





# Ryan Neph

ryanneph   
ryanneph 

neph320@gmail.com   
Los Angeles, CA   
ryanneph.com 

Applied Researcher – Machine/Deep Learning, Optimization & HPC

 Education	<b>University of California, Los Angeles, CA</b> <span style="float: right;">2015-Present</span> <b>Ph.D. Biomedical Physics (GPA: 3.99)</b> <i>Research Focus:</i> <ul style="list-style-type: none"><li>• <b>Algorithm development:</b> GPU-based X-Ray dose estimation, iterative CT reconstruction, large-scale radiation delivery parameter optimization, image registration (optical flow), image-feature-based tumor detection/prognosis</li><li>• <b>Deep learning Applications:</b> X-Ray dose denoising, image segmentation, tumor detection</li><li>• <b>3D Fabrication:</b> Medical X-Ray delivery device prototyping (3D design/print, electronics, embedded development)</li></ul> <i>Notable Coursework:</i> <ul style="list-style-type: none"><li>• Monotone Operator Theory</li><li>• Large-scale Convex Optimization</li><li>• Convex Theory</li><li>• CT/MRI Reconstruction</li><li>• Signal and Image Processing</li><li>• Monte Carlo Sampling Methods</li><li>• Radiation Treatment Optimization</li><li>• Biological Statistics</li><li>• Anatomy and Physiology</li></ul>
	<b>Kettering University, Flint, MI</b> <span style="float: right;">2010-2014</span> <b>B.Sc. Engineering Physics &amp; B.Sc. Mechanical Engineering (GPA 3.91 – Highest Honor)</b>
 Work	<b>University of California, Los Angeles, CA</b> <span style="float: right;">2015-Present</span> <i>Ph.D. Candidate Researcher (Dr. Ke Sheng's Computational Research Lab)</i> <ul style="list-style-type: none"><li>• Develop <b>deep learning</b>, <b>machine learning</b>, and <b>large-scale optimization</b> methods to solve radiation therapy problems</li><li>• Developing advanced novel algorithms using <b>GPU (CUDA)</b> &amp; distributed/multi-GPU environments</li><li>• Managing 6+ multi-GPU servers for use by colleagues – maintaining healthy operation for 12+ users</li><li>• Operating/managing of rapid fabrication tools: SLS (HP), SLA (Form2), FDM 3D printers and desktop laser cutter</li></ul> <b>Siemens PLM, Troy, MI</b> <span style="float: right;">2010-2015</span> <i>NVH Applications Engineer + Software Developer</i> <ul style="list-style-type: none"><li>• Vibration &amp; Acoustic Testing/Analysis – Vibration, acoustic, and strain-based resonance, Center of Mass and Moment of Inertia measurement, operational comfort and durability testing/analysis.</li><li>• Physics Simulation – Finite element (FEA) simulation of automotive dynamics, mechanical stress, struct. resonance.</li><li>• <b>Software Development</b> – Automation of data acquisition and analysis (C#): UI design, project management, signal proc.</li></ul>
	<b>Deep Learning Prediction of Dose from Highly Under Sampled Monte Carlo (preprint)</b> <span style="float: right;">2019</span> Selected for oral presentation at <b>MICCAI 2019</b> (medical image computing conference) <b>Reduced dose error by 2 orders of magnitude (OOM)</b> compared to under sampled MC dose, while <b>reducing calculation time by 2.7 OOM</b> compared to low-variance MC sampling
 Projects	<b>Efficient Multi-GPU Implementation of X-Ray Dose Calculation (published)</b> <span style="float: right;">2017-2019</span> <b>Accelerated best existing GPU method by &gt;30x</b> on 1 GPU. Further extended implementation for multi-node/multi-GPU parallel computation with near linear scaling of calculation time with number of GPUs
	<b>Large-Scale Robust Proton Treatment Optimization (published)</b> <span style="float: right;">2018-2019</span> Novel robust joint optimization of proton beam orientation and intensity with sparsity and biological sensitivity regularization achieved with $L_2^{1/2}$ norm, solved using a <b>Proximal-Gradient Method (FISTA)</b>
	<b>R&amp;D of Sparse Orthogonal Collimator (published: part 1, 2; summary)</b> <span style="float: right;">2018-2019</span> Development of novel hardware and software (serial) control interface for radiation beam shaping device
 Awards	<b>Young Investigator Finalist: Robust Proton Treatment Optimization</b> , AAPM Annual Conference <span style="float: right;">2019</span>
	<b>Best Abstract: Deep Learning Monte Carlo Dose Prediction</b> , AAPM South California Chapter <span style="float: right;">2019</span>
	<b>Best Poster: Radiomic Lung Cancer Prognosis Prediction</b> , UCLA Biomedical Physics Colloquium <span style="float: right;">2017</span>
	<b>Student Commencement Speaker</b> , Kettering University <span style="float: right;">2015</span>
 Leadership	<b>UCLA Programs in Biosciences</b> – Co-organizer of Bi-weekly Deep Learning Journal Club and Summer Seminar on Convolutional Neural Networks <span style="float: right;">2018-2019</span>
	<b>Biomedical Physics Department, UCLA - Student Representative</b> <span style="float: right;">2015-2017</span> <b>Kettering University</b> <span style="float: right;">2012-2014</span> President - Student Senate, Society of Physics Students, Sigma Chi Fraternity Chapter, Order of Omega Director – New Student Orientation Program
 Skills	<b>SW Development:</b> Proficiency in Python, C++/CUDA, TensorFlow, PyTorch, MongoDB, Docker, Git, Linux, Web Technologies <b>Machine Learning:</b> Classification (SVM, Decision Trees, ANN), Unsupervised Clustering (K-means, Hierarchical, Bayesian Non-parametric), Deep Learning (GAN, CNN) for Classification, Detection, and Generation of 3D medical image data (CT+MRI) <b>Rapid Fabrication:</b> 3D modeling (Inventor, Blender), 3D printing (SLS, SLA, FDM), Desktop laser cutting

