

Benjamin D. Killeen



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SUMMARY	<p>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.</p>	
EDUCATION	<p>Ph.D. in Computer Science 08/2019 – now Johns Hopkins University <i>Affiliated with the</i> Laboratory for Computational Sensing and Robotics <i>Primary advisor:</i> Mathias Unberath <i>Secondary advisor:</i> Gregory D. Hager</p> <p>B.A. in Computer Science with Honors, 09/2015 – 06/2019 Minor in Physics University of Chicago <i>Honors thesis advisor:</i> Gordon Kindlmann.</p>	
PROFESSIONAL EMPLOYMENT	<p>Computer Vision / AI Intern, Intuitive Surgical Inc. 06/2020 – 07/2020 Applied Research With Omid Mohareri.</p> <p>Software Development Intern, Epic Systems 06/2018 – 08/2018 Center for Cognitive Computing</p> <p>Research Intern, International Business Machines 06/2017 – 08/2017 IBM Research - Almaden With Geoffrey Burr.</p>	
AWARDS	<p>Personal Awards</p> <ol style="list-style-type: none">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: <i>Interactive Digital Twins for Simulating the Future of Work in AI- and Robot-assisted Operating Rooms</i>	

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

- Nature Communications
- 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. medPhoton Invited Talk Series 06/2023
 medPhoton, Salzburg, Austria
 “Robotic X-ray Imaging Interfaces”
3. 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”
2. [The Artificial Intelligence Society \(HopAI\)](#) 04/2023
 Johns Hopkins University, Baltimore, MD
 “Yet Another Deep Learning Introduction for Everyone”
1. 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 4 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, 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.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.

- [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 November 2, 2023. An up-to-date version is available at https://benjamindkilleen.com/files/cv_killeen.pdf.