

Andrew H. Song, Ph.D.

asong@bwh.harvard.edu - Website - LinkedIn - Scholar

EDUCATION

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
- 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

Postdoctoral Fellow

Brigham and Women's Hospital/Harvard Medical School

Jan. 2022 -

- 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.

Platform Infrastructure Software Engineer Intern

Akamai

June 2014 - Aug. 2014

- Created an internal platform for employees to analyze and visualize the internet traffic data across the world.

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

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

Selected Publications

- **Andrew H. Song**, Mane Williams⁺, Drew F.K. Williamson⁺, Sarah S.L. Chow, ..., Lawrence D. True, Anil V. Parwani, Jonathan T.C. Liu[†], and Faisal Mahmood[†], **Analysis of 3D pathology samples using weakly supervised AI**, *Cell*, 2024
[\[NIH / NIBIB science highlight\]](#) [\[MGB press release\]](#) [\[Video\]](#) [\[Blog\]](#)
- **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
- **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
- Bahareh Tolooshams*, **Andrew H. Song***, Simona Temereanca, and Demba Ba, **Convolutional dictionary learning based auto-encoders for natural exponential-family distributions**, *ICML*, 2020

Journal

- **Andrew H. Song**, Mane Williams⁺, Drew F.K. Williamson⁺, Sarah S.L. Chow, ..., Lawrence D. True, Anil V. Parwani, Jonathan T.C. Liu[†], and Faisal Mahmood[†], **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 Ceruleus 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

- **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
- Guillaume Jaume*, Paul Doucet*, **Andrew H. Song**, ..., and Faisal Mahmood, **HEST-1k: A Dataset for Spatial Transcriptomics and Histology Image Analysis**, *NeurIPS Datasets & Benchmarks*, 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 Arvinth 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

- 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*, **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

- 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**, *In preparation*
- Victor Brodsky*, Ehsan Ullah*, Andrey Bychkov, **Andrew H. Song**, ..., Marilyn M. Bui[†], and Anil V. Parwani[†], **Generative artificial intelligence in anatomical pathology**, *Submitted*, 2024
- Daniel Shao, **Andrew H. Song**⁺, ..., Deepa T. Patil[†] and Faisal Mahmood[†], **Multistain Transformer Predicts Progression to Esophageal Cancer**, *Submitted*, 2024
- Guillaume Jaume, Simone De Brot, **Andrew H. Song**, ..., and Faisal Mahmood, **Towards a Foundation Model for Preclinical Drug Safety Assessment**, *Submitted*, 2024
- Guillaume Jaume*, Thomas Peeters*, **Andrew H. Song**, ..., and Faisal Mahmood, **AI-driven Discovery of Morphomolecular Signatures in Toxicology**, *Submitted*, 2024

PATENTS

- Andrew H. Song and Faisal Mahmood, **Deep learning-based assessment of 3D pathology volumes at scale**, *patent pending*, 2024

INVITED TALKS

3D computational pathology	S.Korea
<i>1st Annual Congress of the Asian Society of Digital Pathology</i>	<i>Oct. 2024</i>
AI-driven 3D computational pathology	USA
<i>3D Spatial Summit @ Alpenglow Biosciences</i>	<i>Oct. 2024</i>
AI-driven 3D computational pathology	S. Korea
<i>Future of Medicine symposium - At the crossroads of computational pathology and spatial biology</i>	<i>Oct. 2024</i>
3D computational pathology	USA
<i>The NRG Oncology Summer meeting 2024</i>	<i>Jul. 2024</i>

A Tour of 2D and 3D computational pathology <i>AI×Med Seminar @ Center for Advanced Medical Computing and Analysis, MGH</i>	USA Jul. 2024
3D computational pathology: The present and the future <i>Charles River Laboratories</i>	USA Jun. 2024
AI-driven efficient patient prognosis based on 3D pathology samples <i>AI in Pathology seminar @ University of California</i>	USA May 2024
3D computational pathology: Towards enhanced patient prognostication <i>Advanced Biomedical Computation (ABC) seminar @ Harvard Medical School</i>	USA Mar. 2024
A Tour of 2D and 3D computational pathology <i>Electrical Engineering Colloquium @ KAIST</i>	S.Korea Mar. 2024
A Tour of 2D and 3D computational pathology <i>Emerging Technology in Electrical and Computer Engineering Talks @ Seoul National University</i>	S.Korea Mar. 2024
AI-driven efficient patient prognosis based on 3D pathology samples <i>Computational Pathology journal club @ AstraZeneca</i>	UK Dec. 2023
AI-driven efficient patient prognosis based on 3D pathology samples <i>TIA Centre seminar series @ Tissue Imaging Analysis Centre, University of Warwick</i>	UK Dec. 2023
AI-driven efficient patient prognosis based on 3D pathology samples <i>NCI Cancer Systems Biology Consortium @ National Cancer Institute</i>	USA Nov. 2023
Capturing 3D histology from tissue samples for 3D computational analysis <i>X-ray in Microscopy in Life Sciences Hybrid Meeting @ ZEISS</i>	UK Oct. 2023
AI-driven efficient patient prognosis based on 3D pathology samples <i>3D Spatial Summit @ Alpenglow Biosciences</i>	USA Sept. 2023
AI-driven efficient patient prognosis based on 3D pathology samples <i>AI seminar @ PathAI</i>	USA Aug. 2023
Generative models for structured neural time series <i>Data science seminar @ Seoul National University</i>	S.Korea Aug. 2021
Neural signal processing with domain constraints <i>AI Symposium @ KAIST</i>	S.Korea Aug. 2020
Neural signal processing with domain constraints <i>EE seminar @ KAIST</i>	S.Korea Mar. 2020

SERVICE

Conference reviewer: **NeurIPS 2024, ICLR 2024, 2025, UAI 2023, IEEE EMBC, COSYNE**
Journal reviewer: **IEEE Transactions on Biomedical Engineering, IEEE Signal Processing Letters**

CITIZENSHIP

United States and South Korea (dual citizenship)

REFERENCES

Faisal Mahmood, Ph.D.

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Jonathan T.C. Liu, Ph.D.

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