

Eric Qu

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Kunshan, Jiangsu 215300, China

EDUCATION

Duke Kunshan University

B.S. in Data Science

Sep 2019 - Present

RESEARCH INTEREST

My research interest mainly falls on hyperbolic machine learning, graph neural networks, and generative models. I also have experience in reinforcement learning and computer vision. In general, I am interested in combining ideas from mathematics with machine learning, and also curious about everything.

PUBLICATIONS

Qu, Eric, and Dongmian Zou. "Hyperbolic Neural Networks for Molecular Generation." *arXiv preprint arXiv:2201.12825* (2022).

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

EXPERIENCE

Teaching Assistant

STATS 303 Statistical Machine Learning

Jan 2022 - May 2022

Duke Kunshan University

Research Intern

Victory Software, Data Analysis Department

Jun 2021 - Aug 2021

China Petrochemical Corporation

Research Assistant

Mentor: Dongmian Zou

Mar 2021 - Present

Duke Kunshan University

Research Assistant

[Kumar Research Group](#)

Apr 2020 - Nov 2021

Columbia University

Research Assistant

Mentor: Kai Zhang

Nov 2019 - Present

Duke Kunshan University

PROJECTS

Hyperbolic Neural Networks for Molecular Generation

Eric Qu, Dongmian Zou

arXiv:2201.12825

- We propose a novel fully hyperbolic model for molecular generation utilizing the junction tree auto-encoder framework.
- Other contributions include novel concatenation and split operations in Lorentz space and a formulation of fully hyperbolic WGAN with novel gradient penalty.

Quantifying Nanoparticle Assembly States in a Polymer Matrix through Deep Learning

Eric Qu, Andrew Matthew Jimenez, Sanat K. Kumar, Kai Zhang

Macromolecules, 54 (7), 3034-3040

- We develop and apply a deep-learning based image analysis method to quantify the distribution of spherical NPs in a polymer matrix directly from their real-space TEM images.

Solving Sticky Hard Sphere Packing Problem through Deep Learning

Eric Qu, Kai Zhang, Dongmian Zou

Mar 2021

- We propose a method of solving sticky hard sphere packing problem. The packing state of the spheres could be mapped to a graph according to the sphere connections.
- A modified version of Graph Isomorphism Network is trained to identify the valid packing with high accuracy.
- Then, we train a Mento Carlo Search Tree to generate new packings with the reward based on perviously trained GIN.

Finding Optimal Order Parameter for Particle Systems

Eric Qu, Kai Zhang

Oct 2021

- We develop a model to find the optimal order parameter for particle packing systems. The packing state is represented by the 3D point cloud data.
- We proposed a novel Kernel Point Autoencoder model using KPConv as encoder and our Kernel Point Generator as decoder.
- Then, the bottleneck layer is extracted to be the order parameter.

Square Object Detection using Bounding Circles

Eric Qu, Kai Zhang

Jan 2021

- We propose a deep learning model for detecting square objects.
- The square objects could have different orientations, which mains that the result of old coordinate aligned bounding boxes is not uniform and representative.
- We change the bounding boxes to be coundng circles in YOLO and use the model to detect the position an size of DNA nanoCrystals.

Accurate Cell Segmentation through Vision Transformer

Eric Qu*, Alex Jin*, Dongmian Zou

Nov 2021

- We use a modified version of vision transformer to enable accurate cell segmentation.
- Our model use Swin transformer as backbone and a novel transformer architecture as segment head.
- This enables it to achieve ultrahigh accuracy in the instance segment of crowded and repeated objects.

HONORS & AWARDS

Summer Research Scholar - Duke Kunshan University

Jun 2020

Mathematical Contest In Modeling - Honorable Mention

Apr 2020

Canadian Computing Competition Senior Division Top 25% (China 2nd, World 35th)

Mar 2019

China National Olympiad in Informatics Senior Group, Frist prize

2016, 2017

SKILLS

Programming: Proficient in Python, C++, R, MATLAB, Mathematica, LaTeX

Frame: Pytorch, TensorFlow, Keras, Gym for RL