

# Andrew H. Song, Ph.D.

asong2@mdanderson.org - Website - LinkedIn - Scholar

## EDUCATION

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### Massachusetts Institute of Technology

Boston, MA, USA

Ph.D. in Electrical Engineering and Computer Science

Sept. 2016 - Feb. 2022

- Thesis: Generative models for neural time series with structured domain priors
- Thesis Advisors: Professors Emery N. Brown, Demba Ba

### Massachusetts Institute of Technology

Boston, MA, USA

B.S. & M.Eng. in Electrical Engineering and Computer Science (Co-terminal)

Sept. 2009 - Jun. 2016

- Took two years of voluntary leave for military service in South Korean military and UN peacekeeping force (2011 - 2012).

## WORK EXPERIENCE

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### Assistant Professor

Department of Translational Molecular Pathology, MD Anderson Cancer Center

Jan. 2026 -

### Adjunct Professor

Department of Computer Science, Rice University

Jan. 2026 -

### Postdoctoral Fellow

Brigham and Women's Hospital/Harvard Medical School

Jan. 2022 - Dec. 2025

- Current research projects include (1) 3D computational pathology and (2) Multimodal deep learning in computational pathology
- Mentor: Professor Faisal Mahmood

### Applied Scientist Intern

Amazon - AWS Audio Machine Learning/Digital Signal Processing team

June 2019 - Aug. 2019

- Worked on designing/implementing a neural network architecture to denoise noisy multi-channel audio data, inspired by classical beamforming application.

### Communication Specialist, English Interpreter, Sergeant

UN Peacekeeping force in Lebanon & South Korean Military

Jan. 2011 - Oct. 2012

- Helped maintain peace and suppress terrorist attacks in unstable areas of Lebanon.
- Worked as an interpreter between the United Nations HQ and the Korean army HQ.

## PUBLICATIONS

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(\*): Co-first authorship (+): Co-second authorship (†): Co-senior authorship

### Selected Publications

- Daniel Shao, Joel Runevic, Richard J. Chen, Drew F.K. Williamson, Ahrong Kim, **Andrew H. Song**<sup>†</sup>, Faisal Mahmood<sup>†</sup>, **Mixture of Mini Experts: Overcoming the Linear Layer Bottleneck in Multiple Instance Learning**, *ICLR*, 2026
- Tong Ding\*, Sophia Wagner\*, **Andrew H. Song**\*, Richard J. Chen\*, ..., Long Phi Le<sup>†</sup>, and Faisal Mahmood<sup>†</sup>, **Multimodal Whole Slide Foundation Model for Pathology**, *Nature Medicine*, 2025
- Anurag Vaidya\*, Andrew Zhang\*, Guillaume Jaume\*, **Andrew H. Song**<sup>+</sup>, ..., Long Phi Le<sup>†</sup>, and Faisal Mahmood<sup>†</sup>, **Molecular-driven Foundation Model for Oncologic Pathology**, *Nature Cancer (In Press)*, 2026
- **Andrew H. Song**, Mane Williams<sup>+</sup>, Drew F.K. Williamson<sup>+</sup>, Sarah S.L. Chow, ..., Lawrence D. True, Anil V. Parwani, Jonathan T.C. Liu<sup>†</sup>, and Faisal Mahmood<sup>†</sup>, **Analysis of 3D pathology samples using weakly supervised AI**, *Cell*, 2024 [[NIH / NIBIB science highlight](#)] [[MGB press release](#)] [[Video](#)] [[Blog](#)]
- **Andrew H. Song**\*, Guillaume Jaume\*, Drew F.K. Williamson, Ming Y. Liu, Anurag Vaidya, Tiffany R. Miller, and Faisal Mahmood, **Artificial intelligence for digital and computational pathology**, *Nature Reviews Bioengineering*, 2023

