

# Yide Zhang

B113 Keck Laboratory  $\diamond$  Pasadena, CA 91125

yzhang34.github.io  $\diamond$  yzhang34@caltech.edu

## TRAINING AND EDUCATION

---

### California Institute of Technology, Pasadena, California USA

Postdoctoral Scholar Research Associate in Medical Engineering

2019 - Present

### University of Notre Dame, Notre Dame, Indiana USA

Doctor of Philosophy in Electrical Engineering

2014 - 2019

Master of Science in Electrical Engineering

2014 - 2017

Dissertation: *Super-Sensitivity and Super-Resolution Quantitative Multiphoton Microscopy*

### Huazhong University of Science and Technology, Wuhan, China

Bachelor of Engineering in Automation *with Highest Honors*

2010 - 2014

Thesis: *Research on Memristor-Based Memory Networks and Computing Technology*

## RESEARCH EXPERIENCE

---

### Caltech Optical Imaging Laboratory

2019 - Present

Postdoctoral Scholar

Advisor: Lihong V. Wang, Ph.D.

Pasadena, California USA

- Developed differentially enhanced compressed ultrafast photography (Diff-CUP), a phase imaging platform that combines high speed (200 billion frames per second) and sensitivity (20  $\mu$ rad), which, for the first time, visualized propagation of passive current flows along myelinated axons, and electromagnetic pulses in lithium niobate.
- Developed photoacoustic computed tomography through an ergodic relay (PACTER), an ultrafast 3D imaging method that uses a single-element detector to capture a 3D image *in vivo* with a single laser exposure.
- Developed imaging by coincidence from entanglement (ICE), a quantum imaging approach that simultaneously provides sub-shot-noise and quantitative quantum birefringence imaging capabilities, enabling the first quantum images of whole biological organisms.

### Biophotonics Research Group

2014 - 2019

Research Assistant

Advisor: Scott S. Howard, Ph.D.

Notre Dame, Indiana USA

- Developed a theoretical framework for optimizing the SNR of multiphoton frequency-domain fluorescence lifetime imaging microscopy (FD-FLIM) and verified the results with Monte Carlo simulations.
- Experimentally demonstrated a super-sensitivity FD-FLIM technique with a two-fold improvement in imaging speed compared to the theoretical limit of conventional FD-FLIM.
- Theoretically analyzed the lifetime measurement error in FD-FLIM under fluorophore saturation conditions and experimentally demonstrated a method for eliminating this error.
- Invented stepwise optical saturation (SOS), a super-resolution fluorescence microscopy technique that could be easily implemented and required neither additional hardware nor complex post-processing.
- Generalized the concept of SOS and experimentally demonstrated the first implementation of super-resolution imaging in FD-FLIM.
- Combined deconvolution with SOS (DeSOS) to image cells in their native physiological environment and provided an open-access application for the generation of DeSOS images.
- Constructed the Fluorescence Microscopy Denoising (FMD) dataset that consisted of 12,000 real fluorescence microscopy images; it was the first microscopy image dataset dedicated to Poisson-Gaussian denoising and had been used to benchmark conventional and deep learning-based denoising methods.

- Developed a novel and unbiased approach to segment FLIM images automatically by K-means clustering of FLIM phasors and demonstrated successful image segmentation on 2D and 3D FLIM images of fixed cells and living animals acquired with two different FLIM systems.
- Demonstrated that super-resolution radial fluctuations (SRRF), a super-resolution fluorescence microscopy technique, can be used to enhance the resolution of transmission electron microscopy images.
- Invented instant FLIM, a method that allows real-time streaming of fluorescence intensity, lifetime, and phasor imaging data through simultaneous image acquisition and instantaneous data processing; it was used to generate the first *in vivo* 4D FLIM of microglial dynamics in intact and injured zebrafish and mouse brains up to 12 hours.
- Took charge of the design, budget, construction, and demonstration of all the experimental setups mentioned above; built the hardware and wrote the software from scratch.
- A news article about my Ph.D. research: “Your Motivation Matters: Engineering to Heal”

### National Key Laboratory of Image Processing & Intelligence

2012 - 2014

Research Assistant

Advisor: Zhigang Zeng, Ph.D.

Wuhan, China

- Simulated neural activities including learning, associative memory, and forgetting in a memristive neural network with integrate-and-fire CMOS neurons and spike-rate-dependent plasticity synapses.
- Implemented exponential adaptive lag synchronization of two memristive neural networks using fuzzy methods.

## PREPRINTS

---

- R2 **Yide Zhang**<sup>†</sup>, Peng Hu<sup>†</sup>, Lei Li, Rui Cao, Anjul Khadria, Konstantin Maslov, Xin Tong, Yushun Zeng, Laiming Jiang, Qifa Zhou, and Lihong V. Wang, “Single-shot 3D photoacoustic tomography using a single-element detector for ultrafast imaging of hemodynamics”, *bioRxiv*, Mar. 2023, DOI: 10.1101/2023.03.14.532661.
- R1 **Yide Zhang**<sup>†</sup>, Zhe He<sup>†</sup>, Xin Tong<sup>†</sup>, David C. Garrett, Rui Cao, and Lihong V. Wang, “Quantum imaging of biological organisms through spatial and polarization entanglement”, *arXiv*, Mar. 2023, DOI: 10.48550/arXiv.2303.05643.

