Mooseok Jang

Assistant Professor

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(Aug. 9, 2023)

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**
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

- POSCO TJ Park Science Fellowship 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. 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"
Under peer review in Nat. Commun.
2. J. Moon, Y. Cho, S. Kang, **M. Jang**, W. Choi*
"Measuring the scattering tensor of a disordered nonlinear medium"
Nature Physics (Early Access) | 2023
⇒ *Highlighted in* **Nature Physics** News & Views: "Transmission matrices go nonlinear"
3. 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
4. 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
5. H. Kim, G. Song, J. You, C. Lee, **M. Jang***
"Deep Learning for Lensless Imaging"
JKPS 81, 570 (Invited Review) | 2022
6. 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
7. 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
8. **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"
9. 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
10. 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
11. **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
12. 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"
Sci. Adv. 3, 12, eaao5020 | 2017

13. **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

14. 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

15. 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

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

17. 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

18. **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

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

20. **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

21. **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

22. **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) | 2023

2. “Ultrasensitive spectrometer”
10-2023-0059986 (KR) | 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. Frontiers in Optics + Laser Science, Tacoma, WA, USA, Oct. 2023 (scheduled), "Solving and Using Optical Disorder for Biophotonic Applications"
2. Optics and Photonics Congress 2023, Jeju, Korea, Aug. 2023 (scheduled), "Digital holographic approaches for imaging applications"
3. Optics and Photonics Congress 2023, Jeju, Korea, Aug. 2023 (scheduled), "Physics-based deep learning approach in holographic imaging"
4. 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"
5. LG Electronics Brain Engeering Lecture Series, Seoul, Korea, May. 2023, "Wave-based Neural Interface"
6. ETRI Media Research Devision Seminar, Daejeon, Korea, Dec. 2022, "Comprehensive Overview of Fourier Ptychographic Microscopy (FPM)"
7. KAIST-SJTU Online Joint Symposium, Online, Dec. 2022, "‘Solving’ optical complexity: Seeing through Biological Tissues"
8. Samsung Electronics Equipment R&D Symposium, Suwon, Korea, Oct. 2022, "Phase Retrieval Problems in Optics"
9. KAIST Future Healthcare Research Center Workshop, Buyeo, Korea, Sep. 2022, "Optimal illumination for LLLT therapy"
10. Department Colloquium, DGIST EECS, Daegu, Korea, Sep. 2022, "‘Solving’ and ‘using’ optical complexity"
11. 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"
12. Equipment R&D Group Seminar, Device Solution, Samsung Electronics, Suwon, Korea, Aug. 2022, "Seeing through scattering media & Physics-constrained deep learning for imaging purpose"
13. 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"
14. OSK Summer Meeting, Jeju, Korea, Jul, 2022, "‘Solving’ optical complexity:Seeing through Biological Tissues"

15. The Korean BioChip Society Spring Meeting, Busan, Korea, May. 2022, "'Solving' optical complexity:Seeing through Biological Tissues"
16. Department Seminar, SNU Applied Bioengineering, Seoul, Korea, Mar. 2022, "'Solving' optical complexity:Seeing through Biological Tissues"
17. ETRI seminar, Daejeon, Korea, Feb. 2022, "An overview of optical imaging techniques in biomedicine & Approaches for optical complexity"
18. Electronic Imaging: Machine Learning for Scientific Imaging, Jan. 2022, "Imaging through Scattering Medium with Deep Phase Retrieval"
19. Japan-Korea Workshop on Digital Holography & Information Photonics, Online, Dec. 2021, "'Solving' and 'using' optical complexity"
20. Optics Group Seminar, KAIST Physics, Daejeon, Korea, Nov. 2021, "'Solving' and 'using' optical complexity"
21. Korean Society of Microscopy Fall Meeting, Online, Jun. 2021, "'Solving' optical complexity: seeing through biological tissues"
22. Department Seminar, POSTECH i-bio, Pohang, Korea, Mar. 2021, "'Solving' optical complexity: seeing through biological tissues"
23. Kyeongbuk Science High School, Pohang, Korea, Mar. 2021, "Career Paths for Scientists/Engineers"
24. OSK Winter Meeting, Online, Feb. 2021, "Holographic detection and playback of ultrasound-modulated light"
25. KU Photonics Workshop, Korea University Physics, Seoul, Korea Feb. 2021, "'Solving' and 'using' optical complexity"
26. Harvard-MIT-KAIST Symposium on Brain and Cognitive Engineering, Online, Dec. 2020, "Optogenetics meets optical wavefront shaping"
27. Healthcare/Brain+ Webinar Series, Online, Nov. 2020, "Introduction to advanced microscopy techniques"
28. Department Seminar, KAIST BBE, Nov. 2020, "Seeing through biological tissues"
29. Seongnam-KAIST Leadership Forum, Jul. 2020, "Trends in biomedical optical imaging techniques"
30. 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"
31. Photonics Conference, OSK, Pyeongchang, Korea, Dec. 2019, "'Solving' and 'Using' optical complexity"
32. Samsung Advanced Institute of Technology (SAIT) Seminar, Suwon, Korea, Nov. 2019, "'Using' optical complexity: unlocking optical space through designed complex nanostructures"
33. Annual Biophotonics Conference, OSK, Suwon, Korea, Nov. 2019, "'Solving' and 'Using' optical complexity"
34. 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"

