Mooseok Jang

Associate Professor

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(Sep. 1, 2025)

EDUCATION

California Institute of Technology | Pasadena, CA, USA **2016**
Ph.D., Electrical Engineering
Advisor: Prof. Changhuei Yang
Thesis: “Optical phase conjugation and its application in biomedicine”
Committee: Prof. Amnon Yariv, Prof. Ivo Vellekoop, Prof. Viviana Gradinaru, Prof. P. P. Vaidyanathan

Korea Advanced Institute of Science and Technology | Daejeon, South Korea **2009**
B.S., Physics
Advisor: Prof. Tae-young Yoon
Honors Thesis: “Multiplex single vesicle FRET with force manipulation and measurement”

PROFESSIONAL EXPERIENCE

KAIST | Daejeon, South Korea **2019 - Present**
Associate, Assistant Professor of Bio and Brain Engineering

Korea University | Seoul, South Korea **2016 - 2019**
Research Fellow of Institute of Basic Science Center for Molecular Spectroscopy and Dynamics & Department of Physics
Advisor: Prof. Wonshik Choi (alternative military service)

HONORS AND AWARDS

- Technology Innovation Award, College of Engineering, KAIST 2024
- KAIST Q-Day Faculty Special Awards, Q category (creative talent) 2023
- ASML Tech Talk Young Professor Paper Contest 2023
- POSCO TJ Park Science Fellowship (Physics) 2019
- Best Student Poster Presentation at the ECI conference 2015
- General Electric Undergraduate Scholarship 2007-2009
- Korea Foundation for Advanced Studies College Student Scholarship 2007-2009
- National Scholarship for Science and Engineering Students 2006-2009
- KAIST Entrance Scholarship 2006
- Silver Medal, 19th Korean Mathematics Olympiad 2005

PUBLICATIONS

† Equal contributions, * Corresponding author

1. T. Kwon†, G. Song†, Y. Kim, J. Kim, J.C. Ye*, **M. Jang***
"Video Diffusion Posterior Sampling for Seeing Beyond Dynamic Scattering Layers"
IEEE TPAMI Early Access | 2025
2. D. Lee†, G. Song†, C. Lee, C. Lee, **M. Jang***
"Reconstructive spectrometer using double-layer disordered metasurfaces"
Science Advances 11, eadv2376 | 2025
⇒ *Selected as* **Featured Article**
3. H. Ko, **M. Jang***
"Aberration Effects of Planar Layers in Near-Field Multistatic Millimeter-Wave Imaging"
IEEE Access 13, 52260 | 2025
4. J. Barg, C. Lee, C. Lee, **M. Jang***
"Adaptable deep learning for holographic microscopy: a case study on tissue type and system variability in label-free histopathology"
Advanced Photonics Nexus 4, 026005 | 2025
⇒ *Selected as* **Cover Article**
5. C. Lee, J. Oh, H. Ko, **M. Jang***
"Monte Carlo simulation of interferometric measurement and wavefront shaping under influence of shot noise and camera noise"
Journal of Physics: Photonics 7, 023001 | 2025
6. J. You, **M. Jang***
"Comparative numerical analysis of astigmatism tolerance in bifocal, extended depth-of-focus, and trifocal intraocular lenses"
Biomedical Optics Express 16, 628 | 2025
7. C. Lee, J. Kim, S. Lee, J. Jung, Y. Cho, T. Kim, T. Jo, M. Lee, **M. Jang***
"Blind Image Deblurring with Noise-Robust Kernel Estimation"
European Conference on Computer Vision (ECCV) | 2024
8. J. You, D. Lee, G. Song, C. Lee, **M. Jang***
"Motion-free high-resolution on-chip microscopy using LED matrixn"
Optics Express 32, 36549 | 2024
9. G.H. Go, D. Lee, J. Oh, G. Song, D. Lee, **M. Jang***
"Meta Shack–Hartmann wavefront sensor with large sampling density and large angular field of view: phase imaging of complex objects"
Light: Science & Applications 13, 187 | 2024
10. A. Shibukawa, R. Higuchi, G. Song, H. Mikami*, Yuki Sudo*, **M. Jang***
"Large-volume focus control at 10 MHz refresh rate via fast line-scanning amplitude-encoded scattering-assisted holography"
Nat. Commun. 15, 2926 | 2024
11. J You, **M. Jang***
"Influence of corneal astigmatism on near and far vision in eyes with bifocal intraocular lenses"
JOSA A 41, 730 | 2024
⇒ *Selected as* **Editors' Pick & Spotlight on Optics in Optica**
12. H. Ko, J. Kim, J. H. Hong, J. Cheon, S. Lee, **M. Jang***, W. Choi*

