LI-HAO YEH

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EDUCATION

UNIVERSITY OF CALIFORNIA, BERKELEY, Berkeley, CA, USA

Ph.D., Electrical Engineering and Computer Science — May 2019
- Thesis: Computational fluorescence and phase super-resolution microscopy
- Advisor: Laura Waller

M.S., Electrical Engineering and Computer Science — May 2016
- Thesis: Analysis and comparison of Fourier ptychographic phase retrieval algorithms
- Advisor: Laura Waller

NATIONAL TAIWAN UNIVERSITY, Taipei, Taiwan — June 2013
B.S., Electrical Engineering minor in Physics

WORK EXPERIENCE

CHAN ZUCKERBERG BIOHUB, San Francisco, CA — 2019 - present
R&D Engineer II, Computational Microscopy Platform (PI: Shalin Mehta)
Developed phase, polarization, and fluorescence microscopy with vector-optical models and optimization-based inverse algorithms
- Multiplexed an additional imaging mode, phase imaging, to a standard polarization and fluorescence microscope, resulting in a team-wide adoption and leading to the first joint fluorescence, phase, and polarization 3D imaging
- Extended the phase and polarization microscopy to measure additional 3D local orientation of structures (permittivity tensor) by constructing a new vector-optical model, deconvolution inverse algorithm, and off-axis illumination system with a compact LCD
- Built a GPU computing pipeline to accelerate the existing one by 10X and equipped all new pipelines with a GPU acceleration option
- Collaborated with scientists from Stanford, UC Berkeley, UCSF, UW Madison, and University of Southampton to seek applicability and deployment of the developed imaging methods
- Mentored 3 interns for the summer projects

UNIVERSITY OF CALIFORNIA, BERKELEY, Berkeley, CA — 2014 - 2019
Graduate Student Researcher, Computational Imaging Lab (PI: Laura Waller)
Developed super-resolution phase and fluorescence microscopy with nonlinear optimization algorithms
- Identified the robust super-resolution algorithms against experimental imperfections by systematically comparing the performance of 9 nonlinear phase retrieval algorithms and 3 nonlinear blind deconvolution algorithms, resulting in major adoption in the field
- Developed a 2D and 3D super-resolution phase imaging method by illuminating samples through a diffuser and inversely retrieving information from the nonlinear scattering events
- Achieved Giga-pixel fluorescence and phase imaging without using expensive long-range translation stage by multiplexing the super-resolution phase imaging framework with fluorescence

Graduate Student Instructor (EE123 Digital Signal Processing, Instructor: Michael Lustig)
Held weekly office hours, discussion, and lab sections; Co-developed course materials; Monitored students learning situations
- Helped migrate lab materials (hardware and software) to RaspberryPi, resulting in lab instruction on a unified platform for efficient debugging during the class
- Mentoring >20 final-project groups for two semesters

NATIONAL TAIWAN UNIVERSITY, Taipei, Taiwan — 2012 - 2014
Research Assistant (PI: Yuan Luo, 2014)
Developed new imaging methods using a volume hologram
- Implemented Gerchberg-Saxton phase retrieval algorithm to enable single-shot phase imaging with a volume hologram

Research Assistant (PI: Jean-Fu Kiang, 2012-2014)
Explored wave propagation phenomena in multilayered superlens and metasurfaces
- Implemented RCWA and 3D Electromagnetic wave simulator (FDTD/FDFD) to analyze the performance of the devices, proposing new designs to achieve better resolution and tunability

Research Assistant (PI: Kwo-Ray Chu, 2012)
Numerically analyzed physical behavior of a waveguide with a tapered open end (open cavity)
- Completed the basic simulation training and organized the results in a report that are used as an updated training manual in the lab

TECHNICAL SKILLS

- Python (GPU), MATLAB, 3D printing, CAD (OnShape), Automation (Arduino, RaspberryPi, Xilinx-PYNQ, μManager), FDTD (Meep)