35. Caltech Biophotonics Laboratory Seminar, Pasadena, CA, USA, Feb. 2019, “Coherent space-gated microscopy: a step towards deep-tissue phase imaging of biological cells”
36. Korean Physics Society Fall Meeting, Changwon, Korea, Oct. 2018, “Acousto-optic gating enables deep tissue optical-resolution imaging inside an acoustic focus”
37. Samsung Advanced Institute of Technology (SAIT) Seminar, Suwon, Korea, Jul. 2018, “Complex wavefront engineering with disorder-engineered metasurfaces”
38. Korea Institute of Science and Technology Seminar, Seoul, Korea, Apr. 2018, “Exploiting randomness”
39. META 2017, Incheon, Korea, Jul. 2017, “Complex wavefront engineering with disorder-engineered metasurfaces”
40. Electrical Engineering Seminar, KAIST EE, Daejeon, Korea, Jul. 2017, “Time-reversed light propagation: seeing through biological tissue and exploiting randomness”
41. Samsung Advanced Institute of Technology (SAIT) Seminar, Suwon, Korea, Apr. 2017, “Reversing light scattering with a handful of photons and seeing through biological tissues”
42. Photonics Conference, Optical Society of Korea, Pyeongchang, Korea, Dec. 2016, “Time-reversed light propagation: seeing through biological tissue”
43. Physics Colloquium, Sookmyung Women’s University, Seoul, Korea, Sep. 2016, “Time-reversed light propagation: seeing through biological tissue and revealing the brain connectome”
44. 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
- BiS553, Biophotonics — Fall 2020, 2021, 2022, Spring 2023
- BiS377, Biomechanics — Spring 2020, 2021, 2022

- HSS090/HSS091, Freshman College Life — 2021, 2022, 2023
- 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

1. Chunghyeong Lee — MS(2021-2023) / PhD(2023-)
2. Chanseok Lee — MS(2020-2022) / PhD(2022-)
3. Gookho Song — MS(2020-2022) / PhD(2022-)
4. Donggu Lee — PhD(2020-)
5. Jongin You — PhD(2021-)
6. Yin Tuo — PhD(2021-)
7. Joeongsol Kim — PhD(2022-)
8. Taesung Kwon — PhD(2022-)
9. Seungmin Lee — MS(2023-)
10. Gyu Huh — MS(2023-)
11. Jaeyeon Oh — MS(2022-)
12. Jiseong Park — MS(2022-)
13. Yoosun Kim — BS(2021-)
14. Sechan Park — BS(2022-)
15. HyeonJun Lee — BS(2023-)
16. Hakseok Ko — Postdoctoral Scholar(2021-)
17. Doeon Lee — Postdoctoral Scholar(2022-)
18. Gi-Hyun Go — Postdoctoral Scholar(2023-)

FORMER

1. Hyeonggeon Kim — BS(2020-2022)
   Next Position: Na Ji Group, UC Berkeley

PROFESSIONAL ACTIVITIES

- Journal Reviewer: Communications Physics, Optica, Optics Letters, Optics Express, Biomedical Optics Express, Journal of Biomedical Optics, Applied Physical Letters, European Physical Journal, IEEE Photonics Journal, photoacoustics, IEEE Transactions on Computational Imaging, Scientific Reports
- Conference Committee: Advanced Biophotonics Conference (2020, 2022), SPIE Advanced Biophotonics Conference (2023), International Conference on Advanced Materials and Devices (ICAMD) (2021, 2023; co-chair of Biosensing, Biophotonics and Biophysics session), Photonics Conference (2021, 2022), NANO KOREA (2022; co-chair of Nanophotonics session, 2023), The Korean Physical Society Spring Meeting (2021, 2023)
- Professional Society: The Korean Physical Society (2020-2024; scientific committee of Applied Physics division)
- Proposal Reviewer: National Research Foundation of Korea, Samsung Research Funding & Incubation Center for Future Technology (SRFC)
- Editorial Board Member: Current Applied Physics (2022-2025)
- KAIST Centennial Vision Committee (2021)