# Benjamin D. Killeen

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## Summary

A Ph.D. Student at Johns Hopkins University, I am interested in intelligent surgical systems trained in dynamic simulated environments for X-ray image-guided procedures. I am a member of the Advanced Robotics and Computationally Augmented Environments (ARCADE) research group and the Computational Interaction and Robotics Laboratory (CIRL).

## Education

**Ph.D., Computer Science**, Johns Hopkins University, Baltimore, MD, USA. 08/2019 - present
With Mathias Unberath and Gregory D. Hager.

**B.A., Computer Science with Honors, Minor in Physics**, University of Chicago, Chicago, IL, USA. 09/2015 - 06/2019
Thesis: Starting from Scratch: Deep Learning for Novel Scientific Image Analysis
With Gordon Kindlmann.

## Research Experience

**Research assistant**, Department of Computer Science, Johns Hopkins University, Baltimore, MD, USA. 08/2020 - present
With Mathias Unberath, Gregory D. Hager.

**Research Assistant**, Laboratory for Computational Sensing and Robotics, Johns Hopkins University, Baltimore, MD, USA. 08/2019 - 06/2020
With Gregory D. Hager, Mathias Unberath, and Russel Taylor.
Recipient: LCSR Fellowship for Outstanding Incoming Ph.D. Students.

**Research assistant**, Department of Computer Science, University of Chicago, Chicago, IL, USA. 03/2018 - 08/2019
With Gordon Kindlmann.

## Professional Experience

**Computer Vision / AI Intern**, Applied Research, Intuitive Surgical Inc., Sunnyvale, CA, USA. 06/2020 - 07/2020
With Omid Mohareri.

**Software Development Intern**, Cognitive Computing, Epic Systems, Verona, WI, USA. 06/2018 - 08/2018
**Research Intern**, IBM Research - Almaden, San Jose, CA, USA. 06/2017 - 08/2017
With Geoffrey Burr.

## Selected Honors

**Best Presentation**, Reliable Software Systems course, Johns Hopkins University, USA. 04/2021
**Best Graduate Project Award**, Computer Integrated Surgical Systems and Technology course, Johns Hopkins University, USA. 05/2020
**COVID-19 Dataset Award**, Kaggle. 04/2020
For our county-level dataset in [M-1].

**Intuitive Surgical Best Project Award**, Deep Learning course, Johns Hopkins University, USA. 12/2019
Project: Enriching Unsupervised Feature Learning via Intermediate Subtasks.
With Michael Peven, Shaoyan Pan, and Matthew Pittman.

## Publications

My publication list is also available on Google Scholar. Unless otherwise noted, (*) denotes equal contribution.

### Peer-reviewed Journal Articles

A. Hundt, **B. Killeen**, H. Kwon, C. Paxton, GD Hager. "Good Robot!": Efficient Reinforcement Learning for Multi-Step Visual Tasks with Sim to Real Transfer. IEEE Robotics and Automation Letters, vol. 5, no. 4, pp. 6724–6731, Oct. 2020. doi: 10.1109/LRA.2020.3015448. J-2

S. Ambrogio, P. Narayanan, H. Tsai, R. M. Shelby, I. Boybat, C. di Nolfo, S. Sidler, M. Giordano, M. Bodini, N. Farinha, **B. Killeen**, C. Cheng, Y. Jaoudi, G. W. Burr. Equivalent-accuracy accelerated neural-network training using analogue memory. Nature, vol. 558, no. 7708, p. 60, Jun. 2018. doi: 10.1038/s41586-018-0180-5. J-1

### Peer-reviewed Conference Papers

**B. D. Killeen**, Shreya Chakraborty, Greg Osgood, Mathias Unberath. Toward perception-based anticipation of cortical breach during K-wire fixation of the pelvis. SPIE Medical Imaging, to appear 2022. C-5

- Selected for **oral** presentation.

J. D. 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), to appear 2021. C-4
*Joint first authors; ** joint last authors.
- Honored with **Best Paper Award in Bioengineering.**

X. Liu*, **B. D. Killeen***, A. Sinha, M. Ishii, G. Hager, R. Taylor, M. Unberath. Neighborhood Normalization for Robust Geometric Feature Learning. Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition, 2021. C-3
*Joint first authors listed alphabetically.

