

# Linghao Kong

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## Education

- ❖ **Massachusetts Institute of Technology (MIT)** Cambridge, MA  
• PhD candidate in Electrical Engineering and Computer Science (GPA: 4.91/5.00) *Sep 2022 – Present*
  - Being advised by Professor Nir N. Shavit
- SM in Electrical Engineering and Computer Science (GPA: 4.91/5.00) *Sep 2022 – May 2024*
  - Advised by Professor Nir N. Shavit
  - Thesis: “Sparse Expansion and Neuronal Disentanglement”
- ❖ **Columbia University in the City of New York (CU)** New York, NY  
• BA in Computer Science and in Neuroscience and Behavior (GPA: 3.97/4.00) *Sep 2018 – May 2022*
  - Honors: *magna cum laude*, Dean’s List for all semesters

## Research Experience

- ❖ **PhD Candidate, *Shavit Lab*, MIT** *Sep 2022 – Present*
  - Investigating the relationship between neuronal entanglement and sparsity in large language models to discover new techniques to induce sparsity in such models to vastly save computational power
  - Analyzing the MICrONS anatomical and functional connectome of the mouse visual cortex to better characterize the border between visual areas and to model the degree of synchrony in neurons
  - Modeling the octopus hippocampus and fruit fly anatomical connectomes as artificial neural networks to investigate the capacity and capabilities of biological neural networks
- ❖ **Research Assistant, *Peter Sims Laboratory*, CU** *Jan 2019 – Aug 2022*
  - Leveraged machine learning model scGen to identify fates of multiple cancer cell types following perturbations
  - Identified the cause of low efficiency in the novel SCOPE-Seq2 technique to be false hybridization
  - Utilized various biochemical assays to demonstrate the inability of emetine-stalled puromycylated polypeptides to remain bound to ribosomes, despite widespread acceptance of their ability to do so in the field of active translation
- ❖ **Research Assistant, *Laboratory for Fluorescence Dynamics*, UC Irvine** *Aug 2015 – Jul 2018*
  - Implemented skills accumulated over three years for independent research project on cancer cell metabolism
  - Became adept in lab techniques such as passaging, transfecting, amplifying DNA, and generating stable cell lines
  - Self-taught in the ImageJ Macro language to expedite batch analysis of images
- ❖ **Research Participant, *COSMOS Summer Research Program*, UC Irvine** *Jul 2016 – Aug 2016*
  - Studied effects of different drugs on the growth rate of tumor spheres and modeled such growth in MATLAB

## Professional Experience

- ❖ **Research Intern, *Machine Learning Research Team*, Red Hat** *May 2025 – Aug 2025*
  - Developed and analyzed scaling laws for speedup with speculative decoding in server-scale inference of large language models, extending prior approaches limited to the synchronous case and informing the design of more effective speculator models
- ❖ **Research Intern, *Machine Learning Research Team*, Neural Magic (acquired by Red Hat)** *Jun 2024 – Aug 2024*
  - Spearheaded initiative to quantize LLMs to new FP8 data format to maintain performance while reducing cost – primary contributor to top-8 trending, most extensive FP8 [model collection](#) on Hugging Face with over 2 million total downloads, work featured by [NVIDIA](#) and [MarkTechPost](#)
  - Tested a variety of different approaches, such as knowledge distillation and speculative decoding, to create more performant compressed LLMs

## Publications (\* denotes equal contribution, † denotes co-correspondence)

- ❖ Kong, L., Ning, A., Adler, M., & Shavit, N. N. (2025). **Negative pre-activations differentiate syntax**. *The 14<sup>th</sup> International Conference on Learning Representations (ICLR 2026)*. <https://openreview.net/forum?id=RzcCrU0tXP>
- ❖ Kong, L.\*, Subramanian, I.\*, Shavit, Y., Adler, M., Alistarh, D., & Shavit, N. N. (2025). **Expand neurons, not parameters**. arXiv preprint. <https://arxiv.org/abs/2510.04500>
- ❖ Tumma, N.\*, Kong, L.\*†, Sawmya, S., Wang, T. T., & Shavit, N. N.† (2024). **A connectomics-driven analysis reveals novel characterization of border regions in mouse visual cortex**. *Neural Networks*, 190, 107688 (Neural Netw). <https://doi.org/10.1016/j.neunet.2025.107688>
- ❖ Sawmya, S.\*, Kong, L.\*, Markov, I., Alistarh, D., & Shavit, N. N. (2025). **Wasserstein distances, neuronal entanglement, and sparsity**. *The 13<sup>th</sup> International Conference on Learning Representations (ICLR 2025, Spotlight Presentation)*. <https://openreview.net/pdf?id=cnKhHxN3xi>

