JinYeop Song

Ph.D. Candidate in Biophysics and Statistics ·

(+1)617-949-1042 | yeopjin@mit.edu | https://github.com/Jinyeop3110

88 Ames St, Cambridge, MA 02139, USA

Education

Massachusetts Institute of Technology *Cambridge, MA, USA*

Ph.D. Candidate in Physics and Statistics - GPA: 4.35/4.5 Aug 2020 - June 2026 (Expected)

Supervisor : Jeff Gore

Korea Advanced Institute of Science and Technology *Daejeon, Korea*

B.S. in Physics (Major) and Math (Minor) - GPA: 4.16/4.3 (*Summa Cum Laude*) Mar 2014 - Jun 2020

Korea Science Academy of KAIST *Busan, Korea*

High School for Gifted Students in Science Mar 2011 - Feb 2014

Interests

I am interested in leveraging AI to unravel the complexities of biology and transform the field of medicine.

(1) **Advancing AI for Medicine** : I aim to develop improved AI frameworks for data acquisition, modeling, and analysis to drive medical advancements, like as in my project [3].

(2) **Interpreting AI and Reverse Engineering** : I seek to interpret the hidden information structures in bio-AI models to uncover insights for medicine, like as in my project [2].

Publications

AI related

[1] **Song, J.***, Han, S.*, Argawal, P., & Gore, J. "Context to Concept : Concept Encoding in In-context learning" *Submitted for ICLR 2025*, 2024.

[2] Yang, S., Nam, J., Perez, T., **Song, J.**, Du, X., & Gomez-Bombarelli, R. "Probing the Embedding Space of Protein Foundation Models through Intrinsic Dimension Analysis" *Neurips 2025 AIDrugX workshop*, 2024.

[3] Ying, A.*, **Song, J.***, Cui. H.* ... et al. "MethylGPT - Foundational GPT-like model for human methylation data" *2024. In preparation for Arxiv and Journal submission*

[4] Pearce, T., & **Song, J** "Reconciling Kaplan and Chinchilla Scaling Laws" *In review process in TMLR*, 2024. [Link]

[5] **Song, J.***, Liu, Z.*, Tegmark, M., & Gore, J. "Resource model for neural scaling law," *2024 ICRL Workshop - Bridging the Gap Between Practice and Theory in Deep Learning*, 2024. [Link]

Physics related

[1] **Song, J.**, Hu, J. & Gore, J. "Emergent cohesiveness governs coalescence between microcosms," *In Preparation*, 2024.

[2] **Song, J.***, Jeong, B.S.*, ..., & Oh, B.H. "Noncovalent antibody catenation on a target surface greatly increases the antigen-binding avidity," *Elife*, 9: e81646, 2023. [Link]

[3] Lee, M.*, Lee, Y. H.*, **Song, J.***, ..., & Park, Y. "Deep-learning-based three-dimensional label-free tracking and analysis of immunological synapses of CAR-T cells," *Elife*, 9, 2020. [Link]

[4] Kim, G., Ahn, D., Kang, M., Jo, Y., Ryu, D., Kim, H., **Song, J.**, ..., & Kim, K. "Rapid species identification of pathogenic bacteria from a minute quantity exploiting three-dimensional quantitative phase imaging and artificial neural network," *Light, Science & Applications*. [Link]

Work Experience

Samsung Electronics Research *Korea*

Summer Research Internship Jun 2020 - Aug 2020

- Investigated Post-Quantum Computing Cryptography algorithm for DRAM security software.

Harvard-MIT Health Sciences and Technology *Boston, MA, USA*

Summer Research Internship Jun 2019 - Aug 2019

- Research internship in Harvard medical, focusing on computational image analysis.

Korea National Police Agency *Korea*

Korea Auxiliary Policeman Apr 2016 - Jan 2018

Awards and Honors

2023	**Scholarship**: "Mokam Research Scholarship"
2021	**Scholarship**: "ASAN Biomedical Research Scholarship"
2016	**Fellowship**: "KAIST Presidential Fellowship (KPF)"
2023	**Award**: "2020 KPS Best Oral Presentation Award"
2020	**Honorary Title**: "Excellent Graduate of KAIST"
2014 - 2020	**Scholarship**: "Korea Presidential Science Scholarship"

Research Projects

Laboratory of Complex Intelligence, MIT *Boston, MA*

PhD Candidate (PI: Prof. Jeff Gore) June 2023 - Present

- A few people, including my PI, have begun to explore the nature of AI following the release of GPT-4.
- (1) Investigating the latent contextual knowledge structures of LLMs.
- (2) Exploring emergent phenomena, such as neural scaling laws.

Laboratory of Complex Ecosystems, MIT *Boston, MA*

PhD Candidate (PI: Prof. Jeff Gore) Feb 2021 - Present

- Employing complex physics approach to understand (1) generic pattern of microbial coalescence and community cohesiveness.
- (2) Emergent pattern of evolution of multispecies community.

Laboratory of Chromatin Imaging, KAIST *Daejeon, Korea*

Research Assistant (PI: Prof. Wonki Cho) Feb 2020 - Present

- Developed thermodynamic simulation code for multivariate Antibody binding.
- Searched dCas9 imaging target sites for whole chromosome paintings.

Laboratory of Biomedical Optics, KAIST *Daejeon, Korea*

Undergraduate Researcher (PI: Prof. YongKeun Park) Feb 2018 - Present

- Developed deep-learning based computational algorithm for 3D time-lapse tracking of T-cell(CAR-T).
- Imaged and analyzed 3D refractive index map of sepsis bacterial pathogens for classification model.

Biomedical OCT Research Center, Massachusetts General Hospital *Boston, MA, USA*

Research Intern (PI: Prof. Brett Bouma) Jun 2019 - Aug 2019

- Developed computational analysis pipeline for mapping brain image to mural connectome.

Laboratory of Quantum and Nanophotonics, KAIST *Daejeon, Korea*

Undergraduate Researcher (PI: Prof. YongHoon Cho) Jul 2014 - Feb 2015

- Investigated exciton-polariton coupling effect of GaN nanoporous DBR cavity using FDTD simulation and optical experiments.

Teaching & Extracurricular Experiences

June 2024 - Present	**Organizer**: PLS-AI Weekly Journal Club	*MIT*
2023	**Teaching Assistant**: "Complex Systems Biology"	*MIT*
2015 - 2018	**Freshmen Tutoring Program**	*KAIST*

References

- Prof. Jeff Gore
  Ph. D, Professor at the Physics of Living Systems, MIT, (+1) 617-715-4251 gore@mit.edu
- Prof. Oh, Byung-Ha
  Professor, Department of Biological Science (+82) 42-350-2648 bhoh@kaist.ac.kr