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 Registrationc. MICCAI, 2020, arxiv:2003.10987. C-2

X. Liu, Y. Zhang, **B. Killeen**, M. Ishii, G. Hager, R. Taylor, M. Unberath. Extremely Dense Point Correspondences using a Learned Feature Descriptor. Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition, pp. 4847-4856, 2020. C-1

## Preprints

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, Jun. 2020, doi: 10.1101/2020.05.31.20118687. M-2

**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. M-1

## Patents

G. W. Burr and **B. D. Killeen**. 2020. Efficient Processing of Convolutional Neural Network Layers Using Analog-memory-based Hardware. 20200117986, filed March 25, 2019, and issued April 16, 2020, uspto.report/patent/app/20200117986. P-1

## Selected Press

Dziarkach, Andrei. **"Details with Andrei Dziarkach."** Voice of America. November 21, 2020 Accessed November 26, 2020. golosameriki.com/a/detali/5671254.html. 2020

Rosen, Jill. **"Dog Training Methods Help JHU Teach Robots to Learn New Tricks."** The Johns Hopkins University Hub. The Johns Hopkins University, October 26, 2020. hub.jhu.edu/2020/10/26/positive-reinforcementfor-robots.

## Teaching

### Supervision

I have supervised a number of talented masters and undergraduate students on research projects and theses:

**Sean Darcy**, Johns Hopkins University, Baltimore, MD, USA. 10/2021 - present

**Zidi Tao**, Johns Hopkins University, Baltimore, MD, USA. 10/2021 - present

**Nethra Venkatayogi**, The University of Texas at Austin, Austin, TX, USA. 05/2021 - 10/2021

**Max Judish**, Brown University, Providence, RI, USA. 01/2021 - 08/2021

**Shreya Chakraborty**, Johns Hopkins University, Baltimore, MD, USA. 08/2020 - 09/2021

**Philipp Nikutta**, Technical University of Munich, Munich, Germany. (Now at Argo AI.) 12/2019 - 03/2020

### Assistant Teaching

**Computer Integrated Surgery**, Department of Computer Science, Johns Hopkins University, Baltimore, MD, USA. 08/2019 - present
With Russ Taylor and Emad Boctor.

**Machine Learning and Large Scale Data Analysis**, Department of Computer Science, University of Chicago, Chicago, IL, USA. 03/2019 - 06/2019
With Yali Amit.
Wrote supplementary course material and held weekly lab sessions.

Selected review: "Ben was incredibly patient during office hours and always responsive to student questions. In addition, he often presented demos during office hours or showed easier ways to handle the homework assignments; both were very helpful."
More reviews available at benjamindkilleen.com/teaching/2019-spring-lsda

### Grading

Department of Computer Science, University of Chicago, Chicago, IL, USA 01/2019 - 08/2019
- **Scientific Visualization**
- **Introduction to Computer Science I**
- **Introduction to Computer Science II**

## Tutoring

**Mentor**, Polygence. 06/2021 - present

**Topics in Computer Science, Machine Learning**, Baltimore, MD, USA. 06/2020 - present

We have covered topics such as differential calculus, neural networks, computer vision, natural language processing, and functional programming.

## Service

**Family Member**, Thread, Baltimore, MD, USA. 06/2021 - present

I volunteer with students at Douglas High School in Baltimore City, helping with homework and fostering personal connections.

**Graduate Student Committee Representative**, Laboratory for Computational Sensing and Robotics, Baltimore, MD, USA. 09/2020 - present

Head of Student Resources

**Volunteer Instructor**, CompileHer, Chicago, IL, USA. 2019

## Peer Review

- IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR) 2021

- Nature Scientific Data 2020

## Selected Coursework

### Graduate

GPA: 3.82

Vision as Bayesian Inference
Reliable Software Systems
Theory of Computation
Parallel Programming
Nonlinear Optimization II
Computer Integrated Surgery II
Computer Integrated Surgery I
Deep Learning

### Undergraduate

GPA: 3.81

Unsupervised Learning*
Computer Vision
Machine Learning and Large Scale Data Analysis
Operating Systems
Honors Combinatorics
Honors Algorithms
Honors Discrete Mathematics
Scientific Visualization
Programming Languages
Networks and Distributed Systems
Quantum Mechanics I \& II
Intermediate Mechanics
Electronics
Wizards

*Graduate level.

## Memberships

IEEE Graduate Student Member 2020 - present

## Extracurricular

In my spare time, I enjoy climbing, running, and making visual art. I also write creatively:
**Creative nonfiction**: benjamindkilleen.medium.com
**Science fiction**.

## Metadata

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