## JOURNAL PUBLICATIONS

---

- J24 Zhe He<sup>†</sup>, **Yide Zhang**<sup>†</sup>, Xin Tong<sup>†</sup>, Lei Li, and Lihong V. Wang, “Quantum microscopy of cells at the Heisenberg limit”, *Nature Communications*, vol. 14, no. 2441, pp. 1-8, Apr. 2023, DOI: 10.1038/s41467-023-38191-4. [Featured News](#)
- J23 Xin Tong<sup>†</sup>, Zhe He<sup>†</sup>, **Yide Zhang**<sup>†</sup>, Samuel Solomon, Li Lin, Qiyuan Song, and Lihong V. Wang, “Experimental full-domain mapping of quantum correlation in Clauser-Horne-Shimony-Holt scenarios”, *Physical Review Applied*, vol. 19, no. 034049, pp. 1-16, Feb. 2023, DOI: 10.1103/PhysRevApplied.19.034049.
- J22 Yogeshwar Nath Mishra<sup>†</sup>, Peng Wang<sup>†</sup>, Florian J. Bauer, **Yide Zhang**, Dag Hanstorp, Stefan Will, and Lihong V. Wang, “Single-pulse real-time billion-frames-per-second planar imaging of ultrafast nanoparticle-laser dynamics and temperature in flames”, *Light: Science & Applications*, vol. 12, no. 47, pp. 1-12, Feb. 2023, DOI: 10.1038/s41377-023-01095-5. [Featured News](#)
- J21 Zhongtao Cheng, Chengmingyue Li, Anjul Khadria, **Yide Zhang**, and Lihong V. Wang, “High-gain and high-speed wavefront shaping through scattering media”, *Nature Photonics*, vol. 17, no. 2, pp. 299-305, Jan. 2023, DOI: 10.1038/s41566-022-01142-4. [Featured News](#)
- J20 Li Lin<sup>†</sup>, Xin Tong<sup>†</sup>, Susana Cavallero, **Yide Zhang**, Shuai Na, Rui Cao, Tzung K. Hsiai, and Lihong V. Wang, “Non-invasive photoacoustic computed tomography of rat heart anatomy and function”, *Light: Science & Applications*, vol. 12, no. 12, pp. 1-9, Jan. 2023, DOI: 10.1038/s41377-022-01053-7.

