Daniel O'Connor

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Google Scholar • Stack Exchange

Education

PhD, Applied Mathematics
University of California, Los Angeles,   *2009–2015*
Thesis topic: Primal-dual operator splitting methods for convex optimization. (Advisor: L. Vandenberghe)

M.A., Applied Mathematics
University of California, Los Angeles,   *2001–2003*

B.S., Mathematics
University of Texas, Austin,   *1996–2001*

Employment

University of San Francisco, Dept. of Mathematics and Statistics   **San Francisco, CA**
Assistant Professor (tenure-track)   *2018–Present*
- Taught upper division courses in Machine Learning, Probability, Statistics, Differential Equations, Numerical Analysis.
- Served as director of Bachelor of Science in Data Science program.
- Mentored Master of Science in Data Science (MSDS) students working on industry practicum projects (for example, deep learning-based image segmentation and anatomical keypoint detection in optical coherence tomography images).
- Performed machine learning consulting for Gore Medical. Wrote PyTorch code for OCT image segmentation using the U-Net neural network architecture. Gave "Ingredients of Deep Learning Algorithms" presentation to Gore engineers.

UCLA, Dept. of Radiation Oncology   **Los Angeles, CA**
Postdoctoral Fellow   *2015–2018*
- Designed optimization algorithms for radiation treatment planning and medical imaging.
- Developed a beam orientation optimization algorithm for non-coplanar IMRT that was an order of magnitude faster than competing algorithms, without sacrificing dosimetric quality. Implemented versions in Matlab, Python, and C++.
- Presented research at AAPM annual conferences. Contributed to projects leading to 16 journal publications.

RefleXion Medical   **Hayward, CA**
Research Intern   *Summer 2015*
- Developed and implemented a fluence map optimization algorithm which was used in a proof-of-concept device, contributing to a successful Series B funding effort. Gave an AAPM 2016 oral presentation based in part on this work.

UCLA, Dept. of Mathematics   **Los Angeles, CA**
Graduate Student Researcher   *2011–2015*
- Researched first-order methods for large-scale optimization and applications in image processing.
- Research on large scale optimization algorithms led to four journal publications, including first-author publications in *SIAM Journal on Imaging Sciences* (with 60+ citations) and *Computational Optimization and Applications*.
- Served as teaching assistant for graduate-level Convex Optimization courses.

UCLA Computer Vision Lab   **Los Angeles, CA**
Research Assistant   *2009–2010*
- Researched motion segmentation algorithms based on the Chan-Vese model and optical flow algorithms using a non-local means regularizer.
- Developed a video segmentation algorithm based on the semi-supervised "segmentation by transduction" algorithm.

Areté Associates   **Los Angeles, CA**
Research Analyst   *2006–2009*
- Wrote code base and played a lead role in algorithm development for a project to determine the velocities of river currents from airborne imagery. The software was demonstrated to analysts in a field test and was met with overwhelming approval, leading to a $3 million contract to create and field a working system.
- Worked on algorithm development for computer vision projects involving Multiple View Geometry (structure from motion), landmine detection, compressed sensing, UAV tracking (Kalman filtering GPS/IMU data), etc.

Programming languages

- Languages: Python, Matlab, C++, IDL, LaTeX
- Related libraries: NumPy, SciPy, Matplotlib, Pandas, Scikit-Learn, TensorFlow, PyTorch, CVXOPT

Highlighted publications

- **D. O'Connor**, V. Yu, D. Nguyen, D. Ruan, and K. Sheng, "Fraction-variant Beam Orientation Optimization for Non-coplanar IMRT." *Physics in Medicine & Biology*, 2018. (23 citations)
- **D. O'Connor** and L. Vandenberghe, "On the Equivalence of the Primal-Dual Hybrid Gradient Method and Douglas-Rachford Splitting." *Mathematical Programming*, 2018. (55 citations)
- **D. O'Connor** and L. Vandenberghe, "Total Variation Image Deblurring with Space-varying Kernel." *Computational Optimization and Applications*, 2017. (17 citations)
- **D. O'Connor** and L. Vandenberghe, "Primal-dual Decomposition by Operator Splitting and Applications to Image Deblurring." *SIAM Journal on Imaging Sciences*, 2014. (74 citations)

Journal publications (full list)

1. Nicholas Dwork, Daniel O'Connor, Ethan MI Johnson, Corey A Baron, Jeremy W Gordon, John M Pauly, and Peder EZ Larson. Optimization in the space domain for density compensation with the nonuniform FFT. *Magnetic Resonance Imaging*, 100:102–111, 2023