## Journal

- Tong Ding\*, Sophia Wagner\*, **Andrew H. Song\***, Richard J. Chen\*, ..., Long Phi Le<sup>†</sup>, and Faisal Mahmood<sup>†</sup>, **Multimodal Whole Slide Foundation Model for Pathology**, *Nature Medicine*, 2025
- Anurag Vaidya\*, Andrew Zhang\*, Guillaume Jaume\*, **Andrew H. Song+**, ..., Long Phi Le<sup>†</sup>, and Faisal Mahmood<sup>†</sup>, **Molecular-driven Foundation Model for Oncologic Pathology**, *Nature Cancer (In Press)*, 2025
- Victor Brodsky\*, Ehsan Ullah\*, Andrey Bychkov, **Andrew H. Song**, ..., Marilyn M. Bui<sup>†</sup>, and Anil V. Parwani<sup>†</sup>, **Generative artificial intelligence in anatomical pathology**, *Archives of Pathology & Laboratory Medicine*, 2025
- **Andrew H. Song**, Mane Williams<sup>+</sup>, Drew F.K. Williamson<sup>+</sup>, Sarah S.L. Chow, ..., Lawrence D. True, Anil V. Parwani, Jonathan T.C. Liu<sup>†</sup>, and Faisal Mahmood<sup>†</sup>, **Analysis of 3D pathology samples using weakly supervised AI**, *Cell*, 2024 [[NIH / NIBIB science highlight](#)] [[MGB press release](#)] [[Video](#)] [[Blog](#)]
- Anurag Vaidya\*, Richard Chen\*, Drew F.K. Williamson\*, **Andrew H. Song**, ..., and Faisal Mahmood, **Demographic bias in misdiagnosis by computational pathology models**, *Nature Medicine*, 2024
- Richard Chen\*, Tong Ding\*, Ming Y. Lu\*, Drew F.K. Williamson\*, Guillaume Jaume, **Andrew H. Song**, ..., and Faisal Mahmood, **Towards a general-purpose foundation model for computational pathology**, *Nature Medicine*, 2024
- **Andrew H. Song\***, Guillaume Jaume\*, Drew F.K. Williamson, Ming Y. Liu, Anurag Vaidya, Tiffany R. Miller, and Faisal Mahmood, **Artificial intelligence for digital and computational pathology**, *Nature Reviews Bioengineering*, 2023
- Alexander Lin, **Andrew H. Song**, Berkin Bilgic, and Demba Ba, **Covariance-Free Sparse Bayesian Learning**, *IEEE Transactions on Signal Processing*, 2022
- **Andrew H. Song\***, Seong-eun Kim\*, and Emery N. Brown, **Adaptive State-space Multitaper Spectral Estimation**, *IEEE Signal Processing Letters*, 2022
- **Andrew H. Song**, Bahareh Tolooshams, and Demba Ba, **Gaussian Process Convolutional Dictionary Learning**, *IEEE Signal Processing Letters*, 2022
- **Andrew H. Song**, Francisco Flores, and Demba Ba, **Convolutional dictionary learning with grid refinement**, *IEEE Transactions on Signal Processing*, 2020
- **Andrew H. Song**, Aaron Kucyi, Vitaly Napadow, Emery N. Brown, Marco L. Loggia, and Oluwaseun Akeju, **Pharmacological Modulation of Noradrenergic Arousal Circuitry Disrupts Functional Connectivity of Locus Coeruleus in Humans**, *Journal of Neuroscience*, 2017
- Oluwaseun Akeju, Allison E. Hamilos, **Andrew H. Song**, Kara J. Pavone, Patrick L. Purdon, and Emery N. Brown, **GABAA circuit mechanisms are associated with ether anesthesia-induced unconsciousness**, *Clinical Neurophysiology*, 2016
- Oluwaseun Akeju, **Andrew H. Song**, Allison E. Hamilos, Kara J. Pavone, Francisco J. Flores, Emery N. Brown, and Patrick L. Purdon, **Electroencephalogram signatures of ketamine anesthesia-induced unconsciousness**, *Clinical Neurophysiology*, 2016
- Ignacio Arnaldo, Kalyan Veeramachaneni, **Andrew H. Song**, Una-May O'Reilly, **Bring your own learner: A cloud-based, data-parallel commons for machine learning**, *IEEE Computational Intelligence Magazine*, 2015

## Conference

- Daniel Shao, Joel Runevic, Richard J. Chen, Drew F.K. Williamson, Ahronng Kim, **Andrew H. Song<sup>†</sup>**, Faisal Mahmood<sup>†</sup>, **Mixture of Mini Experts: Overcoming the Linear Layer Bottleneck in Multiple Instance Learning**, *ICLR*, 2026
- Daniel Shao, Richard Chen, **Andrew H. Song**, Joel Runevic, Ming Y. Lu, Tong Ding, and Faisal Mahmood, **Do Multiple Instance Learning Models Transfer?**, *ICML*, 2025
- **Andrew H. Song**, Richard Chen, Guillaume Jaume, Anurag Vaidya, Alexander S. Baras, and Faisal Mahmood, **Multimodal Prototyping for cancer survival prediction**, *ICML*, 2024
- **Andrew H. Song\***, Richard Chen\*, Tong Ding, Drew F.K. Williamson, Guillaume Jaume, and Faisal Mahmood, **Morphological Prototyping for Unsupervised Slide Representation Learning in Computational Pathology**, *CVPR*, 2024