- J19 Rui Cao†, Jingjing Zhao†, Lei Li, Lin Du, **Yide Zhang**, Yilin Luo, Laiming Jiang, Samuel Davis, Qifa Zhou, Adam de la Zerda, and Lihong V. Wang, “Optical-resolution photoacoustic microscopy with a needle-shaped beam”, *Nature Photonics*, vol. 17, no. 1, pp. 89-95, Dec. 2022, DOI: 10.1038/s41566-022-01112-w. Highlighted by Nature. Featured News
- J18 Rui Cao, Scott D. Nelson, Samuel Davis, Yu Liang, Yilin Luo, **Yide Zhang**, Brooke Crawford, and Lihong V. Wang, “Label-free intraoperative histology of bone tissue via deep-learning-assisted ultraviolet photoacoustic microscopy”, *Nature Biomedical Engineering*, vol. 7, no. 2, pp. 124-134, Sept. 2022, DOI: 10.1038/s41551-022-00940-z. Featured News
- J17 **Yide Zhang**†, Binglin Shen†, Tong Wu, Jerry Zhao, Joseph C. Jing, Peng Wang, Kanomi Sasaki-Capela, William G. Dunphy, David Garrett, Konstantin Maslov, Weiwei Wang, and Lihong V. Wang, “Ultrafast and hypersensitive phase imaging of propagating internodal current flows in myelinated axons and electromagnetic pulses in dielectrics”, *Nature Communications*, vol. 13, no. 5247, pp. 1-12, Sept. 2022, DOI: 10.1038/s41467-022-33002-8. Featured News
- J16 Varun Mannam, **Yide Zhang**, Yinhao Zhu, Evan Nichols, Qingfei Wang, Vignesh Sundaresan, Siyuan Zhang, Cody Smith, Paul W. Bohn, and Scott S. Howard, “Real-time image denoising of mixed Poisson-Gaussian noise in fluorescence microscopy images using ImageJ”, *Optica*, vol. 9, no. 4, pp. 335-345, Apr. 2022, DOI: 10.1364/OPTICA.448287.
- J15 **Yide Zhang**, Ian H. Guldner, Evan L. Nichols, David Benirschke, Cody J. Smith, Siyuan Zhang, and Scott S. Howard, “Instant FLIM enables 4D *in vivo* lifetime imaging of intact and injured zebrafish and mouse brains”, *Optica*, vol. 8, no. 6, pp. 885-897, June 2021, DOI: 10.1364/OPTICA.426870. Optica Top Downloads
- J14 Lei Li†, Yang Li†, **Yide Zhang**, and Lihong V. Wang, “Snapshot photoacoustic topography through an ergodic relay of optical absorption *in vivo*”, *Nature Protocols*, vol. 16, no. 5, pp. 2381-2394, May 2021, DOI: 10.1038/s41596-020-00487-w. Nature Protocols’ Featured Protocol of the Week
- J13 Varun Mannam, **Yide Zhang**, Xiaotong Yuan, Cara Ravasio, and Scott S. Howard, “Machine learning for faster and smarter fluorescence lifetime imaging microscopy”, *Journal of Physics: Photonics*, vol. 2, no. 4, pp. 042005, Sept. 2020, DOI: 10.1088/2515-7647/abac1a.
- J12 **Yide Zhang**, Sergei Rouvimov, Xiaotong Yuan, Karla Gonzalez-Serrano, Alan C. Seabaugh, and Scott S. Howard, “Resolution enhancement of transmission electron microscopy by super-resolution radial fluctuations”, *Applied Physics Letters*, vol. 116, no. 4, pp. 044105, Jan. 2020, DOI: 10.1063/1.5128353.
- J11 **Yide Zhang**, Takashi Hato, Pierre C. Dagher, Evan L. Nichols, Cody J. Smith, Kenneth W. Dunn, and Scott S. Howard, “Automatic segmentation of intravital fluorescence microscopy images by K-means clustering of FLIM phasors”, *Optics Letters*, vol. 44, no. 16, pp. 3928-3931, Aug. 2019, DOI: 10.1364/OL.44.003928. Optics Letters’ Featured Paper of Volume 44, Issue 16
- J10 **Yide Zhang**†, Evan L. Nichols†, Abigail M. Zellmer, Ian H. Guldner, Cody Kankel, Siyuan Zhang, Scott S. Howard, and Cody J. Smith, “Generating intravital super-resolution movies with conventional microscopy reveals actin dynamics that construct pioneer axons”, *Development*, vol. 146, no. 5, pp. dev171512, Mar. 2019, DOI: 10.1242/dev.171512. Supplementary software available at DOI: 10.7274/r0-5hhg-5578. Featured News 1 Featured News 2
- J9 **Yide Zhang**, David Benirschke, Ola Abdalsalam, and Scott S. Howard, “Generalized stepwise optical saturation enables super-resolution fluorescence lifetime imaging microscopy”, *Biomedical Optics Express*, vol. 9, no. 9, pp. 4077-4093, Sept. 2018, DOI: 10.1364/BOE.9.004077.
- J8 **Yide Zhang**, Prakash D. Nallathamby, Genevieve D. Vigil, Aamir A. Khan, Devon E. Mason, Joel D. Boerckel, Ryan K. Roeder, and Scott S. Howard, “Super-resolution fluorescence microscopy by stepwise optical saturation”, *Biomedical Optics Express*, vol. 9, no. 4, pp. 1613-1629, Apr. 2018,

DOI: 10.1364/BOE.9.001613. **NDIIF Award for Best Biological Imaging Publication 2018.**  
Featured News

- J7 Genevieve Vigil, **Yide Zhang**, Aamir Khan, and Scott Howard, “Description of deep saturated excitation multiphoton microscopy for super-resolution imaging”, *Journal of the Optical Society of America A*, vol. 34, no. 7, pp. 1217-1223, July 2017, DOI: 10.1364/JOSAA.34.001217.
- J6 Aamir A. Khan, Genevieve D. Vigil, **Yide Zhang**, Susan K. Fullerton-Shirey, and Scott S. Howard, “Silica-coated ruthenium-complex nanoprobe for two-photon oxygen microscopy in biological media”, *Optical Materials Express*, vol. 7, no. 3, pp. 1066-1076, Mar. 2017, DOI: 10.1364/OME.7.001066.
- J5 **Yide Zhang**, Genevieve D. Vigil, Lina Cao, Aamir A. Khan, David Benirschke, Tahsin Ahmed, Patrick Fay, and Scott S. Howard, “Saturation-compensated measurements for fluorescence lifetime imaging microscopy”, *Optics Letters*, vol. 42, no. 1, pp. 155-158, Jan. 2017, DOI: 10.1364/OL.42.000155.
- J4 **Yide Zhang**, Aamir A. Khan, Genevieve D. Vigil, and Scott S. Howard, “Super-sensitivity multiphoton frequency-domain fluorescence lifetime imaging microscopy”, *Optics Express*, vol. 24, no. 18, pp. 20862-20867, Sept. 2016, DOI: 10.1364/OE.24.020862.
- J3 **Yide Zhang**, Aamir A. Khan, Genevieve D. Vigil, and Scott S. Howard, “Investigation of signal-to-noise ratio in frequency-domain multiphoton fluorescence lifetime imaging microscopy”, *Journal of the Optical Society of America A*, vol. 33, no. 7, pp. B1-B11, July 2016, DOI: 10.1364/JOSAA.33.0000B1.
- J2 Gang Bao, **Yide Zhang**, and Zhigang Zeng, “Memory analysis for memristors and memristive recurrent neural networks”, *IEEE/CAA Journal of Automatica Sinica*, vol. 7, no. 1, pp. 96-105, Jan. 2020, DOI: 10.1109/JAS.2019.1911828.
- J1 Shiping Wen, Zhigang Zeng, Tingwen Huang, and **Yide Zhang**, “Exponential adaptive lag synchronization of memristive neural networks via fuzzy method and applications in pseudorandom number generators”, *IEEE Transactions on Fuzzy Systems*, vol. 22, no. 6, pp. 1704-1713, Dec. 2014, DOI: 10.1109/TFUZZ.2013.2294855.

