



Xianjin Dai, PhD, DABR

Clinical Assistant Professor, Radiation Oncology - Radiation Physics

Bio

BIO

Dr. Xianjin Dai is a Clinical Assistant Professor and the American Board of Radiology certified Medical Physicist in the Department of Radiation Oncology at Stanford University. Dr. Dai completed the CAMPEP-credited Therapeutic Medical Physics residency at Emory University and earned his PhD in Biomedical Engineering at the University of Florida. His research focuses on developing and translating novel biomedical imaging techniques to enhance the diagnosis, management, and treatment of cancer diseases. Dr. Dai's research interests encompass artificial intelligence in medicine, therapeutic physics, medical image analysis, multimodal imaging, biomedical optics, photoacoustic imaging, ultrasound imaging, and optical coherence tomography. He is a recipient of the DOD Prostate Cancer Research Program (PCRP) Early Investigator Research Award and the American Association of Physicists in Medicine (AAPM) Research Seed Funding Grant.

ACADEMIC APPOINTMENTS

- Clinical Assistant Professor, Radiation Oncology - Radiation Physics
- Member, Stanford Cancer Institute

ADMINISTRATIVE APPOINTMENTS

- Associate Editor, Medical Physics Journal, (2023- present)

HONORS AND AWARDS

- Best-in-Physics (multi-disciplinary), AAPM (2024)
- Cum Laude Award, SPIE Medical Imaging (2021)
- Research Travel Award, The University of Florida (2017)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Committee member, Research Committee (RSRCH), AAPM (2024 - present)
- Committee member, Joint Working Group for Research Seed Funding Initiative (JWGRSF), AAPM (2024 - present)
- Member, AAPM (The American Association of Physicists in Medicine) (2018 - present)
- Member, SPIE (the international society for optics and photonics) (2017 - present)
- Member, Optica(formerly OSA) (2016 - present)

PROFESSIONAL EDUCATION

- DABR, The American Board of Radiology , Therapeutic Medical Physics
- Residency, Emory University

- Certificate, University of California, Los Angeles
- PhD, University of Florida
- MS, BS, University of Electronic Science and Technology of China

LINKS

- google scholar: <https://scholar.google.com/citations?user=gyrHTzgAAAAJ&hl=en>

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

AI in Medicine

Biomedical Physics

Multimodal Imaging

Medical Device

Biomedical Optics

Photoacoustic/Thermoacoustic Imaging

Optical Imaging (Microscopy, OCT, DOT, FMT)

Ultrasound Imaging

1. Artificial intelligence (AI) has great potential for improving the efficiency, precision, accuracy, and overall quality of radiation therapy for cancer patients. AI platforms are still not widely adopted in clinical practice due to challenges associated with the clinical development and implementation of AI-based tools in radiation oncology. The goal of this project is to address these challenges with innovative concepts and strategic developments.
2. A multimodal imaging platform that combines the strengths of several different imaging modalities has the capability to characterize biological tissue more completely, offering improved diagnosis, management, and treatment of diseases. While multimodality images can be obtained by performing each individual modality separately without integrating them into a single platform, it is, however, time-consuming to acquire multimodality images through such a process. Additionally, it is hard to avoid errors from the required complex image registration, and more importantly, impossible to capture dynamic biological processes simultaneously. This project has demonstrated a multimodal imaging system integrating three emerging biomedical imaging techniques: photoacoustic imaging (PAI), optical coherence tomography (OCT), and ultrasound imaging (USI) to obtain optical absorption, scattering, and acoustic properties of tissue simultaneously. Several applications of the multimodal imaging platform have been explored preclinically.
3. X-ray luminescence computed tomography (XLCT) has been recently proposed as a new imaging modality by detecting the luminescent emission signals arising from the interaction between X-ray and the media. Compared to the clinically widely used X-ray CT (anatomical imaging), XLCT represents significant progress in X-ray-based imaging techniques, as X-ray-based molecular or functional imaging becomes achievable in XLCT. Moreover, compared to conventional pure optic-based molecular or functional imaging, XLCT offers two main advantages. First, autofluorescence, problematic for fluorescence imaging, can be avoided. Second, deep tissue in vivo imaging with high optical contrast and spatial resolution becomes achievable. However, progress in this area is significantly hindered by technological challenges posed by the fact that currently most XLCT systems take a long time to acquire whole-body images (low speed). Additionally, XLCT has been entirely reliant on conventional nanophosphors emitting light in the visible or near-infrared spectrum region (700-1000 nm) with high photon absorption and scattering in biological tissues, limiting XLCT for deeper tissue

