

# ZHISHENG XIAO

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## EDUCATION

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**The University of Chicago**

2017-2022 (*expected*)

Degree: Ph.D. Computational and Applied Mathematics

GPA: 3.96/4.0

**University of California, Berkeley**

2013-2017

Degree: B.A. Applied Mathematics, B.A. Statistics

GPA: 3.84/4.0, Highest Distinction in Applied Mathematics

## RESEARCH INTERESTS

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Deep Learning, Generative Models (VAEs, GANs, Energy-based Models, Denoising Diffusion Models), Representation Learning, Optimization

## WORK EXPERIENCE

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**Nvidia Corporation**

June 2021-September 2021

Research Intern

- Investigated the slow sampling issue of denoising diffusion generative models and proposed a novel framework that models the denoising distribution with conditional GANs.
- Implemented the model with PyTorch and performed large-scale training with multi-node clusters on Nvidia GPU Cloud.
- Accelerated the sampling process of diffusion models by  $2000\times$  while maintaining high sample quality and diversity.
- One paper in submission to ICLR 2022.

**Nvidia Corporation**

June 2020-September 2020

Research Intern

- Aimed to tackle the blurry sample issue of probabilistic deep generative models and developed an energy-based model with a variational auto-encoder as its backbone.
- Achieved state-of-the-art sample quality among probabilistic generative models, reducing the FID on CIFAR-10 and CelebA by 50%.
- Performed large scale experiments to show that our model achieves state-of-the-art generative quality among likelihood based models.
- Presented the work at ICLR 2021 as spotlight.

## SELECTED RESEARCH PROJECTS

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### Unsupervised Out-of-distribution Detection

February 2020-February 2021

- Explored algorithms to detect out-of-distribution (OOD) samples with unlabelled in-domain data.
- Examined the well-known failure of detection OOD samples with VAEs, and proposed a novel OOD detection score that corrects the likelihood estimate on test sample from VAEs.
- Improved the AUROC over VAE baseline by  $6\times$  on popular image OOD detection benchmark.

### Iteration Complexity of Coordinate Descent

January 2019-May 2020

- Studied convergence properties of optimization algorithms including coordinate descent and ADMM.
- Proved the worst case iteration complexity of two coordinate descent variants. Ran experiments on real and simulated data to verify the theoretical findings.

## PUBLICATIONS

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### Conference and Journal Papers:

Zhisheng Xiao, Karsten Kreis, & Arash Vahdat. **Tackling the Generative Learning Trilemma with Denoising Diffusion GANs.** *In submission to ICLR 2022.*

Zhisheng Xiao, Karsten Kreis, Jan Kautz & Arash Vahdat. **VAEBM: A Symbiosis between Variational Autoencoders and Energy-based Models.** *International Conference on Learning Representations (ICLR)*, 2021. (Spotlight)

Huajie Shao\*, Zhisheng Xiao\*, Shuochao Yao, Aston Zhang, Shengzhong Liu, Tarek Abdelzaher. **ControlVAE: Tuning, Analytical Properties, and Performance Analysis.** *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 2021

Peijun Xiao, Zhisheng Xiao & Ruoyu Sun. **Two Symmetrized Coordinate Descent Methods Can Be  $O(n^2)$  Times Slower Than the Randomized Version.** *SIAM Journal on Optimization*, 2021.

Zhisheng Xiao, Qing Yan & Yali Amit. **Likelihood Regret: An Out-of-Distribution Detection Score For Variational Auto-encoder.** *Thirty-fourth Conference on Neural Information Processing Systems (NeurIPS)*, 2020.

### Workshop Papers:

Zhisheng Xiao, Qing Yan & Yali Amit. **Do We Really Need to Learn Representations from In-domain Data for Outlier Detection?** *ICML Workshop on Uncertainty & Robustness in Deep Learning*, 2021.

Zhisheng Xiao, Qing Yan & Yali Amit. **EBMs Trained with Maximum Likelihood are Generator Models Trained with a Self-adversarial Loss.** *ICLR Energy Based Models Workshop*, 2021.

Zhisheng Xiao, Qing Yan & Yali Amit. **Improving Sample Quality by Training and Sampling from Latent Energy**. *ICML Workshop on Invertible Neural Networks, Normalizing Flows, and Explicit Likelihood Models*, 2020.

## SKILLS

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- **Programming Skills:** Python, MATLAB, R
- **Machine Learning:** PyTorch, TensorFlow, sklearn, Pandas

## SERVICE

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Reviewer for TPAMI, NeurIPS, ICLR, CVPR.

Reviewer for EBM workshop at ICLR 2021, INN+ workshop at ICML 2021, DGM with applications workshop at NeurIPS 2021.