PUBLICATIONS

- Journal Papers
    1. E. Hashemi, H.-C. Tsai, E. Yoseph, M. Moreno, **L.-H. Yeh**, S. B. Mehta, M. Kono, R. Proia, M. H. Han, "Visualizing sphingosine-1-phosphate receptor 1 (s1p1) signaling during central nervous system de-and re-myelination," *Research Square*, 657784, 2021
    2. **L.-H. Yeh**, I. E. Ivanov, B. B. Chhun, S.-M. Guo, E. Hashemi, J. R. Byrum, J. A. Pérez-Bermejo, H. Wang, Y. Yu, P. G. Kazansky, B. R. Conklin, M. H. Han, and S. B. Mehta, "uPTI: uniaxial permittivity tensor imaging of intrinsic density and anisotropy," *bioRxiv*, 2020.12.15.422951, 2020

3. Z. Wu, B. B Chhun, G. Schmunk, C. Kim, **L.-H. Yeh**, T. J. Nowakowski, J. Zou, and S. B. Mehta, "DynaMorph: learning morphodynamic states of human cells with live imaging and sc-RNAseq," *bioRxiv*, 2020.07.20.213074, 2020
4. S.-M. Guo*, **L.-H. Yeh***, J. Folkesson*, I. E. Ivanov, A. P. Krishnan, M. G. Keefe, E. Hashemi, D. Shin, B. B. Chhun, N. H. Cho, M. D. Leonetti, M. H. Han, T. J. Nowakowski, and S. B. Mehta, "Revealing architectural order with quantitative label-free imaging and deep learning," *eLife*, e55502, 2020, *Equal contribution

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5. **L.-H. Yeh**, S. Chowdhury, N. A. Repina, and L. Waller, "Speckle-structured illumination for 3D phase and fluorescence computational microscopy," *Biomed. Opt. Express*, vol.10, pp.3635-3653, 2019
6. **L.-H. Yeh***, S. Chowdhury*, and L. Waller, "Computational structured illumination for high-content fluorescence and phase microscopy," *Biomed. Opt. Express*, vol.10, pp.1978-1998, 2019, *Equal contribution
7. **L.-H. Yeh**, L. Tian, and L. Waller, "Structured illumination microscopy with unknown patterns and a statistical prior," *Biomed. Opt. Express*, vol.8, pp.695-711, 2017
8. **L.-H. Yeh**, J. Dong, J. Zhong, L. Tian, M. Chen, G. Tang, M. Soltanolkotabi, and L. Waller, "Experimental robustness of Fourier Ptychography phase retrieval algorithms," *Opt. Express*, vol.23, pp.33212-33238, 2015
9. L. Tian, Z. Liu, L.-H. Yeh, M. Chen, J. Zhong, and L. Waller, "Computational illumination for high-speed in vitro Fourier ptychographic microscopy," *Optica*, vol.2, pp.904-911, 2015

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10. X. Zhai, W.T. Lin, H.H. Chen, P.H. Wang, **L.-H. Yeh**, J.C. Tsai, V.R. Singh, and Y. Luo, "In-line digital holographic imaging in volume holographic microscopy," *Opt. Lett.*, vol.40, pp.5542-5545, 2015
11. Y.J. Huang, **L.-H. Yeh**, and K.R. Chu, "An analytical study on the diffraction quality factor of open cavities," *Phys. Plasmas*, vol.21, 103112, 2014
12. **L.-H. Yeh** and J.F. Kiang, "Microwave tunable metasurfaces implemented with ferroelectric materials and periodical copper wires," *Progress In Electromagnetics Research (PIER) M*, vol.37, pp.191-202, 2014
13. **L.-H. Yeh** and J.F. Kiang, "Multilayered superlenses containing CsBr or active medium for subwavelength photolithography," *Progress in Electromagnetics Research (PIER) B*, vol.59, pp.1-18, 2014

- Patents
  1. S. B. Mehta, **L.-H. Yeh**, and I. E. Ivanov, "Method and systems for quantitative three dimensional measurement of density, anisotropy, and orientation without label," *US Patent Provisional App. 63/030,841*, 2020
  2. S. B. Mehta, I. E. Ivanov, and **L.-H. Yeh**, "Method and systems for spectral imaging of density, anisotropy, and orientation," *US Patent Provisional App. 63/030,839*, 2020
  3. M. Chen, **L.-H. Yeh**, and L. Waller, "Patterned-illumination systems adopting a computational illumination," *US Patent Provisional App. 62/109,240*, 2015

