

# JinYeop Song

Ph.D. Candidate in Physics and Statistics ·

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## Education

### Massachusetts Institute of Technology

Ph.D. Candidate in Physics and Statistics - GPA: 4.35/4.5

Supervisor : Jeff Gore

Cambridge, MA, USA

Aug 2020 - June 2026 (Expected)

### Korea Advanced Institute of Science and Technology

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

Daejeon, Korea

Mar 2014 - Jun 2020

### Korea Science Academy of KAIST

High School for Gifted Students in Science

Busan, Korea

Mar 2011 - Feb 2014

## Interests

“What I cannot create, I do not understand.”

— Richard Feynman

As a physics major, I'm interested in studying emergent phenomena in LLMs and leveraging insights for efficient training and inference.

(1) **Emergence of high-level concepts** during training and applying mechanistic interventions during inference for desired outcomes, as in my project [1].

(2) Understanding **Neural Scaling law in LLMs**, and how to engineer them for more efficient training and inference, as in my projects [4][5].

## 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

Summer Research Internship

Korea

Jun 2020 - Aug 2020

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

### Harvard-MIT Health Sciences and Technology

Summer Research Internship

Boston, MA, USA

Jun 2019 - Aug 2019

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

### Korea National Police Agency

Korea Auxiliary Policeman

Korea

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”

## 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

## 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.

## Skills

**Programming** Python, Matlab, R, Github, Torch, and Cuda  
**Languages** English(Fluent), Korean(Native), Chinese(Elementary)

## References

- Prof. Jeff Gore  
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- Prof. Oh, Byung-Ha  
Professor, Department of Biological Science 📞(+82) 42-350-2648   ✉️ bhoh@kaist.ac.kr