"Acousto-optic volumetric gating for reflection-mode deep optical imaging within a scattering medium"
ACS Photonics 10, 10, 3664 | 2023

13. J. Moon, Y. Cho, S. Kang, **M. Jang**, W. Choi*
"Measuring the scattering tensor of a disordered nonlinear medium"
Nature Physics 19, 1709 | 2023
⇒ *Highlighted in* **Nature Physics** News & Views: "Transmission matrices go nonlinear"

14. C. Lee, G. Song, H. Kim, J. C. Ye*, **M. Jang***
"Deep learning based on parameterized physical forward model for adaptive holographic imaging with unpaired data"
Nature Machine Intelligence 5, 35 | 2023
⇒ *Covered by* **Nature Machine Intelligence** Reusibility Report "Reusability report: Unpaired deep-learning approaches for holographic image reconstruction"

15. J Oh, C Lee, G Song, **M. Jang***
"Review of endomicroscopic imaging with coherent manipulation of light through an ultrathin probe"
Journal of Optical Microsystems 3, 011004 (Invited Review)| 2023

16. H. Kim, G. Song, J. You, C. Lee, **M. Jang***
"Deep Learning for Lensless Imaging"
JKPS 81, 570 (Invited Review) | 2022

17. E. Cha, C. Lee, **M. Jang**, J. C. Ye*
"DeepPhaseCut: Deep relaxation in phase for unsupervised Fourier phase retrieval"
IEEE TPAMI 40, 12, 9931 | 2022

18. J. Cho†, S. Kang†, B. Lee, J. Moon, Y.S. Lim, **M. Jang***, W. Choi*
"Time-resolved detection of early-arriving ballistic waves in a quasi-diffusive regime"
Opt. Express. 29, 35640 | 2021

19. **M. Jang†,***, H. Ko†, W.K. Lee, J.S. Lee, W. Choi*
"Deep tissue space-gated microscopy via acousto-optic interaction"
Nat. Commun. 11, 710 | 2020
⇒ *Highlighted in* **Nature Methods** In Brief: "Deeper imaging with space gating"

20. S. Yoon, M. Kim, **M. Jang**, Y. Choi, W. Choi, S. Kang , W. Choi*
"Deep optical imaging within complex scattering media"
Nat. Rev. Phys. 2, 141 | 2020

21. D.Y. Kim†, S. Jeong†, **M. Jang**, Y.R. Lee*, and W. Choi*
"Time-gated iterative phase conjugation for efficient light energy delivery in scattering media"
Opt. Express 28, 7382 | 2020

22. **M. Jang†**, Y. Horie†, A. Shibukawa†, J. Brake, Y. Liu, S. M. Kamali, A. Arbabi, H. Ruan, A. Faraon*, C. Yang*
"Wavefront shaping with disorder-engineered metasurfaces"
Nat. Photonics 12, 84 | 2018

23. H. Ruan†, J. Brake†, J. E. Robinson, Y. Liu, **M. Jang**, C. Xiao, C. Zhou, V. Gradinaru, C. Yang*
"Deep tissue optical focusing and optogenetic modulation with time-reversed ultrasonically encoded light"
Science Advances 3, 12, eaao5020 | 2017

24. **M. Jang**, C. Yang*, I. M. Vellekoop
"Optical phase conjugation with less than a photon per degree of freedom"
Phys. Rev. Lett. 118, 93902 | 2017

25. J. Ryu†, **M. Jang†**, T.J. Eom*, C. Yang*, E Chung*
"Optical phase conjugation assisted scattering lens: variable focusing and 3D patterning"
Sci. Rep. 6, 23494 | 2016

26. J. Brake†, **M. Jang†**, C. Yang
"Analyzing the relationship between decorrelation time and tissue thickness in acute rat brain slices using multispeckle diffusing wave spectroscopy"
JOSA A 33, 270 | 2016