- ❖ Hobson, B. D., **Kong, L.**, Angelo, M. F., Lieberman, O. J., Mosharov, E. V., Herzog, E., Sulzer, D., & Sims, P. A. (2022). **Subcellular and regional localization of mRNA translation in midbrain dopamine neurons**. *Cell Reports*, 38(2) (Cell Rep). <https://doi.org/10.1016/j.celrep.2021.110208>
- ❖ Hobson, B. D., **Kong, L.**, Hartwick, E. W., Gonzalez, R. L., Jr., & Sims, P. A. (2020). **Elongation inhibitors do not prevent the release of puromycylated nascent polypeptide chains from ribosomes**. *eLife* 9, e60048 (eLife). <https://doi.org/10.7554/eLife.60048>
- ❖ **Kong, L.\***, Murata, M. M.\*, & Digman, M. A. (2018). **Absence of REV3L promotes p53-regulated cancer cell metabolism in cisplatin-treated lung carcinoma cells**. *Biochemical and Biophysical Research Communications*, 496(1), 199-204 (BBRC). <https://doi.org/10.1016/j.bbrc.2018.01.026>

## Conferences and Workshops (\* denotes equal contribution)

- ❖ **Kong, L.\***, Ning, A., & Shavit, N. N. (2025, July). **Input differentiation via negative computation** [Poster presentation]. *The 3rd Workshop on High-dimensional Learning Dynamics at the 42nd International Conference on Machine Learning (ICML 2025 Workshop HiLD)*, Vancouver, BC, Canada.
- ❖ **Kong, L.\***, Durrezi, H., Mi, L., & Shavit, N. N. (2025, March). **Presynaptic input synchrony at scale** [Poster presentation]. *Computational and Systems Neuroscience (COSYNE 2025)*, Montreal, QC, Canada.
- ❖ Sawmya, S.\*, **Kong, L.\***, Markov, I., Alistarh, D., & Shavit, N. N. (2024, August). **Neuronal disentanglement and Sparse Expansion** [Poster presentation]. *New England Mechanistic Interpretability Workshop Series (NEMI 2024)*, Boston, MA, United States.
- ❖ Hobson, B. D., **Kong, L.**, Angelo, M. F., Lieberman, O. J., Mosharov, E. V., Herzog, E., Sulzer, D., & Sims, P. A. (2021, October). **Subcellular and regional localization of mRNA translation in midbrain dopamine neurons** [Poster presentation]. *2021 Columbia Undergraduate Research Symposium*, New York, NY, United States.
- ❖ Hobson, B. D., **Kong, L.**, Hartwick, E. W., Gonzalez, R. L., Jr., & Sims, P. A. (2020, October). **Elongation inhibitors do not prevent the release of puromycylated nascent polypeptide chains from ribosomes** [Poster presentation]. *2020 Columbia Undergraduate Research Symposium*, New York, NY, United States.
- ❖ **Kong, L.**, Hobson, B. D., & Sims, P. A. (2019, October). **Toward visualization of active translation in dopaminergic neurons** [Poster presentation]. *2019 Columbia Undergraduate Research Symposium*, New York, NY, United States.
- ❖ **Kong, L.\***, Murata, M. M.\*, & Digman, M. A. (2017, October). **Fighting the (chemotherapeutic) resistance: restoring p53 function and silencing REV3L suppresses the cancerous metabolic phenotype in cisplatin treated human non-small lung carcinoma cells** [Poster presentation]. *2<sup>nd</sup> World Congress on Cancer Research and Therapy (WCCRT 2017)*, San Diego, CA, United States.