imaging (insufficient imaging penetration depth) and reducing spatial resolution (limited spatial resolution). This project has been focused on addressing these challenges with innovative concepts and strategic developments.

PROJECTS

- Large Language Model-Augmented Medical Image Analysis (July 2022 - present)

Publications

PUBLICATIONS

- **Auto-delineation of treatment target volume for radiation therapy using large language model-aided multimodal learning.** *International journal of radiation oncology, biology, physics*
Rajendran, P., Chen, Y., Qiu, L., Niedermayr, T., Liu, W., Buyyounouski, M., Bagshaw, H., Han, B., Yang, Y., Kovalchuk, N., Gu, X., Hancock, S., Xing, et al
2024
- **Large Language Model-Augmented Auto-Delineation of Treatment Target Volume in Radiation Therapy.** *ArXiv*
Rajendran, P., Yang, Y., Niedermayr, T. R., Gensheimer, M., Beadle, B., Le, Q. T., Xing, L., Dai, X.
2024
- **Ultrasound-guided needle tracking with deep learning: A novel approach with photoacoustic ground truth.** *Photoacoustics*
Hui, X., Rajendran, P., Ling, T., Dai, X., Xing, L., Pramanik, M.
2023; 34: 100575
- **Landmark tracking in liver US images using cascade convolutional neural networks with long short-term memory.** *Measurement science & technology*
Zhang, Y., Dai, X., Tian, Z., Lei, Y., Wynne, J. F., Patel, P., Chen, Y., Liu, T., Yang, X.
2023; 34 (5): 054002
- **Deformable CT image registration via a dual feasible neural network.** *Medical physics*
Lei, Y., Fu, Y., Tian, Z., Wang, T., Dai, X., Roper, J., Yu, D. S., McDonald, M., Bradley, J. D., Liu, T., Zhou, J., Yang, X.
2022
- **Cascaded Learning-Based Cone Beam CT Head-And-Neck Multi-Organ Segmentation**
Lei, Y., Dai, X., Tian, Z., Wang, T., Zhou, J., Roper, J., Ghavidel, B., McDonald, M., Yu, D., Bradley, J., Liu, T., Yang, X.
WILEY.2022: E551-E552
- **Deformable CT Image Registration Using Unsupervised Deep Learning Networks**
Lei, Y., Fu, Y., Tian, Z., Wang, T., Zhang, J., Dai, X., Zhou, J., Roper, J., McDonald, M., Yu, D., Bradley, J., Liu, T., Yang, et al
WILEY.2022: E527
- **Ultrasound-Based Motion Tracking Using Hybrid Learning Network**
Lei, Y., Axente, M., Dai, X., Roper, J., Dhabaan, A., Chen, Y., Bradley, J., Liu, T., Yang, X.
WILEY.2022: E225-E226
- **Multi-organ auto-delineation in head-and-neck MRI for radiation therapy using regional convolutional neural network.** *Physics in medicine and biology*
Dai, X., Lei, Y., Wang, T., Zhou, J., Rudra, S., McDonald, M., Curran, W. J., Liu, T., Yang, X.
2022; 67 (2)
- **Liver Motion Tracking in Ultrasound images Using Attention Guided Mask R-CNN with Long-Short-Term-Memory Network**
Zhang, Y., Dai, X., Tian, Z., Lei, Y., Chen, Y., Patel, P., Bradley, J. D., Liu, T., Yang, X., Bottenus, N., Ruiter, N. V.
SPIE-INT SOC OPTICAL ENGINEERING.2022
- **Automated CT Segmentation for Rapid Assessment of Anatomical Variations in Head-and-Neck Radiation Therapy**
Dai, X., Lei, Y., Wang, T., Tian, Z., Zhou, J., McDonald, M., Yu, D. S., Ghavidel, B. B., Bradley, J. D., Liu, T., Yang, X., Linte, C. A., Siewerdsen, et al
SPIE-INT SOC OPTICAL ENGINEERING.2022
- **Deep Learning-based Longitudinal CT Registration for Anatomy Variation Assessment during Radiotherapy**