27. H. Ruan†, **M. Jang†**, C. Yang
"Optical focusing inside scattering media with time-reversed ultrasound microbubble encoded light"
Nat. Commun. 6, 8968 | 2015

28. D. Wang†, E. H. Zhou†, J. Brake, H. Ruan, **M. Jang**, C. Yang
"Focusing through dynamic tissue with millisecond digital optical phase conjugation"
Optica 2, 728 | 2015

29. **M. Jang†**, H. Ruan†, I. M. Vellekoop, B. Judkewitz, E. Chung*, C. Yang*
"Relation between speckle decorrelation and optical phase conjugation (OPC)-based turbidity suppression through dynamic scattering media: a study on in vivo mouse skin"
Biomed. Opt. Express 6, 72 | 2015

30. H. Ruan†, **M. Jang†**, B. Judkewitz, C. Yang
"Iterative time-reversed ultrasonically encoded light focusing in backscattering mode"
Sci. Rep. 4, 7156 | 2014

31. **M. Jang†**, H. Ruan†, H. Zhou, B. Judkewitz, C. Yang
"Method for auto-alignment of digital optical phase conjugation systems based on digital propagation"
Opt. Express 22, 14054 | 2014

32. **M. Jang**, H. Ruan, B. Judkewitz, C. Yang
"Model for estimating the penetration depth limit of the time-reversed ultrasonically encoded optical focusing technique"
Opt. Express 22, 5787 | 2014

33. **M. Jang**, A. Sentenac, C. Yang
"Optical phase conjugation (OPC)-assisted isotropic focusing"
Opt. Express 21, 8781 | 2013

PATENTS

1. “Hyperspectral image sensor and system employing the same”
10-2023-0021605 (KR) 18/443488 (US) 202410161906 (CN) | 2023
2. “Ultrasensitive spectrometer”
10-2023-0059986 (KR) 18/598372 (US) 202410239599 (CN) | 2023
3. “Optical modulation device and Optical focus device”
JP7244888B1 / WO2023048159A1| 2023

4. “Highly scattering metasurface phase masks for complex wavefront engineering”
   US10732437B2 / WO2018195309A1 | 2018 / 2020
5. "Optical focusing inside scattering media with time-reversed ultrasound microbubble encoded (TRUME) light”
   US10203274B2 | 2019
6. “Holographic characterization and playback apparatus”
   KR101794268B1 / US9947359B2 | 2017 / 2018

PRESENTATIONS

INVITED

1. Caltech EE Seminar, Pasadena, CA, USA, Apr. 2025, "Mixing and demixing optical information: Reconstructive Spectrometer & Deep Learning-enabled Holography"
2. Optica Biophotonic Congress, Coronado, CA, USA, Apr. 2025, "On the Use of Deep Learning Techniques for Holographic Image Reconstruction"
3. SPIE Photonics West, San Francisco, CA, USA, Jan. 2025, "Accelerating complex wavefront shaping with line-scanning holography using digital micromirror devices"
4. CIOMP Student Chapter, Online, Dec. 2024, "Deep Learning Approaches for Holographic Image Reconstruction"
5. OSJ-Optica-OSK Joint Symposia, Tokyo, Japan, Nov. 2024, "Deep Learning Approaches for Holographic Image Reconstruction"
6. Park Systems Technical Seminar, Suown, Korea, Oct. 2024, "Holographic Image Reconstruction: Opportunities in Semiconductor Metrology & Inspection"
7. Quantitative Phase Imaging Symposium, Daejeon, Korea, Aug. 2024, "Exploring Generalization Capability of Deep Learning-Based Approaches for Holographic Image"
8. CLEO Pacific Rim, Incheon, Korea, Aug. 2024, "Exploring Generalization Capability of Deep Learning-Based Approaches for Holographic Image Reconstruction"
9. Next Generation Lithography + Patterning, Suwon, Korea, Aug. 2024, "Exploring Generalization Capability of Deep Learning-Based Approaches for Holographic Image Reconstruction: Opportunities in Semiconductor Metrology & Inspection" (Keynote)
10. LG Electronics Lecture Series, Seoul, Korea, Aug. 2024, "Principles and Applications of Metasurfaces"
11. 2024 Optica Imaging Congress, Toulouse, France, July. 2024, "Exploring Generalization Capability of Deep Learning-Based Approaches for Holographic Image"
12. Samsung Electronics Equipment R&D Symposium, Suwon, Korea, May. 2024, "Holographic Image Reconstruction: Opportunities in Semiconductor Metrology & Inspection"
13. KSMBE Spring Meeting, Wonju, Korea, May. 2024, "‘Solving’ optical complexity: Seeing through biological tissues"
14. OSK Winter Meeting, Suwon, Korea, Feb. 2024, "Computational approaches in optical imaging: Deep learning based on forward model"
15. Frontiers in Optics + Laser Science, Tacoma, WA, USA, Oct. 2023, "Solving and Using Optical Disorder for Biophotonic Applications"