2. Nicholas Dwork, Corey A Baron, Ethan MI Johnson, Daniel O'Connor, John M Pauly, and Peder EZ Larson. Fast variable density Poisson-disc sample generation with directional variation for compressed sensing in MRI. *Magnetic Resonance Imaging*, 77:186–193, 2021a

3. Nicholas Dwork, Daniel O'Connor, Corey A Baron, Ethan MI Johnson, Adam B Kerr, John M Pauly, and Peder EZ Larson. Utilizing the wavelet transform's structure in compressed sensing. *Signal, Image and Video Processing*, pages 1–8, 2021b

4. Nicholas Dwork, Jeremy W Gordon, Shuyu Tang, Daniel O'Connor, Esben Søvsø Szocska Hansen, Christoffer Laustsen, and Peder EZ Larson. Di-chromatic interpolation of magnetic resonance metabolic images. *Magnetic Resonance Materials in Physics, Biology and Medicine*, pages 1–16, 2021c

5. Qihui Lyu, Ryan Neph, Daniel O'Connor, Dan Ruan, Salime Boucher, and Ke Sheng. ROAD: ROtational direct Aperture optimization with a Decoupled ring-collimator for FLASH radiotherapy. *Physics in Medicine & Biology*, 66(3):035020, 2021

6. Victoria Y Yu, Dan Nguyen, Daniel O'Connor, Dan Ruan, Tania Kaprealian, Robert Chin, and Ke Sheng. Treating glioblastoma multiforme (GBM) with super hyperfractionated radiation therapy: Implication of temporal dose fractionation optimization including cancer stem cell dynamics. *PLOS One*, 16(2):e0245676, 2021

7. Elizabeth M McKenzie, Anand Santhanam, Dan Ruan, Daniel O'Connor, Minsong Cao, and Ke Sheng. Multimodality image registration in the head-and-neck using a deep learning-derived synthetic CT as a bridge. *Medical Physics*, 47(3):1094–1104, 2020

8. Wenbo Gu, Daniel O'Connor, Dan Ruan, Wei Zou, Lei Dong, and Ke Sheng. Fraction-variant beam orientation optimization for intensity-modulated proton therapy. *Medical Physics*, 2020

9. Qihui Lyu, Daniel O'Connor, Tianye Niu, and Ke Sheng. Image-domain multimaterial decomposition for dual-energy computed tomography with nonconvex sparsity regularization. *Journal of Medical Imaging*, 6(4):044004, 2019

10. Ningning Zhao, Daniel O'Connor, Adrian Basarab, Dan Ruan, and Ke Sheng. Motion compensated dynamic MRI reconstruction with local affine optical flow estimation. *IEEE Transactions on Biomedical Engineering*, 66 (11):3050–3059, 2019

11. Wenbo Gu, Dan Ruan, Daniel O'Connor, Wei Zou, Lei Dong, Min-Yu Tsai, Xun Jia, and Ke Sheng. Robust optimization for intensity-modulated proton therapy with soft spot sensitivity regularization. *Medical Physics*, 46(3):1408–1425, 2019

12. Angelia Landers, Daniel O'Connor, Dan Ruan, and Ke Sheng. Automated 4π radiotherapy treatment planning with evolving knowledge-base. *Medical Physics*, 46(9):3833–3843, 2019

13. Kaley Woods, Dan Nguyen, Ryan Neph, Dan Ruan, Daniel O'Connor, and Ke Sheng. A sparse orthogonal collimator for small animal intensity modulated radiation therapy Part I: Planning system development and commissioning. *Medical Physics*, 2019a

14. Robert Hannah, Yanli Liu, Daniel O'Connor, and Wotao Yin. Breaking the span assumption yields fast finite-sum minimization. In *Advances in Neural Information Processing Systems*, pages 2312–2321, 2018

15. Daniel O'Connor, Victoria Yu, Dan Nguyen, Dan Ruan, and Ke Sheng. Fraction-variant beam orientation optimization for non-coplanar IMRT. *Physics in Medicine & Biology*, 63(4):045015, 2018

16. Wenbo Gu, Daniel O'Connor, Dan Nguyen, Victoria Y Yu, Dan Ruan, Lei Dong, and Ke Sheng. Integrated beam orientation and scanning-spot optimization in intensity-modulated proton therapy for brain and unilateral head and neck tumors. *Medical Physics*, 45(4):1338–1350, 2018

