Karan P. Singh

EE PhD Student · Stanford University

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Education

Stanford University Sep. 2023 - Present
PhD in Electrical Engineering

Cal Poly San Luis Obispo Sep. 2019 - Mar. 2022
Bachelor of Science in Electrical Engineering

Research Experience

Stanford University

Graduate Research Assistant — Machine Learning Sep. 2023 - Present
Advisor: Dr. **Ehsan Adeli**

- **Brain Foundation Models**: Developing foundation models for functional MRI to improve understanding of brain functional networks and uncover new insights into neurological disease progression and prediction. Focused on better evaluation, multi-modal architectures, and biology-inspired architectures and training objectives.

Post-Baccalaureate Researcher — Machine Learning, Bioengineering Jun. 2022 - Aug. 2023
Advisors: Dr. **Kim Butts Pauly**, Dr. **Gerald Popelka**

- **TUSNet**: Developed the first machine learning-based approach to phase aberration correction for focused ultrasound neuromodulation, achieving a 1200x efficiency increase over traditional physics-based simulation methods. Additionally applied unsupervised image generation to mitigate data scarcity for this problem, specifically in CT scans of human skulls.
- Analyzed calcium imaging data taken from mice under transcranial ultrasound stimulation to correlate sonication parameters to neural responses.

Radiological Sciences Laboratory REU — Bioengineering Jun. 2021 - Sep. 2021
Advisors: Dr. Kim Butts Pauly, Dr. Gerald Popelka

- Developed a web-based tool to aid in the standardized reporting of focused ultrasound neuromodulation parameters
- Improved and applied a novel metric for assessing signal audibility during transcranial ultrasound stimulation

Cal Poly SLO

Research Assistant — Biomedical Engineering Nov. 2020 - Jun. 2021
Advisor: Dr. Benjamin G. Hawkins

- Developed electrowetting (digital microfluidics) simulations in COMSOL Multiphysics to investigate new theoretical models and recapitulate observed droplet motion
- Assembled and troubleshooted a physical digital microfluidics platform (OpenDrop) for experimental comparison to simulated results and use in bioassays

Publications

A Hierarchical Tokenization Framework for Voxel-Level fMRI Representation Learning

Karanpartap Singh, Yue Zhao, Mohammad H. Abbasi, Ehsan Adeli

NeurIPS 2026 · arXiv:2611.11081 ↗ · Project Site ↗

HalluWorld: A Controlled Benchmark for Hallucination via Reference World Models

Emmy Liu, (…), **Karanpartap Singh**, Sachin Kumar, Steven Y Feng

NeurIPS 2026 · Evaluations and Datasets · arXiv:2605.19341 ↗ · halluworld.ai ↗

Curriculum-Guided Layer Scaling for Language Model Pretraining

Karanpartap Singh, Neil Band, Ehsan Adeli

ICML 2026 · arXiv:2506.11389 ↗

A Unified Definition of Hallucination, Or: It's the World Model, Stupid

Emmy Liu, (…), **Karanpartap Singh**, Sachin Kumar, Steven Y Feng

ICML 2026 · Position Paper · arXiv:2512.21577 ↗

Synthetic Skull CT Generation with Generative Adversarial Networks

Kasra Naftchi-Ardebelli†, **Karanpartap Singh**†, (…), Gerald R. Popelka, Kim Butts Pauly

Medical Physics · 2026 · arXiv:2308.00206 ↗

New Evaluation Metrics Capture Quality Degradation due to LLM Watermarking

Karanpartap Singh, James Zou

Transactions on Machine Learning Research (TMLR) · 2026 · OpenReview ↗

A deep-learning model for one-shot transcranial ultrasound simulation and phase aberration correction

Kasra Naftchi-Ardebelli†, **Karanpartap Singh**†, Reza Pourabolghasem, Gerald Popelka, Kim Butts Pauly

Medical Physics · 2025 · DOI: 10.1002/mp.70259 ↗

Preprints, Under Review, and In Preparation

Scaling The Interaction between Pretraining and Retrieval

Karanpartap Singh, Michael Yu, Varun Gangal, Zhuofu Tao, Sachin Kumar, Emmy Liu, Steven Y. Feng

Submitted to ACL ARR · arXiv:2604.00715 ↗

Terminal-Bench 4.0

Ryan Marten, (…), **Karanpartap Singh**, (…), Ludwig Schmidt

Paper In Preparation · 2026 · tbench.ai ↗

BRIDGE: A Unified Brain Representation for Functional MRI

Karanpartap Singh, Adam Turnbull, Mohammad Abbasi, Feng Vankee Lin, Daniel Yamins, Ehsan Adeli

In Preparation for Nature Methods

Stable Rankings Are Not Enough: Influence Dynamics and Data Selection in Language Models

