

Seungjae Han

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Postdoctoral Fellow (Sejong Science Fellow, Jang Young Sil Fellow)

RESEARCH INTERESTS

Bio-Medical AI Integrating the Physics of Measurement

My research develops computer vision and self-supervised learning for neuroimaging, recovering reliable signal and interpretable structure from data acquired under severe physical constraints. Functional neural imaging and fluorescence microscopy produce high-dimensional, low-signal-to-noise video whose statistics are set by the optics, sensors, and biology of acquisition. By modeling this acquisition process directly, I design learning objectives that require no clean ground truth and that remain valid in real measurement environments.

I pursue three connected directions. **Self-supervised image and video restoration** for biomedical microscopy covers denoising, deconvolution, and multiplexed unmixing. **Physically grounded inverse problems** address three-dimensional and event-based reconstruction of neuronal and vascular dynamics. **Large-scale neural decoding** learns interpretable low-dimensional structure from population recordings, using neuronal identity as an organizing basis. Positioned at the intersection of computer vision, biomedical imaging, and neuroscience, I advance both learning methodology and data-driven discovery in brain science.

Keywords: Self-Supervised Learning · Neuroimaging · Self-supervised learning · Neural Population Decoding

EMPLOYMENT

2026–	KAIST Advisor: Young-Gyu Yoon	Postdoctoral Fellow Sejong Science Fellow · Jang Young Sil Fellow
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EDUCATION

2020–26	KAIST Advisor: Young-Gyu Yoon	Ph.D. in School of Electrical Engineering Outstanding Dissertation Award
2017–20	Yonsei University Advisor: Jiwon Seo	B.S. in School of Integrated Technology

SELECTED PUBLICATIONS

* co-first authors, ** co-corresponding authors

2023	Statistically unbiased prediction enables accurate denoising of voltage imaging data M. Eom*, S. Han* , P. Park*, G. Kim, E.-S. Cho, J. Sim, K.-H. Lee, S. Kim, H. Tian, U. L. Böhm, E. Lowet, H. Tseng, J. Choi, S. E. Lucia, S. H. Ryu, M. Rózsa, S. Chang, P. Kim, X. Han, K. D. Piatkevich, M. Choi, C.-H. Kim, A. E. Cohen, J.-B. Chang, Y.-G. Yoon. <i>Nature Methods</i> (IF=48.0), Sep. 2023. Selected as the Cover and KAIST Breakthroughs
2025	Self-supervised video processing with self-calibration on an analogue selector-less memristor array-based platform H. Jeong*, S. Han* , S.-O. Park, T. R. Kim, J. Bae, T.-H. Jang, Y. Cho, S. Seo, H.-J. Jeong, S. Park, T. Park, J. Oh, J. Park, D. Jeon, I. Kwon, Y.-G. Yoon**, S. Choi**. <i>Nature Electronics</i> (IF=34.5), Jan. 2025. Introduced in Nature Electronics News & Views, Nature Electronics Editorial, KAIST Breakthroughs, 2025 KAIST Top 10 Research Achievements

SELECTED AWARDS AND HONORS

2026	Outstanding Dissertation Award (Top 1 in Signal Division)	KAIST EE
2026–31	Sejong Science Fellowship	National Research Foundation of Korea
2026	Jang Young Sil Fellow	KAIST
2024	Graduate Student Outstanding Paper Award	KAIST
2024	Top Reviewer of NeurIPS 2024 & Complimentary Registration	NeurIPS
2023	AKN Outstanding Research Award (IBS/AKN Pre-doctoral Award)	Association of Korean Neuroscientists
2023	Trainee Professional Development Award	Society for Neuroscience
2022	Outstanding Teaching Assistant Award (Signals and Systems)	KAIST EE