17. Qihui Lyu, Daniel O'Connor, Dan Ruan, Victoria Yu, Dan Nguyen, and Ke Sheng. VMAT optimization with dynamic collimator rotation. *Medical Physics*, 45(6):2399–2410, 2018a

18. Qihui Lyu, Chunlin Yang, Hao Gao, Yi Xue, Daniel O'Connor, Tianye Niu, and Ke Sheng. Iterative megavoltage CT (MVCT) reconstruction using block-matching 3D-transform (BM 3D) regularization. *Medical Physics*, 45 (6):2603–2610, 2018b

19. Qihui Lyu, Y Yu Victoria, Dan Ruan, Ryan Neph, Daniel O'Connor, and Ke Sheng. A novel optimization framework for VMAT with dynamic gantry couch rotation. *Physics in Medicine & Biology*, 63(12):125013, 2018c

20. Daniel O'Connor and Lieven Vandenberghe. Total variation image deblurring with space-varying kernel. *Computational Optimization and Applications*, 67:521–541, 2017a

21. Daniel O'Connor and Lieven Vandenberghe. On the equivalence of the primal-dual hybrid gradient method and Douglas–Rachford splitting. *Mathematical Programming*, pages 1–24, 2017b

22. Dan Nguyen, Daniel O'Connor, Dan Ruan, and Ke Sheng. Deterministic direct aperture optimization using multiphase piecewise constant segmentation. *Medical Physics*, 44(11):5596–5609, 2017a

23. Dan Nguyen, Qihui Lyu, Dan Ruan, Daniel O'Connor, Daniel A Low, and Ke Sheng. A comprehensive formulation for volumetric modulated arc therapy planning. *Medical Physics*, 43(7):4263–4272, 2016a

24. Dan Nguyen, Dan Ruan, Daniel O'Connor, Kaley Woods, Daniel A Low, Salime Boucher, and Ke Sheng. A novel

software and conceptual design of the hardware platform for intensity modulated radiation therapy. *Medical physics*, 43(2):917–929, 2016b

25. Dan Nguyen, David Thomas, Minsong Cao, Daniel O'Connor, James Lamb, and Ke Sheng. Computerized triplet beam orientation optimization for MRI-guided Co-60 radiotherapy. *Medical Physics*, 43(10):5667–5675, 2016c

26. Dan Nguyen, Daniel O'Connor, Victoria Y Yu, Dan Ruan, Minsong Cao, Daniel A Low, and Ke Sheng. Dose domain regularization of MLC leaf patterns for highly complex IMRT plans. *Medical Physics*, 42(4):1858–1870, 2015a

27. Gennifer T Smith, Nicholas Dwork, Daniel O'Connor, Uzair Sikora, Kristen L Lurie, John M Pauly, and Audrey K Ellerbee. Automated, depth-resolved estimation of the attenuation coefficient from optical coherence tomography data. *IEEE Transactions on Medical Imaging*, 34(12):2592–2602, 2015

28. Daniel O'Connor and Lieven Vandenberghe. Primal-dual decomposition by operator splitting and applications to image deblurring. *SIAM Journal on Imaging Sciences*, 7(3):1724–1754, 2014

Conference abstracts

1. Q Lyu, R Neph, D O'Connor, D Ruan, S Boucher, and K Sheng. ROAD: ROtational direct Aperture optimization with a Decoupled ring-collimator for FLASH. In *Medical Physics*, volume 47, pages E294–E295. Wiley 111 River St, Hoboken 07030-5774, NJ USA, 2020

2. E McKenzie, D Ruan, D O'Connor, M Cao, A Santhanam, and K Sheng. Head and neck MR-CT registration using deep learning derived synthetic CT. In *Medical Physics*, volume 46, pages E383–E384. Wiley 111 River St, Hoboken 07030-5774, NJ USA, 2019a

3. E McKenzie, A Santhanam, D O'Connor, M Cao, D Ruan, and K Sheng. From multimodality to monomodality: Head and neck MR-CT registration with synthetic image bridge. *International Journal of Radiation Oncology ▪ Biology ▪ Physics*, 105(1):E724, 2019b

4. K Woods, R Neph, D Nguyen, D O'Connor, and K Sheng. Commissioning and testing of the sparse orthogonal collimator for small animal IMRT. In *Medical Physics*, volume 46, pages E489–E489. Wiley 111 River St, Hoboken 07030-5774, NJ USA, 2019b