- Fu, Y., Lei, Y., Tian, Z., Wang, T., Dai, X., Zhou, J., McDonald, M., Bradley, J. D., Liu, T., Yang, X., Drukker, K., Iftekharuddin, K. M.
SPIE-INT SOC OPTICAL ENGINEERING.2022
- **Deep learning-based motion tracking using ultrasound images.** *Medical physics*
Dai, X., Lei, Y., Roper, J., Chen, Y., Bradley, J. D., Curran, W. J., Liu, T., Yang, X.
2021; 48 (12): 7747-7756
 - **Synthetic CT-aided multiorgan segmentation for CBCT-guided adaptive pancreatic radiotherapy.** *Medical physics*
Dai, X., Lei, Y., Wynne, J., Janopaul-Naylor, J., Wang, T., Roper, J., Curran, W. J., Liu, T., Patel, P., Yang, X.
2021; 48 (11): 7063-7073
 - **Self-Supervised Learning-Based High-Resolution Ultrasound Imaging for Prostate Brachytherapy**
Yang, X., Lei, Y., Dai, X., Wang, T., Lin, J. Y., Axente, M., Roper, J. R., Bradley, J. D., Jani, A., Patel, P. R., Liu, T.
ELSEVIER SCIENCE INC.2021: E119-E120
 - **Automated delineation of head and neck organs at risk using synthetic MRI-aided mask scoring regional convolutional neural network.** *Medical physics*
Dai, X., Lei, Y., Wang, T., Zhou, J., Roper, J., McDonald, M., Beitler, J. J., Curran, W. J., Liu, T., Yang, X.
2021; 48 (10): 5862-5873
 - **Self-supervised learning for accelerated 3D high-resolution ultrasound imaging.** *Medical physics*
Dai, X., Lei, Y., Wang, T., Axente, M., Xu, D., Patel, P., Jani, A. B., Curran, W. J., Liu, T., Yang, X.
2021; 48 (7): 3916-3926
 - **Synthetic MRI-Aided Delineation of Organs at Risk in Head-And-Neck Radiotherapy**
Dai, X., Lei, Y., Wang, T., Zhou, J., Roper, J., McDonald, M., Beitler, J., Bradley, J., Liu, T., Yang, X.
WILEY.2021
 - **Rapid Organ-At-Risk Delineation in Pancreatic CBCT for CBCT-Guided Adaptive Radiotherapy**
Dai, X., Lei, Y., Janopaul-naylor, J., Wynne, J., Wang, T., Zhou, J., Roper, J., Bradley, J., Patel, P., Liu, T., Yang, X.
WILEY.2021
 - **An Unsupervised Ultrasound Liver Motion Tracking Using Deep Convolutional Neural Network**
Lei, Y., Dai, X., Momin, S., Roper, J., Schreiber, E., Patel, P., Bradley, J., Liu, T., Yang, X.
WILEY.2021
 - **High-Resolution Ultrasound Imaging Through Self-Supervised Learning**
Dai, X., Lei, Y., Wang, T., Axente, M., Roper, J., Xu, D., Lin, J., Bradley, J., Liu, T., Yang, X.
WILEY.2021
 - **Head-and-neck organs-at-risk auto-delineation using dual pyramid networks for CBCT-guided adaptive radiotherapy.** *Physics in medicine and biology*
Dai, X., Lei, Y., Wang, T., Dhabaan, A. H., McDonald, M., Beitler, J. J., Curran, W. J., Zhou, J., Liu, T., Yang, X.
2021; 66 (4): 045021
 - **Synthetic MRI-aided Multi-Organ Segmentation in Head-and-Neck Cone Beam CT**
Dai, X., Lei, Y., Wang, T., Zhou, J., Curran, W., Liu, T., Yang, X., Linte, C. A., Siewerdsen, J. H.
SPIE-INT SOC OPTICAL ENGINEERING.2021
 - **Intensity Non-uniformity Correction in MR Imaging using Deep Learning**
Dai, X., Lei, Y., Liu, Y., Wang, T., Curran, W. J., Patel, P., Liu, T., Yang, X., Krol, A., Gimi, B. S.
SPIE-INT SOC OPTICAL ENGINEERING.2021
 - **Multiparametric MRI-guided High-dose-rate Prostate Brachytherapy with Focal Dose Boost to Dominant Intraprostatic Lesions**
Wang, T., Giles, M., Press, R. H., Dai, X., Jani, A. B., Rossi, P., Lei, Y., Curran, W. J., Patel, P., Liu, T., Yang, X., Krol, A., Gimi, et al
SPIE-INT SOC OPTICAL ENGINEERING.2021
 - **Deep Attention Mask Regional Convolutional Neural Network for Head-and-Neck MRI Multi-Organ Auto-Delineation**
Dai, X., Lei, Y., Wang, T., Zhou, J., Curran, W. J., Liu, T., Yang, X., Mazurowski, M. A., Drukker, K.
SPIE-INT SOC OPTICAL ENGINEERING.2021