16. Optics and Photonics Congress 2023, Jeju, Korea, Aug. 2023, "Digital holographic approaches for imaging applications"
17. Optics and Photonics Congress 2023, Jeju, Korea, Aug. 2023, "Physics-based deep learning approach in holographic imaging"
18. Samsung Global Technology Conference 2023 - Challenging Technologies for the Hyper-Realistic Meta-Vision System, Jeju, Korea, May. 2023, "Disordered Metasurface Platform: Potential Optical Components for Meta-Vision"
19. LG Electronics Brain Engeering Lecture Series, Seoul, Korea, May. 2023, "Wave-based Neural Interface"
20. ETRI Media Research Devision Seminar, Daejeon, Korea, Dec. 2022, "Comprehensive Overview of Fourier Ptychographic Microscopy (FPM)"
21. KAIST-SJTU Online Joint Symposium, Online, Dec. 2022, "'Solving' optical complexity: Seeing through Biological Tissues"
22. Samsung Electronics Equipment R&D Symposium, Suwon, Korea, Oct. 2022, "Phase Retrieval Problems in Optics"
23. KAIST Future Healthcare Research Center Workshop, Buyeo, Korea, Sep. 2022, "Optimal illumination for LLLT therapy"
24. Department Colloquium, DGIST EECS, Daegu, Korea, Sep. 2022, "'Solving' and 'using' optical complexity"
25. PI Workshop at Korea University, Samsung Research Funding & Incubation center for Future Technology, Seoul, Korea, Aug. 2022, "Snapshot Hyperspectral Sensor based on 2.5D Disordered Metastructure"
26. Equipment R&D Group Seminar, Device Solution, Samsung Electronics, Suwon, Korea, Aug. 2022, "Seeing through scattering media & Physics-constrained deep learning for imaging purpose"
27. Institute of Basic Science: Center for Cognition and Sociality, Daejeon, Korea, Jul. 2022, "'Solving' optical complexity: seeing through biological tissues and interrogating deep neural circuits"
28. OSK Summer Meeting, Jeju, Korea, Jul, 2022, "'Solving' optical complexity:Seeing through Biological Tissues"
29. The Korean BioChip Society Spring Meeting, Busan, Korea, May. 2022, "'Solving' optical complexity:Seeing through Biological Tissues"
30. Department Seminar, SNU Applied Bioengineering, Seoul, Korea, Mar. 2022, "'Solving' optical complexity:Seeing through Biological Tissues"
31. ETRI seminar, Daejeon, Korea, Feb. 2022, "An overview of optical imaging techniques in biomedicine & Approaches for optical complexity"
32. Electronic Imaging: Machine Learning for Scientific Imaging, Jan. 2022, "Imaging through Scattering Medium with Deep Phase Retrieval"
33. Japan-Korea Workshop on Digital Holography & Information Photonics, Online, Dec. 2021, "'Solving' and 'using' optical complexity"
34. Optics Group Seminar, KAIST Physics, Daejeon, Korea, Nov. 2021, "'Solving' and 'using' optical complexity"