# Published Works

## Papers

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### 2020

**In Review: ROAD: R0tational direct Aperture optimization with a Decoupled ring-collimator for FLASH radiotherapy**

Qihui Lyu, Ryan Neph, Dan Ruan, Salime Boucher, Ke Sheng

Physics in Medicine and Biology

**Many-isocenter Optimization for Robotic Radiotherapy** (<https://iopscience.iop.org/article/10.1088/1361-6560/ab63b8/meta>)

Qihui Lyu, Ryan Neph, Victoria Yu, Dan Ruan, Salime Boucher, Ke Sheng

Physics in Medicine and Biology, 65(4), February 2020

### 2019

**Robust individual Thermoluminescence dosimeter tracking using optical fingerprinting** (<https://doi.org/10.1002/mp.13895>)

Daili Shang, Wenbo Gu, Angelia Landers, Kaley Woods, Victoria Yu, Ryan Neph, Stephen Tenn, Ke Sheng

Medical Physics, 47(1), November 2019

**DeepMCDose: A Deep Learning Method for Efficient Monte Carlo Beamlet Dose Calculation by Predictive Denoising in MR-Guided Radiotherapy**

(<http://arxiv.org/abs/1908.04437>)

Ryan Neph, Yangsibo Huang, Youming Yang, Ke Sheng

Lecture Notes in Computer Science: 2019 MICCAI Workshop on AI in Radiation Therapy (AIRT) ([link \(https://link.springer.com/chapter/10.1007/978-3-030-32486-5\\_17\)](https://link.springer.com/chapter/10.1007/978-3-030-32486-5_17)),

October 2019

**A Sparse Orthogonal Collimator for Small Animal Intensity Modulated Radiation Therapy, Part II: Hardware Development and Commissioning**