- Gan Gao\*, **Andrew H Song\***, ..., Faisal Mahmood, and Jonathan T.C Liu, **Triage of 3D pathology data via 2.5D multiple-instance learning to guide pathologist assessments**, *CVPR CVMI workshop*, 2024
- Guillaume Jaume\*, Paul Doucet\*, **Andrew H. Song**, ..., and Faisal Mahmood, **HEST-1k: A Dataset for Spatial Transcriptomics and Histology Image Analysis**, *NeurIPS*, 2024
- Guillaume Jaume\*, Anurag Vaidya\*, Andrew Zhang+, **Andrew H. Song+**, ..., Long Phi Le, and Faisal Mahmood, **Multistain Pretraining for Slide Representation Learning in Pathology**, *ECCV*, 2024
- Guillaume Jaume\*, Lukas Oldenburg\*, Anurag Vaidya, Richard J. Chen, Drew F.K. Williamson, Thomas Peeters, **Andrew H. Song**, and Faisal Mahmood, **Transcriptomics-guided Slide Representation Learning in Computational Pathology**, *CVPR*, 2024
- Iain Carmichael\*, **Andrew H. Song\***, Richard Chen, Drew F.K. Williamson, Tiffany Chen, and Faisal Mahmood, **Incorporating intratumoral heterogeneity into weakly-supervised deep learning models via variance pooling**, *MICCAI*, 2022
- Alexander Lin, **Andrew H. Song**, Berkin Bilgic, and Demba Ba, **High-dimensional Sparse Bayesian Learning without Covariance Matrices**, *IEEE ICASSP*, 2022
- Alexander Lin, **Andrew H. Song**, and Demba Ba, **Mixture Model Auto-encoders : Deep Clustering through Dictionary Learning**, *IEEE ICASSP*, 2022
- **Andrew H. Song**, Demba Ba, and Emery N. Brown, **PLSO: A generative framework for decomposing nonstationary timeseries into piecewise stationary oscillatory components**, *UAI*, 2021
- Bahareh Tolooshams\*, **Andrew H. Song\***, Simona Temereanca, and Demba Ba, **Convolutional dictionary learning based auto-encoders for natural exponential-family distributions**, *ICML*, 2020
- Bahareh Tolooshams, Ritwik Giri, **Andrew H. Song**, Umut Isik, and Arvinhd Krishnaswamy, **Channel-attention dense u-net for multichannel speech enhancement**, *ICASSP*, 2020
- **Andrew H Song\***, Leon Chlon\*, Hugo Soulat, John Tauber, Sandya Subramanian, Demba Ba, and Michael J Prerau, **Multitaper Infinite Hidden Markov Model for EEG**, *IEEE EMBC*, 2019
- **Andrew H. Song\***, Sourish Chakravarty\*, and Emery N. Brown, **A smoother state space multitaper spectrogram**, *IEEE EMBC*, 2018

## Comments & Workshops

- Guillaume Jaume\*, **Andrew H. Song\***, and Faisal Mahmood, **Integrating Context for Superior Cancer Prognosis**, *Nature Biomedical Engineering*, 2022
- **Andrew H. Song**, Drew F.K. Williamson, and Faisal Mahmood, **Investigating Morphologic Correlates of Driver Gene Mutation Heterogeneity via Deep Learning**, *Cancer Research*, 2022

## In preparation & Submitted

- Gan Gao, Renao Yan+, **Andrew H. Song+**, Huai-Ching Hsieh, ..., Jonathan T.C. Liu, **Deep-learning triage of 3D pathology datasets for comprehensive and efficient pathologist assessments**, *Submitted*, 2025
- Muhammad Shaban\*, Yuzhou Chang\*, Huaying Qiu+, Yao Yu Yeo+, **Andrew H. Song+**, Guillaume Jaume+, ..., Sizun Jiang<sup>†</sup>, Faisal Mahmood<sup>†</sup>, **A Foundation Model for Spatial Proteomics**, *Submitted*, 2025
- Cristina Almagro-Pérez\*, **Andrew H. Song\***, ..., and Faisal Mahmood, **AI-driven 3D Spatial Transcriptomics**, *Submitted*, 2025
- Luca L. Weishaupt\*, Sharifa Sahai\*, Andrew Zhang, **Andrew H. Song**, ..., Faisal Mahmood, **Real-time human-in-the-loop AI-driven measurement of the glomerular basement membrane**, *Submitted*, 2025
- Daniel Shao\*, Sahar Hosseini\*, **Andrew H. Song**, ..., Deepa T. Patil<sup>†</sup> and Faisal Mahmood<sup>†</sup>, **Multistain Transformer Predicts Progression to Advanced Barrett's Esophagus-Related Neoplasia**, *Submitted*, 2025
- Guillaume Jaume, Simone De Brot, **Andrew H. Song**, ..., and Faisal Mahmood, **Towards a Foundation Model for Preclinical Drug Safety Assessment**, *Submitted*, 2024