35. Korean Society of Microscopy Fall Meeting, Online, Jun. 2021, "'Solving' optical complexity: seeing through biological tissues"
36. Department Seminar, POSTECH i-bio, Pohang, Korea, Mar. 2021, "'Solving' optical complexity: seeing through biological tissues"
37. Kyeongbuk Science High School, Pohang, Korea, Mar. 2021, "Career Paths for Scientists/Engineers"
38. OSK Winter Meeting, Online, Feb. 2021, "Holographic detection and playback of ultrasound-modulated light"
39. KU Photonics Workshop, Korea University Physics, Seoul, Korea Feb. 2021, "'Solving' and 'using' optical complexity"
40. Harvard-MIT-KAIST Symposium on Brain and Cognitive Engineering, Online, Dec. 2020, "Optogenetics meets optical wavefront shaping"
41. Healthcare/Brain+ Webinar Series, Online, Nov. 2020, "Introduction to advanced microscopy techniques"
42. Department Seminar, KAIST BBE, Nov. 2020, "Seeing through biological tissues"
43. Seongnam-KAIST Leadership Forum, Jul. 2020, "Trends in biomedical optical imaging techniques"
44. KAIST Institute (KI) for Health Science and Technology (HST) Seminar, Daejeon, Korea, Dec. 2019, "'Solving' and 'using' optical complexity: seeing through biological tissues and unlocking optical space through designed complex nanostructures"
45. Photonics Conference, OSK, Pyeongchang, Korea, Dec. 2019, "'Solving' and 'Using' optical complexity"
46. Samsung Advanced Institute of Technology (SAIT) Seminar, Suwon, Korea, Nov. 2019, "'Using' optical complexity: unlocking optical space through designed complex nanostructures"
47. Annual Biophotonics Conference, OSK, Suwon, Korea, Nov. 2019, "'Solving' and 'Using' optical complexity"
48. Seoul National University Electrical and Computer Engineering Workshop, SNU ECE, Seoul, Korea, Feb. 2019,"'Solving' and 'using' optical complexity: seeing through biological tissues unlocking optical space through designed complex nanostructures"
49. Caltech Biophotonics Laboratory Seminar, Pasadena, CA, USA, Feb. 2019, "Coherent space-gated microscopy: a step towards deep-tissue phase imaging of biological cells"
50. Korean Physics Society Fall Meeting, Changwon, Korea, Oct. 2018, "Acousto-optic gating enables deep tissue optical-resolution imaging inside an acoustic focus"
51. Samsung Advanced Institute of Technology (SAIT) Seminar, Suwon, Korea, Jul. 2018, "Complex wavefront engineering with disorder-engineered metasurfaces"
52. Korea Institute of Science and Technology Seminar, Seoul, Korea, Apr. 2018, "Exploiting randomness"
53. META 2017, Incheon, Korea, Jul. 2017, "Complex wavefront engineering with disorder-engineered metasurfaces"
54. Electrical Engineering Seminar, KAIST EE, Daejeon, Korea, Jul. 2017, "Time-reversed light propagation: seeing through biological tissue and exploiting randomness"

55. Samsung Advanced Institute of Technology (SAIT) Seminar, Suwon, Korea, Apr. 2017, "Reversing light scattering with a handful of photons and seeing through biological tissues"
56. Photonics Conference, Optical Society of Korea, Pyeongchang, Korea, Dec. 2016, "Time-reversed light propagation: seeing through biological tissue"
57. Physics Colloquium, Sookmyung Women's University, Seoul, Korea, Sep. 2016, "Time-reversed light propagation: seeing through biological tissue and revealing the brain connectome"
58. BIO-scopy Seminar, Gwangju Institute of Science and Technology, Gwangju, Korea, Apr. 2014, "Penetration depth limit of the time-reversed ultrasonically encoded optical focusing technique"

REFEREED including poster presentations

1. SPIE Photonics West BIOS, San Francisco, CA, USA, Feb. 5, 2019, "Acousto-optic gating enables deep tissue optical-resolution imaging inside an acoustic focus"
2. 16th Advanced Imaging Workshop, Berkeley, CA USA, Jan.31, 2019, "Coherent space-gated microscopy: a step towards deep-tissue phase imaging of biological cells"
3. HHMI Janelia Conference, Ashburn, VA, USA, Jun.5, 2017, "Experimental investigation on 3D spatio-temporal transmission matrix of scattering media"
4. ECI Conference Advances in Optics in Biotechnology, Medicine and Surgery XIV Vail, Co, USA, Jun.16, 2015, "Seeing through biological tissues with time-reversed light"
5. SPIE Photonics West OPTO, San Francisco, CA, USA, Feb.10, 2015, "DMD-based open-loop wavefront shaping technique: Turbidity suppression in biological tissues"
6. SPIE Photonics West BIOS, San Francisco, CA, USA, Feb.7, 2015,"Effect of speckle decorrelation on the application of optical phase conjugation (OPC) in biological tissue"
7. SPIE Photonics West BIOS, San Francisco, CA, USA, Feb.5, 2014, "Optical phase conjugation-assisted isotropic focusing"