- **Synthetic CT-based Multi-Organ Segmentation in Cone Beam CT for Adaptive Pancreatic Radiotherapy**
Dai, X., Lei, Y., Janopaul-Naylor, J., Wang, T., Roper, J., Zhou, J., Curran, W. J., Liu, T., Patel, P., Yang, X., Isgum, Landman, B. A.
SPIE-INT SOC OPTICAL ENGINEERING.2021
- **Residual Mask Scoring Regional Convolutional Neural Network for Multi-Organ Segmentation in Head-and-Neck CT**
Dai, X., Lei, Y., Wang, T., Zhou, J., Roper, J., McDonald, M., Beittler, J. J., Curran, W. J., Liu, T., Yang, X., Gimi, B. S., Krol, A.
SPIE-INT SOC OPTICAL ENGINEERING.2021
- **Deep Learning-based Volumetric Image Generation from Projection Imaging for Prostate Radiotherapy**
Dai, X., Lei, Y., Tian, Z., Wang, T., Liu, T., Curran, W. J., Yang, X., Linte, C. A., Siewerdsen, J. H.
SPIE-INT SOC OPTICAL ENGINEERING.2021
- **Deep Learning-based Multi-catheter Reconstruction for MRI-guided HDR Prostate Brachytherapy**
Dai, X., Lei, Y., Zhang, Y., Wang, T., Curran, W. J., Patel, P., Liu, T., Yang, X., Linte, C. A., Siewerdsen, J. H.
SPIE-INT SOC OPTICAL ENGINEERING.2021
- **Region Proposal Network for Multi-Organ Segmentation in CT for Pancreatic Radiotherapy**
Dai, X., Lei, Y., Janopaul-Naylor, J., Wang, T., Roper, J., Liu, T., Curran, W. J., Patel, P., Yang, X., Linte, C. A., Siewerdsen, J. H.
SPIE-INT SOC OPTICAL ENGINEERING.2021
- **Multimodal MRI synthesis using unified generative adversarial networks. *Medical physics***
Dai, X., Lei, Y., Fu, Y., Curran, W. J., Liu, T., Mao, H., Yang, X.
2020; 47 (12): 6343-6354
- **Intensity non-uniformity correction in MR imaging using residual cycle generative adversarial network. *Physics in medicine and biology***
Dai, X., Lei, Y., Liu, Y., Wang, T., Ren, L., Curran, W. J., Patel, P., Liu, T., Yang, X.
2020; 65 (21): 215025
- **Automatic multi-catheter detection using deeply supervised convolutional neural network in MRI-guided HDR prostate brachytherapy. *Medical physics***
Dai, X., Lei, Y., Zhang, Y., Qiu, R. L., Wang, T., Dresser, S. A., Curran, W. J., Patel, P., Liu, T., Yang, X.
2020; 47 (9): 4115-4124
- **Multi-Organ Segmentation in Head-And-Neck CT Using Mask Scoring Regional Convolutional Neural Network (MS-RCNN)**
Dai, X., Lei, Y., Liu, Y., Wang, T., Jiang, X., Beittler, J., Curran, W., Liu, T., Yang, X.
WILEY.2020: E302
- **High-speed X-ray-induced luminescence computed tomography. *Journal of biophotonics***
Dai, X. n., Cheng, K. n., Zhao, W. n., Xing, L. n.
2020
- **X-ray-induced shortwave infrared luminescence computed tomography *OPTICS LETTERS***
Dai, X., Cheng, K., Zhao, W., Xing, L.
2019; 44 (19): 4769-72
- **Radiation Activatable Radiosensitizers for Image-Guided and Enhanced Radiation Therapy against Head and Neck Cancer**
Cheng, K., Schueler, E., Dai, X., Zhao, W., Sivasubramanian, K., Jia, M., Xing, L.
ELSEVIER SCIENCE INC.2019: E673-E674
- **Miniature fluorescence molecular tomography (FMT) endoscope based on a MEMS scanning mirror and an optical fiberscope. *Physics in medicine and biology***
Yang, H., Wang, D., Shan, T., Dai, X., Xie, H., Yang, L., Jiang, H.
2019; 64 (12): 125015
- **X-Ray-Induced Shortwave Infrared Luminescence Computed Tomography**
Dai, X., Cheng, K., Zhao, W., Xing, L.
WILEY.2019: E301-E302
- **Deep Learning-Based Dual-Energy CT Imaging Using Only a Single-Energy CT Data**
Zhao, W., Lv, T., Shen, L., Dai, X., Cheng, K., Jia, M., Chen, Y., Xing, L.

