Johns Hopkins University

Fall 2021, Fall 2022

Introduction to Computer Science CMSC 14100/14200, Course Assistant

Department of Computer Science, University of Chicago

Summer 2019

Machine Learning and Large Scale Data Analysis STAT 37601/CMSC 25025, Teaching Assistant

University of Chicago

Spring 2019

Scientific Visualization CMSC 23710, Course Assistant

Department of Computer Science, University of Chicago

Winter 2019

SUPERVISION As a member of the ARCADE Lab with Mathias Unberath, I supervise students' contributions to research. Where known, career steps after completing their research effort are provided.

Graduate

8. **Bohua Wan**, Johns Hopkins University 06/2023 – now
7. **Hengyu Cao**, Johns Hopkins University 08/2023 – now
6. **Shreayan Chaudhary**, Johns Hopkins University 05/2023 – now
5. **Han Zhang**, Johns Hopkins University 01/2023 – now
4. **Aditya Kulkarni**, Johns Hopkins University 09/2022 – now
3. **Qiyuan Wu**, Johns Hopkins University 08/2022 – 06/2023
[Qiyuan joined Cornell University as a Ph.D. Student.](#)
2. **Zidi Tao**, Johns Hopkins University 10/2021 – 06/2022
[Zidi joined Rensselaer Polytechnic Institute as a Ph.D. Student.](#)
1. **Shreaya Chakraborty**, Johns Hopkins University 08/2020 – 09/2021
[Shreya joined PathAI as a Machine Learning Engineer.](#)

Undergraduates

6. **Darren Shih**, Johns Hopkins University 09/2023 – now
5. **Liam Wang**, Johns Hopkins University 01/2023 – now
4. **Sambhav Chordia**, Johns Hopkins University 06/2022 – 12/2022
3. **Sean Sebastian Darcy**, Johns Hopkins Univ 10/2021 – 10/2022
[Sean joined the California Institute of Technology as a Ph.D. Student.](#)
2. **Nethra Venkatayogi**, Johns Hopkins University 05/2021 – 10/2021
[Visiting from the University of Texas at Austin](#)
[Nethra joined Johns Hopkins University as a Ph.D. Student.](#)
1. **Max Judish**, Johns Hopkins University 01/2021 – 08/2021
[Visiting from Brown University.](#)

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

Peer-reviewed Journal Articles

- [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**.
Featured in the **JHU News Letter**.
Featured in 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.
- [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.M. Osgood, **M. Unberath**. “Pelphix: Surgical Phase Recognition from X-ray Images in Percutaneous Pelvis Fixation,” *Medical Image Computing and Computer Assisted Intervention (MICCAI)*, 2023.
- [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 listed alphabetically.

- [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-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 October 30, 2023. An up-to-date version is available at https://benjamindkilleen.com/files/cv_killeen.pdf.