- 2026 **Neuronal Identity as an Organizational Basis for Analyzing Neural Population Dynamics**
S. Han*, J. Y. You*, S. Kim*, M. Eom, J. Park, S. Park, B. Lee**, Y.-G. Yoon**.
(Submitted to NeurIPS 2026)
- Abunmix enables the simple and robust multiplexed immunofluorescence imaging**
W. La*, S. Bae*, J. Seo*, H. Yu*, J. Cho, H. Kim, H. Nam, **S. Han**, E. Yi, E. Kim, C. Kang, H. Shin, C. W. Song, Y.-G. Yoon**, J.-B. Chang**.
View
- Event-based optical imaging and reconstruction of in vivo neuronal and vascular dynamics**
J. Yoon*, S. Kim*, **S. Han***, M. Eom, E.-S. Cho, F. D. Nezhad, S. Hong, E. Kim, I.-H. Park, E. Chung, K. Shin, Y.-G. Yoon**, M. Choi**
Photonix
- 2025 **Nanoscale resolution imaging of the whole mouse embryos and larval zebrafish using expansion microscopy**
J. Sim*, C. E. Park*, I. Cho*, K. Min, M. Eom, **S. Han**, H. Jeon, E.-S. Cho, Y. Lee, Y. H. Yun, S. Lee, D.-H. Cheon, J. Kim, M. Kim, H.-J. Cho, J.-W. Park, A. Kumar, Y. Chong, J. S. Kang, K. D. Piatkevich, E. E. Jung, D.-S. Kang, S.-K. Kwon, J. Kim, K.-J. Yoon, J.-S. Lee, C.-H. Kim, M. Choi, J. W. Kim, M.-R. Song, H. J. Choi, E. S. Boyden, Y.-G. Yoon**, J.-B. Chang**.
ACS Nano
- Self-supervised video processing with self-calibration on an analogue selector-less memristor array-based platform**
H. Jeong*, **S. Han***, S.-O. Park, T. R. Kim, J. Bae, T.-H. Jang, Y. Cho, S. Seo, H.-J. Jeong, S. Park, T. Park, J. Oh, J. Park, D. Jeon, I. Kwon, Y.-G. Yoon**, S. Choi**.
Nature Electronics (Introduced in Nature Electronics News & Views, Nature Electronics Editorial, KAIST Breakthroughs)
- Design Principles of Multi-Scale J-invariant Networks for Self-Supervised Image Denoising**
H. Yu*, **S. Han***, Y.-G. Yoon.
WACV (Oral)
- 2024 **In Vivo Optical Clearing of Mammalian Brain**
G. T. Franzesi*, I. Gupta*, M. Hu, K. Piatkevich, M. Yildirim, J.-P. Zhao, M. Eom, **S. Han**, D. Park, H. Andaraarachchi, Z. Li, J. Greenhagen, A. M. Islam, P. Vashishtha, Z. Yaqoob, N. Pak, A. D. Wissner-Gross, D. A. Martin-Alarcon, J. J. Veinot, P. T. C. So, U. Kortshagen, Y.-G. Yoon, M. Sur**, E. S. Boyden**.
bioRxiv (in revision at Nature Chemical Biology)
- From Pixels to Information: Artificial Intelligence in Fluorescence Microscopy**
S. Han, J. Y. You, M. Eom, S. Ahn, E.-S. Cho, Y.-G. Yoon.
Advanced Photonics Research (Recognized as a Top viewed article)
- 2023 **Statistically unbiased prediction enables accurate denoising of voltage imaging data**
M. Eom*, **S. Han***, P. Park*, G. Kim, E.-S. Cho, J. Sim, K.-H. Lee, S. Kim, H. Tian, U. L. Böhm, E. Lowet, H. Tseng, J. Choi, S. E. Lucia, S. H. Ryu, M. Rózsa, S. Chang, P. Kim, X. Han, K. D. Piatkevich, M. Choi, C.-H. Kim, A. E. Cohen, J.-B. Chang, Y.-G. Yoon.
Nature Methods (Selected as the Cover and KAIST Breakthroughs)
- In vivo whole-brain imaging of zebrafish larvae using three-dimensional fluorescence microscopy**
E.-S. Cho, **S. Han**, G. Kim, M. Eom, K.-H. Lee, C.-H. Kim, Y.-G. Yoon.
Journal of Visualized Experiments
- Robust and Efficient Alignment of Calcium Imaging Data through Simultaneous Low Rank and Sparse Decomposition**
J. Cho*, **S. Han***, E.-S. Cho, K. Shin, Y.-G. Yoon.
WACV
- 2022 **IMPASTO: Multiplexed cyclic imaging without signal removal via self-supervised neural unmixing**
H. Kim*, S. Bae*, J. Cho, H. Nam, J. Seo, **S. Han**, E. Yi, E. Kim, Y.-G. Yoon**, J.-B. Chang**.
bioRxiv