5. D O'Connor, D Nguyen, D Ruan, A Landers, K Woods, E Boehnke, and K Sheng. Fast direct aperture optimization via parallelizable approximate projection onto the set of aperture-ready fluence maps. In *Medical Physics*, volume 45, pages E610–E611. Wiley 111 River St, Hoboken 07030-5774, NJ USA, 2018

6. N Zhao, D O'Connor, W Gu, D Ruan, A Basarab, and K Sheng. Coupling reconstruction and motion estimation for dynamic MRI through optical flow constraint. In *Medical Imaging 2018: Image Processing*, volume 10574, pages 584–591. SPIE, 2018a

7. N Zhao, D O'Connor, D Ruan, and K Sheng. Motion compensated dynamic MRI reconstruction in compressed sensing framework using local affine optical flow constraint. In *Medical Physics*, volume 45, pages E537–E537. Wiley 111 River St, Hoboken 07030-5774, NJ USA, 2018b

8. Q Lyu, V Yu, D O'Connor, R Neph, D Ruan, and K Sheng. 4piVMAT for efficient delivery of highly conformal non-coplanar plans. In *Medical Physics*, volume 45, pages E665–E665. Wiley 111 River St, Hoboken 07030-5774, NJ USA, 2018d

9. Q Lyu, VY Yu, D O'Connor, D Ruan, and K Sheng. 4πVMAT: A novel method to efficiently deliver non-coplanar treatment. *International Journal of Radiation Oncology ▪ Biology ▪ Physics*, 102:e529, 2018e

10. Q Lyu, D O'Connor, T Niu, and K Sheng. A novel multi-material decomposition method for dual energy CT. In *Medical Physics*, volume 45, pages E537–E538. Wiley 111 River St, Hoboken 07030-5774, NJ USA, 2018f

11. K Woods, D Nguyen, R Neph, D O'Connor, S Boucher, and K Sheng. Sparse orthogonal collimator with rectangular aperture optimization for small animal IMRT. In *Medical Physics*, volume 45, pages E559–E560. Wiley 111 River St, Hoboken 07030-5774, NJ USA, 2018a

12. K Woods, D Nguyen, R Neph, D O'Connor, and K Sheng. A sparse orthogonal collimator for small animal IMRT using rectangular aperture optimization. *International Journal of Radiation Oncology ▪ Biology ▪ Physics*, 102(3):S152–S153, 2018b

13. A Landers, D O'Connor, D Ruan, and K Sheng. Automated treatment planning with evolving knowledge-base. In *Medical Physics*, volume 45, pages E391–E391. Wiley 111 River St, Hoboken 07030-5774, NJ USA, 2018

14. D O'Connor, D Nguyen, D Ruan, V Yu, and K Sheng. Fraction-variant beam orientation optimization for IMRT based on group sparsity. In *Medical Physics*, volume 44, pages 2997–2997. Wiley 111 River St, Hoboken 07030-5774, NJ USA, 2017a

15. D O'Connor, D Nguyen, D Ruan, V Yu, and K Sheng. Beam orientation optimization with non-convex group sparsity penalty. In *Medical Physics*, volume 44, pages 3225–3225. Wiley 111 River St, Hoboken 07030-5774, NJ USA, 2017b

16. D Nguyen, Q Lyu, D O'Connor, H Gao, X Qi, and K Sheng. Megavoltage iterative CT reconstruction utilizing L0-penalty based total count variation regularization. In *Medical Physics*, volume 44, pages 3025–3025. Wiley 111 River St, Hoboken 07030-5774, NJ USA, 2017b

17. D Nguyen, D O'Connor, Q Lyu, D Ruan, and K Sheng. Direct aperture optimization utilizing L0-penalty based

total count variation regularization. In *Medical Physics*, volume 44, pages 2902–2902. Wiley 111 River St, Hoboken 07030-5774, NJ USA, 2017c

18. W Gu, D O'Connor, V Yu, D Nguyen, D Ruan, and K Sheng. Integrated beam angle and scanning-spot optimization in intensity modulated proton therapy using group sparsity. In *Medical Physics*, volume 44, pages 3277–3277. Wiley 111 River St, Hoboken 07030-5774, NJ USA, 2017a

19. W Gu, D O'Connor, D Nguyen, VY Yu, D Ruan, and K Sheng. Integrated beam angle and scanning spot optimization for intensity modulated proton therapy. *International Journal of Radiation Oncology • Biology • Physics*, 99(2):S107, 2017b