## SELECTED CONFERENCE PUBLICATIONS

---

- C23 **Yide Zhang**, Binglin Shen, Tong Wu, Jerry Zhao, Joseph Jing, Peng Wang, Kanomi Sasaki-Capela, William Dunphy, David Garrett, Konstantin Maslov, Weiwei Wang, and Lihong V. Wang, “Ultra-fast phase imaging of propagating current flows in myelinated axons and electromagnetic pulses in dielectrics”, *SPIE Photonics West 2023*, San Francisco, California USA, Feb. 2023, DOI: 10.1117/12.2653-137. **Hitachi High-Tech Best Presentation Award.**
- C22 Xin Tong, Li Lin, Susana Cavallero, **Yide Zhang**, Shuai Na, Rui Cao, Tzung K. Hsiai, and Lihong V. Wang, “Non-invasive photoacoustic computed tomography of cardiac anatomy and function in rats”, *SPIE Photonics West 2023*, San Francisco, California USA, Feb. 2023, DOI: 10.1117/12.2653147.
- C21 Rui Cao, Jingjing Zhao, Lei Li, Lin Du, **Yide Zhang**, Yilin Luo, Laiming Jiang, Samuel P. Davis, Qifa Zhou, Adam de la Zerda, and Lihong V. Wang, “Needle-shaped beam optical-resolution photoacoustic microscopy with an extended depth of field”, *SPIE Photonics West 2023*, San Francisco, California USA, Feb. 2023, DOI: 10.1117/12.2650561.
- C20 Rui Cao, Scott D. Nelson, Samuel Davis, Yu Liang, Yilin Luo, **Yide Zhang**, Brooke Crawford, and Lihong V. Wang, “Label-free ultraviolet photoacoustic histology via deep learning for rapid intraoperative diagnosis of bone cancer”, *SPIE Photonics West 2022*, San Francisco, California USA, Feb. 2022. **Best Paper Award of Photons Plus Ultrasound Conference.**
- C19 Varun Mannam, **Yide Zhang**, Xiaotong Yuan, Takashi Hato, Pierre C. Dagher, Evan L. Nichols, Cody J. Smith, Kenneth W. Dunn, and Scott Howard, “Convolutional neural network denoising in