COURSES TAUGHT

- BiS400, Principles of Biomedical Optics — Fall 2023, 2024, 2025
- BiS800, Computational Biomedical Optics — Spring 2024, 2025
- BiS553, Biophotonics — Fall 2020, 2021, 2022, Spring 2023
- BiS377, Biomechanics — Spring 2020, 2021, 2022
- BiS102, Introduction to Bioengineering — Fall 2025
- HSS090/HSS091, Freshman College Life — 2021, 2022, 2023, 2024, 2025
- BCE501, Brain & Cognitive Engineering II — Fall 2020, 2021, 2022
- BiS301, Bioengineering Laboratory — Spring 2020, 2021
- HSS189, Freshman Seminar — Fall 2020
- BiS987, Biofusion Seminar — Fall 2022

STUDENTS AND POSTDOCTORAL SCHOLARS SUPERVISED > 1 year

CURRENT

Donggu Lee (PhD, 2020-), Chanseok Lee (MS, 2020-2022; PhD, 2022-), Gookho Song (MS, 2020-2022; PhD, 2022-), Joeongsol Kim, (PhD, 2022-), Taesung Kwon, (PhD, 2022-), Chunghyeong Lee (MS, 2021-2023; PhD, 2023-), Jaeyeon Oh (MS, 2022-2024; PhD, 2024-), Jiseong Park (MS, 2022-2024; PhD, 2024-), Hyeonseo Na (PhD, 2024-) , Gyu Huh (MS, 2023-2025; PhD, 2025-), Seungmin Lee (MS, 2023-2025; PhD,2025-), Seungju Yoo (PhD, 2025-) Yoosun Kim (MS, 2024-), Sechan Park (MS, 2024-), Chao Tan (MS, 2024-), Nahee Kim (MS, 2025-), Weibo Tian (MS, 2025-), Fangrui Lu (MS, 2025-), Fakhriyya Mammadova (BS, 2023-), Kwanwoo Lee (BS, 2024-)
Hakseok Ko (Postdoctoral Scholar, 2021-), Doeon Lee (Postdoctoral Scholar, 2022-), Gi-Hyun Go (Postdoctoral Scholar, 2023-)

FORMER

Hyeonggeon Kim (BS, 2020-2022; PhD program, UC Berkeley), Yin Tuo (2021-2023; PhD program, University Hospital in Brussel), Jongin You (PhD, 2021-2025; Clinical Professor, Konyang University Hospital),

PROFESSIONAL ACTIVITIES

- Journal Reviewer: Nature Communications, ACS Photonics, Advanced Photonics, Laser & Photonics Reviews, Communications Physics, Photoacoustics, Light: Science & Applications, Optica, Optics Letters, Optics Express, Biomedical Optics Express, Journal of Biomedical Optics, Applied Physical Letters, Physical Review Applied, Applied Physics B, European Physical Journal, IEEE Photonics Journal, Photoacoustics, IEEE Transactions on Computational Imaging, Scientific Reports, JM3
- Conference Committee: Optica Computational Optical Sensing and Imaging (2025), Advanced Biophotonics Conference (2020, 2022), SPIE Advanced Biophotonics Conference (2023, 2025(General Affairs Chair)), International Conference on Advanced Materials and Devices (ICAMD) (2021, 2023; co-chair of Biosensing, Biophotonics and Biophysics session, 2025), Photonics Conference (2021, 2022), NANO KOREA (2022; co-chair of Nanophotonics session, 2023), The Korean Physical Society Spring Meeting (2021, 2023)
- Proposal Reviewer: National Research Foundation of Korea, Samsung Research Funding & Incubation Center for Future Technology (SRFC)
- Editorial Board Member: Advanced Imaging (2025-), Current Applied Physics (2022-2025)
- KAIST Centennial Vision Committee (2021)