20. W Gu, D O'connor, D Nguyen, V Yu, D Ruan, and K Sheng. Fraction-variant beam angle optimization in intensity modulated proton therapy: Su-h2-gepd-t-04. *Medical Physics*, 44(6), 2017c

21. K Woods, D Nguyen, D Ruan, D O'Connor, and K Sheng. Double-focused sparse orthogonal collimator design for small animal x-ray irradiators. In *Medical Physics*, volume 44, pages 3065–3065. Wiley 111 River St, Hoboken 07030-5774, NJ USA, 2017

22. Ke Sheng, Amit Sawant, D O'Connor, D Nguyen, A Modiri, and H Paganetti. Inverse optimization meets high performance computing. In *Medical Physics*, volume 44, pages 3094–3095. Wiley 111 River St, Hoboken 07030-5774, NJ USA, 2017

23. V Yu, D O'Connor, D Nguyen, W Gu, D Ruan, and K Sheng. Predicting time to glioblastoma multiforme (GBM) recurrence with MR image texture analysis. In *Medical Physics*, volume 44, pages 3202–3202. Wiley 111 River St, Hoboken 07030-5774, NJ USA, 2017

24. Q Lyu, C Yang, S Gong, Y Xue, J Wang, D O'Connor, T Niu, and K Sheng. Low-dose conebeam CT reconstruction using block-matching 3D-transform (BM3D) regularization. In *Medical Physics*, volume 44, pages 3284–3284. Wiley 111 River St, Hoboken 07030-5774, NJ USA, 2017a

25. Q Lyu, D Ruan, D Nguyen, D O'Connor, and K Sheng. VMAT optimization with dynamic collimator rotation. In *Medical Physics*, volume 44, pages 3089–3089. Wiley 111 River St, Hoboken 07030-5774, NJ USA, 2017b

26. D Nguyen, Q Lyu, D Ruan, D O'Connor, D Low, and K Sheng. Mo-ab-bra-01: A global level set based formulation for volumetric modulated arc therapy. *Medical Physics*, 43(6Part28):3690–3690, 2016d

27. D Nguyen, D Thomas, M Cao, D O'Connor, J Lamb, and K Sheng. Th-ab-bra-02: Automated triplet beam orientation optimization for MRI-guided Co-60 radiotherapy. *Medical Physics*, 43(6Part43):3853–3854, 2016e

28. D Nguyen, DH Thomas, M Cao, D O'Connor, JM Lamb, and K Sheng. Automated triplet beam orientation optimization for magnetic resonance imaging–guided Co-60 radiation therapy. *International Journal of Radiation Oncology • Biology • Physics*, 96(2):S60, 2016f

29. D O'Connor, Y Voronenko, D Nguyen, W Yin, and K Sheng. Th-ef-brb-05: 4pi non-coplanar IMRT beam angle selection by convex optimization with group sparsity penalty. *Medical Physics*, 43(6Part47):3895–3895, 2016

30. D Nguyen, D Ruan, D O'Connor, D Low, and K Sheng. A novel approach to deliver non-coplanar intensity modulated radiation therapy using simple orthogonal collimators. *International Journal of Radiation Oncology • Biology • Physics*, 93(3):S164–S165, 2015b

31. D Nguyen, D O'Connor, V Yu, D Ruan, M Cao, D Low, and K Sheng. Th-ef-brd-05: A new intensity modulation radiation therapy (IMRT) optimizer solution with robust fluence maps for MLC segmentation. *Medical Physics*, 42(6Part44):3740–3740, 2015c

32. D Nguyen, D Ruan, D O'Connor, D Low, S Boucher, and K Sheng. Su-f-brb-12: A novel Haar wavelet based approach to deliver non-coplanar intensity modulated radiotherapy using sparse orthogonal collimators. *Medical Physics*, 42(6Part25):3532–3532, 2015d

33. N Dwork, D O'Connor, N Addy, R Ingle, J Pauly, and D Nishimura. Using optical flow to estimate displacement between 3D navigators in coronary angiography. In *Proc. Intl. Soc. Mag. Reson. Med*, volume 23, page 2568, 2015

34. D Nguyen, V Yu, D Ruan, H Semwal, D O'Connor, M Cao, D Low, and K Sheng. Tu-c-17a-05: Dose domain optimization of MLC leaf patterns for highly complicated 4pi IMRT plans. *Medical Physics*, 41(6Part27): 459–459, 2014

Patents

Daniel O'Connor and Yevgen Voronenko. Fluence map generation methods for radiotherapy, February 16 2021. US Patent 10,918,884