- fluorescence lifetime imaging microscopy (FLIM)", *SPIE Photonics West 2021*, Online Only, Mar. 2021, DOI: 10.1117/12.2578574. **BiOS'21 3-Minute Poster Prize.**
- C18 Varun Mannam, **Yide Zhang**, Xiaotong Yuan, and Scott Howard, "Deep learning-based super-resolution fluorescence microscopy on small datasets", *SPIE Photonics West 2021*, Online Only, Mar. 2021, DOI: 10.1117/12.2578519.
- C17 Xiaotong Yuan, Varun Mannam, **Yide Zhang**, and Scott Howard, "Overcoming the fundamental limitation of frequency-domain fluorescence lifetime imaging microscopy spatial resolution", *SPIE Photonics West 2021*, Online Only, Mar. 2021, DOI: 10.1117/12.2577284.
- C16 Varun Mannam, **Yide Zhang**, Yinhao Zhu, and Scott Howard, "Instant image denoising plugin for ImageJ using convolutional neural networks", *Biomedical Optics 2020*, Washington, DC USA, Apr. 2020, DOI: 10.1364/MICROSCOPY.2020.MW2A.3.
- C15 **Yide Zhang**<sup>†</sup>, Yinhao Zhu<sup>†</sup>, Evan Nichols, Qingfei Wang, Siyuan Zhang, Cody Smith, and Scott Howard, "A Poisson-Gaussian denoising dataset with real fluorescence microscopy images", *IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR 2019)*, Long Beach, California USA, June 2019, DOI: 10.1109/CVPR.2019.01198.
- C14 **Yide Zhang**, Ian H. Guldner, Evan L. Nichols, David Benirschke, Cody J. Smith, Siyuan Zhang, and Scott S. Howard, "Three-dimensional deep tissue multiphoton frequency-domain fluorescence lifetime imaging microscopy via phase multiplexing and adaptive optics", *SPIE Photonics West 2019*, San Francisco, California USA, Feb. 2019, DOI: 10.1117/12.2510674. **JenLab Young Investigator Award. Featured News**
- C13 **Yide Zhang**, David Benirschke, Ola Abdalsalam, and Scott S. Howard, "Super-resolution multiphoton frequency-domain fluorescence lifetime imaging microscopy by generalized stepwise optical saturation (GSOS)", *SPIE Photonics West 2019*, San Francisco, California USA, Feb. 2019, DOI: 10.1117/12.2507663.
- C12 Ola Abdalsalam, **Yide Zhang**, Scott Howard, and Thomas D. O'Sullivan, "Self-calibrated frequency domain diffuse optical spectroscopy with a phased source array", *SPIE Photonics West 2019*, San Francisco, California USA, Feb. 2019, DOI: 10.1117/12.2510422.
- C11 **Yide Zhang**, Prakash D. Nallathamby, Evan L. Nichols, Cody J. Smith, Ryan K. Roeder, and Scott S. Howard, "Super-resolution and high-speed quantitative multiphoton microscopy", *Seventh Annual Harper Cancer Research Institute Research Day*, Notre Dame, Indiana USA, Apr. 2018, DOI: 10.7274/r0-zqes-kr15. **Poster Contest Third Prize.**
- C10 **Yide Zhang**, David Benirschke, and Scott S. Howard, "Stepwise optical saturation microscopy: obtaining super-resolution images with conventional fluorescence microscopes", *Biomedical Optics 2018*, Hollywood, Florida USA, Apr. 2018, DOI: 10.1364/TRANSLATIONAL.2018.JTh3A.27.
- C9 **Yide Zhang**, David Benirschke, and Scott S. Howard, "Super-resolution fluorescence imaging by stepwise optical saturation microscopy", *IEEE Annual Mini-symposium on Electron Devices and Photonics*, Notre Dame, Indiana USA, Oct. 2017, DOI: 10.7274/r0-bbyt-9j45. **Best Presentation Award.**
- C8 **Yide Zhang**, Genevieve D. Vigil, Aamir A. Khan, and Scott S. Howard, "Doubling the sensitivity of multiphoton frequency-domain fluorescence lifetime images", *CLEO: Science and Innovations 2017*, San Jose, California USA, May 2017, DOI: 10.1364/CLEO\_SI.2017.SM3C.6.
- C7 Genevieve D. Vigil, **Yide Zhang**, Aamir A. Khan, and Scott S. Howard, "Simulation and experimental design of saturated excitation (SAX) multiphoton microscopy (MPM)", *CLEO: Applications and Technology 2017*, San Jose, California USA, May 2017, DOI: 10.1364/CLEO\_AT.2017.JTu5A.64.
- C6 **Yide Zhang**, Genevieve D. Vigil, Aamir A. Khan, and Scott S. Howard, "Super-sensitivity and super-resolution multiphoton fluorescence lifetime imaging microscopy", *NDnano Symposium: Nanotechnol-*

ogy in the Treatment of Neurodegenerative Disorders, Notre Dame, Indiana USA, Mar. 2017, DOI: 10.7274/r0-k1dc-5q52. **Best Poster Award.**

- C5 Aamir A. Khan, Susan K. Fullerton-Shirey, Genevieve D. Vigil, **Yide Zhang**, and Scott S. Howard, “Highly stable two-photon oxygen imaging probe based on a ruthenium-complex encapsulated in a silica-coated nanomicelle”, *CLEO: Applications and Technology 2016*, San Jose, California USA, June 2016, DOI: 10.1364/CLEO\_AT.2016.ATu4O.3.
- C4 Aamir A. Khan, Genevieve D. Vigil, **Yide Zhang**, and Scott S. Howard, “Theoretical analysis of the signal-to-noise ratio of two-photon oxygen imaging probes”, *Biomedical Optics 2016*, Fort Lauderdale, Florida USA, Apr. 2016, DOI: 10.1364/CANCER.2016.JW3A.48.
- C3 **Yide Zhang**, Genevieve D. Vigil, Aamir A. Khan, and Scott S. Howard, “High-resolution frequency-domain multiphoton fluorescence lifetime imaging microscopy”, *Fifth Annual Harper Cancer Research Institute Research Day*, Notre Dame, Indiana USA, Apr. 2016, DOI: 10.7274/r0-vt1g-bp12.
- C2 **Yide Zhang**, and Scott S. Howard, “On increasing the imaging rate of frequency-domain multiphoton fluorescence lifetime imaging microscopy”, *IEEE Annual Mini-symposium on Electronic and Photonics*, Notre Dame, Indiana USA, Oct. 2015, DOI: 10.7274/r0-dw42-x854.
- C1 **Yide Zhang**, Zhigang Zeng, and Shiping Wen, “Implementation of memristive neural networks with spike-rate-dependent plasticity synapse”, *IEEE International Joint Conference on Neural Networks (IJCNN)*, Beijing, China, July 2014, DOI: 10.1109/IJCNN.2014.6889740.