## PATENTS

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- Muhammad Shaban, Andrew H. Song, Guillaume Jaume, Sizun Jiang, and Faisal Mahmood, **Foundation models for spatial proteomics**, *patent pending*, 2025
- Cristina Almagro-Pérez, Andrew H. Song and Faisal Mahmood, **AI-driven 3D spatial transcriptomics**, *patent pending*, 2025
- Andrew H. Song and Faisal Mahmood, **Deep learning-based assessment of 3D pathology volumes at scale**, *US20250349415A1*, 2024

## INVITED TALKS

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<b>Foundation models in pathology: The present and the future</b> <i>Western Bioinformatics Research Seminar</i>	<b>Canada</b> Mar. 2026
<b>The AI revolution in pathology: The present &amp; the future</b> <i>Division of Pathology and Laboratory Medicine Grand Rounds at MD Anderson Cancer Center</i>	<b>USA</b> Mar. 2026
<b>Unlocking 3D molecular landscape with AI</b> <i>3D Spatial Summit @ Alpenglow Biosciences</i>	<b>USA</b> Mar. 2026
<b>The promise of AI in computational and digital pathology</b> <i>MD Anderson Cancer Center Department of Systems Biology Seminar</i>	<b>USA</b> Mar. 2026
<b>The promise of AI in computational and digital pathology</b> <i>Updates on Advanced Breast Cancer conference Keynote</i>	<b>USA</b> Feb. 2026
<b>The promise of AI foundation models in pathology</b> <i>MD Anderson Cancer Center Translational Molecular Pathology Distinguished Speaker Seminar Series</i>	<b>USA</b> Feb. 2026
<b>AI-driven multimodal and multidimensional pathology</b> <i>LG AI Research</i>	<b>S. Korea</b> Nov. 2025
<b>Deep dive into AI revolution in pathology</b> <i>IFEZ × K-BioX AI Biohelathcare Drug Discovery Summit 2025</i>	<b>S. Korea</b> Nov. 2025
<b>AI-driven 3D Multimodal Computational Pathology</b> <i>International Conference of the Genetics Society of Korea 2025</i>	<b>S. Korea</b> Nov. 2025
<b>3D multimodal computational pathology</b> <i>Vanderbilt Symposium on AI, Spatial &amp; Systems Biology 2025</i>	<b>USA</b> Oct. 2025
<b>Exploring the landscape of AI-driven computational pathology</b> <i>Yale School of Medicine</i>	<b>USA</b> Sept. 2025
<b>The AI revolution in pathology for patient prognosis</b> <i>Yonsei University College of Medicine Department of Pathology Seminar</i>	<b>S.Korea</b> Aug. 2025
<b>Harnessing large-scale multi-dimensional pathology data for clinical outcome prediction</b> <i>Seoul National University Institute of New Media and Communications Seminar</i>	<b>S.Korea</b> Aug. 2025
<b>Integration of 3D pathology into oncologic workflow</b> <i>Yonsei University College of Medicine Radiation Oncology seminar</i>	<b>S.Korea</b> Aug. 2025
<b>Multi-dimensional pathology for personalized treatment</b> <i>22nd Avison Biomedical Symposium</i>	<b>S.Korea</b> Aug. 2025
<b>AI-driven multimodal pathology</b> <i>MD Anderson Imaging Physics &amp; Translational Molecular Pathology Seminar</i>	<b>USA</b> June 2025
<b>Multi-dimensional and multi-modal pathology for improving patient prognosis</b> <i>MGH Molecular Pathology Seminar</i>	<b>USA</b> May 2025

