

# Eric Qu

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## EDUCATION

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**University of California, Berkeley** *Sep 2023 - Present*

*Ph.D. in Computer Science*

Member of [Berkeley AI Research Lab](#) *Berkeley, USA*

**Duke Kunshan University / Duke University** dual degree UG program *Sep 2019 - May 2023*

*B.S. in Data Science (by Duke Kunshan)*

*B.S. in Interdisciplinary Studies (Subplan: Data Science; by Duke)* *Kunshan, China / Durham, USA*

- Graduation with Distinction (Top 5%) and Latin Honors *cum laude*; GPA 3.88/4
- Thesis: Stable Generation and Operations in Hyperbolic Space (Zu Chongzhi Math Signature Work Award)

## RESEARCH EXPERIENCES

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**University of California, Berkeley** - Graduate Student Researcher *Aug 2023 - Present*

Adviser: [Aditi S. Krishnapriyan](#) *Berkeley, USA*

### AI for Chemistry and Physics

- Investigated the inductive bias of higher-order symmetries in equivariant NNs, found theoretical and empirical evidence that undermines the necessity of higher-order symmetries in data-abundant settings
- Designed a novel architecture for interatomic potential prediction that has better scalability and efficiency than the current state-of-the-art high-order equivariant models

**Microsoft Research** - Research Intern, [Shanghai AI/ML Group](#) *May 2022 - June 2023*

Adviser: Xufang Luo, [Dongsheng Li](#) *Shanghai, China*

### Sequence Modeling

- Developed a method to improve the performance of sequence models by altering the continuity of the input sequence with the Lipschitz regularizer *[ICLR 2023 Spotlight]*
- Proposed a novel interpretable CNN layer, ShapeConv, that bridges the gap between traditional shapelet-based methods and CNNs *[ICLR 2024]*

### AI for Genomics

- Designed a new architecture for Gene Expression Prediction (GEP) with a linear-attention backbone, which enables larger perception fields and more efficient training
- Constructed a comprehensive GEP dataset that has doubled the sample size than the current dataset

**Duke Kunshan University** - Research Assistant *Mar 2021 - May 2023*

Adviser: Dongmian Zou, [Kai Zhang](#) *Jiangsu, China*

### Hyperbolic Deep Learning

- Proposed a novel hyperbolic convolution operation that is permutation equivariant and parallel transport invariant, proven to be good at capturing local geometric features
- Developed a stable fully hyperbolic generative model, HAEGAN, along with numerous stable hyperbolic neural operations, achieving state-of-the-art performance in molecular generation

### AI for Materials Science

- Developed a deep learning model to quantify the distribution of spherical nanoparticles in a polymer matrix directly from their real-space TEM images *[Macromolecules]*
- Using reinforcement learning to solve the sticky hard sphere packing problem

## PUBLICATIONS & MANUSCRIPTS

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**Qu, Eric**, Wang, Yansen, Luo, Xufang, He, Wenqiang, Kai, Ren, Li, Dongsheng. "CNN Kernels Can Be the Best Shapelets" *International Conference on Learning Representations (ICLR)* (2024).

**Qu, Eric**, Luo, Xufang, Li, Dongsheng. "Data Continuity Matters: Improving Sequence Modeling with Lipschitz Regularizer" *International Conference on Learning Representations (ICLR)* **Spotlight** (Notable Top 25%) (2023).

**Qu, Eric**, Zou, Dongmian. "Hyperbolic Convolution via Kernel Point Aggregation" [arXiv:2306.08862](https://arxiv.org/abs/2306.08862).

**Qu, Eric**, Zou, Dongmian. "Autoencoding Hyperbolic Representation for Adversarial Generation" [arXiv:2201.12825](https://arxiv.org/abs/2201.12825).

**Qu, Eric**, Zou, Dongmian. "Lorentz Direct Concatenation for Stable Training in Hyperbolic Neural Networks" *NeurIPS Symmetry and Geometry in Neural Representations Workshop* (2022).

**Qu, Eric**, Jimenez, Andrew, Kumar, Sanat K., Zhang, Kai. "Quantifying Nanoparticle Assembly States in a Polymer Matrix through Deep Learning." *Macromolecules* 54, no. 7 (2021): 3034-3040.

Bornani, K., Mendez, N. F., Altorbaq, A. S., Müller, A. J., Lin, Y., **Qu, Eric**, Zhang, K., Kumar, S. K., Schadler, L. S. (2022). "In Situ Atomic Force Microscopy Tracking of Nanoparticle Migration in Semicrystalline Polymers." *ACS Macro Letters*, 2022, 11, 6, 818-824.

## PRESENTATIONS

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Stable Hyperbolic Neural Networks for Graph Generation and Classification

- Tokyo, Japan, ICIAM 2023 Mathematics of Geometric Deep Learning Minisymposium

Data Continuity Matters: Improving Sequence Modeling with Lipschitz Regularizer

- Kigali, Rwanda, ICLR 2023 Spotlight Presentation

## LEADERSHIP AND ACTIVITIES

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**Project Lead** - University of California, Berkeley

Nov 2023 - Present

- Leading 3 undergraduate research projects in AI for Science and Geometric Deep Learning

**Teaching Assistant** - Duke Kunshan University

Jan 2022 - May 2022

- Weekly recitations for STATS 303 Statistical Machine Learning & STATS 403 Deep Learning

**Reviewer/PC Member**

- Conference: NeurIPS 2023, ICLR 2024, ICML 2024, NeurIPS 2024, ACML 2024
- Journal: IEEE Transactions on Neural Networks and Learning Systems

## HONORS & AWARDS

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NERSC GenAI for Science CFP Award (2500 GPU hrs) - United States Department of Energy May 2024

Zu Chongzhi Math Signature Work Award - Duke Kunshan University Zu Chongzhi Math Center May 2023

Conference Travel Grant (ICLR 2023) - Duke Kunshan University May 2023

Conference Travel Grant (NeurIPS 2022) - Duke Kunshan University Dec 2022

Summer Research Scholar - Duke Kunshan University Jun 2020, Jun 2022

## SKILLS

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**Programming:** Proficient in Python, C++, C for CUDA, R, MATLAB, Mathematica,  $\LaTeX$

**Deep Learning Frameworks:** Jax, PyTorch, TensorFlow, Keras, Gym for RL

**Math:** Group Representation Theory, Spherical Harmonics, Differential Geometry, Persistent Homology