(<https://aapm.onlinelibrary.wiley.com/doi/10.1002/mp.13870>)

Kaley Woods, Ryan Neph, Dan Nguyen, Ke Sheng

Medical Physics, 46(12), October 2019

**A Sparse Orthogonal Collimator for Small Animal Intensity Modulated Radiation Therapy, Part I: Planning System Development and Commissioning**

(<https://aapm.onlinelibrary.wiley.com/doi/full/10.1002/mp.13872>)

Kaley Woods, Dan Nguyen, Ryan Neph, Dan Ruan, Daniel O'Connor, Ke Sheng

Medical Physics, 46(12), October 2019

**Parallel Beamlet Dose Calculation via Beamlet Contexts in a Distributed Multi-GPU Framework** (<https://aapm.onlinelibrary.wiley.com/doi/abs/10.1002/mp.13651>)

Ryan Neph, Cheng Ouyang, John Neylon, Youming Yang, Ke Sheng

Medical Physics, 46(8), June 2019

**Robust Beam Orientation Optimization for Intensity-Modulated Proton Therapy** (<https://aapm.onlinelibrary.wiley.com/doi/abs/10.1002/mp.13641>)

Wenbo Gu, Ryan Neph, Dan Ruan, Wei Zou, Lei Dong, Ke Sheng

Medical Physics - *Editor's Choice*, May 2019

**Iterative reconstruction for low-dose ct using Plug-and-Play alternating direction method of multipliers (ADMM) framework**

(<https://www.spiedigitallibrary.org/conference-proceedings-of-spie/10949/1094906/iterative-reconstruction-for-low-dose-CT-using-Plug-and-Play/10.1117/12.2512484.full?SSO=1>)

Qihui Lyu, Dan Ruan, John Hoffman, Ryan Neph, Michael McNitt-Gray, Ke Sheng

SPIE Medical Imaging Conference Proceedings, 10949 (2019), March 2019

**Single-Arc VMAT Optimization for Dual-Layer MLC** (<https://iopscience.iop.org/article/10.1088/1361-6560/ab0ddd/meta>)

Qihui Lyu, Ryan Neph, Victoria Y Yu, Dan Ruan, Ke Sheng

Physics in Medicine and Biology, 64 (9), May 2019

### 2018

**Performance Comparison of Knowledge-Based Dose Prediction Techniques Based on Limited Patient Data**

(<https://journals.sagepub.com/doi/abs/10.1177/1533033818811150>)

Angelia Landers, Ryan Neph, Fabien Scalzo, Dan Ruan, Ke Sheng

Technology in Cancer Research & Treatment, 17 (10), October 2018

**A novel optimization framework for VMAT with dynamic gantry couch rotation** (<http://iopscience.iop.org/article/10.1088/1361-6560/aac704/meta>)

Qihui Lyu, Victoria Y Yu, Dan Ruan, Ryan Neph, Daniel O'Connor, Ke Sheng

Physics in Medicine and Biology, 63 (12), June 2018

## Conference Abstracts

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## 2019

### **Deep Learning MC: Fast CNN-Based Prediction of Monte Carlo Dose for MR-Guided Treatment Planning**

(<https://w3.aapm.org/meetings/2019AM/programInfo/programAbs.php?sid=8160&aid=43745>)

Ryan Neph, Yangsibo Huang, Youming Yang, Ke Sheng

Accepted Abstract, AAPM Annual Meeting; San Antonio, Texas 2019, July 2019

### **Robust Beam Orientation Optimization for Intensity-Modulated Proton Therapy** (<https://w3.aapm.org/meetings/2019AM/programInfo/programAbs.php?sid=7994&aid=44017>)

Wenbo Gu, Ryan Neph, Dan Ruan, Wei Zou, Lei Dong, Ke Sheng

Accepted Abstract, AAPM Annual Meeting; San Antonio, Texas 2019, July 2019

### **A Global-Sampling Optimization Framework for Single-Arc VMAT Using Dual Layer MLC** (<https://w3.aapm.org/meetings/2019AM/programInfo/programAbs.php?sid=8002&aid=44537>)