Karanpartap Singh, Steven Y. Feng

In Preparation for ICML 2027

Training fMRI Models to Explain Their Network Dependencies

Karanpartap Singh, Adam Turnbull, Mohammad Abbasi, Feng Vankee Lin, Ehsan Adeli

In Preparation for IEEE Transactions on Medical Imaging (TMI)

The Decodability Trap: Rethinking the Evaluation of fMRI Foundation Models

Karanpartap Singh, Mohammad Abbasi, Daniel Yamins, Ehsan Adeli

In Preparation for Nature Neuroscience

Improved Modeling of Droplet Motion in Open-Format Digital Microfluidic Devices

Karanpartap Singh, Benjamin Hawkins

Preprint · 2022 bioRxiv:2022.11.30.518563 ↗

(† denotes equal contribution)

Posters and Talks

"Application of deep learning to phase aberration correction in transcranial focused ultrasound."
International Symposium on Transcranial Ultrasound (ISTU), Apr. 2023. **Oral: Best Talk Award Winner** ↗

"TUSNet: Deep learning based instant simulations for transcranial focused ultrasound."
Caltech International Symposium on Biomedical Ultrasound & Sonogenetics, Dec. 2022. **Poster presentation**.

"Transcranial Ultrasound Stimulates Neurons at the Focus."
Focused Ultrasound Neuromodulation Symposium, Sep. 2022. **Poster presentation**.

"Development of a computational tool to guide transcranial ultrasound parameter selection and reporting."
Focused Ultrasound Neuromodulation Symposium, Sep. 2021. **Poster presentation**.

Honors and Awards

- Stanford Interdisciplinary Graduate Fellowship (SIGF), Hsieh Family Fellow 2026
- NSF Graduate Research Fellowship 2023
- Ford Foundation Fellowship — Honorable Mention 2023
- Youngest Engineering Graduate in Cal Poly SLO History 2022
- Cal Poly Engineering Graduate of the Year 2022
- Cal Poly SLO President's List 2020 - 2022

Academic Service

Reviewer: ICLR ('26, '27), ICML ('26, **Gold Reviewer Award**), NeurIPS ('25, '26), CVPR ('26), MELBA, TMLR

Work Experience

Noetik.AI Jun. 2025 - Sep. 2025
Machine Learning Intern

- Designed new masking strategies for Noetik's cancer biology **Tissue World Models**. These models are simulators of disease biology at the patient level, and may help select effective therapies for cancer.

Akura Medical Jun. 2024 - Sep. 2024
Machine Learning Intern

- Developed a model for the synthetic generation of CT scans with pulmonary embolisms, for use in a new navigation system for Akura's pulmonary thrombectomy platform. This synthetic data was then used to train effective and better-generalizable segmentation algorithms for the pulmonary artery.

Teaching / Mentoring

Co-Instructor 2023 - 2026
CS25: Transformers United (Stanford University)

- As one of Stanford's hottest seminar courses, CS25 has achieved worldwide recognition with millions of views on YouTube and thousands of attendees. Each week, we feature in-depth talks about research at the cutting-edge of Transformers and AI. Past speakers include Andrej Karpathy, Geoffrey Hinton, Jan Leike, Jim Fan, Ashish Vaswani, Hongyu Ren, Denny Zhou, and Jason Wei. 2026 iteration sponsored by AGI House, Modal, and MongoDB ($12k). cs25.stanford.edu.

REU Mentor Jun. 2022 - Aug. 2022
Stanford RSL REU

- Co-mentored an undergraduate through a quarter-long radiology research program involving image processing and analysis for GCaMP imaging in mice.

Teaching Assistant
Stanford University & Cal Poly SLO

- CS231n: Deep Learning for Computer Vision (Stanford University) Apr. 2026 - Jun. 2026
- EE 409: Electronic Design (Cal Poly SLO) Jan. 2022 - Mar. 2022

Academic Server & Study Session Host Apr. 2020 - Mar. 2021

- To aid students during the pandemic, created and managed various online academic servers for Cal Poly classes and standardized testing with a collective 1000+ members
- Planned and hosted regular study sessions for various core electrical engineering classes

Extracurriculars / Outreach

Co-Founder and Co-President Mar. 2023 - Present
Stanford Piano Society (SPS) [https://piano.stanford.edu/]

President Jan. 2023 - Present
Graduate Students in Electrical Engineering (GSEE)

Volunteer Teacher and Lesson Planner Sep. 2022 - Jan. 2023
Stanford RSL SEED (Science Education Enrichment for Diversity) Program

Skills

Languages: Mandarin (Conversational), Korean (Conversational), Hindi (Native), Punjabi (Native)

Programming: Python (PyTorch, TensorFlow, Huggingface Transformers, FAISS, Nilearn, etc.), MATLAB, C, Java, Verilog, SLURM

Circuit Design / Simulation: SPICE, COMSOL Multiphysics

Last Updated: 11/19/2026