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.

Academic 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.

Services and Leadership

Academic Services

President, LCSR Graduate Student Association at Johns Hopkins University. 08/2022 - present
Organizes social events like First Monday Bagels, Climbing Night, Hydro Lab Happy Hour, and Ice Skating Night.
Established an executive board, annual operating budget, and election process.

Sports Officer, MICCAI Society Student Board. 12/2021 - present

Head of Student Resources, LCSR Graduate Student Committee at Johns Hopkins University. 09/2020 - 08/2022

Community

Family Member, Thread, Baltimore, MD, USA. 06/2021 - 2022
Volunteer Instructor, CompileHer, Chicago, IL, USA. 2019

Peer Review

- IEEE Robotics and Automation Letters (RA-L) 2023
- International Symposium on Medical Robotics (ISMR) 2023
- International Conference on Information Processing in Computer-Assisted Interventions (IPCAI) 2023
- MICCAI Educational Challenge 2022
- Medical Image Analysis 2022
- IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR) 2021-2022
- Nature Scientific Data 2020

Supervision

Graduate Students

Han Zhang, Masters, Johns Hopkins Unviersity, Baltimore, MD, USA. 01/2023 - present

Qiyuan Wu, Masters, Johns Hopkins University, Baltimore, MD, USA. 08/2022 - present

Zidi Tao, Research Assistant, Johns Hopkins University, Baltimore, MD, USA. 10/2021 - 06/2022
Now a PhD student at Rensselaer Polytechnic Institute.

Shreya Chakraborty, Masters, Johns Hopkins University, Baltimore, MD, USA. 08/2020 - 09/2021
Now at PathAI.

Philipp Nikutta, Visiting Masters, Technical University of Munich, Munich, Germany. 12/2019 - 03/2020
Now at Argo AI.

Undergraduates

Sambhav Chordia, Bachelors, Johns Hopkins University, Baltimore, MD, USA. 06/2022 - 12/2022

Sean Sebastian Darcy, Bachelors, Johns Hopkins University, Baltimore, MD, USA. 10/2021 - 10/2022
Now an incoming PhD student at California Institute of Technology.

Nethra Venkatayogi, Bachelors, The University of Texas at Austin, Austin, TX, USA. 05/2021 - 10/2021
Now an incoming PhD student with Muyinatu Bell.

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

Projects

Recreating Pelvic Trauma Surgery in Virtual Reality for the Development of Novel C-arm Interfaces. Han Zhang, Zixuan Liu, Liam Wang. Computer Integrated Surgery II, Johns Hopkins Unviersity. 2023

Real-time Integration of 2D-3D Pelvic Registration with Robotic X-ray Acquisition Jiaming Zhang, Zhangcong She. Computer Integrated Surgery II, Johns Hopkins Unviersity. 2023

3D Segmentation of Hard and Soft Tissue for Simulating X-ray Image Formation with Deep Learning. Qiyuan Wu, Zhiyuan Ding, Sean Darcy. Computer Integrated Surgery II, Johns Hopkins University. 2022

Assistant Teaching

Computer Integrated Surgery, Department of Computer Science, Johns Hopkins University, Baltimore, MD, USA. Fall 2022
With Russ Taylor.
Wrote supplementary course material, led weekly office hours, and taught regular discussion sections.

Computer Integrated Surgery, Department of Computer Science, Johns Hopkins University, Baltimore, MD, USA. Fall 2021
With Russ Taylor and Emad Boctor.
Held weekly office hours and biweekly discussion sections. Managed grading together with Maia Stiber.

Machine Learning and Large Scale Data Analysis, Department of Computer Science, University of Chicago, Chicago, IL, USA. Spring 2019
With Yali Amit.
Wrote supplementary course material and held weekly lab sessions. Graded coursework.

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

Teaching Services

Course assistant. 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 in Computer Science, Machine Learning, Baltimore, MD, USA. 06/2020 - 08/2022
Worked with middle and high school students.

Publications

I have first- (co-) authored 5 (4) peer-reviewed papers and 2 preprints. My publication list is also available on Google Scholar. (*) denotes equal contribution.

Peer-reviewed Journal Articles

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. To appear in International Journal of Computer Assisted Radiology and Surgery, 2023. J-5

C. Gao, **B.D. Killeen**, Y. Hu, R.B. Grupp, R.H. Taylor, M. Armand, M. Unberath. SyntheX: Scaling Up Learning-based X-ray Image Analysis Through In Silico Experiments. To appear in Nature Machine Intelligence, 2023. arXiv:10.48550/arXiv.2206.06127. J-4

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, 7 Dec. 2022, pp. 1-6, doi: 10.1080/21681163.2022.2154272. J-3
Special issue: Augmented Environments for Computer Assisted Interventions (AE-CAI) 2022.

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. Medical Imaging 2022: Physics of Medical Imaging. SPIE. doi: 10.1117/12.2612989. C-5
- Runner-up, SPIE Medical Imaging **Physics of Medical Imaging Best Student Paper Award**

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

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-reinforcement-for-robots

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

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

GPA: 3.81

*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, and running. I also write creatively:
Creative nonfiction: benjamindkilleen.com/blog
Science fiction.

Metadata

This document is available
- online: benjamindkilleen.com/markdown-cv.
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