Three-dimensional fluorescence microscopy through virtual refocusing using a recursive light propagation network

C. Shin*, H. Ryu*, E.-S. Cho, **S. Han**, K.-H. Lee, C.-H. Kim, Y.-G. Yoon.

Medical Image Analysis

2021 **Efficient Neural Network Approximation of Robust PCA for Automated Analysis of Calcium Imaging Data**

S. Han, E.-S. Cho, I. Park, K. Shin, Y.-G. Yoon.

MICCAI

3DM: Deep decomposition and deconvolution microscopy for rapid neural activity imaging

E.-S. Cho*, **S. Han***, K.-H. Lee, C.-H. Kim, Y.-G. Yoon.

Optics Express (Selected as Editor's Pick and Image of the Week)

2019 **Smartphone Application to Estimate Distances from LTE Base Stations Based on Received Signal Strength Measurements**

S. Han, T. Kang, J. Seo.

ITC-CSCC

2018 **Observation of Human Trajectory in Response to Haptic Feedback from Mobile Robot**

H.-S. Moon, W. Kim, **S. Han**, J. Seo.

ICCAS

INVITED TALKS

2023 **SUPPORT: Versatile denoising AI for microscopy data**

Korea Institute of Science and Technology (KIST), Oct. 2023

PROFESSIONAL SERVICE

Reviewer **NeurIPS**

2025 (5 papers), 2024 (6 papers, **Top Reviewer**), 2023 (5 papers)

MICCAI

2024 (4 papers), 2023 (3 papers), 2022 (5 papers)

AAAI

2025 (4 papers)

ICLR

2024 (3 papers)

MENTORING EXPERIENCE

Individual research mentoring

2025 **Juno Cho (Undergraduate Student at KAIST)**

Image processing, cell segmentation

2024 **Hayeong Yu (Undergraduate Student → M.S. student at KAIST)**

Self-supervised learning, image processing, denoising (*WACV* paper published)

2021 **Eunsu Kim (Undergraduate Student at KAIST → M.S. student at KAIST)**

Machine learning basics, processing multiplexed images (*View* paper published)

Group mentoring

2023–24 **Counseling Assistant, KAIST**

Provided academic and career counseling for 200+ Electrical Engineering undergraduates over two semesters. Organized career seminars and other student-facing events

TEACHING EXPERIENCE

2023 **Machine Learning and Big Data (Expert Course), Seongnam-KAIST Center for Next Generation ICT**

Teaching Assistant, course for the general public and office workers, reinforcement learning, **Head TA**

Signals and Systems (EE205), KAIST

Teaching Assistant, introductory-level course, **Head TA**, **Best Teaching Assistant Award**

2022 **Electronics Design Lab (EE305), KAIST**

Teaching Assistant, undergraduate-level course, circuits

Special Topics in Electrical Engineering <AI Capston Design> (EE488), KAIST

Teaching Assistant, senior-level course, reinforcement learning, **Head TA**

2021 **Electronics Design Lab (EE405A), KAIST**

Teaching Assistant, senior-level course, robotics

Basics of Artificial Intelligence (CoE202A), KAIST

Teaching Assistant, introductory-level course, computer vision

2020 **Basics of Artificial Intelligence (CoE202A), KAIST**

Teaching Assistant, introductory-level course, computer vision

REFERENCES

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