# Eric Qu

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## EDUCATION

**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

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

**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*.

**Qu, Eric**, Zou, Dongmian. "Autoencoding Hyperbolic Representation for Adversarial Generation" *arXiv: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

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

**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 AI4S Workshop, ICLR 2024, ICML 2024
· Journal: IEEE Transactions on Neural Networks and Learning Systems

## Honors & Awards

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

**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