WILEY.2019: E276

- **Deep Learning-Based Tomographic Image Reconstruction with Ultra-Sparse Projection Views**
Shen, L., Zhao, W., Dai, X., Xing, L.
WILEY.2019: E436
- **Single Snapshot X-Ray-Induced Luminescence Computed Tomography (SS-XLCT)**
Dai, X., Cheng, K., Zhao, W., Xing, L.
WILEY.2019: E465-E466
- **Deep Learning for High Spatial Resolution X-Ray Luminescence Computed Tomography**
Dai, X., Cheng, K., Zhao, W., Xing, L.
WILEY.2019: E566
- **Reduced acquisition time for L-shell x-ray fluorescence Computed tomography using polycapillary x-ray optics.** *Medical physics*
Vernekohl, D. n., Ahmad, M. n., Dai, X. n., Zhao, W. n., Cheng, K. n., Xing, L. n.
2019
- **High spatial resolution x-ray luminescence computed tomography and x-ray fluorescence computed tomography**
Dai, X., Sivasubramanian, K., Xing, L., Pogue, B. W., Gioux, S.
SPIE-INT SOC OPTICAL ENGINEERING.2019
- **A deep learning approach for dual-energy CT imaging using a single-energy CT data**
Zhao, W., Lv, T., Gao, P., Shen, L., Dai, X., Cheng, K., Jia, M., Chen, Y., Xing, L., Matej, S., Metzler, S. D.
SPIE-INT SOC OPTICAL ENGINEERING.2019
- **Full density fluorescence molecular tomography (FD-FMT) based on a dichroic mirror.** *Applied optics*
Yang, H., Dai, X., Jiang, H.
2018; 57 (27): 7938-7941
- **Fast noninvasive functional diffuse optical tomography for brain imaging.** *Journal of biophotonics*
Dai, X., Zhang, T., Yang, H., Tang, J., Carney, P. R., Jiang, H.
2018; 11 (3)
- **Targeted Molecular Imaging of Pancreatic Cancer with a Miniature Endoscope.** *Applied sciences (Basel, Switzerland)*
Dai, X., Qian, W., Yang, H., Yang, L., Jiang, H.
2017; 7 (12)
- **In vivo photoacoustic imaging of vasculature with a low-cost miniature light emitting diode excitation.** *Optics letters*
Dai, X., Yang, H., Jiang, H.
2017; 42 (7): 1456-1459
- **Low-cost high-power light emitting diodes for photoacoustic imaging**
Dai, X., Yang, H., Jiang, H., Oraevsky, A. A., Wang, L. V.
SPIE-INT SOC OPTICAL ENGINEERING.2017
- **Miniature Endoscope for Multimodal Imaging** *ACS PHOTONICS*
Dai, X., Yang, H., Shan, T., Xie, H., Berceci, S. A., Jiang, H.
2017; 4 (1): 174-180
- **Miniature multimodal endoscopic probe based on double-clad fiber**
Dai, X., Yang, H., Tang, J., Duan, C., Tanguy, Q., Xie, H., Jiang, H., Tearney, G. J., Wang, T. D.
SPIE-INT SOC OPTICAL ENGINEERING.2017
- **A fast atlas-guided high density diffuse optical tomography system for brain imaging**
Dai, X., Zhang, T., Yang, H., Jiang, H., Tromberg, B. J., Yodh, A. G., SevickMuraca, E. M., Alfano, R. R.
SPIE-INT SOC OPTICAL ENGINEERING.2017
- **Wearable scanning photoacoustic brain imaging in behaving rats.** *Journal of biophotonics*
Tang, J., Dai, X., Jiang, H.

