

Daniel Hellfeld, Ph.D.

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SUMMARY	Applied research scientist leveraging computer vision and machine learning techniques to solve complex inversion problems. 5+ years experience in developing, testing and deploying software for anomaly detection, image reconstruction and real-time 3D mapping.	
EDUCATION	Doctor of Philosophy (Ph.D.) , Nuclear Engineering (4.0/4.0) <i>University of California, Berkeley</i> ◦ Thesis: “Free-moving Omnidirectional 3D Gamma-ray Imaging and Localization”. ◦ Advisor: Prof. Kai Vetter.	Jul 2019 <i>Berkeley, CA</i>
	Master of Science (M.S.) , Nuclear Engineering (4.0/4.0) <i>Texas A&M University</i> ◦ Thesis: “Feasibility of Remote Nuclear Reactor Antineutrino Directionality via Elastic Electron Scattering in the WATER Cherenkov Monitor of ANTineutrinos (WATCHMAN)”. ◦ Advisor: Prof. Craig Marianno.	May 2015 <i>College Station, TX</i>
	Bachelor of Science (B.S.) , Physics (3.89/4.0) <i>University of California, Santa Barbara</i>	Jun 2013 <i>Santa Barbara, CA</i>
RESEARCH EXPERIENCE	Senior Scientific Engineering Associate <i>Applied Nuclear Physics Group, Lawrence Berkeley National Laboratory</i> ◦ Real-time quantitative 3D mapping with contextual and radiological data streams. ◦ 3D object detection and tracking in LiDAR point clouds using sparse convolution neural networks for improved radiological source detection and attribution. ◦ Anomaly detection algorithm development for a city-scale network of multi-sensor systems.	Aug 2019 - Present <i>Berkeley, CA</i>
	Research Fellow <i>Nuclear Science and Security Consortium, UC Berkeley</i> ◦ Modeling and imaging algorithm development for free-moving multi-platform (e.g., hand-held, ground robot/vehicles, UAS) gamma-ray imagers. ◦ Fusion of contextual sensors (e.g., LiDAR, RGBD camera, IMU) and computer vision techniques (e.g., SLAM, photogrammetry) with gamma-ray image reconstruction. ◦ Experimental demonstration of omnidirectional 3D active coded mask imaging in real-time.	Nov 2014 - Jul 2019 <i>Berkeley, CA</i>
	Physics Intern <i>Rare Event Detection Group, Lawrence Livermore National Laboratory</i> ◦ Monte Carlo simulations and statistical data analysis for a proposed antineutrino detector. ◦ Study on the feasibility of remote clandestine nuclear reactor directionality. ◦ Investigation of electron scattering background sources in water and the impact of overburden, fiducial volume, and radon contamination on directionality.	Jun - Aug 2015/2014 <i>Livermore, CA</i>
TEACHING EXPERIENCE	Lecturer <i>Department of Nuclear Engineering, UC Berkeley</i> ◦ Undergraduate radiation detection (NE 104): semiconductor and scintillator detector operation, manufacturing, signal generation, readout techniques, applications and limitations. ◦ Undergraduate imaging (NE 107): X-ray detection, image formation, computed tomography, and phase contrast imaging.	Jan - May / Sep - Nov 2018 <i>Berkeley, CA</i>
MENTORSHIP EXPERIENCE	Kalie Knecht , graduate <i>Department of Nuclear Engineering, UC Berkeley</i> ◦ 3D image reconstruction and scene data fusion with a free-moving gamma-ray detector and auxiliary contextual sensor package. ◦ Data analysis for recent measurement campaign at the Fukushima Daiichi NPP, Japan.	Sep 2019 - Present

David Raji, undergraduate

Jun - Aug 2018/2017

Department of Nuclear Engineering, Georgia Institute of Technology

- Sensitivity-weighted adaptive voxelization for free-moving imaging.
- Real-time probabilistic tri-state point cloud occupancy with ray-casting.

SCIENTIFIC
COMPUTING
SKILLS

Languages:

Python, C++, bash

Data/Statistical Analysis:

ROOT, R

Machine Learning:

PyTorch, TensorFlow

Build Systems:

make, CMake, ninja, catkin

Operating Systems:

macOS, Linux, Windows

Resource Management:

SLURM

Robotics:

ROS

GPU Programming:

OpenCL, OpenGL, CUDA

Databases:

HDF5, SQL

CI/CD:

TravisCI, Docker

Documentation:

Doxygen, Sphinx

Markup:

Markdown, XML, HTML

Version Control:

git

Other Software:

L^AT_EX

AWARDS

R&D 100 Award Winner, R&D World Magazine, WTWH Media

Nov 2019

Best Paper Award, UC Berkeley NE Dept.