## PATENTS

---

- P4 **Yide Zhang**, Zhigang Zeng, Yidong Zhu, Mingfu Cao, Junfeng Zhao, “Signal processing circuit”, US Patent Number: US10586590B2 (granted Mar. 10, 2020), EP Patent Number: EP3282449B1 (granted Aug. 7, 2019), CN Patent Number: CN107210064B (granted Feb. 14, 2020).
- P3 Scott Howard, **Yide Zhang**, and Cody J. Smith, “Super-resolution fluorescence microscopy by stepwise optical saturation”, US Patent Number: US11131631B2 (granted Sept. 28, 2021).
- P2 Scott Howard, Genevieve Vigil, and **Yide Zhang**, “Super-sensitivity multiphoton frequency-domain fluorescence lifetime imaging microscopy”, US Patent Number: US11,181,727B2 (granted Nov. 23, 2021).
- P1 **Yide Zhang**, Zhigang Zeng, Shiping Wen, Mingfu Cao, Junfeng Zhao, “Neuron simulation circuit”, CN Patent Application Number: CN201510508806.6A, Publication Number: CN106470023A.

## TEACHING EXPERIENCE

---

**Kaneb Center for Teaching and Learning, University of Notre Dame** 2018

- Certified participant of the Teaching Well Using Technology program that teaches faculty and graduate students how to use multi-media technology tools such as presentations, audios, videos, and digital timelines in an educational setting to enhance teaching and learning.

**Biophotonics Research Group, University of Notre Dame** 2017-2019

- Trained undergraduate and first-year graduate students on how to perform confocal, two-photon, and fluorescence lifetime imaging experiments using commercial and custom-built microscopes.

**Clay Intermediate Center, Clay International Academy** 2016

- Participated in an outreach program to go to middle school classrooms and demonstrate cool optics demos and principles to students and inspire them to pursue a career in science.

**Department of Electrical Engineering, University of Notre Dame** 2015

- As a teaching assistant of EE 30342 - Microelectronic Circuit Design, graded homework, ran weekly Q&A sessions, and assisted undergraduate students in performing microelectronic experiments.

**School of Automation, Huazhong University of Science and Technology**

2014

- Mentored six undergraduate students to complete their undergraduate thesis projects.

## SELECTED AWARDS AND HONORS

---

- 2023 **Hitachi High-Tech Best Presentation Award**,  
High-Speed Biomedical Imaging and Spectroscopy Conference, SPIE Photonics West
- 2022 **IOP Publishing Outstanding Reviewer Award**, IOP Publishing, Bristol UK
- 2021 **IOP Publishing Outstanding Reviewer Award**, IOP Publishing, Bristol UK
- 2021 **OSA Outstanding Reviewer**, The Optical Society, Washington DC USA
- 2021 **BiOS'21 3-Minute Poster Prize**, SPIE Photonics West
- 2020 **IOP Publishing Outstanding Reviewer Award**, IOP Publishing, Bristol UK
- 2019 **NDIIF Best Biological Imaging Publication Award 2018**, Featured News  
Notre Dame Integrated Imaging Facility (NDIIF), Indiana USA
- 2019 **CRC Award for Computational Sciences and Visualization**, Featured News  
Center for Research Computing (CRC), University of Notre Dame, Indiana USA
- 2019 **JenLab Young Investigator Award**, Featured News  
Multiphoton Microscopy in the Biomedical Sciences Conference, SPIE Photonics West
- 2018 **James L. Massey Travel Grant**,  
Department of Electrical Engineering, University of Notre Dame, Indiana USA
- 2018 **Poster Contest Third Prize**,  
Seventh Annual Harper Cancer Research Institute Research Day, Indiana USA
- 2017 **Best Presentation Award**,  
IEEE Annual Mini-symposium on Electron Devices and Photonics, Indiana USA
- 2017 **Berry Family Foundation Graduate Fellowship**, Featured News  
Advanced Diagnostics and Therapeutics (AD&T), Indiana USA
- 2017 **Graduate Student Research Award** (One Awardee at NDEE),  
Department of Electrical Engineering, University of Notre Dame, Indiana USA
- 2017 **Best Poster Award**, NDnano Symposium, University of Notre Dame, Indiana USA
- 2014 **Outstanding Undergraduate Thesis Award** (Ranking 1/205),  
Huazhong University of Science and Technology (HUST), Wuhan, China
- 2013 **Meritorious Winner**, Mathematical Contest in Modeling (MCM),  
Consortium for Mathematics and Its Applications (COMAP)
- 2013 **Decent Capital's Scholarship** (Top 0.1%), Decent Capital
- 2013 **National Scholarship** (Top 1%), Ministry of Education of China
- 2012 **National Scholarship** (Top 1%), Ministry of Education of China
- 2011 **National Scholarship** (Top 1%), Ministry of Education of China
- 2012 **Prominent Student Award** (Top 1%), HUST, Wuhan, China

## MEDIA COVERAGE

---

- “A Quantum Entanglement Microscope”, The Science Blog of Fédération Française de Sociétés Scientifiques, July 3, 2023.
- “Quantum Entanglement Doubles Microscope Resolution”, Physics World, June 6, 2023.
- “Quantum Entanglement of Photons Doubles Microscope Resolution”, Caltech News, May 1, 2023.
- “Worlds Fastest Laser Camera Films Combustion in Real Time”, University of Gothenburg News, Feb. 24, 2023.
- “Wavefront Shaping: From Telescopes to Biological Tissue”, Caltech News, Feb. 24, 2023.