## Honors and Achievements

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| ❖ IBM AI Research Grant – Primary author of funded proposal supporting my research                    | 2025        |
| ❖ Amazon AI PhD Fellowship – MIT nominee, results pending   | 2025        |
| ❖ Apple Scholars in AI/ML PhD Fellowship – One of three MIT nominees                                  | 2025        |
| ❖ Spotlight Presentation at ICLR – Top 5% of submissions  | 2025        |
| ❖ Pillar VC Travel Grant for ICML 2025 – Awardee  | 2025        |
| ❖ COSYNE New Attendee Travel Grant – Awardee  | 2025        |
| ❖ Cerebras Research Fellowship – Awardee  | 2024        |
| ❖ NSF Graduate Research Fellowship Program – Honorable Mention  | 2024        |
| ❖ Columbia University I.I. Rabi Scholar – One of 17 students in class awarded yearly research funding | 2018 – 2022 |
| ❖ American Invitational Mathematics Examination (AIME) qualifier – Top 5% nationally                  | 2015 – 2018 |
| ❖ USA Biology Olympiad (USABO) semifinalist – Top 10% nationally                                      | 2015        |

## Teaching Experience

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| ❖ <b>Teaching Fellow</b> , <i>Department of Electrical Engineering and Computer Science</i> , MIT  | Sep 2025 – Present                         |
| <ul style="list-style-type: none"> <li>• Developing problem sets and holding weekly office hours for the following courses:</li> <li>• 6.4610 Natural Language Processing</li> </ul>   | Fall 2025                                  |
| ❖ <b>Research Mentor</b> , <i>Department of Electrical Engineering and Computer Science</i> , MIT  | Dec 2022 – Present                         |
| <ul style="list-style-type: none"> <li>• Mentoring undergraduate students to conduct research in mechanistic interpretability, model efficiency, and connectomics. Graduated mentees:</li> <li>• Heidi Durrezi, now PhD candidate at MIT</li> <li>• Neehal Tumma, now PhD candidate at MIT</li> </ul>  | Sep 2023 – Sep 2024<br>Dec 2022 – May 2024 |
| ❖ <b>Course Assistant</b> , <i>Computer Science Department</i> , CU  | Jan 2021 – May 2022                        |
| <ul style="list-style-type: none"> <li>• Guided students to implement the mathematical and theoretical principles taught in class in Python-based applications and problem sets through weekly office hours and biweekly lab sessions in the following courses:</li> <li>• COMS W4701 Artificial Intelligence</li> <li>• COMS W4733 Computational Aspects of Robotics</li> <li>• COMS W4701 Artificial Intelligence</li> </ul> | Spring 2022<br>Fall 2021<br>Summer 2021    |

- COMS W3251 Computational Linear Algebra *Spring 2021*
- ❖ **Vice President, Orange County Math Circle (OCMC), Orange County, CA** *Nov 2013 – May 2018*
  - Oversaw logistics of all other math clubs within OCMC; resolved club issues in weekly diagnostic meetings
  - Directed volunteers to serve 2800+ students yearly; trained others to better instruct students

## **Invited Talks**

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- ❖ Talk on *Wasserstein Distances, Neuronal Entanglement, and Sparsity*, Red Hat, Cambridge, MA, USA *Mar 2025*

## **Extracurricular Activities**

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- ❖ **Editor in Chief, Columbia Science Review, CU** *Sep 2018 – May 2022*
  - Supervise over 40 writers and editors to ensure the smooth operation of an online and a biannual publication
  - Coordinate between different teams, including illustrators and layout designers, to produce a cohesive product
- ❖ **Vice President, Columbia Synapse, CU** *Sep 2019 – May 2021*
  - Oversee the organization of events to help unite the community in support of those with traumatic brain injuries, including research panels, socials, as well as of a large conference held during March 13<sup>th</sup> and 14<sup>th</sup>, 2021
- ❖ **RASC-AL Mission Member, Columbia Space Initiative, CU** *Nov 2018 – May 2020*
  - Semifinalist for NASA's RASC-AL competition to design a lunar lander, focused on thermal management