<b>AI-enabled 3D pathology for improved patient prognosis</b> <i>Massachusetts Society of Pathologists &amp; New England Society of Pathologists Joint Meeting</i>	USA Apr. 2025
<b>Dinner with Data: The AI Revolution in 2D and 3D Pathology</b> <i>United States and Canadian Academy of Pathology &amp; Alpenglow dinner presentation</i>	USA Mar. 2025
<b>AI-driven clinical outcome prediction with multi-dimensional human tissue images</b> <i>Penn Medicine Research Seminar</i>	USA Mar. 2025
<b>When AI meets pathology – Harnessing AI for improved patient care</b> <i>MGH Clinical &amp; Translational Epidemiology Unit Research Seminar</i>	USA Mar. 2025
<b>Unsupervised whole slide representation learning in pathology</b> <i>Abbvie CVRT Imaging Seminar</i>	USA Mar. 2025
<b>Taming large-scale pathology data for cancer clinical outcome prediction</b> <i>Johns Hopkins University Electrical and Computer Engineering Department Seminar</i>	USA Nov. 2024
<b>3D computational pathology</b> <i>1st Annual Congress of the Asian Society of Digital Pathology</i>	S.Korea Oct. 2024
<b>AI-driven 3D computational pathology</b> <i>3D Spatial Summit @ Alpenglow Biosciences</i>	USA Oct. 2024
<b>3D computational pathology</b> <i>The NRG Oncology Summer meeting 2024</i>	USA Jul. 2024
<b>A Tour of 2D and 3D computational pathology</b> <i>AI×Med Seminar @ Center for Advanced Medical Computing and Analysis, MGH</i>	USA Jul. 2024
<b>3D computational pathology: The present and the future</b> <i>Charles River Laboratories</i>	USA Jun. 2024
<b>AI-driven efficient patient prognosis based on 3D pathology samples</b> <i>AI in Pathology seminar @ University of California</i>	USA May 2024
<b>3D computational pathology: Towards enhanced patient prognostication</b> <i>Advanced Biomedical Computation (ABC) seminar @ Harvard Medical School</i>	USA Mar. 2024
<b>A Tour of 2D and 3D computational pathology</b> <i>Electrical Engineering Colloquium @ KAIST</i>	S.Korea Mar. 2024
<b>A Tour of 2D and 3D computational pathology</b> <i>Emerging Technology in Electrical and Computer Engineering Talks @ Seoul National University</i>	S.Korea Mar. 2024
<b>AI-driven efficient patient prognosis based on 3D pathology samples</b> <i>Computational Pathology journal club @ AstraZeneca</i>	UK Dec. 2023
<b>AI-driven efficient patient prognosis based on 3D pathology samples</b> <i>TIA Centre seminar series @ Tissue Imaging Analysis Centre, University of Warwick</i>	UK Dec. 2023
<b>AI-driven efficient patient prognosis based on 3D pathology samples</b> <i>NCI Cancer Systems Biology Consortium @ National Cancer Institute</i>	USA Nov. 2023
<b>Capturing 3D histology from tissue samples for 3D computational analysis</b> <i>X-ray in Microscopy in Life Sciences Hybrid Meeting @ ZEISS</i>	UK Oct. 2023
<b>AI-driven efficient patient prognosis based on 3D pathology samples</b> <i>3D Spatial Summit @ Alpenglow Biosciences</i>	USA Sept. 2023
<b>AI-driven efficient patient prognosis based on 3D pathology samples</b> <i>AI seminar @ PathAI</i>	USA Aug. 2023
<b>Generative models for structured neural time series</b> <i>Data science seminar @ Seoul National University</i>	S.Korea Aug. 2021

**Neural signal processing with domain constraints**

*AI Symposium @ KAIST*

**S.Korea**

*Aug. 2020*

**Neural signal processing with domain constraints**

*EE seminar @ KAIST*

**S.Korea**

*Mar. 2020*

## SERVICE

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*Conference reviewer:* **NeurIPS 2024, 2025, ICLR 2024, 2025, ICML 2025, 2026 UAI 2023, IEEE EMBC, COSYNE**

*Journal reviewer:* **Nature Biomedical Engineering, Communications Medicine, NPJ Digital Medicine, Genome Medicine, Cell Reports Methods, Modern Pathology, Scientific Reports, IEEE Transactions on Biomedical Engineering, IEEE Signal Processing Letters**

## CITIZENSHIP

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United States and South Korea (dual citizenship)

## REFERENCES

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**Faisal Mahmood, Ph.D.**

*Associate Professor, Harvard Medical School, Boston*

*FaisalMahmood@bwh.harvard.edu*

**Emery N. Brown, M.D., Ph.D.**

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**Alexander S. Baras, M.D., Ph.D.**

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