Qihui Lyu, Ryan Neph, Victoria Yu, Dan Ruan, Ke Sheng

Accepted Abstract, AAPM Annual Meeting; San Antonio, Texas 2019, July 2019

### **A Flexible Iterative Reconstruction Framework for Low Dose CT** (<https://w3.aapm.org/meetings/2019AM/programInfo/programAbs.php?sid=8010&aid=45368>)

Qihui Lyu, Dan Ruan, John Hoffman, Ryan Neph, Michael McNitt-Gray, Ke Sheng

Accepted Abstract, AAPM Annual Meeting; San Antonio, Texas 2019, July 2019

### **Commissioning and Testing of the Sparse Orthogonal Collimator for Small Animal IMRT** (<https://w3.aapm.org/meetings/2019AM/programInfo/programAbs.php?sid=8242&aid=45371>)

Kaley Woods, Ryan Neph, Dan Nguyen, Daniel O'Connor, Ke Sheng

Accepted Abstract, AAPM Annual Meeting; San Antonio, Texas 2019, July 2019

### **Feasibility of Soft Robot Assisted 4pi Supine Breast Radiotherapy** (<https://w3.aapm.org/meetings/2019AM/programInfo/programAbs.php?sid=7954&aid=46968>)

Daili Shang, Qihui Lyu, Ryan Neph, Wenbo Gu, Ke Sheng

Accepted Abstract, AAPM Annual Meeting; San Antonio, Texas 2019, July 2019

## 2018

### **A Sparse Orthogonal Collimator for Small Animal IMRT Using Rectangular Aperture Optimization** ([https://www.redjournal.org/article/S0360-3016\(18\)31369-5/abstract](https://www.redjournal.org/article/S0360-3016(18)31369-5/abstract))

Kaley Woods, Dan Nguyen, Ryan Neph, Daniel O'Connor, Ke Sheng

International Journal of Radiation Oncology - Biology, Physics, 102 (3), S152-153, November 2018

### **Robust Individual TLD Tracking Using Optical Finger Printing Technology**

Daili Shang, Wenbo Gu, Angelia Landers, Kaley Woods, Ryan Neph, Stephen Tenn, Ke Sheng

Medical Physics 45 (6), E233-233, June 2018

### **Efficient Multi-GPU Calculation of Local Radiomic Features From 2D and 3D Images**

Ryan Neph, Ke Sheng

Medical Physics 45 (6), E233-233, June 2018

### **Distributed Multi-GPU Photon Beamlet Dose Calculation for Efficient Radiation Treatment Planning**

Ryan Neph, Cheng Ouyang, John Neylon, Ke Sheng

Medical Physics 45 (6), E697-698, June 2018

### **4piVMAT for Efficient Delivery of Highly Conformal Non-Coplanar Plans**

Qihui Lyu, Victoria Yu, Daniel O'Connor, Ryan Neph, Dan Ruan, Ke Sheng

Medical Physics 45 (6), E665-E665, June 2018

### **Sparse Orthogonal Collimator with Rectangular Aperture Optimization for Small Animal IMRT**

Kaley Woods, Dan Nguyen, Ryan Neph, Daniel O'Connor, S. Boucher, Ke Sheng

Medical Physics 45 (6), E559-E560, June 2018

### **Performance Comparison of Knowledge-Based Dose Prediction Techniques**

Angelia Landers, Ryan Neph, Fabian Scalzo, Dan Ruan, Ke Sheng

Medical Physics 45 (6), E628-E628, June 2018

## 2017

### **Predicting Risk in NSCLC Patients Using Learned Tumor Sub-Region Appearance From Quantitative Features in CT Images**

Ryan Neph, Ke Sheng

Medical Physics 44 (6), 3289-3289, June 2017