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- **Wearable 3-D Photoacoustic Tomography for Functional Brain Imaging in Behaving Rats.** *Scientific reports*
Tang, J., Coleman, J. E., Dai, X., Jiang, H.
2016; 6: 25470
- **Continuous-wave yellow-green laser at 0.56 μm based on frequency doubling of a diode-end-pumped ceramic Nd:YAG laser.** *Applied optics*
Yao, W., Gao, J., Zhang, L., Li, J., Tian, Y., Ma, Y., Wu, X., Ma, G., Yang, J., Pan, Y., Dai, X.
2015; 54 (18): 5817-21
- **Miniature probe integrating optical-resolution photoacoustic microscopy, optical coherence tomography, and ultrasound imaging: proof-of-concept.** *Optics letters*
Dai, X., Xi, L., Duan, C., Yang, H., Xie, H., Jiang, H.
2015; 40 (12): 2921-4
- **FMTPen: A Miniaturized Handheld Fluorescence Molecular Tomography Probe for Image-Guided Cancer Surgery** *PHOTONICS*
Yang, H., He, B., Dai, X., Satpathy, M., Yang, L., Jiang, H.
2015; 2 (1): 279-287
- **High-power continuous-wave yellow-green laser at 558 nm under in-band pumping** *OPTICS COMMUNICATIONS*
Gao, J., Zhang, L., Sun, H., Dai, X., Wu, X.
2014; 319: 110-112
- **Highly efficient continuous-wave composite Nd:YAG laser at 1,112 nm under diode pumping directly into the emitting level** *APPLIED PHYSICS B-LASERS AND OPTICS*
Gao, J., Dai, X. J., Zhang, L., Sun, H. X., Wu, X. D.
2013; 111 (3): 407-413
- **A Continuous-Wave Medical Yellow Laser at 561 nm**
Gao, J., Dai, X. J., Zhang, L., Sun, H. X., Wu, X. D., IEEE
IEEE.2013
- **All-solid-state continuous-wave yellow laser at 561 nm under in-band pumping** *JOURNAL OF THE OPTICAL SOCIETY OF AMERICA B-OPTICAL PHYSICS*
Gao, J., Dai, X., Zhang, L., Sun, H., Wu, X.
2013; 30 (1): 95-98
- **Efficient continuous-wave 1112 nm Nd:YAG laser operation under direct diode pumping at 885 nm** *LASER PHYSICS LETTERS*
Gao, J., Dai, X. J., Zhang, L., Wu, X. D.
2013; 10 (1)
- **Quasi-three-level neodymium vanadate laser operation under polarized diode pumping: theoretical and experimental investigation** *LASER PHYSICS*
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