Benjamin D. Killeen

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Summary

A Ph.D. Student at Johns Hopkins University, I am interested in intelligent surgical systems that improve patient outcomes. My recent work involves realistic simulation of interventional X-ray imaging for the purpose of developing AI-integrated surgical systems. 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

Runner-up, **Physics of Medical Imaging Best Student Paper Award** 02/2022
For paper [C-5] at SPIE Medical Imaging 2022.

Best Paper Award in Bioengineering 10/2021
For paper [C-4] at IEEE BIBE 2021.

Best Presentation Award 04/2021
In Reliable Software Systems at Johns Hopkins University.

Best Graduate Project Award 05/2020
In Computer Integrated Surgical Systems and Technology II at Johns Hopkins University.

COVID-19 Dataset Award, Kaggle 04/2020
For the dataset in [M-1].

Intuitive Surgical Best Project Award. 12/2019
For Enriching Unsupervised Feature Learning via Intermediate Subtasks in Deep Learning at Johns Hopkins University.

Publications

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

Peer reviewed Journal Articles

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
- Runner-up, SPIE Medical Imaging **Physics of Medical Imaging Best Student Paper Award**
- 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. 2021 IEEE 21st International Conference on Bioinformatics and Bioengineering (BIBE), Kragujevac, Serbia, 2021 pp. 1-8. doi: 10.1109/BIBE52308.2021.9635356. 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. Now at PathAI. 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

Topics in Computer Science, Machine Learning, Baltimore, MD, USA. 06/2020 - present
We have explored numerous topics, including differential calculus, neural networks, computer vision, natural language processing, and functional programming.

Service

Professional

Sports Officer, MICCAI Society Student Board 12/2021 - present
Graduate Student Committee Representative, Laboratory for Computational Sensing and Robotics 09/2020 - present
Head of Student Resources

Community

Family Member, Thread, Baltimore, MD, USA. 06/2021 - present
I volunteer with students at Douglass High School in Baltimore City, helping with algebra or physics homework, organizing social outings, and playing lots of Uno.

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

Peer Review

- IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR) 2021-2022

- 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

International Society for Optics and Photonics (SPIE) Student Member
Institute of Electrical and Electronics Engineers (IEEE) Graduate Student Member

Extracurricular

Outside of the office, I enjoy bouldering, cycling, running, and painting. I also write creatively:
Creative nonfiction: benjamindkilleen.com/blog
Science fiction.

Metadata

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- online: benjamindkilleen.com/markdown-cv.
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