- “Sharp Laser Beam Reveals Internal Organs in Stunning 3D”, Nature Research Highlights, Dec. 6, 2022.
- “Seeing More with a Needle-Shaped Laser”, Caltech News, Dec. 1, 2022.
- “Super-Fast Camera Captures Electrical Signals Moving Through Nerve Cells”, PetaPixel, Oct. 11, 2022.
- “High-Speed Camera Captures Signals Traveling Through Nerve Cells”, Caltech News, Oct. 6, 2022.
- “Laser Light Offers New Tool for Treating Bone Cancer”, Caltech News, Sept. 19, 2022.
- “Notre Dame Professor Discovers New Cell Imaging Technique”, The Observer, Oct. 26, 2020.
- “Super Resolution Ghosts”, University of Notre Dame Stories, Oct. 1, 2019.
- “Bringing Super-Resolution Microscopy to the Masses”, Wiley Analytical Science, Sept. 11, 2019.
- “Your Motivation Matters: Engineering to Heal”, The Wire at the University of Notre Dame, Sept. 10, 2019.
- “NDIIF Celebrates 10 Year Anniversary at Annual Imaging Workshop”, Biophysics at Notre Dame, May 17, 2019.
- “Super Resolution Imaging Made Easy”, Wiley Analytical Science, Mar. 5, 2019.
- “Open-Source Application Creates Super-Resolution Images of Cell Development in Living Animals”, Notre Dame News, Mar. 1, 2019.
- “Graduate Student Receives JenLab Young Investigator Award”, Notre Dame Research, Feb. 18, 2019.
- “K.I.S.S.: A ”Simple” Solution to a Common Situation”, The College of Engineering at the University of Notre Dame, Apr. 5, 2018.
- “Notre Dame Graduate Students Awarded Fellowships for Cross-Disciplinary Biomedical Research”, Notre Dame Research, July 5, 2017.

## RESEARCH INTERESTS

---

Photoacoustic tomography (PAT), compressed ultrafast photography (CUP), quantum imaging, multiphoton microscopy (MPM), fluorescence lifetime imaging microscopy (FLIM), super-resolution microscopy, adaptive optics, wavefront shaping, machine learning.

## PROFESSIONAL SERVICE

---

### Invited Speaker

- “Ultrafast Single-Shot 3D Photoacoustic Tomography *In Vivo* using a Single-Element Detector”, *The 15th International Conference on Ultrasound Engineering for Biomedical Applications*, Torrance, California USA, July 21, 2023.
- “Ultrafast Phase Imaging of Propagating Current Flows in Myelinated Axons and Electromagnetic Pulses in Dielectrics”, *Caltech Postdoc L(a)unch Seminar*, Pasadena, California USA, May 5, 2023.
- “Ultrafast and Hypersensitive Phase Imaging of Propagating Internodal Current Flows in Myelinated Axons”, *The International Society for Brain Mapping and Therapeutics (SBMT) 2023/20th Annual World Congress of SBMT*, Los Angeles, California USA, Feb. 16, 2023.
- “Ultrafast Phase Imaging of Propagating Current Flows in Myelinated Axons and Electromagnetic Pulses in Dielectrics”, *Complex Media Optics Lab (PI: Sylvain Gigan), École Normale Supérieure (ENS)*, Online, Dec. 6, 2022.
- “Ultrafast Phase Imaging of Propagating Current Flows in Myelinated Axons and Electromagnetic Pulses in Dielectrics”, *Caltech Electrical Engineering Advisory Council Meeting*, Pasadena, California USA, Nov. 29, 2022.
- “Ultrafast Phase Imaging of Propagating Current Flows in Myelinated Axons and Electromagnetic Pulses in Dielectrics”, *Dushu Forum/The 2nd Research Forum for Young Scientists, University of Science and Technology of China*, Online, Nov. 25, 2022.
- “NDCSSA Excellent Graduate Experience Sharing Session”, *Notre Dame Chinese Students and Scholars Association (NDCSSA) Talk No. 3*, Notre Dame, Indiana USA, Aug. 28, 2019.



- “NDIIF Best Biological Imaging Publication Award 2018: Stepwise Optical Saturation (SOS) Microscopy and Beyond”, *6th Annual Midwest Imaging and Microanalysis Workshop*, Notre Dame, Indiana USA, May 6, 2019.
- “Three-Dimensional, Deep Tissue, Super-Resolution Multiphoton FLIM via Phase Multiplexing”, *AD&T External Review*, Notre Dame, Indiana USA, Mar. 25, 2019.
- “Research in ND Electrical Engineering: A Graduate Student’s Perspective”, *Notre Dame Electrical Engineering Graduate Applicant Recruiting Event*, Notre Dame, Indiana USA, Mar. 8, 2019.
- “Novel Super-Resolution Fluorescence Microscopy Methods in Application to Bio and Materials Sciences”, *Notre Dame Electron Microscopy Club Meeting*, Notre Dame, Indiana USA, Feb. 13, 2019.

