

# HAO WU

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## RESEARCH INTERESTS

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Deep Generative Modeling, Variational Inference, Representation Learning, Probabilistic Programming

## EDUCATION

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<b>Northeastern University</b> Ph.D., Computer Science	<i>Boston, MA</i> 2017 - Current
<b>University of Virginia</b> M.Sc., Computer Science	<i>Charlottesville, VA</i> 2015 - 2016
<b>University of Washington</b> M.Sc., Applied Mathematics	<i>Seattle, WA</i> 2014 - 2015
<b>Sichuan University</b> B.Sc., Mathematics	<i>Chengdu, China</i> 2010 - 2014

## EXPERIENCE

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<b>Google Research</b> Research Intern	<i>Cambridge, MA</i> May 2022 - Dec 2022
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- Developed variational inference methods for learning multimodal dynamics from time series. Designed an end-to-end training framework for high-dimensional dynamical systems.
- Implemented methods in **JAX + TensorFlow**. Evaluated our methods on 50k videos with physical dynamics. Achieved interpretable representations that can explain the dynamical systems in time series while VAEs failed.

<b>IBM Research</b> Research Intern	<i>Cambridge, MA</i> Jun 2021 - Sep 2021
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- Developed contrastive learning methods to discover semantically meaningful features from noisy data.
- Implemented deep generative models in **PyTorch**. Used this approach to learn representations of images with background noise and detect human activities using healthcare data.

<b>Oracle Labs</b> Research Intern	<i>Burlington, MA</i> Jun 2020 - Aug 2020
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- Developed novel energy-based models for unsupervised representation learning on large-scale image data.
- Evaluated methods on 4 image datasets using downstream tasks including logistic classification out-of-distribution detection, and kNN. Improved classification accuracy by **15%** on average against VAEs and GANs.
- Implemented deep generative models using **PyTorch**. Paper was accepted to **ICML 2021** with a **talk**.

<b>Northeastern University</b> Research Assistant	<i>Boston, MA</i> Sep 2018 - Dec 2019
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- Developed a scalable variational inference approach for learning deep generative models. Characterized prediction uncertainty for hierarchical data using probabilistic modeling techniques.
- Evaluated methods on 10k multi-object detection tasks and 20k clustering tasks. Achieved accurate results and good model scalability while VAEs + MCMC methods completely failed.
- Implemented deep probabilistic models in **Pytorch** and ProbTorch. Paper was accepted to **ICML 2020**.

<b>MicroStrategy</b> Software Engineer	<i>Tysons, VA</i> Jan 2017 - May 2017
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- Developed statistical models for analyzing user activities as new features. Implemented custom visualization tools that support various use cases in Business Intelligence. Deployed these tools in the integrated Platform.

## SKILLS

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**Programming Languages:** Python (PyTorch, TensorFlow, JAX), Java, C/C++, R, Matlab, SQL, JavaScript  
**Environments:** Unix/Linux, Windows, AWS

## PUBLICATIONS

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- Nested Variational Inference **NeurIPS, 2021**  
H Zimmermann, **H Wu**, B Esmaili, S Stites, JW van de Meent
- Learning Proposals for Probabilistic Programs with Inference Combinators **AISTATS, 2021**  
S Stites\*, H Zimmermann\*, **H Wu**, E Sennesh, JW van de Meent
- Conjugate Energy-Based Models **ICML, 2021**  
**H Wu\***, B Esmaili\*, M Wick, JB Tristan, JW van de Meent
- Amortized Population Gibbs Samplers with Neural Sufficient Statistics **ICML, 2020**  
**H Wu**, H Zimmermann, E Sennesh, TA Le, JW van de Meent
- Structured Disentangled Representations **AISTATS, 2019**  
B Esmaili, **H Wu**, S Jain, A Bozkurt, N. Siddharth, B Paige, DH Brooks, J Dy, JW van de Meent

## TALKS

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- Contributed talk at ICLR Energy-Based Models Workshop *2021*  
Contributed talk at Symposium on Advances in Approximate Bayesian Inference *2021*

## SERVICES

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**Reviewer:** ICML 2021 2023, ProbProg 2021, AISTATS 2022 2023, NeurIPS 2022