Dec 2018

Runner-up Student Paper Competition, IEEE NSS-MIC

Oct 2017

Best Oral Presentation, University Program Review Meeting

Jun 2017

Best Poster Award, INMM Annual Meeting

Jul 2015

Nuclear Science and Security Consortium Fellowship, UC Berkeley

Nov 2014

Graduate Enhancement Fellowship, Texas A&M University

Aug 2013

Highest Academic Honor Award, UC Santa Barbara, Physics Dept.

May 2013

Highest Honors, UC Santa Barbara

May 2013

PUBLICATIONS,
PROCEEDINGS
& PAPERS

- [1] **D. Hellfeld**, P. Barton, A. Haefner, D. Gunter, L. Mihailescu, and K. Vetter, "Real-time Free-moving Active Coded Mask 3D Gamma-ray Imaging," *IEEE Trans. Nucl. Sci.*, vol. 66, no. 10, pp. 2252–2260, Oct. 2019.
- [2] **D. Hellfeld**, T. H. Y. Joshi, M. S. Bandstra, R. J. Cooper, B. J. Quiter, and K. Vetter, "Gamma-Ray Point-Source Localization and Sparse Image Reconstruction using Poisson Likelihood," *IEEE Trans. Nucl. Sci.*, vol. 66, no. 9, pp. 2088–2099, Jul. 2019.
- [3] **D. Hellfeld**, "Free-moving Omnidirectional 3D Gamma-ray Imaging and Localization," Ph.D. dissertation, University of California, Berkeley, Jul. 2019.
- [4] K. Vetter, A. Haefner, R. Barnowski, P. Barton, **D. Hellfeld**, T. H. Y. Joshi, R. Pavlovsky, Y. Sanada, Y. Shikaze, and T. Torii, "3D Radiation Mapping and Data Fusion for Environmental Remediation and Cleanup," in *Proc. Waste Management Symp.*, Phoenix, AZ, Mar. 2018.
- [5] **D. Hellfeld**, P. Barton, D. Gunter, L. Mihailescu, and K. Vetter, "A Spherical Active Coded Aperture for 4π Gamma-ray Imaging," *IEEE Trans. Nucl. Sci.*, vol. 64, no. 11, pp. 2837–2842, Nov. 2017.
- [6] **D. Hellfeld**, P. Barton, A. Haefner, D. Gunter, L. Mihailescu, and K. Vetter, "Omnidirectional 3D Gamma-ray Imaging with a Free-moving Spherical Active Coded Aperture," in *Proc. IEEE NSS-MIC*, Atlanta, GA, Oct. 2017.
- [7] S. Dazeley, A. Bernstein, T. Classen, E. Reedy, **D. Hellfeld**, M. Duvall, and C. Marianno, "Antineutrino Detection based on ^6Li -doped Pulse Shape Sensitive Plastic Scintillator and Gd-doped Water," in *Proc. Int. Conf. App. Nucl. Tech.*, Crete, Greece, Jun. 2017.
- [8] **D. Hellfeld**, S. Dazeley, A. Bernstein, and C. Marianno, "Reconstructing the Direction of Reactor Antineutrinos via Electron Scattering in Gd-Doped Water Cherenkov Detectors," *Nucl. Instrum. Meth. A*, vol. 841, pp. 130–138, Jan. 2017.

- [9] **D. Hellfeld**, P. Barton, D. Gunter, L. Mihailescu, and K. Vetter, “Optimization of a Spherical Active Coded Mask Imager,” *in Proc. IEEE NSS-MIC*, Strasbourg, France, Nov. 2016.
- [10] N. S. Bowden, K. M. Heeger, P. Huber, C. Mariani, and R. B. Vogelaar, “Applied Antineutrino Physics - Conference Summary,” *arXiv:1602.04759*, Arlington, VA, Dec. 2015.
- [11] **D. Hellfeld**, A. Bernstein, S. Dazeley, and C. Marianno, “Nuclear Reactor Antineutrino Directionality via Elastic Electron Scattering in a Gd-Doped Water Cherenkov Detector,” *in Proc. INMM Annual Meeting*, Indian Wells, CA, Jul. 2015.
- [12] **D. Hellfeld**, “Feasibility of Nuclear Reactor Antineutrino Directionality via Elastic Electron Scattering in the WATER Cherenkov Monitor of ANTineutrinos (WATCHMAN),” Master’s thesis, Texas A&M University, May 2015.
- [13] A. Bernstein and the WATCHMAN collaboration, “The Physics and Nuclear Nonproliferation Goals of WATCHMAN: A WATER Cherenkov Monitor for ANTineutrinos,” *arXiv:1502.01132*, Feb. 2015.

REFERENCES

Available upon request.