### Editorship

- Topic Editor, Research Topics “Phasor Analysis for Fluorescence Lifetime Data”, *Frontiers in Bioinformatics*
- Guest Editor, Special Issue “Interpretation of Machine Learning: Prediction, Representation, Modeling, and Visualization”, *Computational Intelligence and Neuroscience*
- Guest Editor, Special Issue “Advanced Optics Engineering”, *Materials*

### Journal Reviewer

- **Nature Portfolio**: Nature Methods, Nature Biomedical Engineering, Light: Science & Applications, Scientific Reports
- **Optica (OSA)**: Optica, Photonics Research, Biomedical Optics Express, Optics Letters, Optics Express, Journal of the Optical Society of America A, Applied Optics
- **SPIE**: Journal of Biomedical Optics, Optical Engineering, Journal of Electronic Imaging
- **IEEE**: IEEE Electron Device Letters, IEEE Transactions on Biomedical Engineering
- **IOP**: Physics in Medicine and Biology, Methods and Applications in Fluorescence, Journal of Optics, Inverse Problems, Engineering Research Express
- **AIP**: Applied Physics Letters, Journal of Applied Physics, Review of Scientific Instruments, APL Machine Learning
- **Elsevier**: Knowledge-Based Systems, Pattern Recognition Letters, Optics Communications
- **MDPI**: Bioengineering, Sensors, Photonics, Diagnostics, Applied Sciences, Life, Micromachines, Electronics, Mathematics, Information
- **Frontiers**: Frontiers in Physiology, Frontiers in Computer Science, Frontiers in Earth Science
- **Springer**: Food and Bioprocess Technology
- **Wiley**: Journal of Biophotonics

### Conference Reviewer

- European Conference on Computer Vision (ECCV)
- IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)
- Conference on Neural Information Processing Systems (NeurIPS)
- International Conference on Intelligent Control and Information Processing (ICICIP)

### Grant Reviewer

- Berthiaume Institute For Precision Health Technology Development Fund 2023
- Berthiaume Institute For Precision Health Discovery Fund 2023
- Berthiaume Institute For Precision Health Discovery Fund 2022
- Institute for Precision Health at Notre Dame Fund 2021

### Contributor to Research Community

- Program Committee Member, ICICIP 2021, June 16, 2021.

- IOP Trusted Reviewer, IOP Publishing, Sept. 22, 2020.
- Certified Publons Academy Peer Reviewer, Publons, June 8, 2020.
- Certified Reviewer for OSA Journals, The Optical Society (OSA), Dec. 15, 2019.
- “ ‘Publish or perish’ will not perish”, Behavioural and Social Sciences at Nature Research, Oct. 10, 2019.

## PROFESSIONAL MEMBERSHIP

---

Member, Optica - formerly the Optical Society (OSA)  
 Member, International Society for Optics and Photonics (SPIE)  
 Member, Institute of Electrical and Electronics Engineers (IEEE)

## PROFESSIONAL REFERENCES

---

### **Lihong Wang, Ph.D.**

Bren Professor of Medical Engineering and Electrical Engineering  
 Andrew and Peggy Cherng Department of Medical Engineering  
 Department of Electrical Engineering  
 Division of Engineering and Applied Science  
 California Institute of Technology  
 1200 E. California Blvd., MC 138-78, Pasadena, CA 91125, USA  
 Tel: (626) 395-1959, Email: LVW@caltech.edu

### **Scott S. Howard, Ph.D.**

Associate Professor  
 Department of Electrical Engineering  
 University of Notre Dame  
 262 Fitzpatrick Hall, Notre Dame, IN 46556, USA  
 Tel: (574) 631-2570, Email: showard@nd.edu

### **Alan Seabaugh, Ph.D.**

Frank M. Freimann Professor  
 Department of Electrical Engineering  
 University of Notre Dame  
 266 Fitzpatrick Hall, Notre Dame, IN 46556, USA  
 Tel: (574) 631-4473, Email: aseabaug@nd.edu

### **Cody J. Smith, Ph.D.**

Elizabeth and Michael Gallagher Associate Professor  
 Department of Biological Sciences  
 University of Notre Dame  
 015 Galvin Life Science Center, Notre Dame, IN 46556, USA  
 Tel: (574) 631-3959, Email: csmith67@nd.edu

### **Thomas D. O’Sullivan, Ph.D.**

Associate Professor  
 Department of Electrical Engineering  
 University of Notre Dame  
 227B Cushing Hall, Notre Dame, IN 46556, USA  
 Tel: (574) 631-4287, Email: tosullivan@nd.edu