- Conference Proceedings
  1. **L.-H. Yeh**, I. E. Ivanov, S.-M. Guo, B. B. Chhun, E. Hashemi, M. H. Han, and S. B. Mehta, "uPTI: uniaxial permittivity tensor imaging of intrinsic density and anisotropy," *Biophotonics Congress 2021*, paper NM3C.4, April 2021, USA
  2. **L.-H. Yeh**, S. Chowdhury, and L. Waller, "Computational structured illumination for high-content multimodal microscopy," *SPIE Photonics West 2019*, 10883-1, February 2019, San Francisco, CA, USA
  3. R. Eckert, M. Chen, **L.-H. Yeh**, and L. Waller, "3D phase imaging for thick biological samples," *SPIE Photonics West 2019*, 10883-28, February 2019, San Francisco, CA, USA
  4. **L.-H. Yeh**, S. Chowdhury, and L. Waller, "Computational structured illumination microscopy with scattering media for high-throughput fluorescent and phase imaging," *SPIE Photonics West 2019*, 10883-28, February 2019, San Francisco, CA, USA
  5. S. Chowdhury, **L.-H. Yeh**, and L. Waller, "Structured illumination microscopy with scattering media," *SPIE Photonics West 2018*, 10499-1, January 2018, San Francisco, CA, USA
  6. **L.-H. Yeh**, S. Chowdhury, and L. Waller, "3D structured illumination microscopy with algorithmic self-calibration," *SPIE Photonics West 2018*, 10499-4, January 2018, San Francisco, CA, USA
  7. **L.-H. Yeh**, and L. Waller, "2D and 3D structured illumination microscopy with unknown patterns and a statistical prior," *Engineering Conferences International 2017: Advances in Optics for Biotechnology, Medicine and Surgery XV*, poster 12, July 2017, Snowmass Village, CO, USA
  8. **L.-H. Yeh**, N. A. Repina, and L. Waller, "3D structured illumination microscopy with unknown patterns and a statistical prior," *OSA Computational Optical Sensing and Imaging conference*, paper DW2F.3, June 2017, San Francisco, CA, USA
  9. D. Ren, E. Bostan, **L.-H. Yeh**, and L. Waller, "Total-variation regularized Fourier ptychographic microscopy with multiplexed coded illumination," *OSA Computational Optical Sensing and Imaging conference*, paper MM3C.5, June 2017, San Francisco, CA, USA
  10. L. Tian, **L.-H. Yeh**, R. Eckert, and L. Waller, "Computational microscopy: Illumination coding and nonlinear optimization enables Gigapixel 3D phase imaging," *The 42nd IEEE International Conference on Acoustics, Speech and Signal Processing, Special Session on Large-Scale Computational Imaging with Wave Models*, paper SS-L5.4, Mar. 2017, New Orleans, LA, USA
  11. **L.-H. Yeh** and L. Waller, "3D super-resolution optical fluctuation imaging(3D-SOFI) with speckle illumination," *OSA Computational Optical Sensing and Imaging conference*, paper CW5D.2, Aug. 2016, Heidelberg, Germany
  12. J. Zhong, L. Tian, M. Chen, **L.-H. Yeh**, Z. Phillips, H.-Y. Liu, and L. Waller, "Computational phase microscopy," *International Conference on Computational Photography*, poster 43, May 2016, Chicago, IL, USA
  13. **L.-H. Yeh**, L. Tian, M. Chen, Z. Liu, J. Zhong, and L. Waller, "Experimental robustness of Fourier ptychographic phase retrieval algorithms," *OSA Computational Optical Sensing and Imaging conference*, paper CW4E.2, June 2015, Arlington, VA, USA
  14. Y. Hu, **L.-H. Yeh**, D. Parkinson, A. Shanker, A. MacDowell, and L. Waller, "X-ray phase imaging and computed tomography with sandpaper analyzer," *OSA Computational Optical Sensing and Imaging conference*, paper CM3E.6, June 2015, Arlington, VA, USA